

SPECIFICATION

TITLE OF THE INVENTION: HARNESS TYPE SAFETY BELT

TECHNICAL FIELD

[0001]

Embodiments described herein relate generally to a structure of a harness type safety belt.

BACKGROUND ART

[0002]

In general, when working at high places such as construction sites, users are obliged to wear safety belts for fall prevention. This kind of safety belt is composed of, in general, a body belt to be worn around the trunk of a human body, a rope of a predetermined length connected to the body belt, and an anchoring hook attached to the tip of the rope. The anchoring hook is connected to a parent rope etc. at the work site. However, since such body belt type safety belts are worn around the trunk of a human body, the tension of the rope concentrates on the trunk and a suspended posture is likely to become unstable. Therefore, what has been referred to as a harness type safety belt is known, which includes a strap that extends not only over the trunk of a human body but also extends over both shoulders, a back, and both thighs, dispersing the tension of a rope applied to the human body and support the human body in a stable manner, by connecting the rope to a back strap.

[0003]

The kinds of harness type safety belts includes the followings: a leg loop type harness (or a sit harness) that holds the portions of thighs and waist; a chest harness that holds the chest portion above the trunk; and further, what is referred to as a full body harness. The full body harness is also referred to as a “full harness type”, and it is a type of safety belt that holds the whole body by having straps that cross the thighs and shoulders in addition to the trunk. For convenience of description, a “full body harness type safety belt” will be referred to as a “harness type safety belt” or simply as a “harness”. In comparison to a body belt type, the harness is superior in that there is no concern for falling out from the harness and falling off, the weight is not concentrated on the trunk at the time of falling, and that a natural posture can be maintained even in the case of being suspended. For this reason, the use of the harness is spreading mainly around construction sites in Japan in recent years.

[0004]

Examples of such conventional harnesses include a type referred to as the Y-type. The Y-type harness includes the followings: shoulder straps that cross over the respective shoulders of the user; thigh straps that are worn as encircling the respective thighs of the user; an upper strap branching member that is disposed on the upper and lower sides of the back of the user, and branches the shoulder straps to the respective shoulders of the user or converges the shoulder straps from the respective shoulders; a lower strap branching member that is connected to the thigh straps or a connecting strap; and a D-ring that fixes a lanyard. In other

words, a harness can be said to mainly have a structure made of a band-like strap(s) that encircles around the entire body. Each strap are adopted a wide width fabric formed of flexible fibers. The fibers may be polyester fibers or nylon fibers. In addition, the strap is provided with a length adjuster. The length of the strap can be adjusted by folding back the strap and pushing or pulling the strap.

[0005]

Patent Document 1 below discloses a harness including the followings: a pair of shoulder straps that extends, in a state of a user wearing the harness, from the left and right of a waist to a back side, intersects with each other, crosses over the respective shoulders, becomes substantially parallel to each other on the left and right sides of a chest, and returns to the left and right of the waist; a pair of loop-shaped thigh straps that is connected to the respective shoulder straps on the left and right sides of the waist, extends from the left and right of the waist to the respective thighs, and returns to the left and right of the waist along the bases of the thighs; a chest strap that connects the left and right shoulder straps on the chest side; and a connecting strap that connects the pair of thigh straps by crossing inside the respective loops at two locations of each of the thigh straps. Patent Document 1 aims to prevent entanglement of the straps with the above structure.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0006]

Patent Document 1: Japanese Unexamined Patent Application Publication No. 2009-112368

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0007]

A harness is used for fall prevention and is a protection for the body from the impact of a fall in case of falling accident for workers operating at heights. Therefore, it is required for users to tightly wear the harness so that the body does not fall off and come out from the harness.

[0008]

However, each strap of the harness is configured without taking the comfort of the user at the time of wearing the harness into consideration. Therefore, the stretchability (i.e., the capability of being expanded and contracted) of each strap has not been taken into consideration in the conventional harness. Accordingly, if the harness is excessively tightened, it may be too tight for users to work, so the users have a tendency to wear the harness loosely by, for example, having the length of each strap adjusted to be long. Such a loose state results in an unacceptable gap between the thigh straps and the thighs, for example. As a result, the amount of movement of the body at the time of a fall impact becomes larger than expected due to this gap, causing a problem of increasing the degree of danger.

[0009]

The present invention has been invented in view of the above points, and an object of the present invention is to provide a structure of a harness type safety belt which does not give a sense of tightness when wearing the harness in order to make a user wear the harness in a proper way.

MEANS OF SOLVING THE PROBLEMS

[0010]

A harness type safety belt according to the present invention includes the followings: a shoulder strap that crosses over a shoulder of a user and extends downward from the shoulder on a front side of the user; a thigh strap that is directly or indirectly connected to one end of the shoulder strap; and a back strap that is either integrally formed with or connected to the shoulder strap, and extends downward on a back side of the user. Further, in the harness type safety belt according to the present invention, part of the thigh strap, the back strap or the shoulder strap may be provided with a stretchable member that is stretchable. In addition, the harness type safety belt according to the present invention may further include a connecting strap that is connected to the thigh strap via a lower strap holder from the lower end of the back strap. Further, the stretchable member may be provided for both the back strap and the thigh strap, or both the connecting strap and the thigh strap. Moreover, the stretchable member may be provided for each of a pair of connecting straps and a pair of thigh straps.

[0011]

The stretchable member may be an elastic strap. In addition, the stretchable member may have a hollow tube body in which a plurality of wrinkles is arranged in the length direction thereof. Moreover, the elastic strap may be inserted inside the tube of the hollow tube body, and the hollow tube body may have a kinked (corrugated) structure in which the widths of the wrinkles change in accordance with the expansion and contraction of the elastic strap. Further, the elastic strap may include a bello-like part having a kinked (corrugated) structure that stretches in a length direction and connecting parts that are respectively connected to both ends of the bello-like part, the bello-like part may have a band-like part including a first layer and a second layer that are woven with a non-stretchable yarn, the band-like part may include a plurality of elastic yarns woven in a length direction thereof, a plurality of first layer woven parts of the respective elastic yarns may be provided at a plurality of locations in the length direction of the band-like part on a side of the first layer of the band-like part, a plurality of second layer woven parts of the respective elastic yarns may be provided at a plurality of locations in the length direction of the band-like part on a side of the second layer of the band-like part, the first layer woven parts and the second layer woven parts may be arranged in an alternate manner in the length direction of the band-like part, and the first layer woven parts and the second layer woven parts may be formed by weaving the elastic yarns in a width direction of the band-like part. Note that the bello-like part may be configured to regulate the maximum stretch length of the stretchable member.

EFFECTS OF THE INVENTION

[0012]

The harness type safety belt according to the present invention includes the stretchable member that is stretchable (i.e., capable of being expanded and contracted) provided for the shoulder strap, the thigh strap, or the back strap. According to such a configuration, the burden at the time of work is alleviated by reducing the sense of tightness given at the time of wearing the harness in order to make the user wear the harness in a proper way. Therefore, it becomes possible to prompt the improvement of the degree of adhesion to the body at the time of wearing the harness, which in turn leads to a decrease in falling accidents.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

[FIG. 1A] FIG. 1A is a schematic view illustrating an example of a harness according to a first embodiment.

[FIG. 1B] FIG. 1B is a schematic view illustrating a modification example of a connecting structure between a thigh strap and a connecting strap.

[FIG. 1C] FIG. 1C is a schematic view illustrating a modification example of the connecting structure between the thigh strap and the connecting strap.

[FIG. 1D] FIG. 1D is a schematic view illustrating a modification example of the connecting structure between the thigh strap and the connecting strap.

[FIG. 2] FIG. 2 is a rear view illustrating a state in which a user is wearing the harness according to the first embodiment.

[FIG. 3A] FIG. 3A is a side view illustrating an example of a stretchable member according to the embodiment.

[FIG. 3B] FIG. 3B is a side view illustrating another example of the stretchable member according to the embodiment.

[FIG. 4] FIG. 4 is a schematic view illustrating an example of a harness according to a second embodiment.

[FIG. 5] FIG. 5 is a rear view illustrating a state in which a user is wearing the harness according to the second embodiment.

[FIG. 6A] FIG. 6A is a side view illustrating an example of a stretchable member of a thigh strap.

[FIG. 6B] FIG. 6B is a side view illustrating another example of the stretchable member of the thigh strap.

[FIG. 7] FIG. 7 is a schematic view illustrating an example of a harness according to a third embodiment.

[FIG. 8] FIG. 8 is a rear view illustrating a state in which a user is wearing the harness according to the third embodiment.

[FIG. 9A] 9A is a side view illustrating an example of a stretchable member of a connecting strap.

[FIG. 9B] FIG. 9B is a side view illustrating another example of the stretchable member of the connecting strap.

[FIG. 10] FIG. 10 is a schematic diagram illustrating an example of stretchability of the connecting strap.

[FIG. 11] FIG. 11 is a diagram illustrating a result of a tensile test for the connecting strap.

[FIG. 12] FIG. 12 is a diagram illustrating a result of the tensile test for a harness fabric.

[FIG. 13A] FIG. 13A is a schematic view illustrating a modification example of the harness according to the third embodiment.

[FIG. 13B] FIG. 13B is a rear view illustrating a state in which a user is wearing a modification example of the harness according to the third embodiment.

[FIG. 14] FIG. 14 is a schematic view illustrating an example of a harness according to a fourth embodiment.

[FIG. 15] FIG. 15 is a rear view illustrating a state in which a user is wearing the harness according to the fourth embodiment.

[FIG. 16A] FIG. 16A is a side view illustrating an example of a stretchable member of a thigh strap.

[FIG. 16B] FIG. 16B is a side view illustrating an example of a stretchable member of a back strap.

[FIG. 16C] FIG. 16C is a side view illustrating an example of a stretchable member of a connecting strap.

[FIG. 17A] FIG. 17A is a drawing illustrating how a back strap and a thigh strap slide upward by the body movement of a user wearing a conventional harness.

[FIG. 17B] FIG. 17B is a drawing illustrating how the back strap and the thigh strap slide upward by the body movement of a user wearing the conventional harness.

[FIG. 18A] FIG. 18A is a schematic view illustrating an upright state of a human.

[FIG. 18B] FIG. 18B is a schematic diagram illustrating a bent state of a human.

[FIG. 18C] FIG. 18C is a schematic diagram illustrating a crouched down state of a human.

[FIG. 19] FIG. 19 is a rear view illustrating a state in which a user is wearing a harness according to a modification example of the Y-type.

[FIG. 20A] FIG. 20A is a schematic front view illustrating a harness according to a modification example of the X-type.

[FIG. 20B] FIG. 20B is a schematic front view illustrating a harness according to the modification example of the X-type.

[FIG. 21] FIG. 21 is a schematic rear view illustrating a harness according to a modification example of the H-type.

[FIG. 22] FIG. 22 is a schematic rear view illustrating a harness according to another modification example.

DESCRIPTION OF THE EMBODIMENTS

[0014]

Before describing embodiments, the background of the achievement of the present invention will be briefly described. As described in the background art, there is a tendency for a wearer to wear a harness type safety belt loosely, and a major factor for this tendency is a decrease in the degree of freedom of the body due to the harness type safety belt. This can be easily seen if taking wearing items of clothing as an example. That is, if one repeats stretching and bending a number of times while wearing trousers with a bottom hem of a top tucked in, the bottom hem of the top tucked in will come out from the trousers. This is because every time the back muscle stretches for each posture, it pulls the hem out from the trousers. Since the hem of the top is released from the fixation made by the trousers due to the dishevelment of clothes, the degree of restraint against bending of the body decreases, which means that the degree of freedom of the body movement increases.

[0015]

Based on the background above, the case of a harness type safety belt will be described. In the event where the harness type safety belt is worn tightly (i.e., worn in close contact with the body) in the same way as the wearing items of clothing described above, there is no space between the thigh strap and the thigh, and between the strap around the trunk and the trunk. Together with causing difficulty with bending, having no such space could lead to a problem in that the length of the strap that has been adjusted by a length adjuster may be

forcibly changed when the spine is straightened.

[0016]

It is necessary to investigate the range within which the required minimum stretchability of the stretchable material of the harness type safety belt according to the embodiment of the present invention should be. For that purpose, the applicant of the present application has measured a relationship between the height and the length of the spine at the time of bending for 10 subjects. Specifically, the length from the base of the neck to the tailbone of each subject has been measured for 10 subjects, whose heights range from 152cm to 182cm, in each of the following states: an upright state; and a state where the subjects are crouched down and bending forward (referred to as a bent state). Table 1 below shows the results of the measurements of the 10 subjects, and the unit used here is a centimeter (cm). As shown in Table 1, as a result, the difference between the length between the upright state and the bent state ranges from a minimum of 4.5 cm to a maximum of 12 cm.

[0017]

[Table 1]

Height	Measurement value in the upright state	Measurement value in the bent state	Difference
152	46	50.5	4.5
155	48	53.5	5.5
161	52	59	7
162	54	61.5	7.5
165	56	65.5	9.5

170	60.5	69	8.5
171	61	70	9
172	61.5	72.5	11
181	67	79	12
182	69	78	9

[0018]

In the event where a user has performed the above body movement, a difference of at least 4.5 cm to 12 cm occurs according to the results shown in Table 1. If this difference occurs, the conventional harness type safety belt is thought to apply pressure to the human body and give a sense of tightness, or the length of the strap that has been adjusted by a length adjuster gets forcibly changed, since the conventional harness type safety belt does not stretch.

[0019]

Next, when performing the same verification for a harness equipped with a stretchable member, the applicant of the present application has investigated whether there is any part that causes discomfort other than the back when wearing the harness. The thigh has turned out to be the part that causes discomfort for many subjects. In the conventional harness type safety belt, the length from the buttock to the thigh is short. Given that, it has been found that a phenomenon of giving a sense of tightness is caused since the thigh strap and the connecting strap do not stretch when the user twists the body to the left and right or when the user moves up and down. Here, the up and down movement includes movement in the

vertical direction with a height difference such as climbing and descending steps and a ladder.

[0020]

In addition, when a person crouches down, the thigh deforms and enlarges due to the weight etc., and the resulting length of the circumference of the thigh (i.e., the resulting length of the closed curve along the circumference of the thigh) becomes longer than the original length of the circumference of the thigh. In fact, when the length of the circumference of the thigh of the subject with the height of 170 cm among the above-mentioned 10 subjects is measured, 52 cm has lengthened to 56 cm. Also, when the length of the circumference of the thigh of the subject with the height of 181cm is measured, 58 cm has lengthened to 64 cm. As a result of such measurement, in the event that the harness type safety belt is tightly attached to the body of a user at the time of standing, it has been found that the thigh strap bites into the thigh when the user crouches down and this causes discomfort to the user. Further, there is a possibility that the thigh strap may also bite into the thigh when the user twists the body to the left and right.

[0021]

Based on the above verification, it has been found that the sense of tightness when wearing the harness may be reduced by introducing a stretchable member to the strap for the back and a stretchable member to each of the straps for the respective thighs, for example.

[0022]

Hereinafter, embodiments of the present invention will be described with referring to

the drawings. In the drawings, the same reference symbols are given to the same parts, and redundant descriptions will be omitted. Further, it should be noted that the drawings may be exaggerated in order to help understanding the present invention, and are not necessarily precisely drawn to scale. It should also be noted that the present invention is not limited to the embodiments shown below.

[0023]

[First embodiment]

[Overall configuration]

The first embodiment will be described with referring to FIG. 1A to FIG. 3B. FIG. 1A is a diagram schematically illustrating an overall configuration of the harness type safety belt 100. FIG. 1A shows one aspect from among embodiments of a full harness referred to as the Y-type harness as it is called. However, embodiments of the present invention are not limited to such a Y-type harness and any types of full harnesses such as other Y-type harnesses, X-type harnesses, and H-type harnesses may be employed.

[0024]

As shown in FIG. 1A, the harness type safety belt 100 includes the shoulder straps 101A and 101B, the thigh straps 102A and 102B, the back strap 103, the connecting straps 104A and 104 B, the D-ring 107, the upper strap holder 108, the lower strap holder 109, and the chest straps 112A and 112B.

[0025]

The shoulder strap 101A is a band-like strap having a predetermined length. One end of the shoulder strap 101A is connected to the thigh strap 102A (described later), and the other end is integrally formed with the back strap 103. The back strap 103 formed integrally with the shoulder strap 101A extends downward from the boundary between the back strap 103 and the shoulder strap 101A and is formed integrally with the connecting strap 104B. Note that the shoulder strap 101A, the back strap 103, and the connecting strap 104B are distinguished from each other by having given mutually different reference symbols in the description of the harness type safety belt 100 for the convenience of description. That is to say, presenting these straps by mutually different reference symbols does not mean to indicate that the straps are individually manufactured and put into one. However, it is also possible to adopt a configuration in which the individual straps are separately manufactured and connected by using respective connection means of any kinds. The total length of the shoulder strap 101A, the back strap 103, and the connecting strap 104B is set for each physical constitution (body type) of the user, for example, by taking the followings into consideration: the length from the top surface of the shoulder to the center of the thigh of the user; the thickness of the shoulder of the user; the length from the lower end of the neck to the center of the buttock of the user; and the length from the center of the buttock to the center of the thigh of the user.

[0026]

The thigh strap 102A is a band-like strap having a predetermined length. The

predetermine length is, for example, a length slightly longer than the length of the circumference of the thigh of the user. As shown in FIG. 1A, a part (for example, an end part) of the connecting strap 104A is fixed at a predetermined position in the thigh strap 102A. This fixation is made, for example, by sewing (stitching) or adhesion. Incidentally, the connecting part 123A in FIG. 1A is an example of such a fixation part. The first buckle 124A and the second buckle 125A are respectively provided at both ends of the thigh strap 102A and are connected to each other so that a holding state is formed between the thigh of the user and the thigh strap 102A that encircles the thigh of the user. The aspect of the first buckle 124A and that of the second buckle 125A are not limited to those shown in FIG. 1A, and other forms can be adopted. Further, an end part of the shoulder strap 101A is connected to and fixed at a position, in the thigh strap 102A, on the connecting part 123A side from the second buckle 125A. As for this fixation as well, sewing or adhesion can be applied, for example. As shown in FIG. 1B to FIG. 1D, the end part of the connecting strap 104A (the connecting strap 104B) may be formed into a loop shape and the thigh strap 102A may be passed through the loop. If this is the case, movable fasteners may be provided on both sides adjacent to the part in which the connecting strap 104A and the thigh strap 102A intersect with each other. With this, the relative position between the connecting strap 104A and the thigh strap 102A may be maintained.

[0027]

The shoulder strap 101B is a band-like strap having a predetermined length. One end

of the shoulder strap 101B is connected to the thigh strap 102B (described later), and the other end is integrally formed with another back strap (not shown). Note that the other back strap (not shown) is located behind the back strap 103 in FIG. 1A (i.e., the back side of the paper sheet of FIG. 1A). The other back strap (not shown) extends downward from the boundary between the other back strap (not shown) and the shoulder strap 101B and is formed integrally with the connecting strap 104A. Note that the reason for distinguishing the shoulder strap 101B and the connecting strap 104A from each other by having given mutually different reference symbols in the description of the harness type safety belt 100 is because of the convenience of description as described above. The total length of the shoulder strap 101B, the other back strap (not shown), and the connecting strap 104A is set in the same manner as described above.

[0028]

As with the thigh strap 102A, the thigh strap 102B is a band-like strap having a predetermined length, and a part (for example, an end part) of the connecting strap 104B is fixed near the center in the longitudinal direction thereof (the connecting part 123B). Further, as in the case with the thigh strap 102A, the first buckle 124A and the second buckle 125A are respectively provided at both ends of the thigh strap 102B.

[0029]

In addition, the shoulder straps 101A and 101B are connected to each other or coupled together with the upper strap holder 108. Further, the shoulder strap 101A and the

back strap 103 integrated therewith, and the shoulder strap 101B and the other back strap (not shown) integrated therewith are connected to each other or coupled together with the lower strap holder 109. Each of the upper strap holder 108 and the lower strap holder 109 is formed with two elongated holes, into which the corresponding strap is inserted, at an interval in the vertical direction. The shoulder straps 101A and 101B (the “first strap” and the “second strap” described later) are respectively passed through the two elongated holes of the upper strap holder 108. Similarly, the back strap 103 and the other back strap (not shown) are respectively passed through the two elongated holes of the lower strap holder 109. The boundary between the back strap and the connecting strap, which are conceptually distinguished from one another in the present embodiment, is determined in accordance with the position of the lower strap holder 109 (for example, the central position of the lower strap holder 109).

[0030]

The harness type safety belt 100 can be said to be composed by including the followings: one of the straps constituting the shoulder strap 101A, the back strap 103, and the connecting strap 104B (hereinafter the one of the straps may be referred to as a “first strap” in some cases); and another one of the straps constituting the shoulder strap 101B, the other back strap (now shown), and the connecting strap 104A (hereinafter the another one of the straps may be referred to as a “second strap” in some cases). The first strap and the second strap are held via the upper strap holder 108 and the lower strap holder 109 at positions corresponding to the upper part and the lower part of the back of the user (for example, the back strap 103).

With this, the relative position between the first strap and the second strap is fixed. Incidentally, as will be described later, the first strap of the harness type safety belt 100 holds the right half of the user's body, and the second strap holds the left half of the user's body.

[0031]

Note that it is preferable to employ a wide width woven fabric formed of flexible fibers for each strap. As for the fibers, polyester fibers and nylon fibers can be used. In addition, each strap has a length adjuster, and the length of each strap can be adjusted by folding back the concerned strap and pushing or pulling the concerned strap. Further, each of the pair of shoulder straps 101A and 101B may be provided with a shoulder pad at a part that is in contact with the shoulder of the user.

[0032]

The harness type safety belt 100 can be provided with the chest straps 112A and 112B, which are coupled together at the chest of the user, in the pair of shoulder straps 101A and 101B that extends downward from the respective shoulders on the front side of the user. It is to be noted that the chest straps 112A and 112B may be connected to each other with the chest strap female buckle 113A and the chest strap male buckle 113B. The D-ring 107 connecting to the lanyard is preferably attached to the upper end of the back strap 103 (for example, attached to an any position between the upper strap holder 108 and the lower strap holder 109). The D-ring 107 in the example shown in FIG. 1 is provided below and adjacent to the upper strap holder 108.

[0033]

In addition, the overall configuration of the harness type safety belt 100 described above can be paraphrased as the followings, as an example of the above configuration.

[0034]

Referring now to FIG. 2 which illustrates a state in which a user is wearing the harness type safety belt 100. As shown in FIG. 2, the harness type safety belt 100 includes the followings: the pair of shoulder straps 101A and 101B that is branched into two and extends upward from the upper strap holder 108 disposed on the back of the user, crosses over the respective shoulders of the user, and extends downward from the respective shoulders on the front side of the user; the pair of thigh straps 102A and 102B that is attached to the respective lower ends of the pair of shoulder straps 101A and 101B; the back strap 103 that extends downward from the upper strap holder 108 through the center of the back of the user; and the pair of connecting straps 104A and 104B that is branched into two via the lower strap holder 109, extends from the lower end of the back strap 103, and is connected to the pair of thigh straps 102A and 102B respectively. In the present embodiment, the “upper back” is a position substantially equal distance from the left and right shoulder blades (scapulae). The “upper back” is the position of the upper strap holder 108 or that of the D-ring 107.

[0035]

One end of the shoulder strap 101A is fixed on the thigh strap 102A, and one end of the shoulder strap 101B is fixed on the thigh strap 102B. The fixations may be made by

sewing, adhesion, or the like. On the other hand, the pair of connecting straps 104A and 104B is connected to each other or intersects with each other in a bifurcated manner and extends via the lower strap holder 109, and is connected to the pair of thigh straps 102 A and 102 B respectively.

[0036]

[Stretchable member]

In the first embodiment, part of the back strap 103 of the harness type safety belt 100 is provided with the stretchable member 130 that is stretchable. Similarly, a stretchable member may be provided for the other back strap (not shown). The stretchable member 130 may be provided for any one or more of the following straps: the pair of shoulder straps 101A and 101B; the pair of thigh straps 102A and 102B; and the pair of connecting straps 104A and 104B. Next, a specific configuration of the stretchable member 130 will be described.

[0037]

FIG. 2 is a rear view illustrating a state in which a user is wearing the harness type safety belt 100 according to the first embodiment of the present invention. The stretchable member 130 includes the bello-like part 131 and the connecting parts 132. The bello-like part 131 has an kinked(corrugated) structure that stretches in the length direction (e.g., the longitudinal direction of the back strap 103). The connecting parts 132 are provided at the respective ends of the bello-like part 131 in the length direction. In other words, the connecting parts 132 are provided so as to sandwich the bello-like part 131. In addition, each

of the connecting parts 132 is connected to the back strap 103. The same applies to the stretchable member provided for the back strap (not shown).

[0038]

FIG. 3 is a schematic side view showing an example of the stretchable member 130 according to the embodiment. FIG. 3A shows a side view of the stretchable member 130 according to the embodiment. As described above, the stretchable member 130 stretches in the length direction. The bello-like part 131 of the stretchable member 130 has a kinked (corrugated) structure. Here, the bello-like part 131 is arranged so as to be sandwiched between the connecting parts 132.

[0039]

Further, the bello-like part 131 is configured as a band-like part having a first layer and a second layer that are woven with a non-stretchable yarn. In the band-like part, a plurality of elastic yarns is inserted in the length direction mentioned above and woven for both the first layer and the second layer. In addition, a first layer woven part, which is closed with a weaving yarn in the width direction at regular (fixed) intervals, is provided on the first layer of the band-like part. Similarly, a second layer woven part, which is closed with a weaving yarn in the width direction at regular (fixed) intervals, is provided on the second layer. With these, when the elastic yarn contracts, the band-like part forms up and downs (mountains and valleys, or peaks and troughs) of the bello-like part. Besides nylon, a yarn with strong tensile force may be selected as a non-stretchable yarn. On the other hand,

synthetic resin or natural rubber that has elasticity may be used as an elastic yarn, in addition to stretch nylon. As for the woven parts, the both ends in the length direction and the both ends in the width direction of the bello-like part 131 may be sewn (stitched). The first layer and the second layer of the band-like part may be sewn in a cylindrical shape.

[0040]

On the other hand, FIG. 3B shows a side view of the stretchable member 130' which is a modification example of the stretchable member 130. A flat elastic strap, such as a rubber strap, can be used as the stretchable member 130' according to the modification example.

[0041]

In the first embodiment, the stretchable member 130 is provided for the back strap 103 of the harness type safety belt 1. However, a stretchable member may be provided only for the pair of connecting straps 104A and 104B instead of the back strap 103. The third embodiment should be referred to for this.

[0042]

[Second embodiment]

The second embodiment will be described with referring to FIG. 4 to FIG. 6B. FIG. 4 is a diagram that schematically shows an overall configuration of the harness type safety belt 200. FIG. 4 shows one aspect of the Y-type harness safety belt. The basic configuration of the harness type safety belt 200 in the second embodiment is the same as the basic configuration of the harness type safety belt 100 in the first embodiment. Therefore, description of the basic

configuration of the harness type safety belt 200 may be omitted. As shown in FIG. 4, the harness type safety belt 200 includes the shoulder straps 201A and 201B, the thigh straps 202A and 202B, the back strap 203, the connecting straps 204A and 204B, the D-ring 207, the upper strap holder 208, the lower strap holder 209, and the chest straps 212A and 212B. The functions and the dispositions of the shoulder straps 201A and 201B, the thigh straps 202A and 202B, the back strap 203, the connecting straps 204A and 204B, the D-ring 207, the upper strap holder 208, the lower strap holder 209, and the chest straps 212A and 212B are the same as the functions and the dispositions of the respective parts in the harness type safety belt 100 as the followings: the shoulder straps 101A and 101B, the thigh straps 102A and 102B, the back strap 103, the connecting straps 104A and 104B, the D-ring 107, the upper strap holder 108, the lower strap holder 109, and the chest straps 112A and 112B.

[0043]

A state of the harness type safety belt 200 being worn by the user will be described with referring to FIG. 5. FIG. 5 is a rear view showing a state in which the user is wearing the harness type safety belt 200 according to the second embodiment. As shown in FIG. 5, the shoulder straps 201A and 201B on the back side of the user are branched into two upward from the upper strap holder 208, extend upward, and cross over the respective shoulders of the user. The back strap 203 extends downward from the upper strap holder 208 through the center of the back of the user. The connecting straps 204A and 204B are branched into two and extend from the lower end of the back strap 203 via the lower strap holder 209 and are

fixed onto the respective thigh straps 202A and 202B.

[0044]

In the second embodiment, the thigh straps 202A and 202B of the harness type safety belt 200 respectively include the stretchable members 220A and 220B that are stretchable. As with the first embodiment, the stretchable member 230 that is stretchable is provided for the back strap 203 of the harness type safety belt 200. Similarly, a stretchable member may be provided for the other back strap (not shown). In addition, the stretchable member may be provided for any one or more of the pair of shoulder straps 201A and 201B and the pair of connecting straps 204A and 204B.

[0045]

As shown in FIG. 6, the stretchable member 220A includes the bello-like part 221A and the connecting parts 222A. The configuration of the bello-like part 221A and the configuration of the connecting parts 222A are basically the same as that of the bello-like part 131 and that of the connecting parts 132 of the first embodiment, respectively. Note that the bello-like part 221A also stretches in the length direction, and the length direction in which the bello-like part 221A stretches corresponds to the longitudinal direction of the thigh strap 202A. The stretchable member 220B is the same as the stretchable member 220A. By providing the stretchable members 220A and 220B that are stretchable in the respective thigh straps 202A and 202B in this manner, it becomes possible to suppress the state in which the thigh straps bite into the thighs to cause discomfort when the user twists the body to the left or

right or when the user crouches down. Note that the stretchable member 230 and the stretchable member provided for the back strap (not shown) are the same as those in the first embodiment, and thus, description thereof will be omitted.

[0046]

FIG. 6 is a side view showing an example of the stretchable members 220A and 220B according to the present invention. FIG. 6A illustrates a side view of the stretchable members 220A and 220B according to the second embodiment; however, the side view thereof will be described here as that of the stretchable member 220. As shown in FIG. 6A, the configuration of the stretchable member 220 is the same as that of the stretchable member 130 of the first embodiment. Therefore, detailed description of the configuration thereof will be omitted.

[0047]

On the other hand, FIG. 6B shows a side view of the stretchable member 220' which is a modification example of the stretchable member 220. A flat elastic strap such as a rubber strap can be used as the stretchable member 220'. Note that the stretchable members 220A and 220B are provided for the respective thigh straps 202A and 202B in the harness type safety belt 200. When such a configuration is employed, it is also possible to adopt a configuration in which no buckles for connection (224A, 225A, 224B and 225B) are provided for the thigh straps 202A and 202B. In other words, it is also possible to form each of the thigh straps 202A and 202B into an endless shape (circular or ring shape). When such a

configuration is employed, the user can expand the outer diameter of the thigh straps 202A and 202B using the elastic stretch of the stretchable members 220A and 220B and easily wear the thigh straps 202A and 202B on the left and right thighs respectively.

[0048]

[Third embodiment]

The third embodiment will be described in detail with referring to FIG. 7 to FIG.13B. It is to be noted that the third embodiment is an example that corresponds to the fact that the contraction of the straps of the harness is required for the parts from the buttocks to the thighs when the human shifts from a bent state to a crouched down state as shown in FIG. 18C (described later).

[0049]

FIG. 7 is a diagram schematically showing an overall configuration of the harness type safety belt 300. FIG. 7 shows one aspect of the Y-type harness safety belt. The basic configuration of the harness type safety belt 300 in the third embodiment is the same as the basic configuration of the harness type safety belt 100 in the first embodiment. Therefore, description of the basic configuration of the harness type safety belt 300 may be omitted. As shown in FIG. 7, the harness type safety belt 300 includes the shoulder straps 301A and 301B, the thigh straps 302A and 302B, the back strap 303, the connecting straps 304A and 304B, the D-ring 307, the upper strap holder 308, the lower strap holder 309, and the chest straps 312A and 312B. The functions and the dispositions of the shoulder straps 301A and 301B, the thigh

straps 302A and 302B, the back strap 303, the connecting straps 304A and 304B, the D-ring 307, the upper strap holder 308, the lower strap holder 309, and the chest straps 312A and 312B are the same as the functions and the dispositions of the respective parts in the harness type safety belt 100 as the followings: the shoulder straps 101A and 101B, the thigh straps 102A and 102B, the back strap 103, the connecting straps 104A and 104B, the D-ring 107, the upper strap holder 108, the lower strap holder 109, and the chest straps 112A and 112B.

[0050]

A state of the harness type safety belt 300 being worn by the user will be described with referring to FIG. 8. FIG. 8 is a rear view showing a state in which the user is wearing the harness type safety belt 300 according to the third embodiment. As shown in FIG. 8, the shoulder straps 301A and 301B on the back side of the user are branched into two upward from the upper strap holder 308 and extend crossing over the respective shoulders of the user. The back strap 303 extends downward from the upper strap holder 308 through the center of the back of the user. The connecting straps 304A and 304B are branched into two and extend from the lower end of the back strap 303 via the lower strap holder 309 and are fixed onto the respective thigh straps 302A and 302B.

[0051]

In the third embodiment, the stretchable members 340A and 340B that are stretchable are provided for the respective connecting straps 304A and 304B of the harness type safety belt 300.

[0052]

In addition, the thigh straps 302A and 302B in the harness type safety belt 300 may respectively be provided with the stretchable members 320A and 320B that are stretchable. Further, similarly to the second embodiment, each of the back strap 303 and a back strap (not shown) of the harness type safety belt 300 in the third embodiment may be provided with a stretchable member that is stretchable. In addition, the stretchable members in another example may be provided for the pair of shoulder straps 301A and 301B.

[0053]

The stretchable member 320A includes the bello-like part 321A and the connecting parts 322A. The bello-like part 321A and the connecting parts 322A have basically the same configuration as the bello-like part 221A and the connecting parts 222A of the second embodiment. The stretchable member 320B is similar to the stretchable member 320A. By providing the stretchable members 320A and 320B that are stretchable in the respective thigh straps 302A and 302B in this manner, it is possible to suppress the state in which the thigh straps bite into the thighs to cause discomfort when the user twists the body to the left or right or when the user crouches down.

[0054]

As shown in FIG. 9A, the stretchable members 340A and 340B that are stretchable are provided for the connecting straps 304A and 304B in the harness type safety belt 300. The stretchable member 340A includes the bello-like part 341A and the connecting parts 342A.

The bello-like part 341A and the connecting parts 342A have basically the same configuration as the bello-like part 131 and the connecting parts 132 of the first embodiment. As with the bello-like part 131 of the first embodiment, the bello-like part 341A also stretches in the length direction. However, the length direction in which the bello-like part 341A stretches corresponds to the longitudinal direction of the connecting strap 304A. The stretchable member 340B is similar to the stretchable member 340A. By providing the stretchable members 340A and 340B that are stretchable in the pair of connecting straps 304A and 304B in this manner, it is possible to resolve the phenomenon in which the straps give a sense of tightness by being stretched from the thighs to the buttocks and bite into the thighs when the user crouches down.

[0055]

On the other hand, FIG. 9B shows a side view of the stretchable member 340' which is a modification example of the stretchable member 340. A flat elastic strap such as a rubber strap can be used as the stretchable member 340'. Note that the stretchable members 320A and 320B are provided for the respective thigh straps 302A and 302B in the harness type safety belt 300. When such a configuration is employed, it is also possible to adopt a configuration in which no buckles for connection (324A, 325A, 324B and 325B) are provided for the thigh straps 302A and 302B. In other words, it is also possible to form the respective thigh straps 302A and 302B into an endless shape (circular or ring shape). When such a configuration is employed, the user can expand the outer diameter of the thigh straps 302A

and 302B owing to the elastic stretch of the stretchable members 320A and 320B and easily wear the thigh straps 302A and 302B on the left and right thighs respectively.

[0056]

Moving onto considering the stretchable member 340 to be disposed in the connecting straps 304A and 304B. By providing the stretchable members 340 for the respective places of the connecting straps 304A and 304B where it is likely to stretch, rather than forming the whole of the connecting straps 304A and 304B to be the stretchable member 340, the safety of the harness type safety belt improves in the regions where stretching is unnecessary. In addition, it is considered that the sense of tightness given at the time of wearing the harness can be reduced in places where stretching is necessary. However, since it is unclear which part is likely to stretch, the applicant of the present invention has carried out a demonstration experiment on a subject whose height is 173 cm and the length from the base of the neck to the tailbone is 75 cm. The results of this demonstration experiment are shown in Fig. 10. For this subject, the base of the neck is near the position of the upper end part of the back strap 303 (that is, near the position of the upper strap holder 308) of the harness type safety belt, and the tailbone is near the positions of the respective lower end parts of the connecting straps 304A and 304B (that is, near the positions of the respective connecting parts between the pair of connecting straps 304A and the 304B and the pair of the thigh straps 302A and 302B). In the case where the back strap 303 and the connecting strap 304A are a single strap, the connecting part corresponds to, for example, the middle position of the lower

strap holder 309 or a position near and above the lower strap holder 309 (that is, on the upper strap holder 308 side).

[0057]

As shown in FIG. 10, the length from the base of the neck to the tailbone of the concerned subject has stretched by 10 cm, becoming 85 cm, when the subject has bent forward. On the other hand, stretching has not occurred in the region from the base of the neck down to 35 cm (the first region). In other words, when the position of the upper strap holder 308 in the back strap 303 is taken as an upper end, and when the positions of the connecting parts between the pair of connecting straps 304A and 304B and the pair of thigh straps 302A and 302B are taken as a lower end, the region within $40/75 \div 53\%$ from the lower end has stretched by 10 cm.

[0058]

From the result shown in FIG. 10, when the middle position of the upper strap holder 308 in the back strap 303 is taken as an “upper end” and the above connecting part (for example, the middle position of the lower strap holder 309) is taken as a “lower end”, it is preferable to provide a stretchable member in a region where the ratio of the distance from the lower end with respect to the distance from the lower end to the upper end is equal to or less than 53 %. The distance from the lower end of the stretchable member is the distance from the lower end to the middle position in the longitudinal direction of the stretchable member, or the distance from the lower end to a position on the lower end side in the stretchable member.

[0059]

Regarding the stretch of 10 cm, as shown in FIG. 10, the stretch of 4 cm has been detected in the region 20 cm from the tailbone (the third region), whereas the stretch of 6 cm has been detected in the region 20 cm to 40 cm from the tailbone (the second region). That is, a larger stretch has been detected in the region of $20/75 \doteq 27\%$ or more from the lower ends of the pair of connecting straps 304A and 304B.

[0060]

From this result, when the position of the upper strap holder 308 in the back strap is taken as an upper end, and when the connecting parts between the pair of connecting straps 304A and 304B and the pair of thigh straps 302A and 302B (for example, the middle position of the lower strap holder 309, or the position near and above the lower strap holder 309) are taken as a lower end, it is considered as preferable to provide the stretchable member 340 in a region where the ratio of the distance from the lower end with respect to the distance from the lower end to the upper end ranges between 27 % and 53 %.

[0061]

As already shown in Table 1, it has been confirmed that the pair of connecting straps 304A and 304B is required to be stretched to the extent of $4.5/46 \doteq 10\%$ at the minimum. The numerical value “4.5” is a numerical value indicating a “difference” of the measurement result of the subject with the height of 152 cm in Table 1, and “46” is a measurement value indicating the length from the base of the neck to the tailbone in the upright state. In addition,

it has been confirmed that the pair of connecting straps 304A and 304B is required to be stretched to the extent of $12/67 \approx 18\%$ at the maximum (see the measurement result of the subject with the height of 181 cm). That is, it is considered as preferable that the stretchable members provided for the pair of connecting straps 304A and 304B are configured to be capable of stretching each of the connecting straps 304A and 304B by 10 % to 18 % in the direction in which the corresponding connecting strap extends.

[0062]

It is considered as preferable that the stretchable member 340 includes a material (an elastic member) that elastically deforms in such a way that the stretchable member is being contracted in a state where the user is standing, and that the stretchable member is being stretched in a state where the user is bending. However, if the elastic member is easy to stretch (i.e., loose), there is a risk of hindering the safety of the harness. On the contrary, if the elastic member is difficult to stretch, it may be impossible to suppress the sense of tightness during wearing the harness. Therefore, the applicant of the present invention has conducted a demonstration experiment in order to investigate the optimal elastic member for the stretchable member 340. First of all, various types of elastic members have been applied to the connecting straps and a questionnaire has been given to ten subjects. Then, an elastic member that is not loose, and at the same time, does not give the sense of tightness is selected. Subsequently, the relationship between the stretchability and strength (force) of the selected elastic member and the harness fabric has been measured by performing a tensile test under

the following conditions. The results are shown in FIG. 11 and FIG. 12.

<Test conditions>

Test machine: Autograph (model AG-IS 50-KN, manufactured by Shimadzu Corporation)

Temperature 10 degrees and Humidity 20 %

Measurement object: 1. Elastic member (length: 60 mm)

2. Harness fabric (length: 60 mm)

[0063]

As shown in FIG. 11, the above elastic member has a static load of 5 N to 25 N required for stretching by 45 mm (the minimum value of difference in Table 1) and has a static load of 30 N to 50 N required for stretching by 120 mm (the maximum value of difference in Table 1). In detail, the above elastic member satisfies the relationship of the following formula (1), having the static load F (N) required for stretching the length ΔL (mm) in the range of 45 mm to 120 mm.

[Formula 1]

$$\Delta L/3 - 10 \leq F \leq \Delta L/3 + 10 \dots\dots \text{Formula (1)}$$

[0064]

On the other hand, as shown in FIG. 12, a static load required for stretching the harness fabric by 80 mm is about 55 kN, and therefore it has become clear that the harness fabric hardly stretches in comparison to the aforementioned elastic member. That is to say, it has been found that there is no need to take the stretchability of the harness fabric into

account in the evaluation of the stretchable member.

[0065]

From the result of the tensile test on the elastic member that is not loose and hard to give the sense of tightness selected based on the results of the questionnaire (see FIG. 11), and from the result of the tensile test on the harness fabric (see FIG. 12), it has been found that if the stretchable member 340 of the connecting strap is as the following, then it satisfies the condition that it is not loose and does not give the sense of tightness. That is, the stretchable member 340 has a static load of 5 N to 25 N required for stretching by 45 mm and has a static load of 30 N to 50 N required for stretching by 120 mm. In the case where the stretchable member 340 having such static loads is employed, the sense of tightness can be reduced even when the harness type safety belt 300 is worn in close contact with the body, so that the situation where the harness type safety belt 300 is worn loosely can be suppressed. As a result of this, the safety of the harness type safety belt improves. In other words, the static load F (N) of the stretchable member 340 required for stretching the length ΔL (mm) within the range of 45 mm to 120 mm satisfies the relationship of the above formula (1). Furthermore, since the harness fabric hardly stretches in comparison to the elastic member, it has been found that the maximum stretch length of the stretchable member can be regulated by weaving an elastic member in the harness fabric, for example.

[0066]

Next, the stretchable members 320A and 320B disposed in the thigh straps 302A and

302B will be considered. As already mentioned, the measured values of the length of the circumference of the thigh of the subject with the height of 170 cm has lengthened from 52 cm to 56 cm, and the measured values of the length of the circumference of the thigh of the subject with the height of 181 cm has lengthened from 58 cm to 64 cm. In addition, a larger stretching has been found on the back side (buttock) than the front side of the user in any of the subjects. From this fact, it has been considered as preferable that the stretchable members 320A and 320B in the thigh straps 302A and 302B are provided on the buttock side of the user.

[0067]

Let us move on to consider the characteristics or features required for an elastic member in the case where an elastically deformable elastic member is used as the stretchable member of the harness type safety belt 300. Based on the above-described formula (1), it is considered as preferable that such an elastic member has the length of 60 mm and stretches about 80 mm when the load of 17 N has been applied. On the other hand, a restoring force with little shape change, even when repeatedly stretched, is required for an elastic member of the harness type safety belt 300. It is considered that the restoring force is influenced not only by the physical properties such as the Young's modulus of the elastic member but also by the shape and the like. Therefore, a demonstration experiment has been carried out on elastic members of various kinds and shapes.

[0068]

First, five types of rubbers A to E have been selected and processed into the following shapes respectively. Then, a load of 17 N has been applied to each rubber, and the stretched length of the rubber has been measured. The measurement has been carried out ten times for each rubber, and the average value thereof has been calculated. The results are shown in Table 2.

<Shapes of rubber>

Flat type: thickness 0.5 mm × width 12 mm, length 60 mm

String shape: outer diameter 2.5 mm, length 60 mm

Line shape: outer diameter 0.5 mm, length 60 mm

[0069]

[Table 2]

	Flat type	String shape	Five line shape	Seven line shape
A	140	63	110	65
B	151	65	118	70
C	173	69	135	80
D	249	84	195	115
E	310	94	243	143

[0070]

Based on the above-described formula (1), it is considered as preferable that an elastic member has the length of 60 mm and stretches about 80 mm when a load of 17 N has been applied. Therefore, regardless of the material, it has been considered that the string shape

or the seven line shape is preferable as the shape of the elastic member.

[0071]

Subsequently, the restoring force of the string shape and the seven line shape has been investigated. The rubber of type C has been selected, each of a string shape member and a seven line shape member has been cut into 400 mm, the act of extending and contracting the members has been repeated 10000 times, and the lengths of the elastic members, on which no load has been applied, has been measured every 2000 times. The results of such measurement are shown in Table 3.

[0072]

[Table 3]

	String shape	Seven line shape
1~2000	400.00	400.00
2001~4000	400.25	400.01
4001~6000	401.02	400.00
6001~8000	402.83	400.02
8001~10000	405.02	400.05

[0073]

From the results shown in Table 3, it has been found as preferable that the elastic member is composed of a plurality of line shape members, in particular, that the elastic member is composed of seven members of the line shape each having an outer diameter of 0.5 mm. That is, it has been considered as preferable that the elastic member is constituted by

seven members of the line shape each having an outer diameter of 0.5 mm. With such a configuration, it is considered that a stretchable member having a high restoring force can be obtained.

[0074]

When the position of the upper strap holder 308 in the back strap 303 is taken as an upper end, and when the positions of the connecting parts between the pair of connecting straps 304A and 304B and the pair of thigh straps 302A and 302B are taken as a lower end, the stretchable member 340 of the harness type safety belt 300 configured as described above is arranged in a region where the ratio of the distance from the lower end with respect to the distance from the lower end to the upper end is equal to or less than 53 %. By providing the stretchable member 340 within such a region, the safety of the harness type safety belt 300 improves in regions where stretching is unnecessary, and the sense of tightness at the time of wearing the harness can be reduced at places where stretching of the pair of connecting straps 304A and 304B is necessary.

[0075]

Further, when the position of the upper strap holder 308 in the back strap 303 is taken as an upper end and the positions of the connecting parts between the pair of connecting straps 304A and 304B and the pair of thigh straps 302A and 302B are taken as a lower end, the stretchable member 340 is provided within a region where the ratio of the distance from the lower end with respect to the distance from the lower end to the upper end ranges between

27 % and 53 %. By providing the stretchable member 340 in this region, it is possible to further reduce the sense of tightness at the time of wearing the harness at places where stretching of the pair of connecting straps 304A and 304B is necessary. This configuration also contributes to secure the degree of adhesion to the body in regions where stretching is unnecessary, and further improves the safety of the harness type safety belt 300.

[0076]

The stretchable members 340 provided for the pair of connecting straps 304A and 304B are configured to be capable of stretching the connecting straps 304A and 304B by 10 % to 18 % in the extending direction of the connecting straps 304A and 304B respectively. Stretching of the stretchable member 340 within this range can enhance the safety of the harness type safety belt 300 and reduce the sense of tightness at the time of wearing the harness.

[0077]

The stretchable members 340 provided for the connecting straps 304A and 304B have a static load of 5 N to 25 N required for stretching by 45 mm and a static load of 30 N to 50 N required for stretching by 120 mm. When the force required to stretch the stretchable member by 45 mm is within the above corresponding range and the force required to stretch the stretchable member by 120 mm is within the above corresponding range, the sense of tightness can be reduced even when the harness type safety belt is worn in close contact with the body. Therefore, the situation in which the harness type safety belt is worn loosely can be

suppressed. As a result, both the improvement of the safety of the harness type safety belt 500 and the reduction of the sense of tightness at the time of wearing the harness, which could not be compatible with each other in the past, can be achieved.

[0078]

In addition, as for the stretchable members 340 provided for the connecting straps 304A and 304B, the static load F (N) required for stretching the length ΔL (mm) within the range of 45 mm to 120 mm satisfies the relationship of the above formula (1). By having the force required to stretch the stretchable member 340 by 45 mm to 120 mm in the range of the above formula (1), the sense of tightness can be reduced even when the harness type safety belt is worn in close contact with the body. This can suppress the situation in which the harness type safety belt is worn loosely. As a result, both the improvement of the safety of the harness type safety belt 500 and the reduction of the sense of tightness at the time of wearing the harness, which could not be compatible with each other in the past, can be achieved.

[0079]

Further, the stretchable members 320A and 320B respectively provided for the thigh straps 302A and 302B are disposed on the buttock side of the user. By providing the stretchable members 320A and 320B on the buttock side of the user, it becomes possible to further reduce the sense of tightness at the time of wearing the harness at places where the stretching of the thigh straps 302A and 302B is necessary. This also contributes to secure the degree of adhesion to the body in regions where stretching is unnecessary, and further

improves the safety of the harness type safety belt 300.

[0080]

In addition, the stretchable member 340 includes an elastically deformable elastic member, and the elastic member is composed of a plurality of line shape members. The elastic member is composed of seven members of the line shape each having an outer diameter of 0.5 mm. With this, the stretchable member 340 that has appropriate elasticity and restoring force for the harness type safety belt 300 can be obtained.

[0081]

A modification example of the harness type safety belt according to the third embodiment will be described with referring to FIG. 13A and FIG. 13B. The harness type safety belt 500 according to the modification example of the third embodiment is different from the harness type safety belt 300 according to the third embodiment in that a stretchable member is disposed in a back strap, rather than in a pair of connecting straps. The rest of the configuration of the harness type safety belt 500 is the same as that of the harness type safety belt 300.

[0082]

The harness type safety belt 500 includes the shoulder straps 501A and 501B, the thigh straps 502A and 502B, the back strap 503, the connecting straps 504A and 504B, the D-ring 507, the upper strap holder 508, the lower strap holder 509, and the chest straps 512A and 512B. The functions and the dispositions of the shoulder straps 501A and 501B, the thigh

straps 502A and 502B, the back strap 503, the connecting straps 504A and 504B, the D-ring 507, the upper strap holder 508, the lower strap holder 509, and the chest straps 512A and 512B are the same as the respective parts in the harness type safety belt 100 as the followings: the shoulder straps 101A and 101B, the thigh straps 102A and 102B, the back strap 103, the connecting straps 104A and 104B, the D-ring 107, the upper strap holder 108, the lower strap holder 109, and the chest straps 112A and 112B. Therefore, their description will be omitted. The stretchable members 520A, 520B, and 530 that are stretchable are respectively provided for the pair of thigh straps 502A and 502B and the back strap 503. Note that a stretchable member may be provided for each of the pair of shoulder straps 501A and 501B.

[0083]

The stretchable members 520A, 520B and 530 are, for example, elastic straps. The configurations of the stretchable members 520A, 520B and 530 are the same as what have been described thus far. Also, the arrangement positions of the stretchable members 520A, 520B and 530 in the respective straps are the same as what have been described thus far. Therefore, detailed description of their configurations will be omitted.

[0084]

When the position of the upper strap holder 508 in the back strap 503 is taken as an upper end and the positions of the connecting parts between the pair of connecting straps 504A and 504B and the pair of thigh straps 502A and 502B is taken as a lower end, the stretchable member 530 of the harness type safety belt 500 is provided in a region where the

ratio of the distance from the lower end with respect to the distance from the lower end to the upper end is equal to or less than 53 %. By providing the stretchable member 530 in this region, the safety of the harness type safety belt 500 can be improved in regions where stretching is unnecessary, and the sense of tightness at the time of wearing the harness can be reduced at places where stretching of the back strap 503 is necessary.

[0085]

In addition, the stretchable member 530 provided for the back strap 503 is configured to be capable of stretching the back strap 503 by 10 % to 18 % in the extending direction of the back strap 503. By having the stretchable member 530 stretching within this range, the safety of the harness type safety belt 500 can be enhanced, and the sense of tightness at the time of wearing the harness can be reduced.

[0086]

[Fourth embodiment]

The fourth embodiment will be described with referring to FIG. 14 to FIG. 16C. FIG. 14 schematically shows an overall configuration of the harness type safety belt 400. As shown in FIG. 14, the harness type safety belt 400 according to the fourth embodiment includes the shoulder straps 401A and 401B, the thigh straps 402A and 402B, the back strap 403, the connecting straps 404A and 404B, the D-ring 407, the upper strap holder 408, the lower strap holder 409, and the chest straps 412A and 412B. The functions and the dispositions of the shoulder straps 401A and 401B, the thigh straps 402A and 402B, the back strap 403, the

connecting straps 404A and 404B, the D-ring 407, the upper strap holder 408, the lower strap holder 409, and the chest straps 412A and 412B are the same as the respective parts in the harness type safety belt 100 as the followings: the shoulder straps 101A and 101B, the thigh straps 102A and 102B, the back strap 103, the connecting straps 104A and 104B, the D-ring 107, the upper strap holder 108, the lower strap holder 109, and the chest straps 112A and 112B. Therefore, their description will be omitted.

[0087]

Let us refer to FIG. 15. FIG. 15 is a rear view illustrating a state in which a user is wearing the harness type safety belt 400 according to the fourth embodiment. As shown in FIG. 15, the shoulder straps 401A and 401B on the back side of the user are branched into two upward from the upper strap holder 408 and extend crossing over the respective shoulders of the user. The back strap 403 extends downward from the upper strap holder 408 through the center of the back of the user. The connecting straps 404A and 404B are branched into two and extend from the lower end of the back strap 403 via the lower strap holder 409 and are fixed onto the respective thigh straps 402A and 402B.

[0088]

In the fourth embodiment, the harness type safety belt 400 includes the followings: the stretchable members 420A and 420B that are stretchable respectively provided in the pair of thigh straps 402A and 402B; the stretchable member 430 that is stretchable provided in the back strap 403; a stretchable member that is not shown in a back strap that is not shown; and

the stretchable members 440A and 440B that are stretchable respectively provided in the connecting straps 404A and 404B.

[0089]

Referring now to FIG. 16. FIG. 16A is a side view showing an example of the stretchable members 420A and 420 B according to the present invention, FIG.16B is a side view showing an example of the stretchable member 430, and FIG. 16C is a side view showing an example of the stretchable members 440A and 440B. As shown in FIG. 16A, the stretchable member 420A includes the bello-like part 421A and the connecting parts 422A. The configuration of the bello-like part 421A is basically the same as that of the bello-like part 221A of the second embodiment, and the configurations of the connecting parts 422A are basically the same as those of the connecting parts 222A of the second embodiment. The stretchable member 420B is similar to the stretchable member 420A. By providing the stretchable members 420A and 420B that are stretchable in the respective thigh straps 402A and 402B in this manner, it is possible to suppress the state in which the thigh straps bite into the thighs to cause discomfort when the user twists the body to the left or right or when the user crouches down.

[0090]

Referring to FIG. 16B, the stretchable member 430 includes the bello-like part 431 and the connecting parts 432. The bello-like part 431 has an kinked(corrugated) structure that stretches in a length direction. The kinked(corrugated) structure is arranged in the middle of

the stretchable member 430. The connecting parts 432 are connected to respective ends of the bello-like part 431 and are connected to the back strap 403.

[0091]

Referring to FIG. 16C, the stretchable members 440A (440B) include the bello-like part 441A (441B) and the connecting parts 442A (442B). The bello-like part 441A (441B) has an kinked(corrugated) structure that stretches in a length direction. The kinked(corrugated) structure is arranged in the middle of the stretchable member 440A (440B). The connecting parts 442A (442B) are connected to the respective ends of the bello-like part 441A (441B) and are connected to the back strap 403. By providing the stretchable members 440A and 440B that are stretchable in the connecting straps 404A and 404B in this manner, it is possible to resolve the phenomenon in which the straps of the harness give a sense of tightness and the phenomenon in which the straps bite into the thighs when the user crouches down.

[0092]

As described above, the configurations and dispositions of the stretchable members 420A, 420B, 430, 440A, and 440B are respectively the same as the configurations and dispositions of the stretchable members 220A, 220B, 130, 340A, and 340B described above. Therefore, concrete description of them will be omitted.

[0093]

When the position of the upper strap holder 408 in the back strap 403 is taken as an upper end and the positions of the connecting parts between the pair of connecting straps

404A and 404B and the pair of thigh straps 402A and 402B are taken as a lower end, the stretchable member 430 of the harness type safety belt 400 is arranged in a region where the ratio of the distance from the lower end with respect to the distance from the lower end to the upper end is equal to or less than 53 %. By providing the stretchable member 430 in this region, the safety of the harness type safety belt 400 can be improved in regions where stretching is unnecessary, and the sense of tightness at the time of wearing the harness can be reduced at places where stretching of the back strap 403 is necessary.

[0094]

In addition, the stretchable member 430 provided for the back strap 403 is configured to be capable of stretching the back strap 403 by 10 % to 18 % in the extending direction of the back strap 503. By having the stretchable member 430 stretching within this range, the safety of the harness type safety belt 400 improves, and the sense of tightness at the time of wearing the harness can be reduced.

[0095]

[Effects]

To describe effects of the present embodiments, description will be made with referring to FIGS. 17A and 17B, and FIGS. 18A to 18C, as a premise, on the tendency of the conventional harness type safety belt. FIGS. 17A and 17B are drawings showing how the back strap and the thigh straps slide upward due to the body movement of the user wearing a conventional harness. FIG. 17A shows a state in which the user O is wearing a conventional

harness and standing with the spine straightened. The user O is wearing the conventional harness with the shoulder strap 1, the back strap 3, and the thigh strap 2 fastened tightly. FIG. 17B shows a state in which the user O is working in a forward bending posture. If the user adjusts the length of each strap long and loosens it, the back strap is pulled up and the thigh strap, connected to the back strap, slides upward to the upper portion of the thigh when the user is in the forward bending posture. This brings upon a problem of hindering the comfort in the work activity.

[0096]

If this is the case, since each strap is fastened tightly to the body, the back strap 3 shifts in the direction of the arrow, that is, the back strap 3 rises upward when the user bends forward. Then, the thigh strap 2 connected to the back strap 3 is also pulled up in the direction of the arrow. This results in a state in which either the thigh strap 2 bites into the thigh of the user O, or the shoulder strap 1 bites into the shoulder of the user O.

[0097]

FIG. 18A shows an upright state, FIG. 18B shows a bent state, and FIG. 18C shows a crouched down state. As shown in FIG. 18B, when a human bends forward, the back becomes rounded. That is, the part B illustrated with a thick line stretches. Further, as shown in FIG. 18C, when a human has crouched down, the part from the buttock to the thigh becomes rounded, so that the part H illustrated with a thick line stretches. In this way, with regard to the degree of bending, it can be found that the contraction of the straps of the harness is

necessary for the part from the buttock to the thigh, when the posture of the user is changed from a bending state to a crouched down state.

[0098]

As shown above, the sliding up of the back strap and the thigh strap occurs due to a regular or irregular body movement. If the length of the strap is adjusted to tighten the strap, the force that is generated by body movement and makes the back strap sliding upward can be suppressed with the thigh straps worn at the thighs; however, on the contrary, the freedom of body movement is restricted and the comfort in wearing the harness is markedly deteriorated.

[0099]

To deal with such a problem, in the above embodiments, a stretchable member(s) that is/are stretchable is/are provided for any of the shoulder strap, the thigh strap, the connecting strap, and the back strap, or stretchable members are provided for any combination thereof respectively. According to such a configuration, the burden at the time of work activity is lessened by reducing the sense of tightness given at the time of wearing the harness to achieve proper attachment of the harness to the body (to make the user properly wear the harness). Therefore, it is possible to prompt the improvement of the degree of adhesion to the body at the time of wearing the harness, which in turn leads to a decrease in falling accident.

[0100]

In the conventional harness type safety belt, there has also been a risk that the user

avoids wearing of a harness type safety belt, disliking the tightness at the time of wearing it. In fact, there have also been situations in which safety belts of non-full harness type have been worn or safety belts themselves have not been worn at all. To take care of such risks, the sense of tightness given when the harness is worn is reduced in the harness type safety belt of the present embodiment. Therefore, it is possible to prompt wearing of the full harness and to improve the wearing ratio of the full harness.

[0101]

Further, the harness type safety belt can also play the role of a suspender of a workwear worn in the lower body. In the configuration in which a stretchable member is provided for any one or both of the thigh strap and the connecting strap, the above effects can be achieved without impairing the function of the suspender.

[0102]

In addition, the adequate length of the stretchable member determined through the demonstration experiment makes it possible to maximize the functionality of the harness and to secure the safety of the harness. Therefore, the harness type safety belt according to the above embodiments is made easy to move and has an effect of significantly reducing the risk of being caught by other structures etc.

[0103]

[Modification examples]

As described at the beginning of the first embodiment, the first to the fourth

embodiments, and the modification examples and the additional embodiments described in the respective embodiments are exemplary aspects from among various aspects of full harnesses referred to as Y-type harnesses. The first to the fourth embodiments, and the modification examples and the additional embodiments described therein are not limitations, and various kinds of full harnesses such as other Y-type harnesses, X-type harnesses, and H-type harnesses can be employed in the present invention. Hereinafter, the outlines of basic configurations of various kinds of full harnesses such as other Y-type harnesses, X-type harnesses, and H-type harnesses will be described.

[0104]

[Modification example of Y-type]

FIG. 19 is a rear view showing a state in which the user is wearing a harness according to a modification example of the Y-type. As shown in FIG. 19, the harness type safety belt 300Y includes the shoulder straps 301AY and 301BY, the thigh straps 302AY and 302BY, the back strap 303Y, the connecting straps 304AY and 304BY, the D-ring 307Y, the upper strap holder 308Y, the lower strap holder 309Y, and the chest straps 312AY and 312BY. In the harness type safety belt 300Y, a significant difference from the above embodiments is that the shoulder straps 301AY and 301BY are not integrated with the back strap 303Y but separated from the back strap 303Y, and that the shoulder straps 301AY and 301BY are connected to the back strap 303Y via the upper strap holder 308Y. Further difference is that the back strap 303Y is not integrated with the connecting straps 304AY and

304BY but separated from the connecting straps 304AY and 304BY, and that the back strap 303Y is connected to the connecting straps 304AY and 304BY via the lower strap holder 309Y.

[0105]

Each of the upper strap holder 308Y and the lower strap holder 309Y is formed with two elongated holes, into which the corresponding strap is inserted, at an interval in the vertical direction. The shoulder straps 301AY and 301BY are passed through the upper elongated hole of the upper strap holder 308Y and intersected with each other. In the example of FIG. 19, the shoulder straps 301AY and 301BY are shown to branch into two, one toward the right shoulder side and the other toward the left shoulder side of the user, via the upper elongated hole of the upper strap holder 308Y. Further, in the example of this drawing, the shoulder straps 301AY and 301BY are a single strap. In addition, the folded back part of the shoulder straps 301AY and 301BY at the upper elongated hole of the upper strap holder 308Y is sewn, and the position thereof is fixed with respect to the entire strap as well as with respect to the back strap 303Y. One end of the back strap 303Y is folded back through the lower elongated hole of the upper strap holder 308Y and is sewn at a position slightly on the side of the lower strap holder 309Y.

[0106]

Further, the back strap 303Y is passed through the upper elongated hole of the lower strap holder 309Y. The other end of the back strap 303Y is folded back through the upper

elongated hole of the lower strap holder 309Y and is passed through a strap adjuster provided at a position on the side of the upper strap holder 308Y. The respective upper ends of the connecting straps 304AY and 304BY are passed through the lower elongated hole of the lower strap holder 309Y.

[0107]

In the present modification example of the Y-type, the stretchable members 340AY and 340BY that are stretchable are provided for the respective connecting straps 304AY and 304BY of the harness type safety belt 300Y. Further, in the harness type safety belt 300Y, the stretchable members 320AY and 320BY that are stretchable are provided for the respective thigh straps 302AY and 302BY. The configurations, placement positions, etc. of these stretchable members are the same as those of the third embodiment. Therefore, it is possible to apply any of the additional embodiments and any of the modification examples of the third embodiment, to the modification example of the Y-type.

[0108]

[Modification example of X-type]

FIG. 20A is a schematic front view showing a harness according to a modification example of the X-type. As shown in FIG. 20A, the harness type safety belt 300X includes the shoulder straps 301AX and 301BX, the thigh straps 302AX and 302BX, the back straps 3031X and 3032X, the connecting straps 304AX and 304BX, a D-ring (not shown), the upper strap holder 308X, the lower strap holder 3091X and 3092X, and the chest straps 312AX and

312BX. In common with the first to the fourth embodiments, the shoulder strap 301AX of the harness type safety belt 300X is a single strap which is formed integrally with the back strap 3031X and the connecting strap 304 BX. Likewise, the shoulder strap 301BX of the harness type safety belt 300X is another single strap which is formed integrally with the back strap 3021X and the connecting strap 304AX.

[0109]

As for differences, while the back straps in the first to the fourth embodiments described above overlap with each other in the anteroposterior direction of the user, the back straps 3031X and 3032X in the modification example of the X-type branches to the left and to the right (defined using the left and right direction of the user as the standard) via the upper strap holder 308X. Further, a connecting strap is provided to connect between the back straps of both sides in the way of bridging. The connecting strap is provided at a position that is slightly below the upper strap holder 308X (defined using the head-to-foot direction of the user as the standard) and that corresponds to substantially the back side of the chest of the user.

[0110]

Further, the relative position of the shoulder strap 301AX and the back strap 3031X is held by the lower strap holder 3091X. Unlike the first to the fourth embodiments, the lower strap holder 3091X is arranged at a point corresponding to a position on the right side of the waist of the user, or at a point corresponding to a position adjacent to above or below the right

side of the waist of the user. Similarly, the relative position of the shoulder strap 301BX and the back strap 3032X is held by the lower strap holder 3092X. The lower strap holder 3092X is arranged at a point corresponding to a position on the left side of the waist of the user, or at a point corresponding to a position adjacent to above or below the left side of the waist of the user.

[0111]

In the present modification example of the X-type, the stretchable members 340AX and 340BX that are stretchable are provided for the respective connecting straps 304AX and 304BX of the harness type safety belt 300X. Further, in the harness type safety belt 300X, the stretchable members 320AX and 320BX that are stretchable are provided for the respective thigh straps 302AX and 302BX. The configurations, placement positions, etc. of these stretchable members are the same as those of the third embodiment. Therefore, it is possible to apply any of the additional embodiments and any of the modification examples of the third embodiment, to the modification example of the X-type. Incidentally, the modification example of the X-type includes an aspect in which the thigh straps are inclined upward toward the respective lateral sides thereof (the positions corresponding to the sides of the ilium bones of the user) as shown in FIG. 20B.

[0112]

[Modification example of H-type]

FIG. 21 is a schematic rear view showing a harness according to a modification

example of the H-type. As shown in FIG. 21, the harness type safety belt 300H includes the shoulder straps 301AH and 301BH, the thigh straps 302AH and 302BH, the back straps 3031H and 3032H, the D-ring 307H, the upper strap holder 308H, and the chest straps 312AH and 312BH. The harness type safety belt 300H has much in common with the harness type safety belt 300X of the X-type described above. For example, the shoulder strap 301AH is a single strap which is formed integrally with the back strap 3031H and the connecting strap 304BH. Likewise, the shoulder strap 301BH is another single strap which is formed integrally with the back strap 3032H and the connecting strap 304AH.

[0113]

As with the harness type safety belt 300X of the X-type, the back straps branch to the left and to the right (defined using the left and right direction of the user as the standard) via the upper strap holder 308H in the modification example of the H type. Further, it is also common in that a connecting strap is provided to connect between the back straps of both sides in the way of bridging. However, unlike the harness type safety belt 300X of the X-type, the branching angle of the back strap is small. Therefore, the back strap and the shoulder strap do not intersect with each other and a lower strap holder like the one in the harness type safety belt 300X of the X-type cannot be provided. In the first to the fourth embodiments as well, the distinction between a connecting strap and a back strap has been conceptual. In the harness type safety belt 300H of the H-type, the back strap is connected directly to the thigh strap, and thus, a connecting strap is not defined.

[0114]

In the harness type safety belt 300H according to the present modification example of the H-type, the stretchable members 340AH and 340BH that are stretchable are provided at the respective positions in the back straps from the buttocks to the thighs of the user (at the positions corresponding to the connecting straps in the other examples described above). In addition, in the harness type safety belt 300H, the stretchable members 320AH and 320BH that are stretchable are provided for the respective thigh straps 302AH and 302BH. The configurations, placement positions, etc. of these stretchable members are the same as those of the third embodiment. Therefore, it is possible to apply any of the additional embodiments and any of the modification examples of the third embodiment, to the modification example of the H-type.

[0115]

It is also possible in the Y-type harness to employ a configuration in which a back strap and a shoulder strap are reversed in the anteroposterior direction.

[0116]

[Other modification examples]

FIG. 22 is a rear view showing an outline of a harness according to another modification example. As shown in FIG. 22, the harness type safety belt 300A includes the shoulder straps 301A α and 301B α , the thigh straps 302A α and 302B α , the back strap 303 α , the connecting straps 304A α and 304B α , the D-ring 307 α , the upper strap holder 308 α , and

the chest straps 312A α and 312B α . The harness type safety belt 300 α is largely different from the above embodiments in that a part of the lower side of each shoulder strap and a part of the corresponding connecting strap are connected to each other. Another difference is that each connecting strap is integrally formed, the connecting straps are not integrated with the back strap 303 α but separated from the back strap 303 α , and the connecting straps are connected at the lower end side of the back strap. The functions and the dispositions of other parts are the same as corresponding elements described above.

[0117]

From the harness type safety belts according to the above embodiments, it is possible to mention the following features.

[0118]

[Supplementary note 1]

A harness type safety belt comprising:

a shoulder strap that crosses over a shoulder of a user and extends downward from the shoulder on a front side of the user;

a thigh strap that is directly or indirectly connected to one end of the shoulder strap;

and

a back strap that is either integrally formed with or connected to the shoulder strap, and extends downward on a back side of the user,

wherein the pair of shoulder straps, the pair of thigh straps or the back strap is provided with a stretchable member that is stretchable.

[Supplementary note 2]

The harness type safety belt of supplementary note 1, wherein each of the thigh strap and the back strap is provided with a stretchable member that is stretchable.

[Supplementary note 3]

The harness type safety belt of supplementary note 1, further comprising a connecting strap that is connected to the thigh strap from a low end of the back strap via a lower strap holder,

wherein each of the connecting strap and the thigh strap is provided with a stretchable member that is stretchable.

[Supplementary note 4]

The harness type safety belt of supplementary note 3, wherein the back strap is provided with a stretchable member that is stretchable.

[Supplementary note 5]

The harness type safety belt of any one of supplementary notes 1 to 4, wherein the stretchable member comprises an elastic strap.

[Supplementary note 6]

The harness type safety belt of any one of supplementary notes 1 to 4, wherein the stretchable member comprises an elastic strap that passes through a tube of a hollow tube

body, the hollow tube body has wrinkles arranged in a length direction, and widths of the wrinkles change in accordance with stretch of the elastic strap to form a bellows-like shape.

[Supplementary note 7]

The harness type safety belt of any one of supplementary notes 1 to 4, wherein
the stretchable member comprises an bello-like part having an kinked(corrugated) structure that stretches in a length direction positioned in a middle, and connecting parts that are respectively bound to both ends of the bello-like part, wherein

the bello-like part is formed by weaving a plurality of elastic yarns in a length direction of a band-like part that comprises a first layer and a second layer that are woven with a non-stretchable yarn, wherein

a plurality of first layer woven parts of the respective elastic yarns is provided at a plurality of locations in the length direction of the band-like part, on a side of the first layer of the band-like part, and

a plurality of second layer woven parts of the respective elastic yarns is provided at a plurality of locations in the length direction of the band-like part, on a side of the second layer of the band-like part, wherein

the first layer woven parts and the second layer woven parts are arranged in an alternate manner in the length direction of the band-like part, and

the first layer woven parts and the second layer woven parts are formed by weaving the elastic yarns in a width direction of the band-like part.

[Supplementary note 8]

The harness type safety belt of supplementary note 6 or 7, wherein the bello-like part regulates a maximum stretching length of the stretchable member.

[Supplementary note 9]

The harness type safety belt of any one of supplementary notes 1 to 8, wherein when a position of the upper strap holder in the back strap is taken as an upper end and a boundary part between the connecting strap and the thigh strap is taken as a lower end, the stretchable member is arranged in a region where a ratio of a distance from the lower end with respect to a distance from the lower end to the upper end is equal to or less than 53 %.

[Supplementary note 10]

The harness type safety belt of any one of supplementary notes 1 to 8, wherein when a position of the upper strap holder in the back strap is taken as an upper end and a boundary part between the connecting strap and the thigh strap is taken as a lower end, the stretchable member is arranged in a region where a ratio of a distance from the lower end with respect to a distance from the lower end to the upper end is a value between 27 % and 53 %.

[Supplementary note 11]

The harness type safety belt of any one of supplementary notes 1 to 10, wherein the stretchable member disposed in the connecting strap or the back strap is configured to be capable of stretching a concerned strap by a proportion between 10 % and 18 % in a direction in which the concerned strap extends.

[Supplementary note 12]

The harness type safety belt of any one of supplementary notes 1 to 11, wherein the stretchable member disposed in the connecting strap or the back strap has a static load value between 5 N and 25 N required for stretching by 45 mm, and a static load value between 30 N and 50 N required for stretching by 120 mm.

[Supplementary note 13]

The harness type safety belt of any one of supplementary notes 1 to 12, wherein the stretchable member disposed in the connecting strap or the back strap has a static load F (N) required for stretching a length ΔL (mm) within a range of 45 (mm) to 120 (mm), wherein the static load F satisfies a relationship of the following formula (1).

[Formula 1]

$$\Delta L/3 - 10 \leq F \leq \Delta L/3 + 10 \dots\dots \text{Formula (1)}$$

[Supplementary note 14]

The harness type safety belt of any one of supplementary notes 1 to 13, wherein the stretchable member disposed in the pair of thigh straps is disposed on a buttock side of the user.

[Supplementary note 15]

The harness type safety belt of any one of supplementary notes 1 to 14, wherein the stretchable member comprises an elastic member that is elastically deformable,

wherein the elastic member is composed of a plurality of line shape members.

[Supplementary note 16]

The harness type safety belt of any one of supplementary notes 1 to 15, wherein the stretchable member comprises an elastic member that is elastically deformable,

wherein the elastic member is composed of seven members of line shape each having an outer diameter of 0.5 mm.

[0119]

While preferred embodiments of the harness type safety belt according to the present invention have been illustrated and described, it should be understood that various modifications are possible without departing from the technical scope of the present invention.

[INDUSTRIAL APPLICABILITY]

[0120]

The harness type safety belt according to the present invention does not give a sense of tightness at the time of wearing and reduces the burden at the time of work activity in order to make a proper wearing on the body. This prompts the improvement of the wearing rate and leads to a decrease in falling accidents. The harness type safety belt according to the present invention can be widely utilized as a tool that contributes to a significant reduction of the casualty rate due to accidents. Furthermore, the harness type safety belt according to the present invention may not only be used as a harness type safety belt for construction sites but

also be diverted as a harness type safety belt for fall prevention as mountaineering equipment.

[EXPLANATION OF SYMBOLS]

[0121]

100, 200, 300, 400, 500: harness type safety belt

130, 230, 430: stretchable member

220, 320, 420, 520A, 520B: stretchable member

340, 440: stretchable member

101A, 101B, 201A, 201B, 301A, 301B, 401A, 401B, 501A, 501B: shoulder strap

102A, 102B, 202A, 202B, 302A, 302B, 402A, 402B, 502A, 502B: thigh strap

103, 203, 303, 403: back strap

104A, 104B, 204A, 204B, 304A, 304B, 404A, 404B: connecting strap

107, 207, 307, 407, 507: D-ring

108, 208, 308, 408, 508: upper strap holder

109, 209, 309, 409, 509: lower strap holder

[DOCUMENT TITLE] CLAIMS

[Claim 1]

A harness type safety belt comprising:

a shoulder strap that crosses over a shoulder of a user and extends downward from the shoulder on a front side of the user;

a thigh strap that is directly or indirectly connected to one end of the shoulder strap;
and

a back strap that is either integrally formed with or connected to the shoulder strap, and extends downward on a back side of the user,

wherein the shoulder strap, the thigh strap or the back strap is provided with a stretchable member that is stretchable.

[Claim 2]

A harness type safety belt comprising:

a shoulder strap that crosses over a shoulder of a user and extends downward from the shoulder on a front side of the user;

a thigh strap that is directly or indirectly connected to one end of the shoulder strap;

a back strap that is either integrally formed with or connected to the shoulder strap, and extends downward on a back side of the user; and

a connecting strap that is either integrally formed with or connected to a lower end of the back strap and is connected to the thigh strap, and extends downward along at least one of a buttock and a thigh of the user,

wherein the shoulder strap, the thigh strap, the back strap or the connecting strap is provided with a stretchable member that is stretchable.

[Claim 3]

The harness type safety belt of claim 1 or 2, wherein a stretchable member that is stretchable is provided for each of the back strap and the thigh strap.

[Claim 4]

The harness type safety belt of claim 1, further comprising a connecting strap that is either integrally formed with or connected to a lower end of the back strap and is connected to the thigh strap, and extends downward along at least one of a buttock and a thigh of the user,

wherein a stretchable member that is stretchable is provided for each of the connecting strap and the thigh strap.

[Claim 5]

The harness type safety belt of claim 2, wherein
the connecting strap is connected to the thigh strap via a lower strap holder from the lower end of the back strap, and

a stretchable member that is stretchable is provided for each of the connecting strap and the thigh strap.

[Claim 6]

The harness type safety belt of claim 4 or 5, wherein the stretchable member that is stretchable is further provided for the back strap.

[Claim 7]

The harness type safety belt of any one of claims 1 to 6, wherein
the stretchable member comprises an bello-like part having an kinked structure that stretches in a length direction, and connecting parts that are respectively bound to both ends of the bello-like part, and

the bello-like part has a band-like part comprising a first layer and a second layer that are woven with a non-stretchable yarn, wherein

the band-like part comprises a plurality of elastic yarns woven in a length direction thereof, wherein

a plurality of first layer woven parts of the respective elastic yarns is provided at a plurality of locations in the length direction of the band-like part, on a side of the first layer of the band-like part, and

a plurality of second layer woven parts of the respective elastic yarns is provided at a plurality of locations in the length direction of the band-like part, on a side of the second layer of the band-like part, wherein

the first layer woven parts and the second layer woven parts are arranged in an alternate manner in the length direction of the band-like part, and

the first layer woven parts and the second layer woven parts are formed by weaving the elastic yarns in a width direction of the band-like part.

[Claim 8]

A harness type safety belt comprising:

a pair of shoulder straps that extends upward from an upper back of a user, intersects with each other, crosses over respective shoulders of the user, and extends downward from the respective shoulders on a front side of the user;

a pair of thigh straps that is attached to respective ends of the pair of shoulder straps;

a back strap that extends downward through a center of a back of the user via an upper strap holder that is attached to the pair of shoulder straps intersecting with each other; and

a pair of connecting straps that is branched into two and extends via a lower strap holder, extends from a lower end of the back strap, and is connected to the pair of thigh straps,

wherein at least any of the pair of the shoulder straps, the thigh straps, the back strap, or the pair of connecting straps is provided with a stretchable member that is stretchable.