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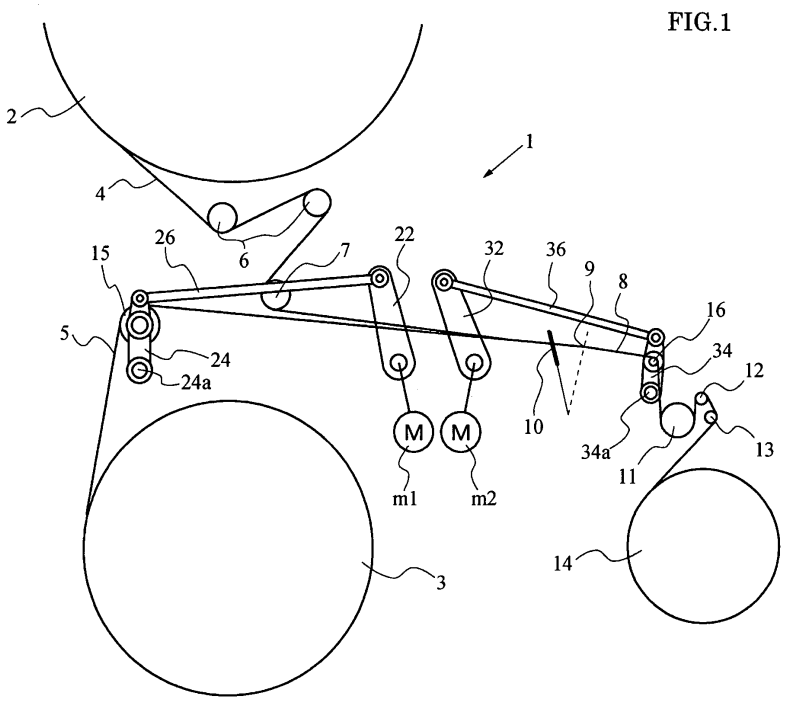
(54) Driving device for terry motion members in cloth-shifting-type pile loom

(57) In a pile loom (1) in which terry motion members (15, 16) are driven by at least one designated driving motor (ml, m2), a braking unit (b1, b2, b3, b4) is provided in at least one driving mechanism for the terry motion members (15, 16). The braking unit (b1, b2, b3, b4) stops the terry motion members (15, 16) from moving when electricity supplied to at least one driving motor (m1, m2) for driving the terry motion members (15, 16) is interrupted.

FIG.1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to driving devices for terry motion members, and particularly, to a driving device for let-off-side and take-up side terry motion members in a cloth-shifting-type pile loom in which the let-off-side and take-up side terry motion members are driven by a designated driving motor or designated driving motors provided independent of a main driving motor of the pile loom.

2. Description of the Related Art

[0002] Japanese Unexamined Patent Application Publication No. 2-47334, for example, discloses a cloth-shifting-type pile loom of the abovementioned type.

[0003] According to the cloth-shifting-type pile loom disclosed in Japanese Unexamined Patent Application Publication No. 2-47334, a back roller defining the let-off-side terry motion member and a breast beam defining the take-up-side terry motion member are driven by a single driving motor or by designated driving motors provided individually for the two terry motion members.

[0004] In a cloth-shifting-type pile loom of this type, when electricity supplied to the driving motor(s) for driving the terry motion members is interrupted, the terry motion members may continue to move in an uncontrolled state, which could lead to problems in the weaving operation and to problems related with safety concerns. Such interruption of the electricity supplied to the driving motor (s) may possibly be caused by, for example, a power failure, a malfunction in a device for supplying the driving motor(s) with electricity, or when the power of the pile loom is artificially turned off.

[0005] If a power failure or a malfunction occurs during an operation of the pile loom, the driving force of the driving motor(s) is lost. Due to an inertia force, each of the let-off-side and the take-up side terry motion members continues to operate while exceeding its normal operational range. This may be problematic in view of the weaving operation in that an excess tension may be applied to ground warp yarns wound around the let-off-side terry motion member, thus leading to a breakage of the ground warp yarns.

[0006] If the pile loom is stopped due to a certain reason, there are cases where an operator approaches the pile loom in order to repair what had caused the pile loom to stop. In that case, the operator may at times need to work near the let-off-side and the take-up side terry motion members. If a second operator comes and accidentally turns off the power of the pile loom without noticing that the first operator is working near the let-off-side and the take-up side terry motion members, the terry motion members will operate in an uncontrolled manner due to their own weight. This may be problematic in view of safety concerns in that if the first operator's hands come into contact with the terry motion members, the operator could get injured.

[0007] Moreover, if the power of the pile loom is turned off after the pile loom is temporarily stopped, the let-off-side and the take-up-side terry motion members may shift from the positions at which the terry motion members were at the time of the shut off process due to their own weight. This could significantly break the synchronized state between the pile loom and each terry motion member. In that case, the synchronization process performed when the pile loom is to be reactivated becomes complicated and time consuming.

SUMMARY OF THE INVENTION

[0008] Accordingly, it is an object of the present invention to solve the aforementioned problems in the weaving operation and the problems related with safety concerns by providing a cloth-shifting-type pile loom in which braking forces are applied to the let-off-side and the take-up-side terry motion members when the electricity supplied to driving motors for driving the let-off-side and the take-up-side terry motion members is interrupted so as to prevent the terry motion members from moving in an uncontrolled manner.

[0009] In order to achieve the aforementioned object, the present invention provides a driving device for terry motion members in a cloth-shifting-type pile loom, in which the driving device includes a braking unit provided in at least one driving mechanism. The braking unit stops the terry motion members from moving when electricity supplied to at least one driving motor for driving the terry motion members is interrupted.

[0010] Furthermore, the braking unit may be a non-exciting actuation type electromagnetic brake provided in at least one driving motor. Furthermore, at least one driving motor may include a plurality of driving motors, and at least one driving mechanism may include a plurality of driving mechanisms. In this case, the let-off-side terry motion member and the take-up-side terry motion member may be driven individually by the designated driving motors and the designated driving mechanisms.

[0011] In the driving device for the terry motion members in the cloth-shifting-type pile loom according to the present invention, when the electricity supplied to at least one driving motor for driving the terry motion members is interrupted, a braking force from the braking unit is applied to at least a portion of at least one driving mechanism for driving the terry motion members. Thus, the terry motion members are restricted from moving after the interruption of the electricity supplied to at least one driving motor. Accordingly, the aforementioned problems in the weaving operation and the problems related with safety concerns, such as broken warp yarns and injured operators, can be effectively solved.

[0012] Furthermore, in comparison with a separately-

placed braking unit, the non-exciting actuation type electromagnetic brake defining the braking unit and provided in at least one driving motor occupies a less amount of space and does not require, for example, a dedicated bracket for setting the braking unit. Accordingly, this contributes to a cost reduction of the driving device.

[0013] Furthermore, in a pile loom in which the let-off-side terry motion member and the take-up-side terry motion member are driven individually by the designated driving motors and the designated driving mechanisms, there are cases where the two terry motion members move away from each other when the electricity supplied to the driving motors is interrupted. This could damage the warp yarns and the cloth more severely. By applying the driving device according to the present invention to a pile loom of this type, these problems can be advantageously solved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is a side view illustrating a cloth-shifting-type pile loom according to a first embodiment of the present invention;

Fig. 2 is a front view illustrating a relevant portion in the first embodiment of the present invention;

Fig. 3 is a partially cross-sectional front view illustrating the relevant portion in the first embodiment of the present invention; and

Fig. 4 is a partially cross-sectional front view illustrating a relevant portion in a second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Embodiments of the present invention will now be described with reference to the drawings.

[0016] Figs. 1 to 3 illustrate a first embodiment according to the present invention. A pile loom 1 shown in Fig. 1 to which a driving device according to the present invention is applied is a cloth-shifting type which shifts the cloth fell during a pile-weaving operation in order to form a pile fabric.

[0017] The cloth-shifting-type pile-loom 1 includes an upper pile-warp beam 2 around which a plurality of pile warp yarns 4 are wound in a sheet-like manner, and a lower ground-warp beam 3 around which a plurality of ground warp yarns 5 are wound in a sheet-like manner. The pile warp yarns 4 are fed from the pile-warp beam 2 and are wound around two guide rollers 6, 6 and a pile-warp tension roller 7 disposed at a downstream side of the guide rollers 6, 6 so as to be supplied to a cloth fell 9 of cloth 8 via a heald (not shown) and a reed 10.

[0018] On the other hand, the ground warp yarns 5 are fed from the ground-warp beam 3 and are wound around a ground-warp tension roller 15, which defines a let-off-side terry motion member. Similar to the pile warp yarns 4, the ground warp yarns 5 guided by the tension roller 15 are then supplied to the cloth fell 9 of the cloth 8 via the heald and the reed 10.

[0019] Together with each inserted weft yarn (not shown), the pile warp yarns 4 and the ground warp yarns 5 form the cloth 8. The cloth 8 is subsequently guided by a cloth guide roller 16, which defines a take-up-side terry motion member, towards a take-up roller 11 and guide rollers 12, 13 so as to be finally taken up by a cloth roller 14.

[0020] In the pile loom 1, the let-off-side terry motion member (i.e. the ground-warp tension roller 15) and the take-up-side terry motion member (i.e. the cloth guide roller 16) are driven individually by designated driving motors and designated driving mechanisms.

[0021] Specifically, opposite ends of the ground-warp tension roller 15 are supported by a pair of supporting levers 24 (only one of which is shown in Fig. 1). The supporting levers 24 are respectively supported by opposite side frames of the pile loom 1 in a rocking manner. The supporting levers 24 are linked with a rocking lever unit 22 via a linking rod 26. The rocking lever unit 22 is driven in a rocking motion by a driving motor m1. When the driving motor m1 drives the rocking lever unit 22 in a rocking motion, the supporting levers 24 become rocked around a rocking shaft 24a, whereby the tension roller 15 moves in a rocking motion in a front-back direction.

[0022] On the other hand, similar to the ground-warp tension roller 15, the cloth guide roller 16 is supported between the opposite side frames of the pile loom 1 via a pair of supporting levers 34. The supporting levers 34 are linked with a rocking lever unit 32 via a linking rod 36. The rocking lever unit 32 is driven in a rocking motion by a driving motor m2. When the driving motor m2 drives the rocking lever unit 32 in a rocking motion, the supporting levers 34 become rocked around a rocking shaft 34a, whereby the cloth guide roller 16 moves in a rocking motion in the front-back direction.

[0023] Referring to Fig. 2, the two driving motors m1, m2 are supported by one of side frames 17 of the pile loom 1 via respective brackets 18a, 18b. During a weaving operation, the two driving motors m1, m2 are driven in the same rotational direction in synchronization with a main shaft of the pile loom 1 (i.e. a main driving motor which is not shown). In response to the rotation of the driving motors m1, m2, the ground-warp tension roller 15 and the cloth guide roller 16 are rocked forward or backward at a predetermined timing in each pile formation cycle, whereby the cloth fell 9 of the cloth 8 is shifted at the predetermined timing.

[0024] According to the pile loom 1, since the let-off-side terry motion member and the take-up-side terry motion member are driven respectively by the designated driving motors m1, m2, the two terry motion members can be driven in an asynchronous manner. In other words, the two terry motion members can be driven at different drive-start timings and different drive-end timings and by different driving distances. For example, the

ground-warp tension roller 15 may be driven in a manner such that the fluctuation of the ground warp tension is moderate during each cycle of the pile loom 1.

[0025] According to the present invention, the pile loom 1 is equipped with braking units for preventing the terry motion members from being in a freely movable state after the electricity supplied to the driving motors m1, m2 is interrupted. In the drawings, the braking units are defined by non-exciting actuation type electromagnetic brakes b1, b2. Referring to Figs. 2 and 3, the electromagnetic brakes b1, b2 are respectively integrated with the driving motors m1, m2. In other words, the driving motors m1, m2 are respectively equipped with the electromagnetic brakes b1, b2.

[0026] Although non-exciting actuation type electromagnetic brakes are already known to those skilled in the art, the electromagnetic brakes b1, b2 of the non-exciting actuation type type will be described below in detail. The following description is directed to both the electromagnetic brake b1 and the electromagnetic brake b2, but since the electromagnetic brake b2 has the same structure as the electromagnetic brake b1, the electromagnetic brake b2 will be omitted in the description below. Referring to Fig. 3, the electromagnetic brake b1 is provided with a field core 41 housing an electromagnetic coil 42, and is attached to multiple stationary sections of the driving motor m1 with, for example, attachment bolts (not shown). Moreover, the electromagnetic brake b1 is also provided with an armature 43 formed of a magnetic material. The armature 43 is loosely fitted to an output shaft m1a of the driving motor m1 in a movable manner in the axial direction of the output shaft m1a. A tubular disc 44 is provided with a polygonal hole 44a to which an outer periphery of a hub 45 is engaged. The tubular disc 44 is disposed in a movable manner in the axial direction of the output shaft m1a and in a relatively unrotatable manner with respect to the hub 45. The hub 45 is engaged with a key m1b provided on the output shaft m1a such that the hub 45 is prevented from rotating relatively with respect to the output shaft m1a. Moreover, the hub 45 is fixed to a shaft end of the output shaft m1a with a stopper ring 46. A circular side plate 47 and the armature 43 are attached to multiple sections of the field core 41 in a movable manner in the axial direction with attachment screws 48. An outer periphery of each attachment screw 48 is provided with a collar 49 having a length that is greater than the total thickness of the armature 43 and the disc 44 by a dimension a, such that the dimension a defines a magnetic gap a. The armature 43 is pressed towards the disc 44 by compression springs 41b fitted in a plurality of holes 41a provided in the field core 41. Accordingly, this forms the magnetic gap a between the field core 41 and the armature 43.

[0027] The electromagnetic coil 42 is in an electrified state (excited state) when electricity is being supplied to the driving motor m1. This allows the armature 43 to be attached to the field core 41 against the biasing force of the compression springs 41b. As a result, narrow gaps are formed between the armature 43 and the disc 44 and between the disc 44 and the side plate 47, such that the frictional force between the armature 43 and the disc 44 and the frictional force between the disc 44 and the side plate 47 are close to zero. In this state, a braking force for the output shaft m1a is not generated, such that the output shaft m1a of the driving motor m1 is in a rotatable state.

[0028] On the other hand, when the electricity supplied to the driving motor m1 is interrupted, the electromagnetic coil 42 becomes non-excited so that the armature 43 is pressed towards the side plate 47 via the disc 44 by the biasing force of the compression springs 41b. Thus, the frictional force between the armature 43 and the disc 44 and the frictional force between the disc 44 and the side plate 47 generate a braking force, whereby the output shaft m1a of the driving motor m1 is restricted from rotating.

[0029] Accordingly, when the electricity supplied to the driving motors m1, m2 is interrupted, the braking forces of the electromagnetic brakes b1, b2 respectively stop the rotations of the output shafts m1a, m2a of the driving motors m1, m2. This means that even when the electricity supplied to the driving motors m1, m2 is interrupted, the rocking lever units 22, 32 are restricted from rocking, and moreover, the tension roller 15 and the cloth guide roller 16 are restricted from moving via the linking rods 26, 36 and the supporting levers 24, 34. Accordingly, this prevents the tension roller 15 and the cloth guide roller 16 from moving in an uncontrolled state after the interruption of the electricity supplied to the driving motors m1, m2, whereby the aforementioned problems can be effectively prevented from occurring.

[0030] According to the first embodiment, the pile loom 1 to which the driving device of the present invention is applied is a type in which the let-off-side terry motion member and the take-up-side terry motion member are driven individually by designated driving motors and designated driving mechanisms. However, the present invention is not necessarily limited to this type of a pile loom, and may alternatively be directed to a type in which the two terry motion members are driven with a single driving motor. (For example, the pile loom disclosed in Fig. 9 of Japanese Unexamined Patent Application Publication No. 2-47334).

[0031] Furthermore, in the first embodiment, the braking units are integrated with the driving motors m1, m2 so as to apply braking forces to the corresponding output shafts m1a, m2a of the driving motors m1, m2. Alternatively, the positional settings of the braking units and the subjects of the braking units to which the braking forces are applied may be set differently. For example, each of the braking units may apply a braking force to an alternative portion between the driving motor and the terry motion member of the corresponding driving mechanism. Specifically, in the pile loom 1, the braking forces may be applied to, for example, the rocking shafts 24a, 34a of the supporting levers 24, 34 that support the terry mo-

tion members.

[0032] Fig. 4 illustrates a second embodiment of the present invention in which a braking force is applied to each of the rocking shafts 24a, 34a. Each of braking units b3, b4 shown in Fig. 4 has substantially the same structure as the braking unit b1 (i.e. the electromagnetic brake b1) according to the first embodiment. For this reason, components in the second embodiment that are the same as those in the first embodiment are given the same reference numerals as the first embodiment, and therefore, descriptions of those components will be omitted below.

[0033] Referring to Fig. 4, the supporting levers 24 (34) that support the corresponding terry motion member are supported by the rocking shaft 24a (34a) in a relatively unrotatable manner. The opposite ends of the rocking shaft 24a (34a) are rotatably supported by the side frames 17, 17 of the pile loom 1 via, for example, shaft bearings 17a, 17a. In Fig. 4, only one of the side frames 17 is shown. The side frame 17 is provided with a non-exciting actuation type electromagnetic brake b3 (b4) defining one of the braking units. The electromagnetic brake b3 (b4) is fixed to the side frame 17 shown in Fig. 4 with, for example, attachment bolts (not shown), and the rocking shaft 24a (34a) extends through the electromagnetic brake b3 (b4). The electromagnetic brake b3 (b4) may either be disposed adjacent to one end portion of the rocking shaft 24a (34a), or may include two brake components that are respectively disposed adjacent to two opposite end portions of the rocking shaft 24a (34a).

[0034] In the electromagnetic brake b3 (b4), the hub 45 is engaged with a key 24b (34b) provided on the rocking shaft 24a (34a) such that the hub 45 is prevented from rotating relatively with respect to the rocking shaft 24a (34a). Moreover, the hub 45 is fixed to the rocking shaft 24a (34a) with the stopper ring 46, which is fastened to the rocking shaft 24a (34a) with a setscrew 46a.

[0035] When the electricity supplied to the driving motor m1 (m2) is interrupted, the power supply for the electromagnetic coil 42 is simultaneously stopped such that the electromagnetic coil 42 becomes non-excited. This means that a braking force of the electromagnetic brake b3 (b4) is generated simultaneously with the interruption of the electricity supplied to the driving motor m1 (m2), thereby stopping the rotation of the rocking shaft 24a (34a). Consequently, this stops the rocking motion of the supporting levers 24 (34) attached to the rocking shaft 24a (34a) in a relatively unrotatable manner, whereby the corresponding terry motion member is restricted from being in a freely movable state.

[0036] As an alternative to the above example in which braking forces are applied to the rocking shafts 24a, 34a rotated in response to the driving operation of the driving motors m1, m2, the braking units may apply braking forces to, for example, the linking rods 26, 36. In that case, each braking unit may include a pair of braking plates disposed adjacent to opposite sides of the corresponding linking rod 26, 36. When electricity is being applied to each braking unit, the braking plates are separated from each other by a distance greater than the width of the corresponding linking rod 26, 36, whereas when the electricity supplied to each braking unit is interrupted, the braking plates squeeze against the corresponding linking rod 26, 36 from opposite directions so as to stop the linking rod 26, 36 from moving. In that case, due to the fact that the vertical positions of the linking rods 26, 36 change slightly in response to the rocking motions of the rocking lever units 22, 32 and the supporting levers 24, 34, the two pairs of braking plates must be disposed in a manner such that the braking plates cover the range in which these vertical positions of the linking rods 26, 36 change.

[0037] In the embodiments described above, the braking units generate braking forces when the electricity supply is interrupted. Alternatively, the braking units according to the present invention may be provided with, for example, designated power supply units. In that case, when the power of the pile loom 1 is turned off or when it is detected that the electricity supplied to the driving motors is interrupted, the braking units may receive power from the power supply units to generate the braking forces.

[0038] The technical scope of the present invention is not limited to the above embodiments, and modifications are permissible within the scope and spirit of the present invention.

Claims

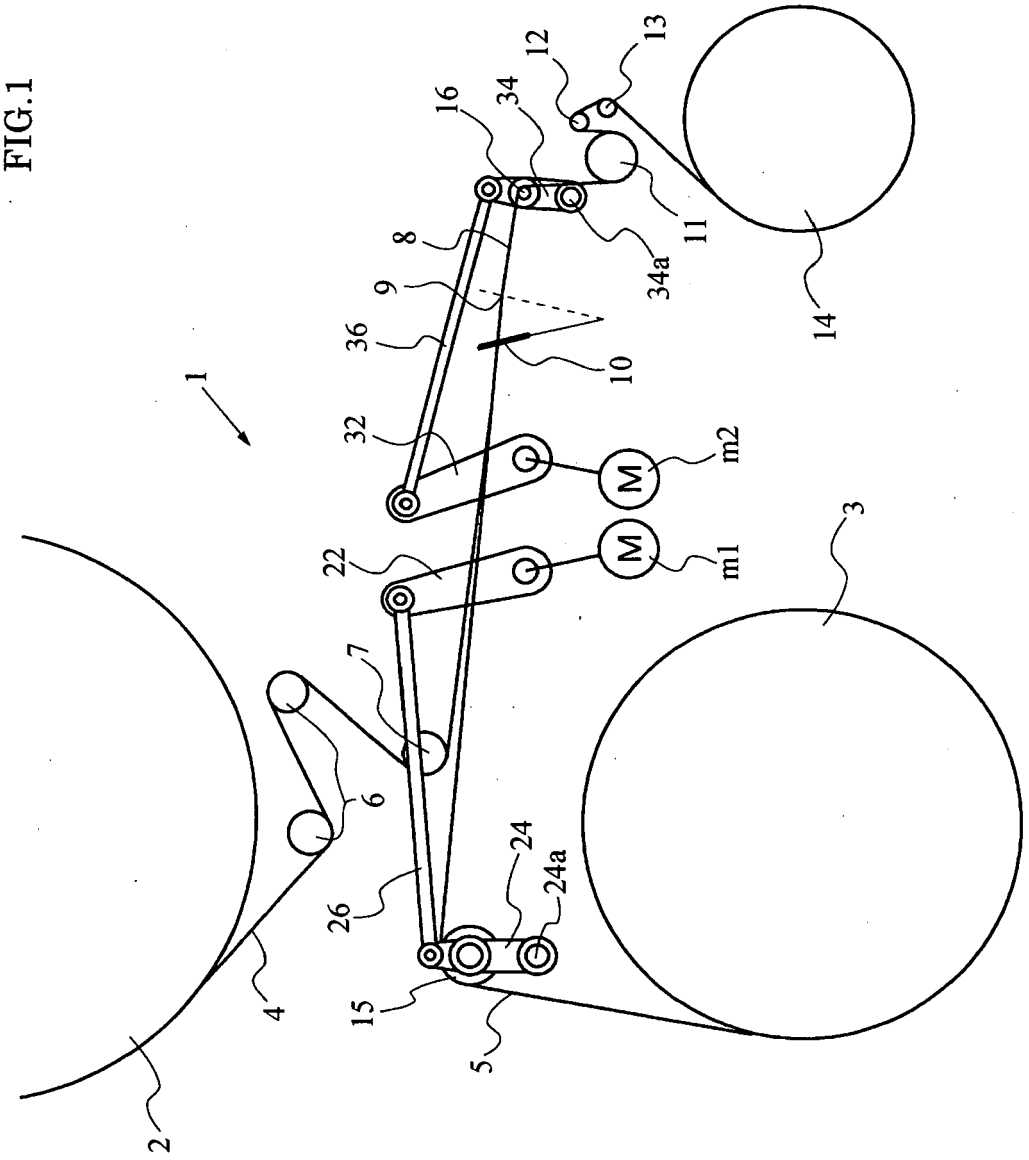
1. A driving device for a let-off-side terry motion member (15) and a take-up-side terry motion member (16) in a cloth-shifting-type pile loom (1), the let-off-side terry motion member (15) and the take-up-side terry motion member (16) being driven by at least one driving motor (m1, m2) via at least one driving mechanism, said at least one driving motor (m1, m2) being independent of a main driving motor of the pile loom (1),
   wherein the driving device comprises a braking unit provided in said at least one driving mechanism, the braking unit stopping the terry motion members (15, 16) from moving when electricity supplied to said at least one driving motor (m1, m2) for driving the terry motion members (15, 16) is interrupted.

2. The driving device according to Claim 1, wherein the braking unit comprises a non-exciting actuation type electromagnetic brake (b1, b2, b3, b4) provided in said at least one driving motor (m1, m2).

3. The driving device according to one of Claims 1 and 2, wherein said at least one driving motor (m1, m2) comprises a plurality of driving motors,
   wherein said at least one driving mechanism comprises a plurality of driving mechanisms, and
   wherein the let-off-side terry motion member (15) and the take-up-side terry motion member (16) are

driven individually by the designated driving motors (m1, m2) and the designated driving mechanisms.

FIG.1



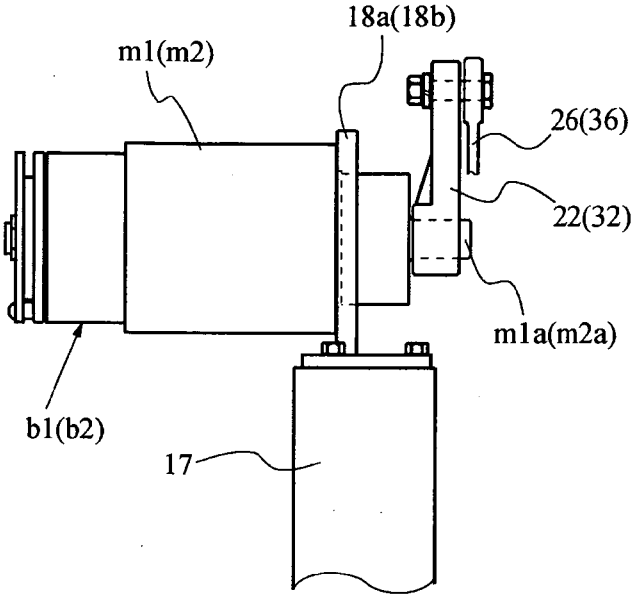

18a(18b)
m1(m2)
26(36)
22(32)
m1a(m2a)
b1(b2)
17

FIG. 2

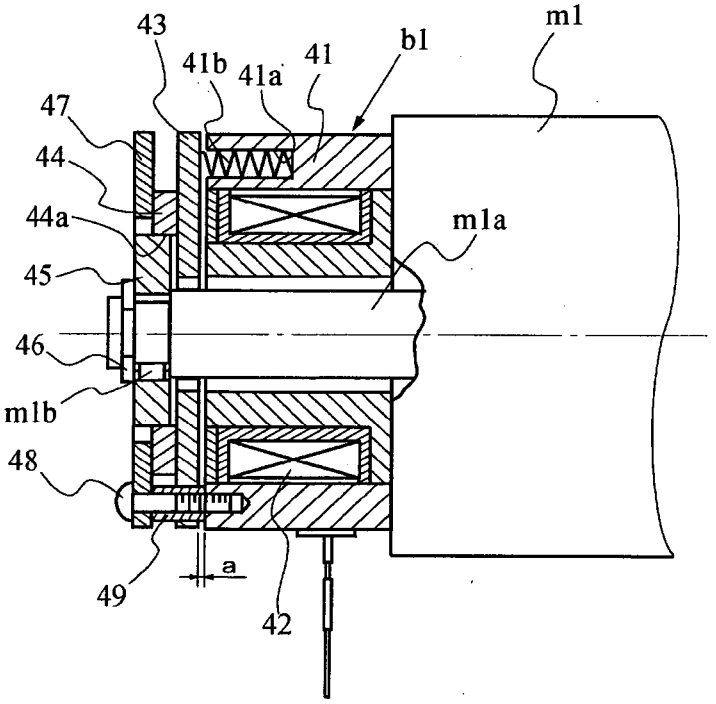

43
41b
41a
41
b1
m1
47
44
44a
m1a
45
46
m1b
48
49
a
42

FIG. 3

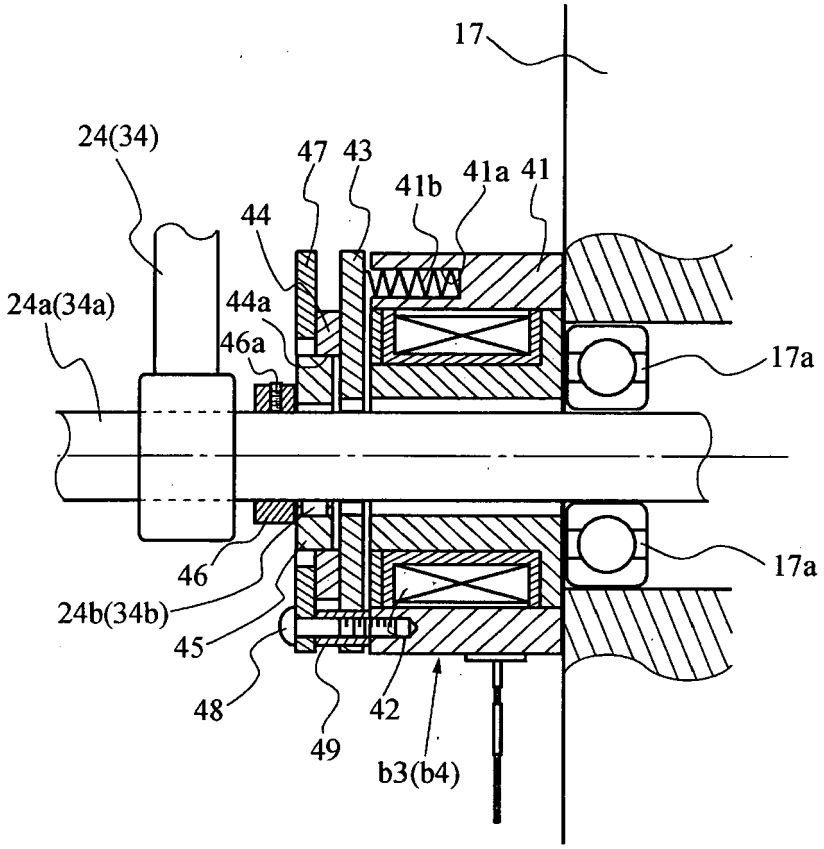

17
24(34)
47
43
41b
41a
41
44
24a(34a)
44a
46a
17a
46
17a
24b(34b)
45
48
49
42
b3(b4)

FIG. 4