(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 807 393 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.11.1997 Bulletin 1997/47

(51) Int. Cl.[6]: **A47H 5/02**

(21) Application number: **97107884.5**

(22) Date of filing: **14.05.1997**

(84) Designated Contracting States:
DE FR GB

(30) Priority: **17.05.1996 JP 147976/96**

(71) Applicant:
TOYOTA SHATAI KABUSHIKI KAISHA
Kariya-shi Aichi-ken (JP)

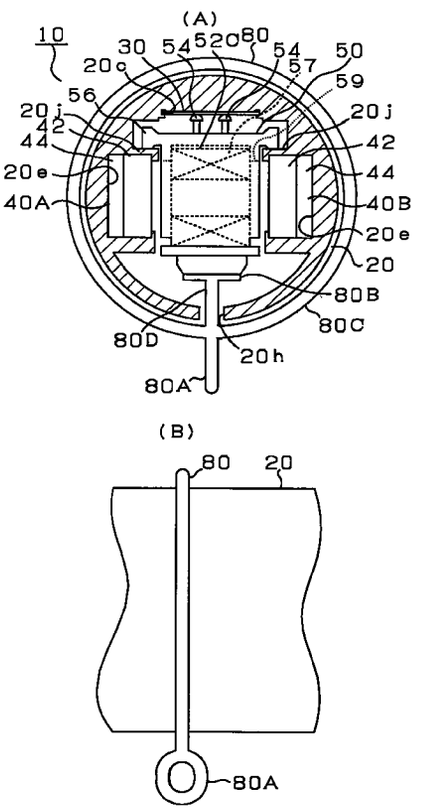
(72) Inventor: **Kato, Naoyuki**
Ichiriyama-Cho, Kariya-shi, Aichi-ken (JP)

(74) Representative:
VOSSIUS & PARTNER
Siebertstrasse 4
81675 München (DE)

(54) Linear motor type curtain opening and closing device

(57) To provide a linear motor type curtain opening and closing device capable of smoothly running ring runners, there is provided a linear motor type curtain opening and closing device constituted by an outer rail (20) incorporating stators, a movable element (50) running in the outer rail (20) and a plurality of ring runners (80, 82A, 82B....) fitted movably to the outer periphery of the outer rail (20) along the outer rail (20) and capable of hanging a curtain where a forefront one of the ring runner (80) is fixed to the movable element (50) by which in running the movable element (50), the ring runner (80) moving along with the movable element (50) is not inclined and is not twisted in respect of the outer rail (20).

Fig. 1



EP 0 807 393 A2

Description

The present invention relates to a linear motor type curtain opening and closing device, particularly to a linear motor type curtain opening and closing device of a ring runner type.

A linear motor is currently used at a curtain rail to electrically open and close a curtain in residence, an office building, a hotel and the like. An explanation will be given of the structure of a linear motor in reference to Fig. 6.

Fig. 6 is a perspective view showing constituent parts of a linear motor. The linear motor is constituted by stators 40A and 40B incorporated in an outer rail 220, a movable element 50 incorporated in the outer rail 220 abrasively in the longitudinal direction, a strip-like cable 30 accommodated at an upper wall of the outer rail 220. The section of the outer rail 220 is formed substantially in an inversed-U shape. The stators 40A and 40B each comprising a permanent magnet 42 and a yoke 44 along the longitudinal direction are incorporated in the outer rail 220. Further, the movable element 50 is provided with three armatures 52A, 52B and 52C in a substantially cylindrical shape and is abrasively mounted in the outer rail 220.

A forefront runner 74 is connected to the lower end of the movable element 50 via a metal piece, not illustrated. The lower end of the forefront runner 74 is projected downwardly from an opening 220h of the outer rail 220. Wheels 74a attached to the forefront runner 74 are constituted to roll over horizontal pieces 220g formed at the lower end of the outer rail 220. Runners 76 for hanging a curtain, not illustrated, are arranged at the inside of the outer rail 220 along with the forefront runner 74.

According to the linear motor type curtain rail, the rail (outer rail 220) is uncovered and curtain hook hanging portions of the runners 74 and 76 are exposed from the opening 220h at the lower side of the rail. According to the curtain rail, it is devised that the outer rail 220 is not seen by attaching the upper end of the curtain, not illustrated, at a position higher than the upper end of the outer rail 220.

Currently, ring-like runners referred to as ring runners are arranged to the outer periphery of a rail in a manual type curtain rail and the ring runners are positively shown along with the curtain rail whereby an accent is constituted in view of design.

Here, when the curtain runners of the so-called ring runner type are driven by a rotating motor, it is anticipated that a large rotating motor needs to be arranged at the side portion of the rail, arrangement of a wire for tracting the ring runners at the inside of the rail becomes complicated and the curtain may not be manually opened or closed.

Meanwhile, when the curtain runners of the ring runner type are driven by the linear motor shown by Fig. 6, it is conceived as illustrated by Fig. 7 that a ring runner 80 connected to the movable element 50 is inclined at the start of running and is twisted in respect of the outer rail 220 whereby the ring runner 80 cannot be driven smoothly.

The linear motor of the present invention is achieved in order to solve the above-described problem and it is an object of the present invention to provide a linear motor type curtain opening and closing device capable of smoothly running ring runners.

In order to achieve the above-described object, a linear motor type curtain opening and closing device of the present invention comprises:

a rail main body incorporating stators;
a movable element running in the rail main body; and
a plurality of ring-like runners fitted movably to an outer periphery of the rail main body along the rail main body capable of hanging a curtain, characterized in that
a forefront ring-runner among the plurality of ring-like runners is fixed to the movable element.

According to the linear motor type curtain opening and closing device of the present invention, the forefront ring-like runners is fixed to the movable element and accordingly, in running the movable element, the forefront ring-like runner moving along with the movable element is not inclined and is not twisted in respect of the rail main body.

Fig. 1(A) is a sectional view of a linear motor according to a first embodiment and Fig. 1(B) is a side view of the linear motor.

Fig. 2 is a perspective view of constituent parts of the linear motor shown by Fig. 1.

Fig. 3 is a perspective view showing attachment of a ring runner to a movable element.

Figs. 4(A) and 4(B) are side views showing opening and closing operation of a curtain by a linear motor according to the first embodiment where Fig. 4(A) shows a state before opening and closing a curtain and Fig. 4(B) shows a state of opening and closing the curtain.

Fig. 5(A) is a sectional view of a linear motor according to a second embodiment and Fig. 5 (B) is a side view of the linear motor.

Fig. 6 is a perspective view of constituent parts of a linear motor according to a conventional technology.

Fig. 7 is a side view showing opening and closing operation of a curtain by the linear motor of the conventional technology.

An explanation will be given of embodiments implementing the present invention in reference to the drawings as follows.

Fig. 1(A) is a sectional view of a linear motor 10 constituting a linear motor type curtain opening and closing device according to a first embodiment and Fig. 1(B) is a side view thereof. Further, Fig. 2 is a perspective view showing constituent parts of the linear motor 10. According to the linear motor 10, a ring runner 80 is

fixed to a movable element 50 running in the linear motor 10.

An explanation will firstly be given to the constitution of the linear motor according to the first embodiment. As shown by Fig. 1(A), the linear motor is constituted by stators 40A and 40B incorporated in an outer rail 20 and the movable element 50 incorporated in the outer rail 20 abrasively in the longitudinal direction. The outer rail 20 is formed in a cylindrical shape and a pair of magnet fitting grooves 20e each having a section in a channel-like shape are provided at intermediate portions in the up and down direction of the outer rail 20.

The stators 40A and 40B each comprising a permanent magnet 42 and a yoke 44 are incorporated in the respective magnet fitting grooves 20e in the longitudinal direction. The permanent magnet 42 on the side of the stator 40A is formed with a plurality of magnetized portions 42A, 42B, 42C,... (refer to Fig. 2) in the longitudinal direction and the respective magnetized portions 42A, 42B, 42C,... are magnetized in the thickness direction of the permanent magnet 42. In this case, magnetizing polarities of the respective magnetized portions which are mutually contiguous to each other in the respective magnetized portions 42A, 42B, 42C,..., are mutually reversed.

Meanwhile, the permanent magnet 42 on the side of the stator 40B is similarly magnetized in the thickness direction and magnetizing polarities of contiguous respective magnetized portions are mutually reversed. Also, respective two opposed magnetic poles of the magnetized portions of the permanent magnets 42 on the side of the stator 40A and on the side of the stator 40B which are opposed to each other, are provided with reverse polarities.

A cable fitting groove 20C for incorporating a strip-like cable 30 is formed at the upper portion of the outer rail 20 as illustrated by Fig. 1(A). The cable 30 is provided with a flexible insulating film and two electrode patterns 30A and 30B are formed in a pattern shape interposing a narrow gap 30C in a broken line along the longitudinal direction as shown by Fig. 2. The electrode patterns 30A and 30B each is formed by a copper foil of the illustrated shape and is constituted to repeat at a predetermined pitch to correspond to the couple of permanent magnets 42.

As shown by Fig. 2, a movable element 50 is provided with a head wall 56 having an elongated plate shape and the head wall 56 is mounted abrasively on respective upper walls 20j of the two left and right magnet fitting grooves 20e in the longitudinal direction as shown by Fig.1(A).

As shown by Fig. 2, the movable element 50 is provided with a body 58 having a rectangular parallelepiped shape and the body 58 is hung from the central portion in the left and right direction of the head wall 56 and between respective two opposed ends of the two left and right magnet fitting grooves 20e movably in the longitudinal direction (refer to Fig. 1(A)). As shown by Fig. 2, the body 58 is provided with three armatures 52A, 52B and 52C each having a substantially cylindrical shape. As shown by Fig. 1 (A), each of the armatures 52A, 52B and 52C is provided with a core 59 made of iron and the axial direction of the core 59 is in parallel to the magnetizing direction of the respective magnetized portions of the permanent magnets 42 of the stators 40A and 40B (that is, orthogonal to the longitudinal direction of the two permanent magnets 42). A coil 57 is wound around the outer periphery of the core 59 and pole magnetisms of the both ends of the core 59 are determined in accordance with the polarity of a direct current voltage applied on brushes 54 connected to the coil 57.

Further, the pair of brushes 54 are respectively projected from portions of the upper face of the head wall 56 corresponding to the respective armatures 52A, 52B and 52C and front ends thereof are brought into contact with either of the two electrode patterns 30A and 30B of the cable 30 as shown by Fig. 2.

Fig. 3 is a view magnifying a lower end portion of a ring runner 80. A ring runner 80 is integrally formed by a synthetic resin and is constituted by an attaching portion 80B horizontally extended to be able to fix to the movable element 50, a ring portion 80C surrounding the outer periphery of the outer rail 20 as shown by Fig. 1(A), a connecting portion 80D for connecting the attaching portion 80B and the ring portion 80C, and a hanging portion 80A for hanging a curtain arranged at the lower end of the ring portion 80C. The connecting portion 80D is extended downwardly from an opening groove 20h formed at the lower end of the outer rail 20 to support the ring portion 80C as shown by Fig. 1(A).

As illustrated by Fig. 3, screw holes 50a, 50b and 50c are perforated at the lower end of the movable element 50. Meanwhile, screw holes 80a, not illustrated, 80b and 80c are perforated also at the attaching portion 80B of the ring runner 80. The ring runner 80 is fixed to the movable element 50 by fastening screws 84 to the screw holes 50a, 50b and 50c and the screw holes 80a, 80b and 80c.

Next, an explanation will be given of opening and closing operation of a curtain by the linear motor of the first embodiment in reference to Fig. 4 (A) and Fig. 4(B). The forefront ring runner 80 at the left end in Fig. 4(A) is fixed to the movable element 50 as explained above in reference to Figs. 1(A), 1(B), 2 and 3 and other ring runners 82A, 82B and 82C are fitted abrasively to the outer rail 20. Also, a curtain 90 hangs down from the ring runners 80, 82A, 82B and 82C via curtain hooks.

When an opening and closing switch, not illustrated, of the curtain is operated and electricity is supplied to the cable 30 shown by Fig. 2, current is made to flow to the respective armatures 52A, 52B and 52C of the movable element 50 via the brushes 54 and magnetic fluxes are generated. A thrust in the right direction of Fig. 4 (A) is generated in the movable element 50 by the mutual action of the magnetic fluxes of the respective armatures 52A, 52B and 52C and the permanent

magnets 42 whereby running in the right direction is started. The forefront ring runner 80 is moved in the right direction along with the running of the movable element 50 and presses the ring runner 82A, 82B and 82C arranged on the right side by being brought in contact therewith as shown by Fig. 4(B) by which the ring runners 82A, 82B and 82C are moved horizontally in the right direction on the outer rail 20 whereby the curtain 90 is opened.

According to the linear motor of the first embodiment, different from the linear motor of the conventional technology described above in reference to Fig. 7, the ring runner 80 is fixed to the movable element and therefore, the ring runner 80 is not inclined and is not twisted in respect of the outer rail. Therefore, the curtain 90 can be opened and closed by abrasively moving the ring runner 80 smoothly on the outer rail 20.

An explanation will be given successively of a second embodiment of the present invention in reference Fig. 5.

Fig. 5(A) shows a sectional view of a linear motor 110 constituting a linear motor type curtain opening and closing device according to the second embodiment and Fig. 5(B) shows a side view thereof. Although in the above-described first embodiment, the outer rail 20 is formed in a cylindrical shape, according to the second embodiment, an outer rail 120 is formed in a shape of a square prism. Incidentally, with regard to the second embodiment, the same reference notations are used in respect of members similar to those in the first embodiment and an explanation thereof will be omitted.

A ring runner 180 is integrally formed by a synthetic resin and is constituted by an attaching portion 180B horizontally extended to be able to fix to the movable element 50, a rectangular ring portion 180C surrounding the outer periphery of the outer rail 20, a connecting portion 180D for connecting the attaching portion 180B and the ring portion 180C and a hanging portion 180A for hanging a curtain arranged at the lower end of the ring portion 180C. The connecting portion 180D is extended downwardly from an opening groove 120h formed at the lower end of the outer rail 120 to support the ring portion 180C. Similar to the first embodiment explained above in reference to Fig. 3, the ring runner 180 is fixed to the movable element 50 by fastening screws to screw holes, not illustrated, of the movable element 50 and screw holes, not illustrated, formed at the attaching portion 180B of the ring runner 180.

Also in the linear motor of the second embodiment, the ring runner 180 is fixed to the movable element 50 and therefore, the ring runner 180 is not inclined and is not twisted in respect of the outer rail 120 in opening and closing the curtain. Therefore, the ring runner 180 is abrasively moved smoothly on the outer rail 120 whereby a curtain can be opened and closed.

Incidentally, although in the first embodiment, the example of using the cylindrical outer rail 20 and the ring-like ring runner 80 has been described and according to the second embodiment, the example of using the outer rail 120 having a square prism shape and the ring runner 180 having a square shape has been described, it is possible in the present invention to use outer rails having various shapes of a triangular shape, a pentagonal shape, a hexagonal shape and the like and ring runners having various shapes surrounding outer peripheries of the outer rails. Also, although the magnet movable type linear motor is exemplified in the first and the second embodiments, the present invention is naturally applicable to a linear motor of a coil movable type.

As described above, according to the linear motor type curtain opening and closing devices of the present invention, the ring runner is fixed to the movable element and therefore, the ring runner is not twisted in respect of the outer rail 20 whereby the curtain can be opened and closed smoothly.

Claims

1. A linear motor type curtain opening and closing device including :

   a rail main body incorporating stators (40A, 40B);
   a movable element (50) running in the rail main body; and
   a plurality of ring-like runners (80,82) fitted movably to an outer periphery of the rail main body along the rail main body and capable of hanging a curtain, wherein
   a forefront one of the ring-like runner (80) among the plurality of ring-like runners (80,82) is fixed to the movable element (50).

2. A device according to claim 1, wherein the outer rail (20) is formed in a cylindrical, rectangular or square shape.

Fig. 1

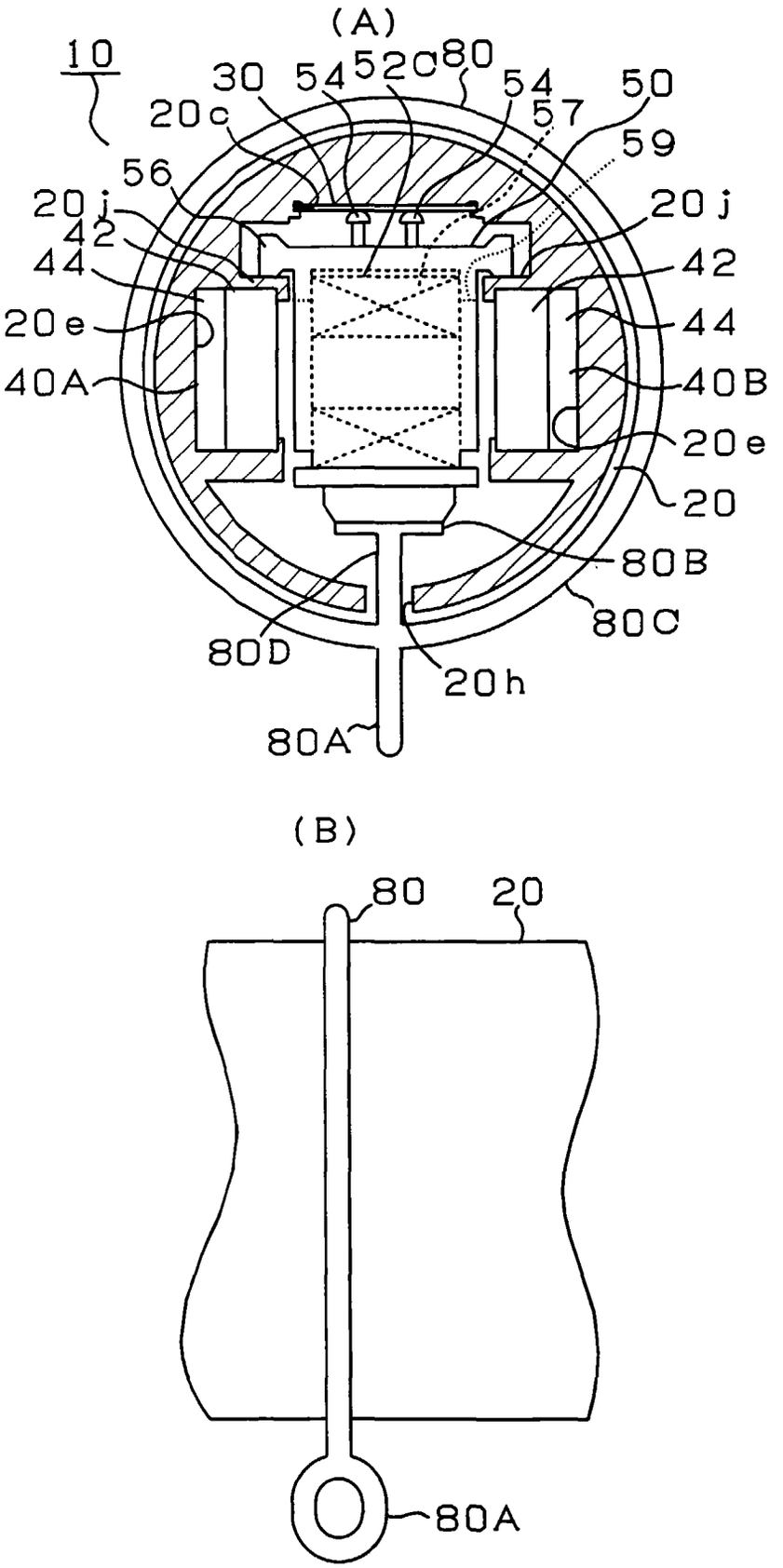

(A)
10
30
54
52
80
54
50
20c
57
59
56
20j
42
44
20e
40A
20j
42
44
40B
20e
20
80B
80C
80D
20h
80A
(B)
80
20
80A

Fig.2

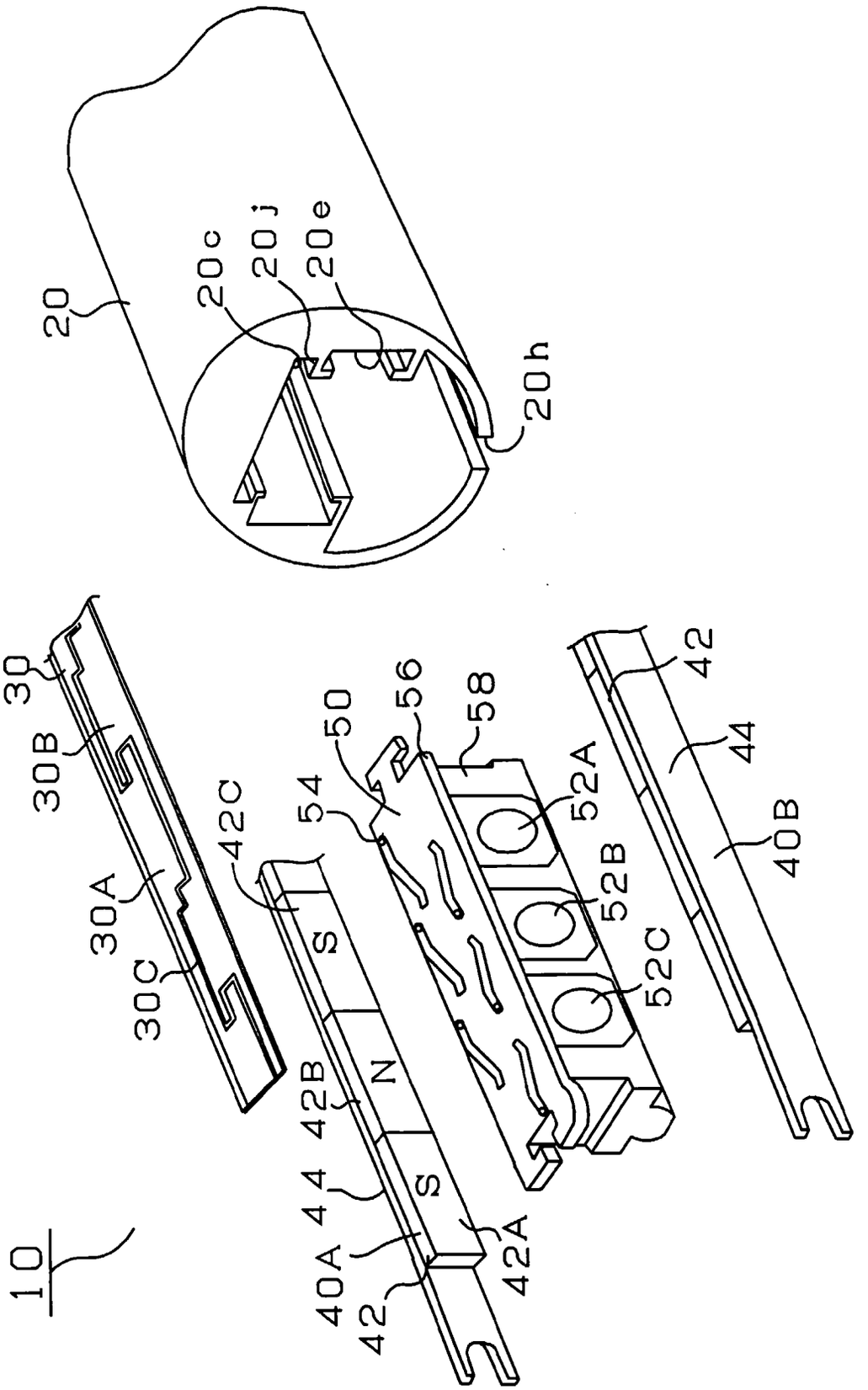

20
20c
20j
20e
20h
10
30
30B
30A
30C
42C
54
50
56
58
52A
52B
52C
42
44
40B
S
N
S
42B
44
40A
42
42A

Fig. 3

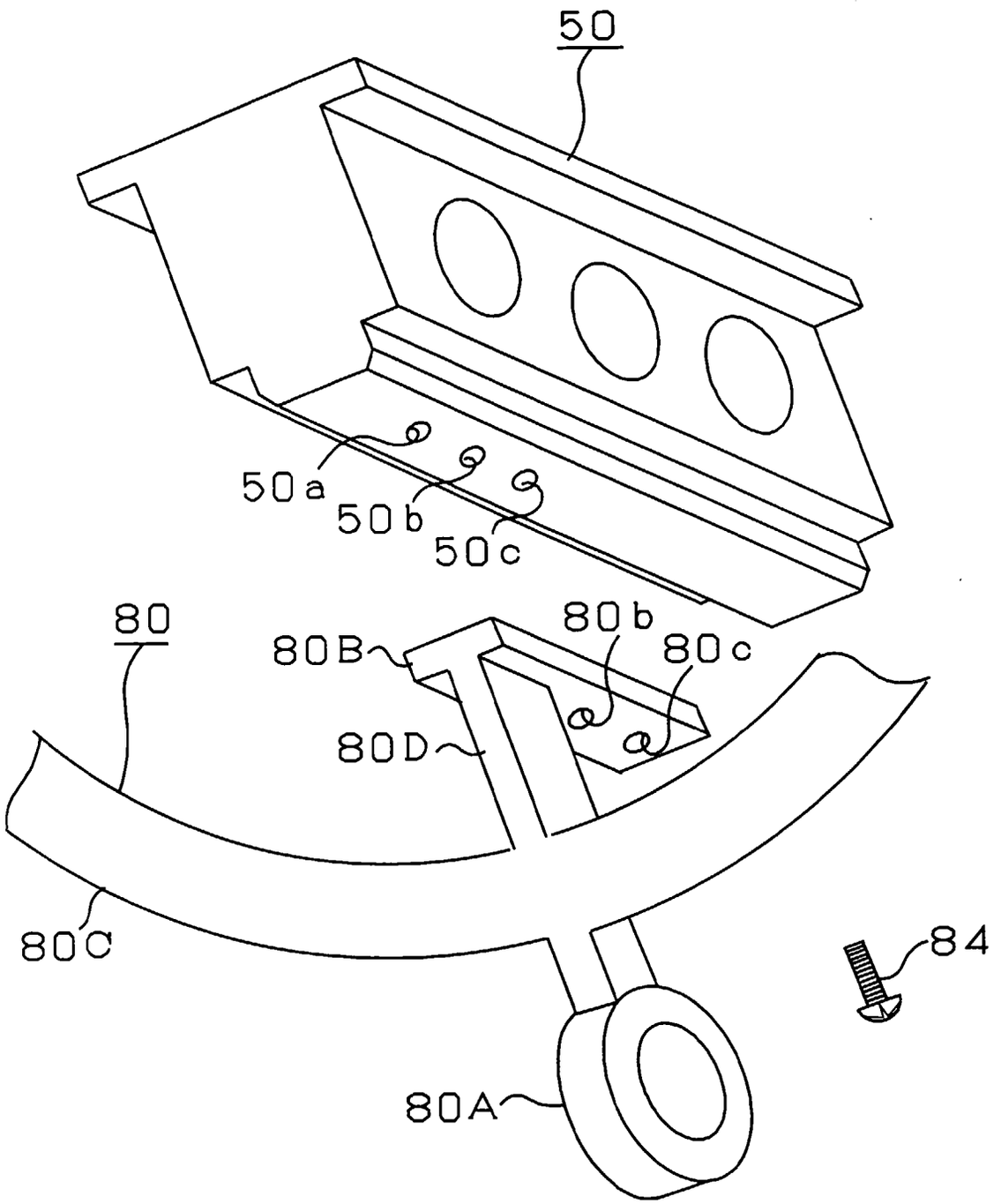
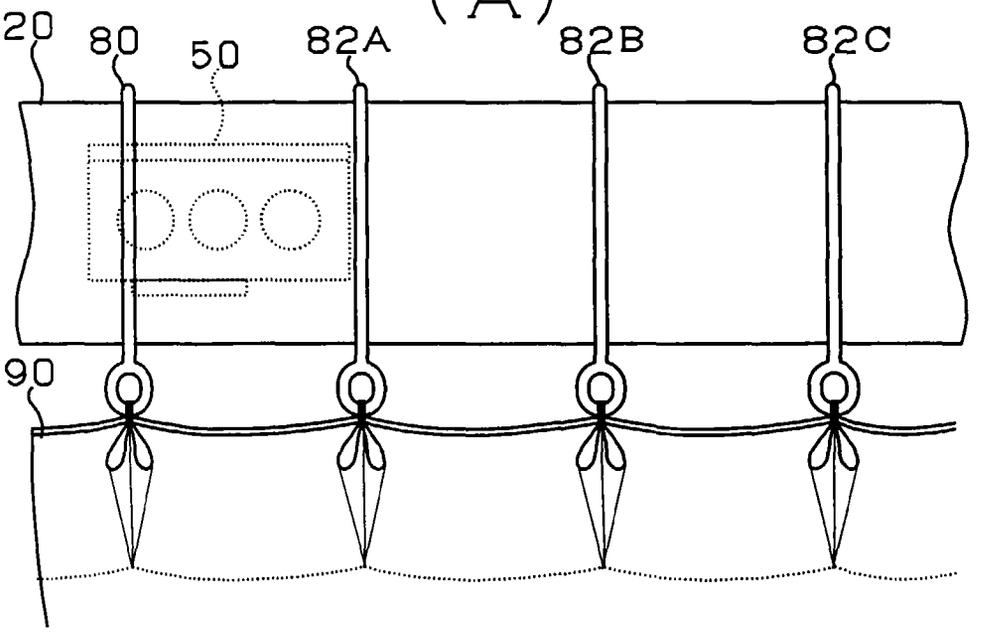


Fig. 4

(A)



(B)

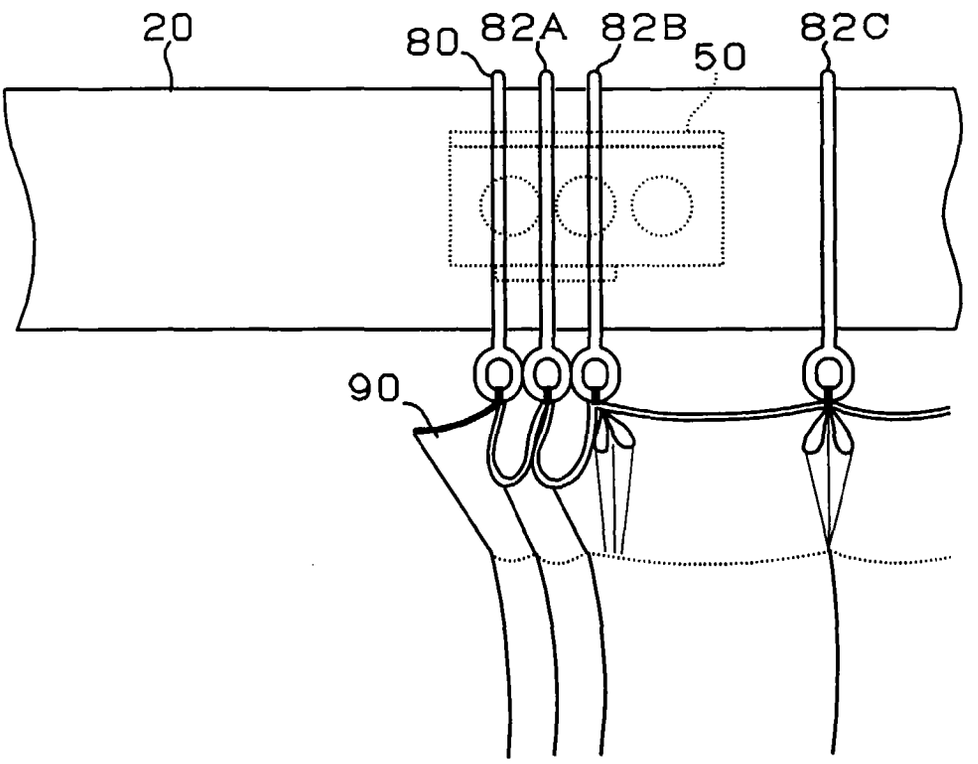


Fig. 5

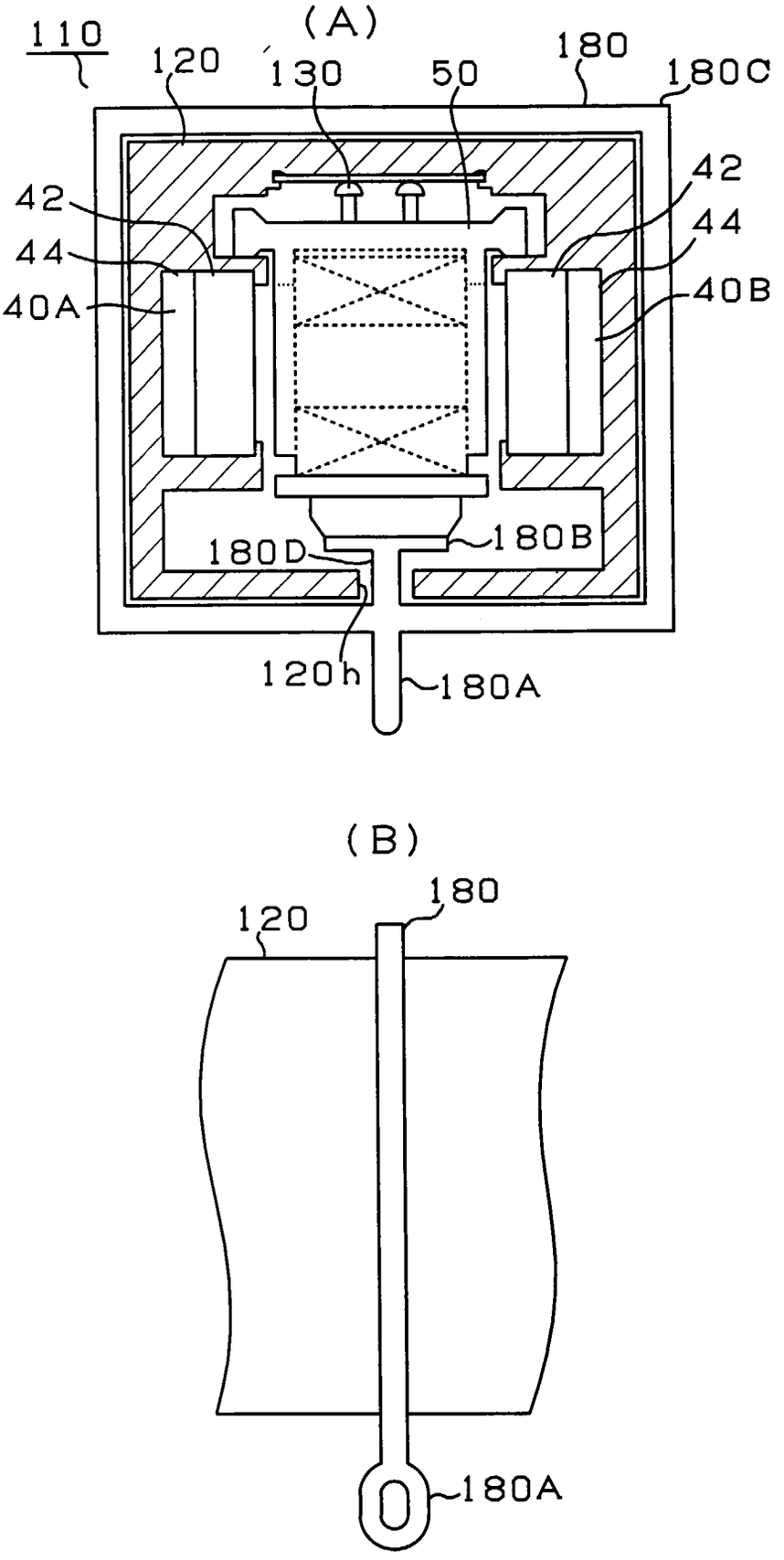

(A)
110
120
130
50
180
180C
42
44
40A
42
44
40B
180D
180B
120h
180A
(B)
180
120
180A

Fig. 6

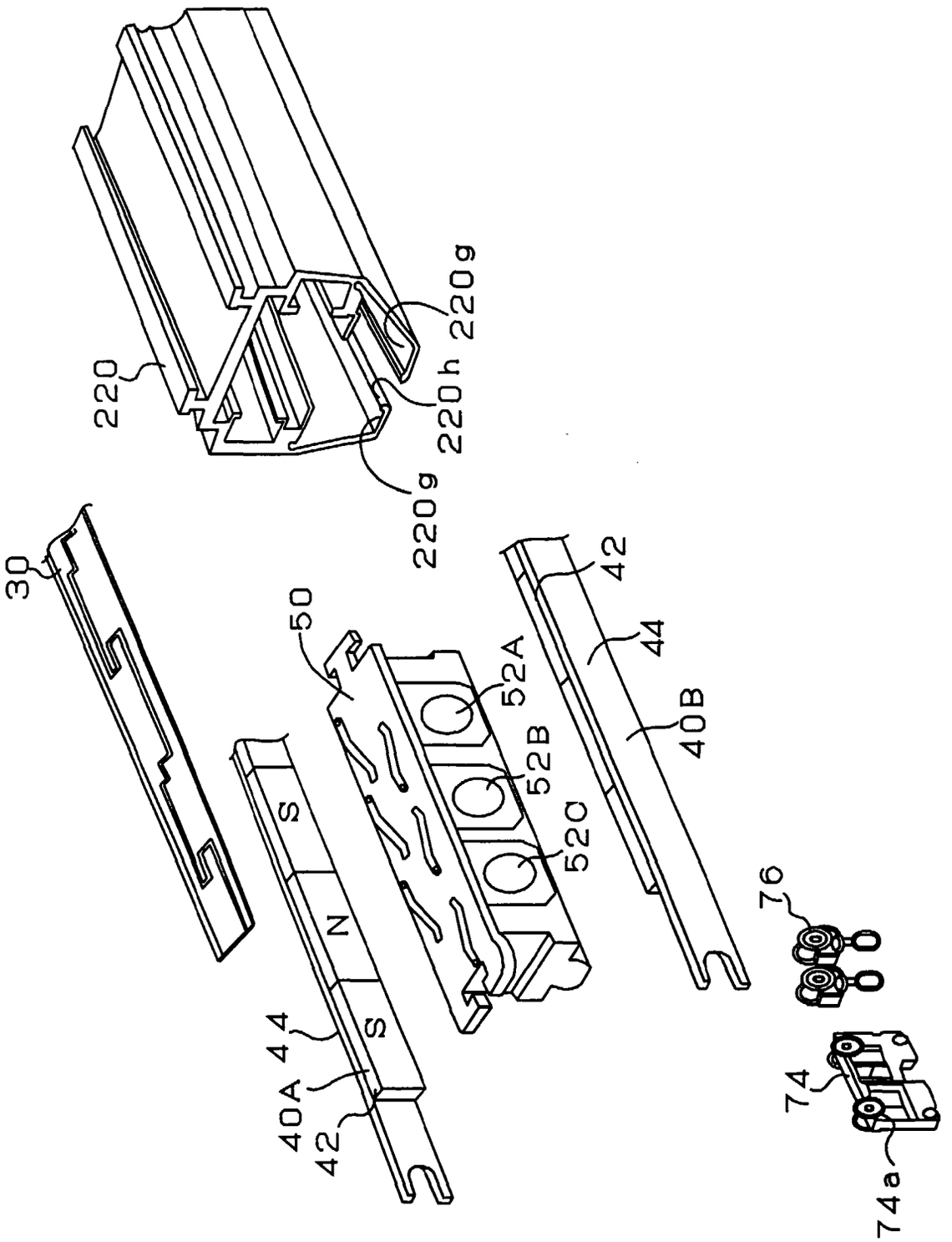

220
220g
220h
220g
30
50
52A
52B
52C
42
44
40B
76
S
N
S
44
40A
42
74
74a

Fig. 7