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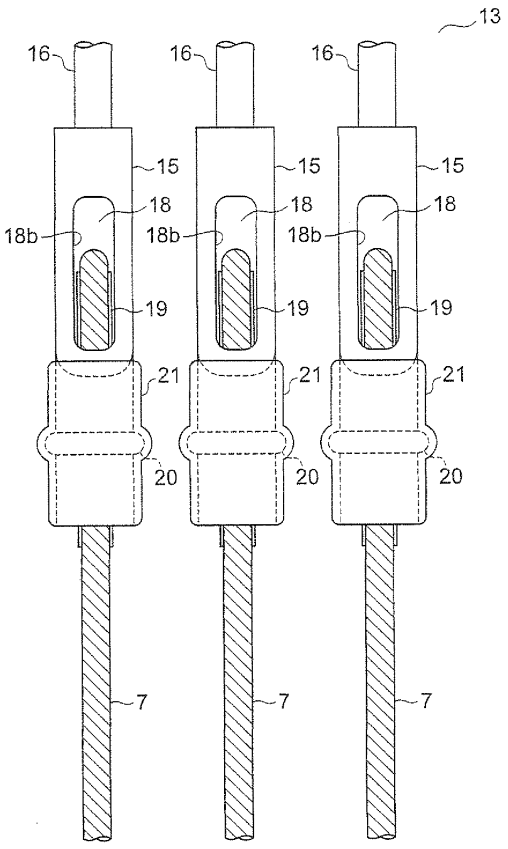
(54) **MAIN-ROPE FASTENING DEVICE FOR ELEVATOR**

(57) A main rope that suspends a hoisted body is connected to a socket. At least one of a salient portion or a recess portion is disposed as a socket interfitting portion on an outer circumferential portion of the socket. The outer circumferential portion of the socket is covered by an elastic coating body. A coating body interfitting portion that fits together with the socket interfitting portion when the elastic coating body covers the outer circumferential portion of the socket is formed on an inner circumferential portion of the elastic coating body.

FIG. 2



EP 2 495 207 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator main rope fixing apparatus that has a socket to which a main rope that suspends a hoisted body (a car or a counterweight, for example) is connected, and that is mounted to the hoisted body or a fixing member, etc., inside a hoistway.

BACKGROUND ART

[0002] Conventionally, elevator apparatuses are known in which a plurality of main rope fastening plates are mounted so as to line up on an upper portion of a car, and the car is suspended by a plurality of main ropes that are connected to each of main rope fastening plates separately. Each of main rope fastening plates has a socket to which an end portion of the main rope is connected. Each of the main rope fastening plates is mounted to the car by means of a spring. Consequently, in conventional elevator apparatuses, there has been a risk that noise may be generated when the car is raised and lowered by each of main rope fastening plates leaning over and the sockets contacting each other.

[0003] Conventionally, in order to prevent noise due to contact among the sockets, elevator rope apparatuses have been proposed in which elastic blocks that have dimensions that are larger than a width dimension of the sockets are mounted to the main ropes. The elastic blocks are disposed in a vicinity of the main rope fastening plates. If the respective main rope fastening plates lean over, contact among the sockets is prevented by the elastic blocks contacting each other first (See Patent Literature 1).

[0004] Conventionally, in order to prevent noise due to contact among the sockets, elevator rope apparatuses have also been proposed in which outer circumferential surfaces of all of the sockets are coated with an elastic material that is made of rubber, etc., (See Patent Literature 1).

CITATION LIST

PATENT LITERATURE

[Patent Literature 1]

[0005] Japanese Patent Laid-Open No. 2006-143435 (Gazette)

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0006] However, in conventional elevator rope apparatuses in which elastic blocks are mounted to the main ropes, because fittings (bolts, for example) are required to mount the elastic blocks to the main ropes, the operation of mounting the elastic blocks is labor-intensive, and costs are also increased.

[0007] In conventional elevator rope apparatuses in which the outer circumferential surfaces of all of the sockets are coated with an elastic material, there is a risk that the position of the elastic material may shift and the elastic material may dislodge from the sockets due to repeated contact between the elastic material, which is less likely to slip.

[0008] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator main rope fixing apparatus in which noise due to contact among the sockets can be prevented, cost reductions can be achieved, and dislodging of elastic coating bodies from sockets can be prevented more reliably.

MEANS FOR SOLVING THE PROBLEM

[0009] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator main rope fixing apparatus characterized in including: a socket to which a main rope that suspends a hoisted body is connected, and on an outer circumferential portion of which at least one of a salient portion or a recess portion is disposed as a socket interfitting portion; and an elastic coating body that covers the outer circumferential portion of the socket, and on an inner circumferential portion of which is formed a coating body interfitting portion that fits together with the socket interfitting portion when covering the outer circumferential portion of the socket.

EFFECTS OF THE INVENTION

[0010] In an elevator main rope fixing apparatus according to the present invention, because the socket interfitting portion is formed on the outer circumferential portion of the socket, and the coating body interfitting portion that fits together with the socket interfitting portion is formed on the inner circumferential portion of the elastic coating body when the elastic coating body covers the outer circumferential portion of the socket, contact among mutually adjacent sockets can be prevented by the elastic coating body, enabling the generation of noise due to contact among the sockets to be prevented. Even if elastic coating bodies that are mounted to mutually adjacent sockets contact each other, displacement of the elastic coating bodies relative to the sockets can be stopped by the socket interfitting portions, enabling shifting of the positions of the elastic coating bodies relative to the sockets to be made less likely. Dislodging of the elastic coating bodies from the sockets can thereby be reliably prevented. In addition, because fittings are not required to mount the elastic coating bodies to the sockets, cost reductions can also be achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Figure 1 is a configuration diagram that shows an elevator according to Embodiment 1 of the present invention;
Figure 2 is a partial front elevation that shows first main rope fixing apparatuses from Figure 1;
Figure 3 is a side elevation that shows a first main rope fixing apparatus from Figure 2;
Figure 4 is an enlargement that shows a socket from Figure 3;
Figure 5 is a front elevation that shows a state when an elastic coating body of an elevator main rope fixing apparatus according to Embodiment 2 of the present invention is disengaged from a socket;
Figure 6 is a side elevation that shows a socket and an elastic coating body of an elevator main rope fixing apparatus according to Embodiment 3 of the present invention;
Figure 7 is a front elevation that shows a state when the elastic coating body from Figure 6 is disengaged from a socket; and
Figure 8 is a partial front elevation that shows an elevator main rope fixing apparatus according to Embodiment 4 of the present invention.

DESCRIPTION OF EMBODIMENTS

[0012] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0013] Figure 1 is a configuration diagram that shows an elevator according to Embodiment 1 of the present invention. In the figure, a car (a hoisted body) 2 and a counterweight (a hoisted body) 3 are disposed inside a hoistway 1 so as to be able to be raised and lowered. A hoisting machine (a driving apparatus) 4 that generates a driving force that raises and lowers the car 2 and the counterweight 3 is installed inside the hoistway 1.

[0014] The hoisting machine 4 includes: a hoisting machine main body (a driving machine main body) 5 that includes a motor; and a driving sheave 6 that is rotated by the hoisting machine main body 5. A plurality of main ropes 7 are wound around the driving sheave 6. The car 2 and the counterweight 3 are suspended by the main ropes 7.

[0015] A pair of car suspending sheaves 8 are disposed on a lower portion of the car 2, and a counterweight suspending sheave 9 is disposed on an upper portion of the counterweight 3. A fixed beam 10 that is disposed horizontally is fixed to an upper portion inside the hoistway 1. A car return sheave 11, a counterweight return sheave 12, and first and second main rope fixing apparatuses 13 and 14 are mounted to the fixed beam 10.

[0016] The main rope fixing apparatuses 13 and 14 respectively have: a plurality of metal sockets 15 that are connected to the main ropes 7 separately; a plurality of metal rods 16 to which each of the sockets 15 is mounted separately, and that are passed through penetrating apertures that are disposed on the fixed beam 10; and a plurality of springs (elastic bodies) 17 that are compressed between the fixed beam 10 and spring bearing portions 16a that are disposed on the end portions (upper end portions) of the rods 16 to bear forces from the main ropes 7.

[0017] First end portions of the main ropes 7 are separately connected to respective sockets 15 of the first main rope fixing apparatuses 13. Second end portions of the main ropes 7 are separately connected to respective sockets 15 of the second main rope fixing apparatuses 14. The main ropes 7 are wound from the first main rope fixing apparatuses 13 sequentially around each of the car suspending sheaves 8, the car return sheave 11, the driving sheave 6, the counterweight return sheave 12, and the counterweight suspending sheave 9, to reach the second main rope fixing apparatuses 14. In other words, the method for suspending the car 2 and the counterweight 3 is a two-to-one (2:1) roping method. The car 2 and the counterweight 3 are raised and lowered inside the hoistway 1 by the driving sheave 6 being rotated.

[0018] Figure 2 is a partial front elevation that shows the main rope fixing apparatuses 13 from Figure 1. Figure 3 is a side elevation that shows a main rope fixing apparatus 13 from Figure 2. Moreover, configuration of the main rope fixing apparatuses 14 is also similar to that of the configuration of the main rope fixing apparatuses 13. In the figures, each of the rods 16 is lined up so as to be spaced apart from each other. Consequently, the respective sockets 15 also line up so as to be spaced apart from each other so as to correspond to the spacing between the respective rods 16. Because the respective rods 16 are supported by the springs 17, they may lean over in directions in which the distances between the respective sockets 15 change when the car 2 and the counterweight 3 are raised and lowered.

[0019] Radial cross-sectional area of the socket 15 (area of a cross section that is perpendicular to a central axis A (Figure 3) of the rods 16) is at a maximum at an intermediate portion of the socket 15. Consequently, among the outer circumferential portions of the socket 15, a radial apex 15a that is a portion that is farthest away from the central axis A of the rods 16 is positioned at the intermediate portion of the socket 15. A main rope passage aperture 18 that the main rope 7 is passed through is disposed on the socket 15. The main rope passage aperture 18 has: a main rope end opening portion 18a that is positioned at a tip end portion of the socket 15 (an end portion of the socket 15 away from the rod 16); and a rod end opening portion 18b that is disposed at a position that is closer to the rod 16 than the radial apex 15a. A radial cross-sectional area of the main rope passage aperture 18 is at a minimum at the tip end portion of the

socket 15, and increases continuously toward to the rod 16.

[0020] A wedge (a chock) 19 is inserted inside the main rope passage aperture 18 through the rod end opening portion 18b. The main rope 7 is turned over by being wound around an outer peripheral portion of the wedge 19. The main rope 7 is wedged between the inner surfaces of the main rope passage aperture 18 and the wedge 19 by the portion of the main rope 7 that is wound around the wedge 19 being pulled inside the main rope passage aperture 18 together with the wedge 19. The main rope 7 is connected to the socket 15 in a wedged state between the inner surfaces of the main rope passage aperture 18 and the wedge 19.

[0021] Figure 4 is an enlargement that shows the socket 15 from Figure 3. In the figure, a salient portion 20 that protrudes radially outward from the socket 15 is formed as a socket interfitting portion on an outer circumferential portion of the socket 15. The salient portion 20 is disposed circumferentially around the socket 15 in an annular shape so as to surround the socket 15. The salient portion 20 is disposed at a position between the intermediate portion and the tip end portion of the socket 15. In addition, a distance D1 from the central axis A of the rod 16 to the protruding end portion of the salient portion 20 is made less than a distance D2 from the central axis A of the rod 16 to the radial apex 15a of the socket 15.

[0022] The outer circumferential portion of the socket 15 is coated together with the salient portion 20 by a tubular elastic coating body 21 that is constituted by an elastic material that can expand and contract (a rubber, etc., that is a polymeric material, for example). The portion of the outer circumferential portion of the socket 15 that is coated by the elastic coating body 21 is the portion at which the sockets 15 are most likely to contact each other when the rods 16 lean over. In this example, the elastic coating body 21 covers a portion of the outer circumferential portion of the socket 15 from the intermediate portion of the socket 15 that includes the radial apex 15a to the tip end portion of the socket 15.

[0023] The elastic coating body 21 is mounted to the outer circumferential portion of the socket 15 so as to be widened elastically by the socket 15. Specifically, the elastic coating body 21 generates an elastic force of recovery in a direction that fastens the socket 15, and is held on the outer circumferential portion of the socket 15 by this elastic force of recovery.

[0024] An inner circumferential portion of the elastic coating body 21 is elastically deformed by the elastic coating body 21 being widened by the socket 15. Consequently, a recess portion 22 that fits over the salient portion 20 is formed on an inner circumferential portion of the elastic coating body 21 as a coating body interfitting portion by the elastic coating body 21 being elastically deformed to the shape of the salient portion 20 when the elastic coating body 21 covers the outer circumferential portion of the socket 15.

[0025] Next, a procedure when mounting the elastic coating body 21 to the socket 15 will be explained. The elastic coating body 21 is mounted to the socket 15 before connecting the main rope 7 to the socket 15. When the elastic coating body 21 is mounted to the socket 15, the socket 15 is first inserted inside the elastic coating body 21 while widening the opening portion of the elastic coating body 21 in opposition to the elastic force of recovery of the elastic coating body 21. The opening portion of the elastic coating body 21 is then contracted to allow the elastic coating body 21 to contract elastically. The outer circumferential portion of the socket 15 is thereby covered by the elastic coating body 21. At this point, a recess portion 22 arises on the inner circumferential portion of the elastic coating body 21 due to the elastic coating body 21 being elastically deformed to the shape of the salient portion 20.

[0026] Connection of the main rope 7 to the socket 15 is performed after the socket 15 is covered by the elastic coating body 21. Moreover, the operation by which the elastic coating body 21 is mounted to the socket 15 may be performed inside a factory, or may be performed at an elevator installation site.

[0027] In an elevator main rope fixing apparatus of this kind, because the salient portion (the socket interfitting portion) 20 is formed on the outer circumferential portion of the socket 15, and the recess portion (the coating body interfitting portion) 22 that fits over the salient portion 20 is formed on the inner circumferential portion of the elastic coating body 21 when the elastic coating body 21 covers the outer circumferential portion of the socket 15, contact among mutually adjacent sockets 15 can be prevented by the elastic coating body 21, enabling the generation of noise due to contact among the sockets 15 to be prevented. Even if the elastic coating bodies 21 that are mounted to the mutually adjacent sockets 15 contact each other, displacement of the elastic coating bodies 21 relative to the sockets 15 can be stopped by the salient portions 20, enabling shifting of the positions of the elastic coating bodies 21 relative to the sockets 15 to be made less likely. Dislodging of the elastic coating bodies 21 from the sockets 15 can thereby be reliably prevented. In addition, because fittings are not required to mount the elastic coating bodies 21 to the sockets 15, cost reductions can also be achieved. Installation space for the elastic coating bodies 21 can also be reduced significantly, also enabling overall reductions in the size of the main rope fixing apparatuses to be achieved.

[0028] Because the elastic coating body 21 generates an elastic force of recovery in a direction that fastens the socket 15, and is held on the outer circumferential portion of the socket 15 by this elastic force of recovery, dislodging of the elastic coating body 21 from the socket 15 can be even more reliably prevented.

[0029] Moreover, in the above example, the salient portion 20 is formed on the outer circumferential portion of the socket 15 as the socket interfitting portion, and the recess portion 22 that fits over the salient portion 20 forms on the inner circumferential portion of the elastic coating

body 21 as the coating body interfitting portion, but a recess portion may also be formed on the outer circumferential portion of the socket 15 as the socket interfitting portion such that a salient portion that fits into the recess portion forms on the inner circumferential portion of the elastic coating body 21 as the coating body interfitting portion by elastic deformation of the elastic coating body 21.

[0030] In the above example, only a portion of the outer circumferential portion of the socket 15 is covered by the elastic coating body 21, but the entire outer circumferential portion of the socket 15 may also be covered by the elastic coating body 21.

Embodiment 2

[0031] In Embodiment 1, the recess portion 22 that fits over the salient portion 20 forms on the inner circumferential portion of the elastic coating body 21 due to the elastic coating body 21 being elastically deformed to the shape of the salient portion 20, but a recess portion that fits over the salient portion 20 may also be formed on an inner circumferential portion of an elastic coating body 21 in advance.

[0032] Specifically, Figure 5 is a front elevation that shows a state of an elevator main rope fixing apparatus according to Embodiment 2 of the present invention before an outer circumferential portion of a socket 15 is covered by the elastic coating body 21. In the figure, a recess portion 31 that fits over the salient portion 20 is formed in advance as the coating body interfitting portion on the inner circumferential portion of the elastic coating body 21 by working the elastic coating body 21. The inner circumferential portion of the elastic coating body 21 is formed to match the shape of the outer circumferential portion of the socket 15 in advance. Specifically, the inner circumferential portion of the elastic coating body 21 is worked in advance to a shape that fits over both the outer circumferential portion and the salient portion 20 of the socket 15.

[0033] The elastic coating body 21 is configured so as to be mounted to the socket 15 by fitting the recess portion 31 over the salient portion 20, and so as to be removed from the socket 15 by removing the recess portion 31 from the salient portion 20. In other words, the elastic coating body 21 is mountable to and removable from the socket 15. The rest of the configuration is similar to that of Embodiment 1.

[0034] Because the recess portion 31 that fits over the salient portion 20 is formed on the inner circumferential portion of the elastic coating body 21 in advance in this manner, the elastic coating body 21 can be easily mounted to the appropriate position on the socket 15 by fitting the recess portion 31 onto the salient portion 20.

[0035] Moreover, in the above example, the salient portion 20 is formed on the outer circumferential portion of the socket 15 as the socket interfitting portion, and the recess portion 31 that fits over the salient portion 20 is formed in advance on the inner circumferential portion of the elastic coating body 21 as the coating body interfitting portion, but a recess portion may also be formed on the outer circumferential portion of the socket 15 as the socket interfitting portion, and a salient portion that fits into the recess portion formed in advance on the inner circumferential portion of the elastic coating body 21 as the coating body interfitting portion.

Embodiment 3

[0036] Figure 6 is a side elevation that shows a socket and an elastic coating body of an elevator main rope fixing apparatus according to Embodiment 3 of the present invention. In the figure, a salient portion 41 that protrudes radially outward from a socket 15 is formed as a restricting portion on a tip end portion of the socket 15. The salient portion 41 is disposed circumferentially around the socket 15 in an annular shape so as to surround the socket 15.

[0037] An elastic coating body 21 covers a portion of the outer circumferential portion of the socket 15 from an intermediate portion to just short of the tip end portion of the socket 15. In other words, the elastic coating body 21 covers the outer circumferential portion of the socket 15 so as to avoid the salient portion 41, and the salient portion 41 is exposed.

[0038] The salient portion 41 bears the elastic coating body 21 in a longitudinal direction of the socket 15 (a direction that is parallel to the central axis A of the rod 16). Displacement of the elastic coating body 21 in a direction of removal from the socket 15 is thereby restricted by the salient portion 41. The rest of the configuration is similar to that of Embodiment 1.

[0039] Figure 7 is a front elevation that shows a state before the outer circumferential portion of the socket 15 from Figure 6 is covered by the elastic coating body 21. As shown in the figure, the inner circumferential portion of the elastic coating body 21 is worked in advance to match the shape of the outer circumferential portion of the socket 15. When the elastic coating body 21 is mounted to the socket 15, the socket 15 is inserted inside the elastic coating body 21 from the tip portion end while elastically deforming the elastic coating body 21. Insertion of the socket 15 into the elastic coating body 21 is performed until the salient portion 41 is exposed.

[0040] In an elevator main rope fixing apparatus of this kind, because the salient portion 41 is formed on the outer circumferential portion of the socket 15, and the elastic coating body 21 covers the outer circumferential portion of the socket 15 so as to avoid the salient portion 41, and displacement of the elastic coating body 21 in the direction of removal from the socket 15 is restricted by the salient portion 41, dislodging of the elastic coating body 21 from the socket 15 can be more reliably prevented. Installation space for the elastic coating body 21 can also be reduced, enabling overall reductions in the size of the main rope fixing apparatuses 13 and 14 to be achieved.

In addition, because fittings are not required to mount the elastic coating body 21 to the socket 15, cost reductions can also be achieved.

[0041] Moreover, in the above example, the inner circumferential portion of the elastic coating body 21 is worked in advance to match the shape of the outer circumferential portion of the socket 15, but the inner circumferential portion of the elastic coating body 21 may also be made to adopt a shape that follows the shape of the outer circumferential portion of the socket 15 by elastic deformation of the elastic coating body 21.

When made in this manner, an elastic force of recovery can be generated in the elastic coating body 21 in a direction that fastens the socket 15, enabling the elastic coating body 21 to be made even less likely to shift relative to the socket 15.

Embodiment 4

[0042] In each of the above embodiments, the elastic coating bodies 21 are mounted to all of the sockets 15, but because it is sufficient that elastic coating bodies 21 be interposed between the respective sockets 15, the elastic coating bodies 21 may also be mounted to only some of the respective sockets 15.

[0043] Specifically, Figure 8 is a partial front elevation that shows an elevator main rope fixing apparatus according to Embodiment 4 of the present invention. In the figure, respective sockets 15 are disposed so as to be spaced apart from each other. An elastic coating body 21 is disposed on only one of the mutually adjacent sockets 15. In this example, the elastic coating body 21 is disposed only on the socket 15 that is positioned centrally among three sockets 15. Consequently, outer circumferential portions of two sockets 15 that are positioned on two sides are completely exposed. The rest of the configuration is similar to that of Embodiment 1.

[0044] In an elevator main rope fixing apparatus of this kind, because the elastic coating body 21 is disposed on only one of the mutually adjacent sockets 15, noise due to contact among the sockets 15 can be prevented. Even if the rods 16 lean over, because the resin elastic coating body 21 and the metal socket 15 contact, friction to which the elastic coating body 21 is subjected can be made lower than friction due to contact between the elastic coating bodies 21. The elastic coating body 21 can thereby be made less likely to shift relative to the socket 15, enabling dislodging of the elastic coating body 21 from the socket 15 to be suppressed more reliably. In addition, because the elastic coating bodies 21 do not need to be mounted to all of the sockets 15, cost reductions can be achieved, and size reductions in the main rope fixing apparatuses can also be achieved.

[0045] Moreover, in the above example, the salient portion 20 is disposed on the outer circumferential portion of the socket 15 as the socket interfitting portion, but the salient portion 20 may also be omitted. In that case also, because friction due to contact between the elastic coating body 21 and the socket 15 is less than friction due to contact between elastic coating bodies 21, the elastic coating body 21 is less likely to shift relative to the socket 15, enabling dislodging of the elastic coating body 21 from the socket 15 to be suppressed more reliably.

[0046] in the above example, the configuration of the socket 15 and the elastic coating body 21 is similar to the configuration according to Embodiment 1, but the configuration of the socket 15 and the elastic coating body 21 may also be made similar to the configuration according to either of Embodiments 2 or 3.

[0047] In each of the above embodiments, the elastic coating body 21 is disposed on the outer circumferential portion of the socket 15 by elastically deforming the elastic coating body 21, but the elastic coating body 21 may also be disposed on the outer circumferential portion of the socket 15 by injection molding. In that case, the material that constitutes the elastic coating body 21 is a thermoplastic resin. In injection molding, the socket 15 is inserted inside a molding frame, liquid resin is injected into a space between the outer circumferential portion of the socket 15 and an inner circumferential portion of the molding frame, and then the resin, which is hardened by cooling, is formed as the elastic coating body 21. The outer circumferential portion of the socket 15 can also be easily covered by the elastic coating body 21 in this manner.

[0048] In each of the above embodiments, the elastic coating body 21 is disposed on the outer circumferential portion of the socket 15 by elastically deforming the elastic coating body 21, but the material that constitutes the elastic coating body 21 may also be a resin that contracts on being subjected to heat, and the elastic coating body 21 mounted to the outer circumferential portion of the socket 15 by thermal contraction. The elastic coating body 21 can also be mounted onto the outer circumferential portion of the socket 15 simply by applying heat to the elastic coating body 21 in this manner, enabling the operation of covering the outer circumferential portion of the socket 15 with the elastic coating body 21 to be facilitated.

[0049] In each of the above embodiments, the elastic coating body 21 may also be constituted by a transparent material. Visual inspection can thereby be performed for the presence or absence of abnormalities in the socket 15 (such as cracking, for example) when the elastic coating body 21 is mounted to the socket 15.

[0050] In each of the above embodiments, the elastic coating body 21 may also be constituted by a flame retardant material. The occurrence of fire can thereby be suppressed, and even if a fire does occur, spreading of flames can be suppressed.

[0051] In each of the above embodiments, the elastic coating body 21 is mountable to and removable from the socket 15, but the elastic coating body 21 may also be fixed to the outer circumferential portion of the socket 15 by means of an adhesive. Dislodging of the elastic coating body 21 from the socket 15 can thereby be even more

reliably prevented.

[0052] In each of the above embodiments, the method for suspending the car 2 and the counterweight 3 is a two-to-one (2:1) roping method, but the method for suspending the car 2 and the counterweight 3 may also be a one-to-one (1:1) roping method. In that case, the first main rope fixing apparatus 13 to which the first end portions of the main ropes 7 are connected is mounted to the car 2, and the second main rope fixing apparatus 14 to which the second end portions of the main ropes 7 are connected is mounted to the counterweight 3.

EXPLANATION OF NUMBERING

[0053] 2 CAR (HOISTED BODY), 3 COUNTERWEIGHT (HOISTED BODY), 15 SOCKET, 20 SALIENT PORTION (SOCKET INTERFITTING PORTION), 21 ELASTIC COATING BODY, 22, 31 RECESS PORTION (COATING BODY INTERFITTING PORTION), 41 SALIENT PORTION (RESTRICTING PORTION).

Claims

1. An elevator main rope fixing apparatus **characterized in** comprising:

a socket to which a main rope that suspends a hoisted body is connected, and on an outer circumferential portion of which at least one of a salient portion or a recess portion is disposed as a socket interfitting portion; and
an elastic coating body that covers the outer circumferential portion of the socket, and on an inner circumferential portion of which is formed a coating body interfitting portion that fits together with the socket interfitting portion when covering the outer circumferential portion of the socket.

2. An elevator main rope fixing apparatus according to Claim 1, **characterized in that** the coating body interfitting portion is formed on the inner circumferential portion of the elastic coating body in advance by working the elastic coating body.

3. An elevator main rope fixing apparatus **characterized in** comprising:

a socket to which a main rope that suspends a hoisted body is connected, and on an outer circumferential portion of which a salient portion is disposed; and
an elastic coating body that covers the outer circumferential portion of the socket so as to avoid the salient portion, displacement of the elastic coating body in a direction of removal from the socket being restricted by the salient portion.

4. An elevator main rope fixing apparatus according to either of Claims 1 or 3, **characterized in that** the elastic coating body is constituted by a thermoplastic resin, and is disposed on the outer circumferential portion of the socket by injection molding.

5. An elevator main rope fixing apparatus according to either of Claims 1 or 3, **characterized in that** the elastic coating body is constituted by a resin that contracts on being subjected to heat, and is mounted to the outer circumferential portion of the socket by thermal contraction.

6. An elevator main rope fixing apparatus according to either of Claims 1 or 3, **characterized in that** the elastic coating body generates an elastic force of recovery in a direction that fastens the socket, and is held on the outer circumferential portion of the socket by the elastic force of recovery.

7. An elevator main rope fixing apparatus according to either of Claims 1 or 3, **characterized in that** the elastic coating body is constituted by a transparent material.

8. An elevator main rope fixing apparatus according to either of Claims 1 or 3, **characterized in that** the elastic coating body is constituted by a flame-retardant material.

9. An elevator main rope fixing apparatus according to either of Claims 1 or 3, **characterized in that** the elastic coating body is fixed to the outer circumferential portion of the socket by means of an adhesive.

10. An elevator main rope fixing apparatus **characterized in** comprising:

a plurality of sockets that are disposed so as to be spaced apart from each other, and to which main ropes that suspend a hoisted body are respectively connected; and
an elastic coating body that is disposed on only one of mutually adjacent sockets, and that coats an outer circumferential portion of the socket.

FIG. 1

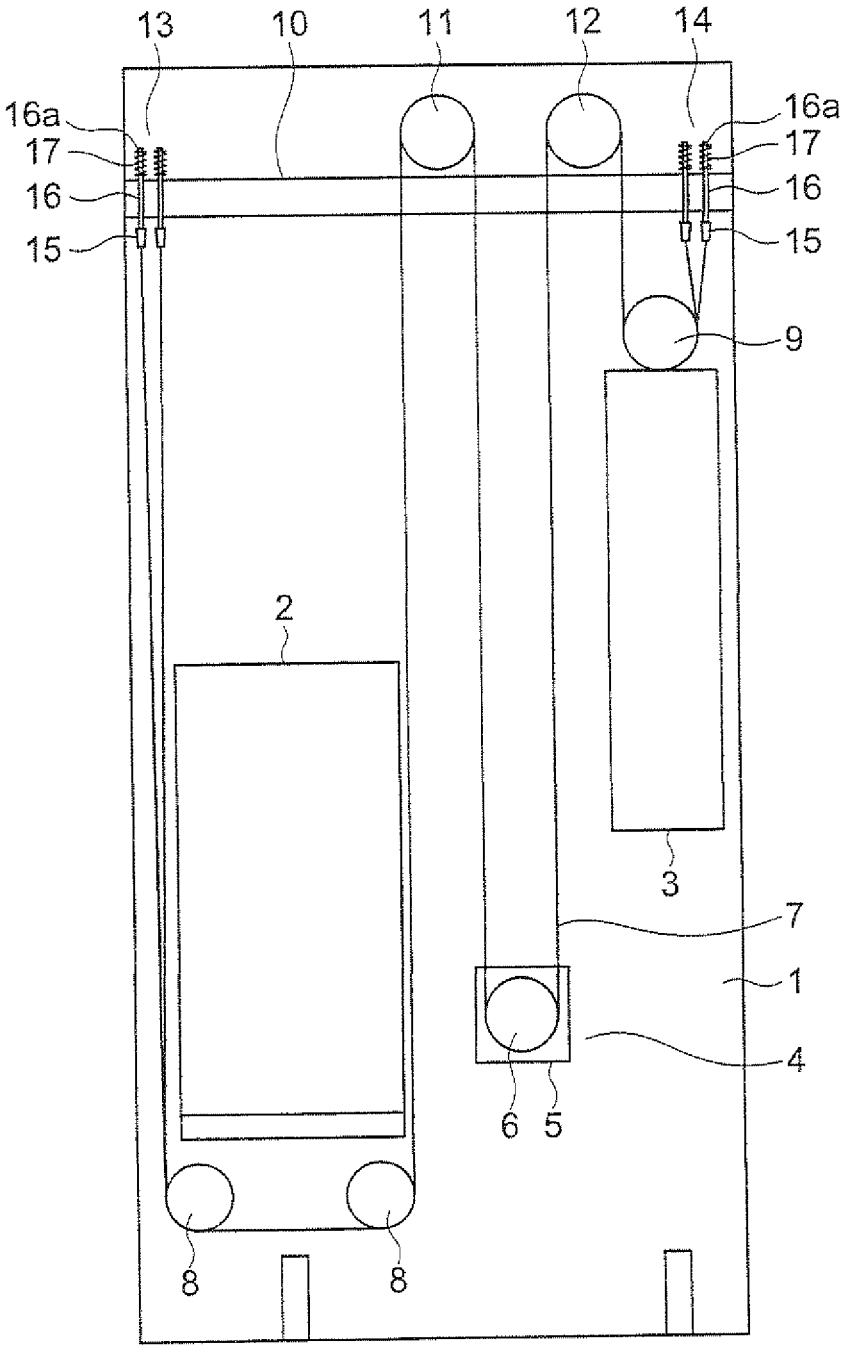


FIG. 2

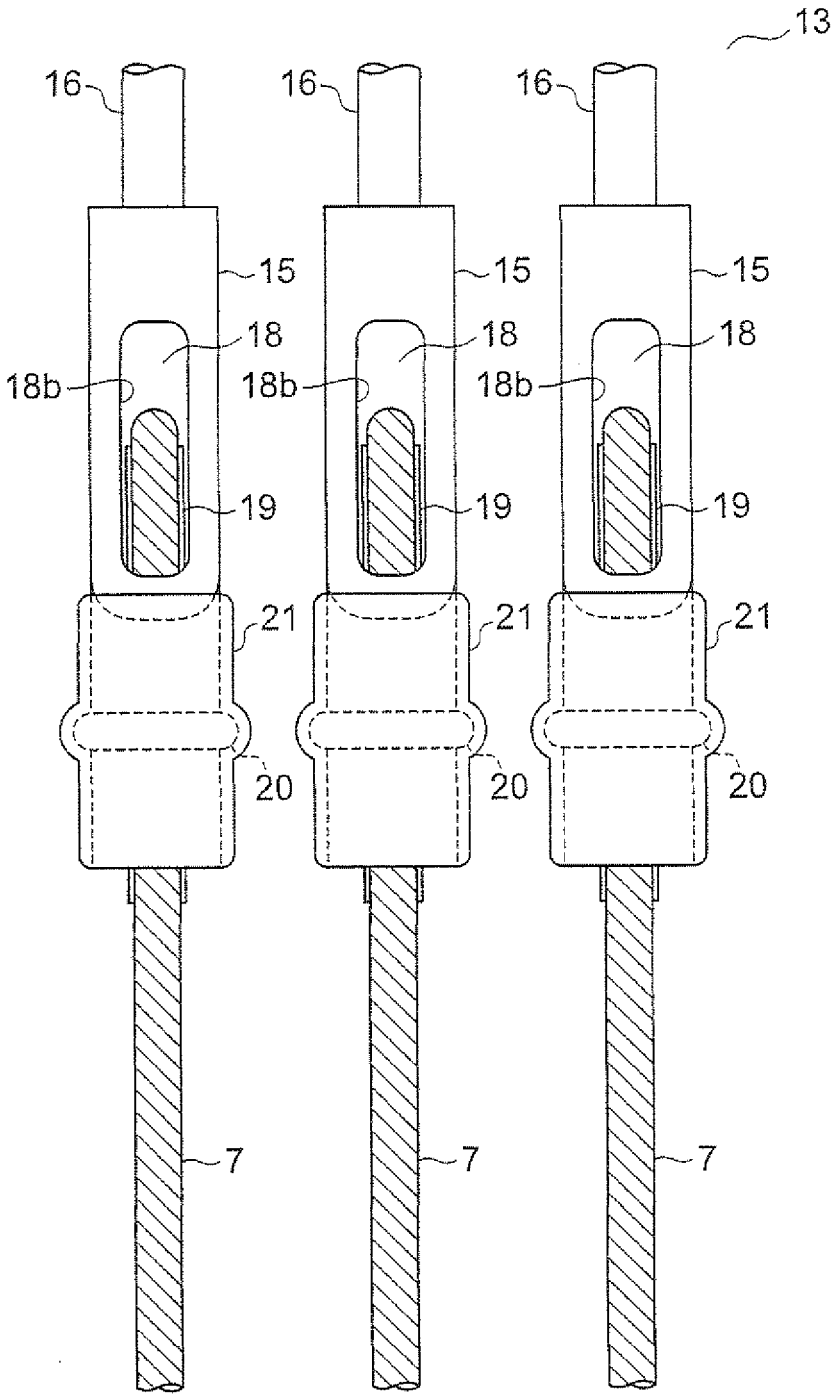

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FIG. 3

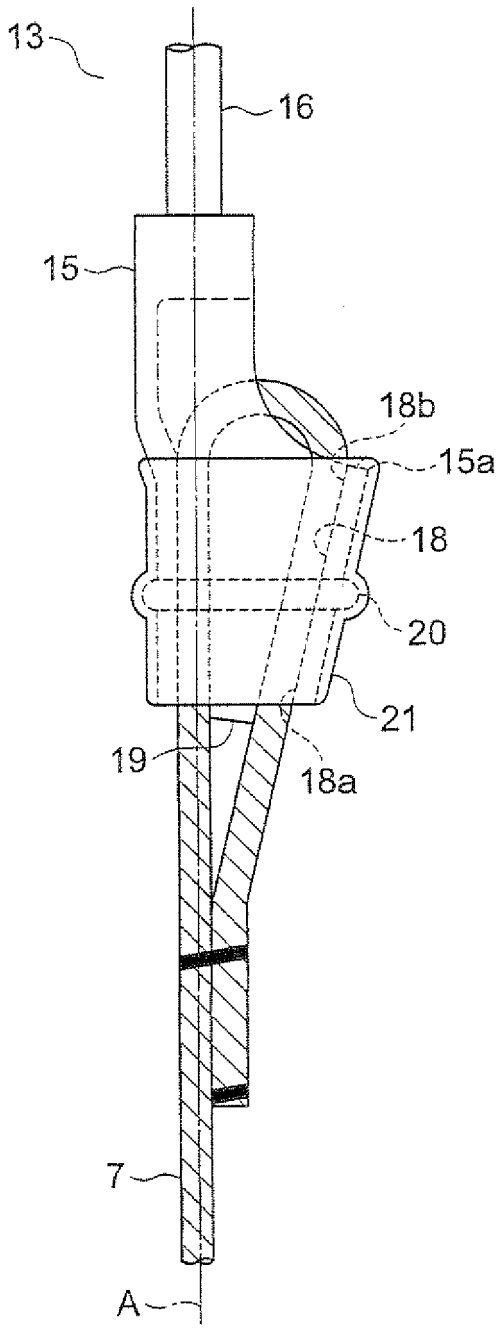


FIG. 4

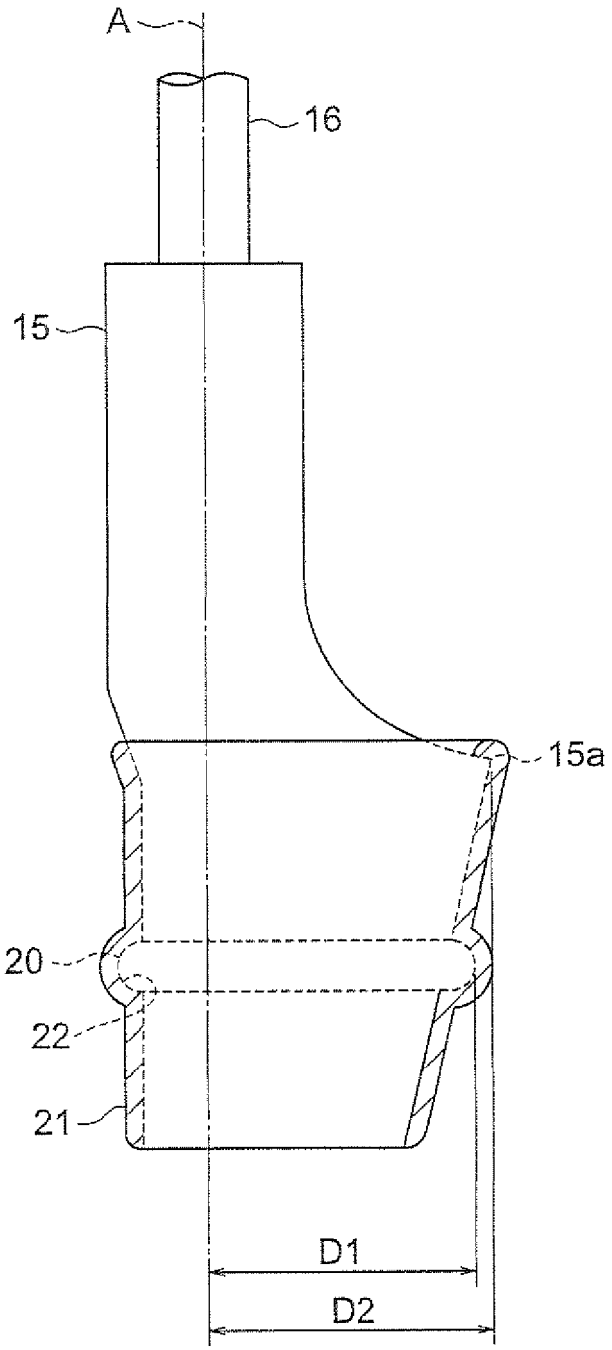


FIG. 5

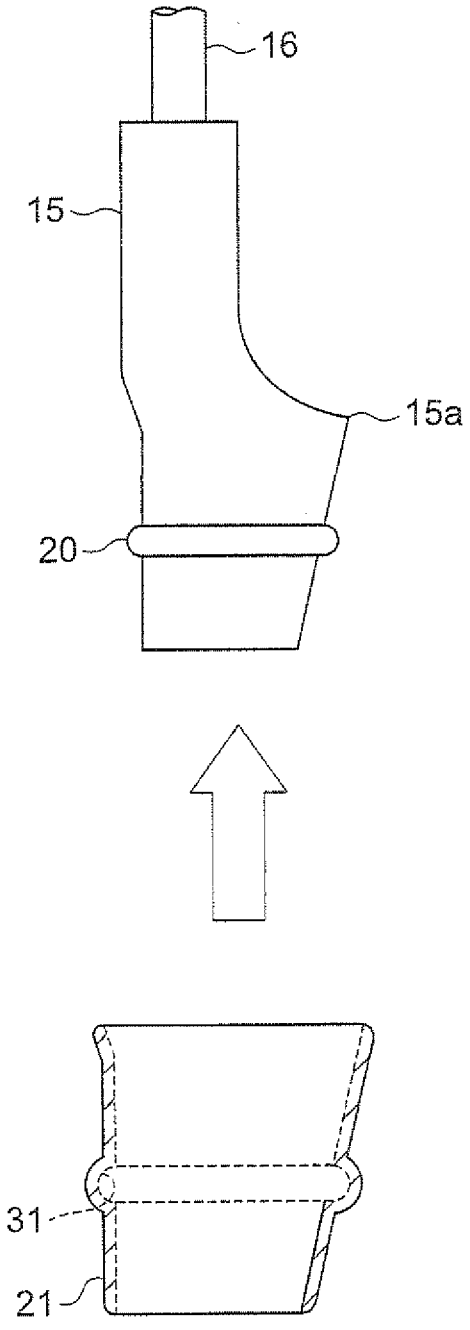


FIG. 6

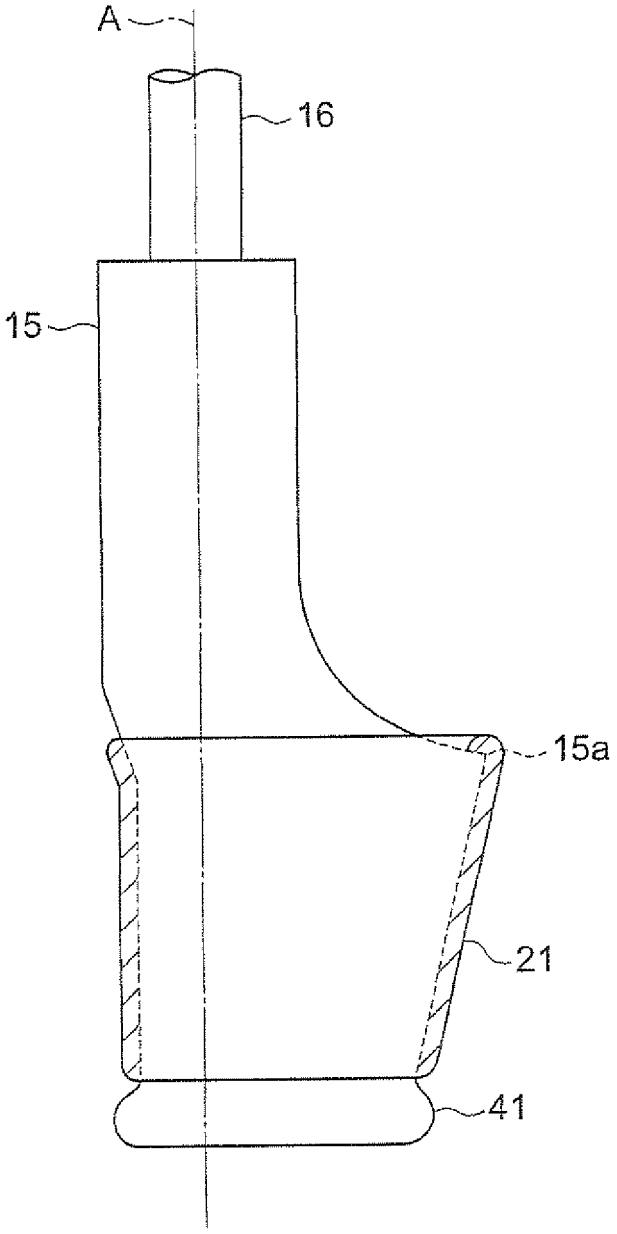


FIG. 7

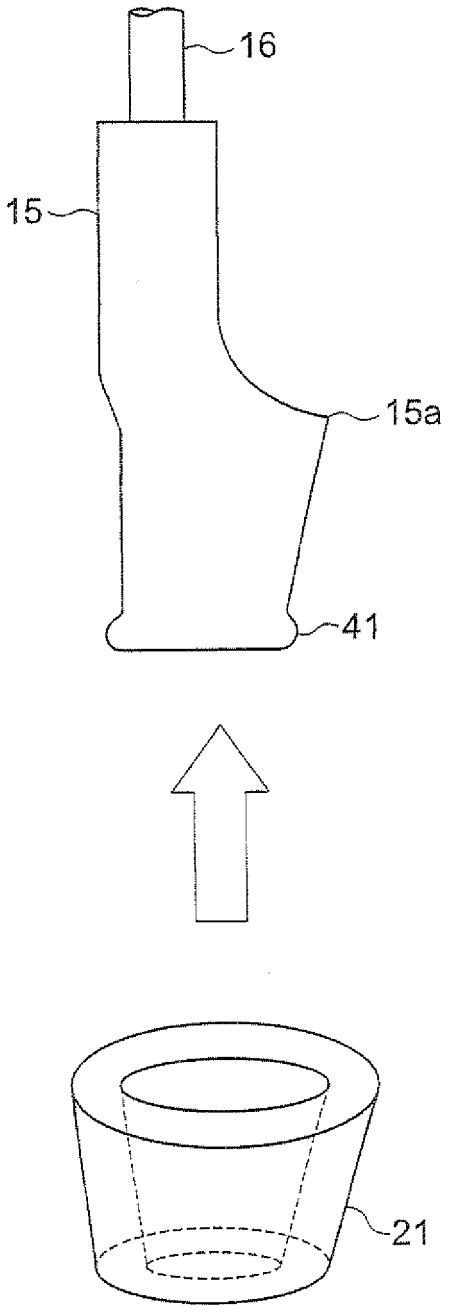
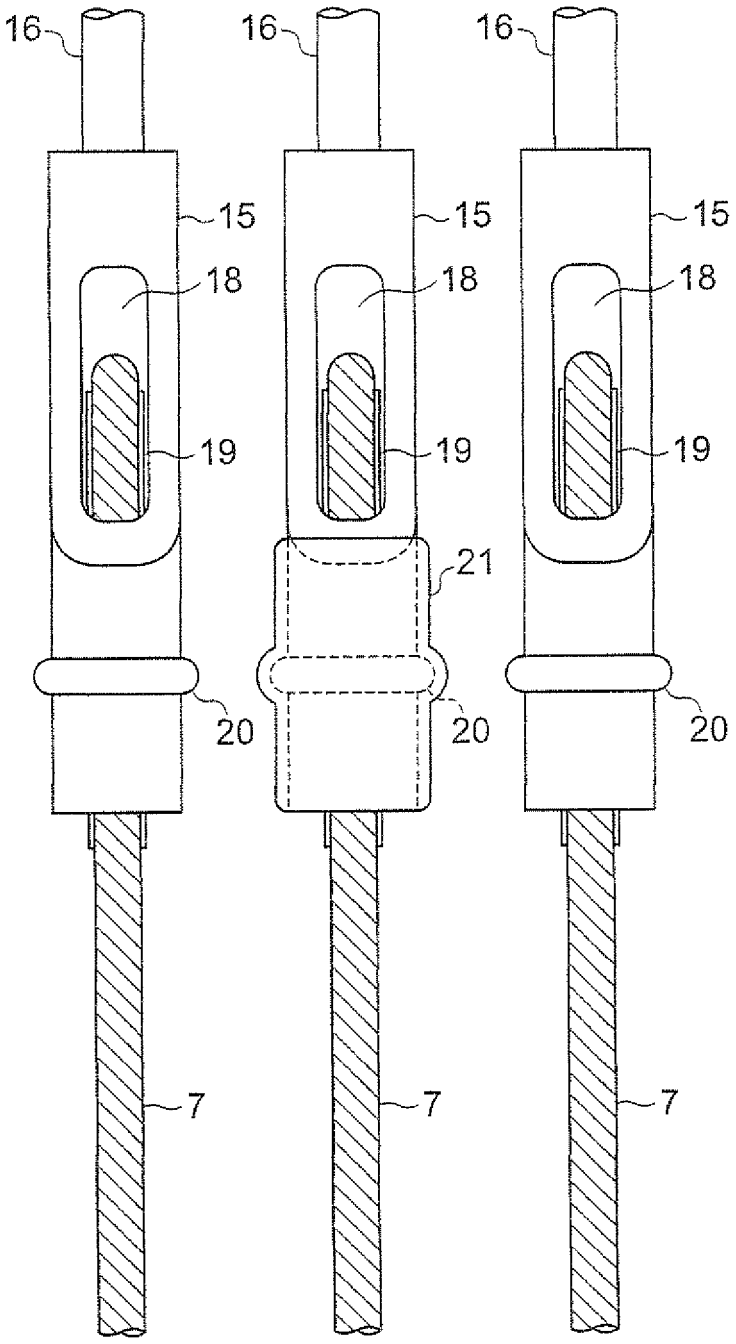


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/068597

A. CLASSIFICATION OF SUBJECT MATTER
B66B7/08(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B66B7/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2010
Kokai Jitsuyo Shinan Koho 1971-2010 Toroku Jitsuyo Shinan Koho 1994-2010

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 151102/1976(Laid-open No. 070056/1978) (Hitachi, Ltd.), 12 June 1978 (12.06.1978), description, page 3, line 15 to page 4, line 2; fig. 3 (Family: none)	1-10
Y	JP 2009-202453 A (Pilot Corp.), 10 September 2009 (10.09.2009), paragraphs [0018] to [0019]; fig. 3 (Family: none)	1-2

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 January, 2010 (07.01.10)	19 January, 2010 (19.01.10)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/068597

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2007-029559 A (Zetto Corp.), 08 February 2007 (08.02.2007), paragraphs [0026], [0029], [0048] to [0053], [0055], [0071] (Family: none)	3-9
Y	JP 2006-244443 A (Yasuhiro TOMITA), 14 September 2006 (14.09.2006), paragraph [0006]; fig. 1 (Family: none)	5
Y	JP 2005-194046 A (Hitachi, Ltd.), 21 July 2005 (21.07.2005), paragraphs [0011] to [0012]; fig. 2 (Family: none)	10

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/068597

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The technical feature of the inventions in claims 1-9 is "a main-rope fastening device for an elevator, provided with an elastic covering body for covering the outer periphery of a socket and having a covering body-side fitting section formed on the inner periphery of the elastic covering body, the covering body-side fitting section being adapted to be fitted to a socket-side fitting section with the elastic covering body covering the outer periphery of the socket." The technical feature of the invention in claim 10 is "a main-rope fastening device for an elevator, provided with an elastic covering body provided to only one of sockets which are arranged adjacent to each other (continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/068597

Continuation of Box No.III of continuation of first sheet(2)

and covering the outer periphery of the socket." Since the inventions have no technical relationship involving one or more of the same or corresponding special technical features, the inventions are not so linked as to form a single general inventive concept.

Form PCT/ISA/210 (extra sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2006143435 A **[0005]**