

## Specification

### Spinal Member for Assist Suit and Assist Suit

#### Technical Field

5 [0001] The present invention relates to an assist suit that corrects the posture of the body of the wearer and assists his/her forward bending motion when he/she transports or lifts and lowers baggage, and a spinal member for the assist suit.

#### 10 Background Art

[0002] There have conventionally been proposed a wearable tool (see, for example, patent literature 1) for correcting the poor posture of the upper body of the wearer and a wearable tool (see, for example, patent  
15 literatures 2 to 4) that assists his/her forward bending motion when he/she transports or lifts and lowers baggage.

#### Related Art Literature

##### Patent Literature

20 [0003] Patent Literature 1: Japanese Patent Laid-Open No. 2001-218779

Patent Literature 2: Japanese Patent Laid-Open No. 2002-161414

Patent Literature 3: Japanese Patent Laid-Open  
25 No. 2011-188896

Patent Literature 4: Japanese Patent Laid-Open No. 2013-144858

## Disclosure of Invention

### Problem to be Solved by the Invention

[0004] For example, the wearable tool disclosed in patent literature 1 is a posture correction wearable tool for the upper body, which includes a back support, shoulder belts, and waist belts and is configured such that the right and left shoulder belts are made to extend through the lower portion of the back support, while being crossed, and then engaged with each other, and the waist belts coupled to the two side edge portions of the lower portion of the back support are engaged with each other. Right and left two plate-like pieces for enhancing the posture correction effect are inserted into the pockets of the back support.

[0005] Patent literature 2 discloses an upper body support device including a back pad covering the entire back of the wearer and extending to the back sides of the thigh regions. The upper end of the back pad is fixed to the upper body with shoulder belts. The lower end of the back pad is separated into right and left portions, which are respectively fixed to the right and left thigh regions. This device is configured to exert a force to raise the upper body in forward bending motion by using the repulsion force of an elastic columnar support incorporated in the back pad. In addition, patent literatures 3 and 4 each have proposed an assist tool including an elastic member that extends

from the back of the body to the thigh regions to assist the forward bending motion of the wearer.

[0006] The wearable tool disclosed in patent literature 1 is worn on only the upper body, and hence provides a comfortable feeling in wearing and does not give much irritation or restriction of daily activities. However, the two plate-like pieces inserted in the back support are only long enough to extend from the back of the wearer to the waist region. Accordingly, this tool cannot be expected to provide the effect of assisting the forward bending motion of the wearer even though it can correct the poor posture such as a hunched-back posture.

[0007] In contrast, the upper body support device disclosed in patent literature 2 has the function of assisting forward bending motion but has a problem that the device gives the wearer an uncomfortable feeling of wearing and provides a greater restriction of daily activities, such as body twisting motion, a body tilting motion, and motion of sitting on a chair as the back pad is covering the entire back of the wearer, and the back pad extends to the back sides of the thigh regions.

[0008] The assist tools disclosed in patent literatures 3 and 4 each provide a more comfortable feeling to a wearer compared to the prior art technology using the back pad as disclosed in patent literature 2. However, the assist tools disclosed in patent

literatures 3 and 4 still cannot reduce restriction of daily activities of the wearer such as motion of sitting on a chair because the elastic member extends from the back of the body to the thigh regions.

5 [0009] The present invention has been made to solve the above problem, and has as its object to provide an assist suit that achieves both a posture correction effect and a forward bending assisting effect, provides a more comfortable feeling of wearing, and provides less  
10 restriction of daily activities.

#### Means of Solution to the Problem

[0010] The present invention provides a spinal member for an assist suit worn by a wearer, the member including a plate-like member having a vertically long  
15 shape extending from an upper portion of a back region of the wearer to a buttock region, bending along the back region of the wearer, having elasticity in a bending direction, and having a plurality of different widths in a longitudinal direction of the plate-like  
20 member, the plate-like member including a part of a portion in the spinal member located above a middle portion in a longitudinal direction of the spinal member, and is narrower than remaining parts of the portion in the spinal member, or a part of a portion in  
25 the spinal member located above the middle portion in the longitudinal direction of the spinal member, having a width near a shoulder blade of the back region of the

wearer that is narrower than remaining parts of the portion in the spinal member.

#### Effects of the Invention

[0011] The present invention can provide an assist  
5 suit that achieves both a posture correction effect and a forward bending assisting effect, provides a more comfortable feeling of wearing, and provide less restriction of daily activities.

#### Brief Description of Drawings

10 [0012] Fig. 1 is a view showing an example of the configuration (rear view) of an assist suit;

Fig. 2 is a view showing another example of the configuration (rear view) of the assist suit;

15 Fig. 3 is a view showing an example of the spinal member of the assist suit;

Fig. 4 is a view showing an example of the configuration (rear and side views) of the assist suit worn by the wearer;

20 Fig. 5 is a view showing an operation example (side view) of the assist suit when the wearer makes forward bending motion;

Fig. 6 is a view showing another operation example (side view) of the assist suit when the wearer makes forward bending motion;

25 Fig. 7 is a view showing an example of a spinal member having laterally separated portions;

Fig. 8 is a view showing another example of

the spinal member having laterally separated portions;

Fig. 9 is a view showing an example of a spinal member having a protruding portion;

Fig. 10 is a view showing an example of a spinal member having both laterally separated portions and a protruding portion;

Fig. 11 is a view showing an example of a spinal member having a protruding portion with a groove; and

Fig. 12 is a view showing another example of the spinal member having a protruding portion with a groove.

Best Mode for Carrying Out the Invention

[0013] An embodiment of the present invention will be described next with reference to the accompanying drawings.

[0014] <Assist Suit>

An assist suit including a spinal member for the assist suit according to an embodiment of the present invention will be described first with reference to Figs. 1 and 2.

[0015] An assist suit 10 in Fig. 1 includes a back region wearing unit 11 worn on the back region of the wearer. The back region wearing unit 11 includes shoulder belts 14 to be fixed to the back region of the wearer and waist belts 15. The back region wearing unit 11 is preferably formed from a cloth material, a knitted

fiber material, or the like that has certain flexibility and extensibility for improvement in comfort of wearing. However, they are not exhaustive. The back region wearing unit 11 may be formed from a combination of a cloth material and an extensible belt-like member.

[0016] The shoulder belts 14 and the waist belts 15 each are configured to be adjustable in length with engaging members such as a belt, a buckle, and a surface fastener and adjustable in degree of contact between the back region wearing unit 11 and the wearer.

[0017] The back region wearing unit 11 includes an elongated spinal member 20 extending from the upper portion of the back region of the wearer to the thigh region. The spinal member 20 is formed from a member that bends along the back region of the wearer and has elasticity in the bending direction. The spinal member 20 and the back region wearing unit 11 are in tight contact with each other and move together. This makes it possible to correct the posture of the wearer and assist the forward bending motion of the wearer.

[0018] The assist suit 10 in Fig. 2 includes a buttock region wearing unit 12 worn on the buttock regions of the wearer and thigh region wearing units 13 worn on the right and left thigh regions of the wearer in addition to the components of the assist suit in Fig. 1. The buttock region wearing unit 12 is coupled to the back region wearing unit 11 and the thigh region wearing

units 13. Like the back region wearing unit 11, the buttock region wearing unit 12 and the thigh region wearing units 13 each are preferably formed from a cloth material, a knitted fiber material, or the like that has certain flexibility and extensibility for improvement in feeling of wearing. However, they are not exhaustive. These wearing units each may be formed from a combination of a cloth material and an extensible belt-like member.

10 [0019] The thigh region wearing units 13 are formed from cylindrical members having extensibility to be fixed to the right and left thigh regions of the wearer, and are fixed to the thigh regions by being circumferentially fastened. The thigh region wearing units 13 each may be formed from a belt-like member having an engaging means.

[0020] The buttock region wearing unit 12 is formed from a member having higher extensibility than the back region wearing unit 11. The buttock region wearing unit 12 formed from a member having high extensibility is coupled to the thigh region wearing units 13 fixed to the thigh regions of the wearer. Accordingly, when the wearer makes forward bending motion, the buttock region wearing unit 12 expands and contracts to assist the wearer to raise his/her upper body upon making forward bending motion.

[0021] The buttock region wearing unit 12 may be

detachably coupled to the back region wearing unit 11.  
Detachable coupling makes it easy to adjust the  
extensibility of the members forming the buttock region  
wearing unit 12.

5 [0022] The lower end of the buttock region wearing  
unit 12 may be separated into right and left portions,  
which may be respectively coupled to the right and left  
thigh region wearing units 13.

[0023] <Spinal Member>

10 The spinal member 20 of the assist suit 10  
will be described with reference to Fig. 3.

[0024] The spinal member 20 in this configuration  
example is formed from a member that has a vertically  
long shape extending from the upper portion of the back  
15 region of the wearer to the buttock region, bends along  
the back region of the wearer, and has elasticity in the  
bending direction. A member forming the spinal member  
20 is a member formed from a metal material, resin  
material, or the like having elasticity in the bending  
20 direction. However, the member is not limited to these  
materials.

[0025] The spinal member 20 may be formed from a  
plate-like member having different widths in the  
longitudinal direction. In the configuration example in  
25 Fig. 2, a part of the spinal member which is located  
above a middle portion in the longitudinal direction,  
for example, a part near the shoulder blade of the back

region of the wearer is narrower than the remaining parts. This makes it possible to configure the spinal member 20 so as not to interfere with the twisting motion of the upper body of the wearer as much as possible while maintaining the elastic force of the spinal member.

[0026] <Wearing of Assist Suit>

Fig. 4 shows a state in which the assist suit 10 described with reference to Fig. 2 is being worn. The state in which the assist suit 10 in Fig. 1 is being worn is the same as that shown in Fig. 2 except that the suit does not include the buttock region wearing unit 12 and the thigh region wearing units 13, and hence a description of the state will be omitted.

[0027] For the sake of brevity, the side view of Fig. 4 shows a state in which the spinal member 20 is separated from the back region wearing unit 11. However, the spinal member 20 according to the present invention is in tight contact with the back region wearing unit 11, and the back region wearing unit 11 and the spinal member 20 move together. This applies to other drawings.

[0028] As shown in the rear view of Fig. 4, the back region wearing unit 11 of the assist suit 10 according to the present invention is fixed to the back region of a wearer 1 with the shoulder belts 14 and the waist belts 15. The buttock region wearing unit 12 is coupled

to the back region wearing unit 11 and is coupled to the thigh region wearing units 13 fixed to the thigh regions of the wearer 1. In addition, as shown in the side view of Fig. 4, the spinal member 20 according to the present invention bends along the back region of the wearer 1, and the back region wearing unit 11 is in tight contact with a region extending from the upper portion of the back region of the wearer 1 to the buttock region. The poor posture of the wearer 1, such as a hunched-back posture, can be corrected by fixing the back region wearing unit 11 including the spinal member 20 to the back region of the wearer 1 with the shoulder belts 14 and the waist belts 15.

[0029] The buttock region wearing unit 12 is coupled to the back region wearing unit 11 and is coupled to the thigh region wearing units 13 fixed to the right and left thigh regions of the wearer 1. The thigh region wearing units 13 are formed from extensible cylindrical members to be fixed to the right and left thigh regions of the wearer, and each are configured to circumferentially fasten the upper and lower portions of the knee region of the wearer. In this case, the thigh region wearing units 13 may be fixed to the thigh regions of the wearer 1 while the buttock region wearing unit 12 is stretched. Maintaining the stretched state of the buttock region wearing unit 12 in advance while the wearer 1 is in an upright state can increase the

extension/contraction force of the buttock region wearing unit 12 when the wearer 1 makes forward bending motion.

[0030] According to the configuration in Fig. 4, the thigh region wearing units 13 are formed from the extensible cylindrical members to be fixed to the right and left thigh regions of the wearer. However, the thigh region wearing units 13 each may be formed from a belt-like member including an engaging means. In this case, each thigh region wearing unit 13 is fixed by fastening the upper and lower portions of the knee region of the wearer with the belt-like member.

[0031] <Operation of Assist Suit>

The operation of the assist suit 10 when the wearer 1 of the assist suit 10 makes forward bending motion will be described with reference to Figs. 5 and 6.

[0032] Referring to Fig. 5, when the wearer 1 wearing the assist suit 10 makes forward bending motion, the back region wearing unit 11 is fixed to the back region of the wearer 1 with the shoulder belts 14 and the waist belts 15, and hence moves together with the forward bending motion of the wearer 1. At this time, because the upper body of the wearer 1 bends from the waist region of the wearer 1 in the forward direction, the spinal member 20 in tight contact with the back region wearing unit 11 of the wearer 1 is also forcibly bent in

the forward bending direction of the wearer 1.

[0033] In this case, because the spinal member 20 is in tight contact with the back region wearing unit 11 throughout the region from the upper portion of the back region of the wearer 1 to the buttock region, an elastic force acts on the spinal member 20 in the bending direction, with the buttock region of the wearer 1 serving as a starting point. This elastic force acting on the spinal member 20, starting from the buttock region, will produce a force acting on the shoulder belts 14 of the back region wearing unit 11 in tight contact with the spinal member 20 so as to assist the wearer 1 bent forward to raise his/her upper body. In this manner, the spinal member 20 in tight contact with the region from the upper portion of the back region of the wearer 1 to the buttock region can achieve both the posture correction effect and the forward bending assisting effect. The spinal member 20 does not reach the thigh regions of the wearer 1, and hence provides less restriction of daily activities of the wearer, such as motion of sitting on a chair.

[0034] Fig. 6 shows an example of the operation of the assist suit 10 when the wearer 1 wearing the assist suit 10 in Fig. 2 makes forward bending motion. The assist suit 10 in Fig. 2 includes the buttock region wearing unit 12 worn on the buttock regions of the wearer and the thigh region wearing units 13 worn on the

right and left thigh regions of the wearer in addition to the components of the assist suit in Fig. 1.

Including the buttock region wearing unit 12 and the thigh region wearing units 13 can further enhance the

5 forward bending motion assisting effect as compared with the cases shown in Figs. 1 and 5.

[0035] The buttock region wearing unit 12 is coupled to the thigh region wearing units 13 fixed to the thigh regions of the wearer 1. Accordingly, when the wearer 1  
10 makes forward bending motion, the buttock region wearing unit 12 is stretched from the thigh region wearing units 13 as starting points. When the buttock region wearing unit 12 is stretched, a force that causes the buttock region wearing unit 12 to contract from the thigh region  
15 wearing units 13 as starting points acts on the back region wearing unit 11 to which the buttock region wearing unit 12 is coupled. As a consequence, the extension/contraction force of the buttock region wearing unit 12, with the thigh region wearing units 13  
20 serving as starting points, generates a force acting on the shoulder belts 14 of the back region wearing unit 11 to assist the wearer 1 bending forward to raise his/her upper body. As also described with reference to Fig. 4, fixing the thigh region wearing units 13 to the thigh  
25 regions of the wearer 1 while the buttock region wearing unit 12 is stretched can further enhance the assisting force. The buttock region wearing unit 12 is formed

from a highly extensible member, and hence provides less restriction of daily activities of the wearer 1, such as motion of sitting on a chair.

[0036] According to the configuration example in Fig. 5 6, the thigh region wearing units 13 are formed from the extensible cylindrical members to be fixed to the right and left thigh regions of the wearer and configured to circumferentially fasten the upper and lower portions of the knee regions of the wearer. This configuration 10 makes it difficult for the thigh region wearing units 13 to shift upward when the wearer makes forward bending motion, thereby enhancing the forward bending motion assisting effect.

[0037] The extension/contraction force of the buttock 15 region wearing unit 12 coupled to the back region wearing unit 11 and the thigh region wearing units 13 can achieve a higher forward bending motion assisting effect than in the case of using only the spinal member 20 in Fig. 5. The highly extensible thigh region 20 wearing units 13 provide much less restriction of daily activities of the wearer 1 than that of the conventional elastic member.

[0038] As described above, the assist suit according to this embodiment of the present invention can achieve 25 both the effect of correcting the posture of the wearer and the forward bending assisting effect with the spinal member that is in tight contact with the region from the

upper portion of the back region of the wearer to the thigh regions. In addition, further including the buttock region wearing unit and the thigh region wearing units can further enhance the forward bending motion assisting effect with the extension/contraction force of the buttock region wearing unit coupled to the thigh region wearing units.

<Configuration of Another Spinal Member>

[0039] Fig. 3 exemplarily shows the configuration in which the spinal member 20 is formed from the plate-like member having different widths in the longitudinal direction, and a part of the spinal member which is located above the middle portion in the longitudinal direction, for example, a part near the shoulder blade of the back region of the wearer 1 is narrower than the remaining parts. However, a portion of the spinal member 20 in the longitudinal direction may be laterally separated along an axis corresponding to the spine of the wearer 1.

[0040] Fig. 7 shows an example of the spinal member 20 having a portion 30 in which the spinal member 20 is laterally separated in the longitudinal direction. Having a laterally separated spinal member 20 makes it easy for the wearer to twist the spinal member 20. This makes it possible to provide the spinal member 20 that less interferes with the twisting motion of the upper body of the wearer 1 as compared with the configuration

in Fig. 2. In addition, because the spinal member 20 is being laterally separated along the axis corresponding to the spine, there is no need to concern about a force degradation in the elastic force of the spinal member 20.

[0041] As shown in Fig. 8, the portion 30 laterally separating the spinal member may be configured to extend from the upper portion of the back region of the wearer 1 to the buttock region such that a portion corresponding to the buttock region of the wearer 1 is wider than the remaining portion. This configuration can prevent the spinal member 20 from coming into contact with the spine of the wearer 1 at the buttock region of the wearer 1, thereby providing an assist suit that provide a more comfortable feeling of wearing.

[0042] As shown in Fig. 9, the spinal member 20 may include protruding portions 40 extending in the longitudinal direction on the two sides of an axis corresponding to the spine of the wearer 1. Including the protruding portions 40 can increase the elastic force of the spinal member 20 while reducing the width of the spinal member 20. Although at least one protruding portion 40 is required on each of the right and left sides, a plurality of protruding portions 40 may be provided on each of the right and left sides.

[0043] As shown in Fig. 10, the spinal member 20 may include both the portion 30 laterally separating the

spinal member 20 and the protruding portions 40  
extending in the longitudinal direction. This  
configuration can provide an assist suit that provides a  
more comfortable feeling of wearing and has a greater  
5 assisting effect for forward bending motion.

[0044] The protruding portions 40 of the spinal  
member 20 may further include a second spinal member 60  
that is formed from a member having elasticity in the  
bending direction, includes a plurality of grooves  
10 crossing the protruding portions 40 and open outward  
from the spine region side of the wearer 1, and come  
into tight contact with the spinal member 20 from the  
spine region side of the wearer 1. Figs. 11 and 12 each  
show an example of the configuration of the spinal  
15 member 20 including the second spinal member 60 in  
addition to a corresponding one of the configurations in  
Figs. 9 and 10, with the protruding portions 40 having a  
plurality of grooves 50 open outward.

[0045] According to each of the configuration  
20 examples of the spinal members 20 described with  
reference to each of Figs. 3, 7, and 10, the spinal  
member 20 is formed from one plate-like member. With  
such a configuration, when the elastic force of the  
member forming the spinal member 20 is too strong as  
25 compared with the muscle force of the wearer 1, the  
wearer may experience difficulty in making forward  
bending motion itself, resulting in uncomfortable

feeling of wearing. In contrast to this, when the elastic force of the member forming the spinal member 20 is too weak, a forward bending motion assisting effect may not be obtained.

5 [0046] The spinal members 20 in Figs. 11 and 12 each present an example of the configuration of a spinal member for solving the above situation. That is, the protruding portions 40 of the spinal member 20 have the plurality of grooves 50 that cross the protruding  
10 portions 40 and are open outward from the back region side of the wearer 1. This makes it easy for the wearer 1 to make forward bending motion.

[0047] Letting the protruding portions 40 have the grooves 50 will weaken the elastic force of the spinal  
15 member 20. In order to compensate for this, therefore, the spinal member 20 further include the second spinal member 60 formed from a member having elasticity in the bending direction, which is in tight contact with the spinal member 20 from the back region side of the wearer  
20 1. Using a plurality of such spinal members allows easy adjustment of the elastic forces of the spinal members depending on the muscle force of the wearer 1. In addition, the second spinal member 60 may be formed by punching through a portion of a plate-like spinal member  
25 to adjust the elastic force, as exemplarily shown in Figs. 11 and 12.

Reference Signs List

[0048] 1...wearer, 10...assist suit, 11...back region  
wearing unit, 12...buttock region wearing unit,  
13...thigh region wearing unit, 14...shoulder belt,  
15...waist belt, 20...spinal member

C L A I M S

1. A spinal member for an assist suit worn by  
a wearer, the member comprising a plate-like member  
having a vertically long shape extending from a back  
region of the wearer to a buttock region, bending along  
the back region of the wearer, having elasticity in a  
bending direction, and having a plurality of different  
widths in a longitudinal direction of the plate-like  
member,

the plate-like member including:

a part of a portion in the spinal member  
located above a middle portion in a longitudinal  
direction of the spinal member, and is narrower than  
remaining parts of the portion in the spinal member, or  
a part of a portion in the spinal member which  
is located above the middle portion in the longitudinal  
direction of the spinal member, having a width near a  
shoulder blade of the back region of the wearer that is  
narrower than remaining parts of the portion in the  
spinal member.

2. The spinal member according to claim 1,  
wherein a part in the longitudinal direction includes  
laterally separated portions that are laterally  
separated along an axis corresponding to a spine of the  
wearer.

3. The spinal member according to claim 2,  
wherein the laterally separated portions extend from the

3 back region of the wearer to buttock regions of the  
4 wearer, and an interval between the laterally separated  
5 portions at the buttock regions of the wearer is greater  
6 than an interval between the laterally separated  
7 portions at other regions.

4. The spinal member according to any one of  
2 claims 1 to 3, further comprising at least two  
3 protruding portions extending in the longitudinal  
4 direction on two sides of an axis corresponding to the  
5 spine of the wearer.

5. An assist suit including a spinal member  
2 defined in any one of claims 1 to 4, the assist suit  
3 comprising a back region wearing unit worn on a back  
4 region of a wearer, a buttock wearing unit worn on a  
5 buttock region of the wearer, and thigh region wearing  
6 units worn on right and left thigh regions of the  
7 wearer,

8 wherein the buttock region wearing unit is  
9 coupled to the back region wearing unit,

10 the thigh region wearing units are formed from  
11 cylindrical or belt-like members coupled to the buttock  
12 region wearing unit and having an extensibility so as to  
13 be fixed to the right and left thigh regions of the  
14 wearer, and

15 the back region wearing unit includes shoulder  
16 belts and waist belts to be fixed to a back region of  
17 the wearer and the spinal member that comes into contact

18 with the back region wearing unit from the back region  
19 of the wearer to the buttock region.