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

(57) A cloth-shifting-type pile loom (1) includes a first driving mechanism (20) for driving a first terry motion member (15) disposed at a feeding side of the pile loom (1), and a second driving mechanism (30) for driving a second terry motion member (16) disposed at a take-up side of the pile loom (1). Each of the driving mechanisms (20, 30) includes a rocking lever (22, 32) that is driven in

a rocking motion in a displacement direction of the corresponding terry motion member (15, 16) by a corresponding one of driving means (M1, M2, 50, 60). The rocking lever (22) of the first driving mechanism (20) and the rocking lever (32) of the second driving mechanism (30) have a connection member (46) disposed therebetween such that the connection member connects the two rocking levers (22, 32).

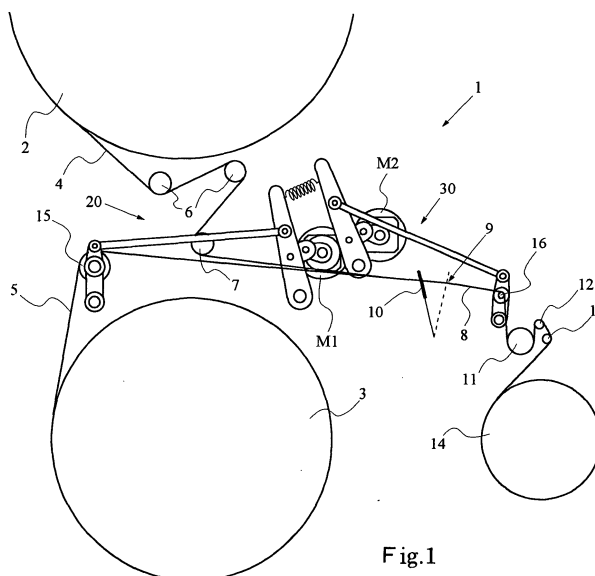


Fig.1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a driving system for terry motion members, and specifically, to a driving system for terry motion members in a cloth-shifting-type pile loom including a first driving mechanism for driving a first terry motion member disposed at a feeding side of the pile loom; and a second driving mechanism for driving a second terry motion member disposed at a take-up side of the pile loom, each driving mechanism including a rocking lever that is driven in a rocking motion in a displacement direction of the corresponding terry motion member by a corresponding one of driving means.

2. Description of the Related Art

[0002] Japanese Unexamined Patent Application Publication No. 2-47334 and Japanese Unexamined Patent Application Publication No. 11-172552 disclose examples of a cloth-shifting-type pile loom mentioned above.

[0003] A pile loom disclosed in Japanese Unexamined Patent Application Publication No. 2-47334 is provided with a back roller defining a feeding-side terry motion member for guiding ground warp yarns, and a breast beam defining a take-up-side terry motion member for guiding woven cloth. The back roller and the breast beam are supported by corresponding rocking levers. Each of the rocking levers is driven in a rocking motion by one of dedicated driving motors defining driving means.

[0004] On the other hand, according to Japanese Unexamined Patent Application Publication No. 11-172552, a ground-weaving tension roller, which defines a feeding-side terry motion member, and a take-up-side terry motion member are individually driven by corresponding cam mechanisms defining driving means and by corresponding driving mechanisms including rocking levers that are driven in a rocking motion by the corresponding cam mechanisms.

[0005] According to these types of pile looms, the displacement amounts and the displacement timings, for example, can be set individually for the feeding-side terry motion member and the take-up-side terry motion member. Consequently, the displacement amount, for example, for only the feeding-side terry motion member may be set such that the displacement amount is determined not only in view of the terry motion but also in view of compensating for a tension fluctuation caused by, for example, shedding motion of warp yarns. This is significantly advantageous in comparison with a structure in which the feeding-side terry motion member and the take-up-side terry motion member are driven simultaneously via a driving mechanism linked with common driv-

ing means. Such a comparative structure is described as conventional art in Japanese Unexamined Patent Application Publication No. 11-172552.

[0006] However, for driving the feeding-side terry motion member and the take-up-side terry motion member individually with corresponding driving means, as in the pile looms mentioned above, the tension of the warp yarns and the tension of the woven cloth directly act upon the corresponding driving means. As a result, this increases the amount of load acting on each driving means.

[0007] In detail, the warp tension applied to the feeding-side terry motion member and the cloth tension applied to the take-up-side terry motion member act as forces that bias the two terry motion members toward each other. If the two terry motion members are driven via a single rocking lever that is rocked by common driving means, as in the conventional art described in Japanese Unexamined Patent Application Publication No. 11-172552, the effect of the warp tension and the cloth tension is not significant since the forces generated in opposite directions in response to the warp tension and the cloth tension simultaneously act on the single rocking lever and thus counterbalance each other. In contrast, when the two terry motion members are individually driven by corresponding driving means, each of the driving means receives a unidirectional load via the corresponding rocking lever. In this case, since such a load constantly acts on each of the driving means in response to the corresponding tension, if each driving means is, for example, a driving motor, as used in Japanese Unexamined Patent Application Publication No. 2-47334, such a load may induce an increase in power consumption or damaged driving means at an early stage of use. On the other hand, if each driving means is a cam mechanism, as used in Japanese Unexamined Patent Application Publication No. 11-172552, a large amount of load may act on components such as a rotational shaft of each cam and a rocking shaft of each rocking lever, thus leading to wear abrasions and damages in these components at an early stage of use.

[0008] In Japanese Unexamined Patent Application Publication No. 2-47334, each rocking lever driven in a rocking motion by the corresponding driving motor and a stationary section of the pile loom have a bias spring attached therebetween, such that the bias spring absorbs the tension of the warp yarns. However, according to such a structure of Japanese Unexamined Patent Application Publication No. 2-47334, even though the effect of the warp tension or the cloth tension can be reduced, an additional force that overpowers the spring force of each bias spring must be generated when the corresponding driving means drives the corresponding terry motion member via the corresponding rocking lever in order to form a pile fabric. Consequently, this increases the amount of load acting on each driving motor during terry motion.

SUMMARY OF THE INVENTION

[0009] Accordingly, it is an object of the present invention to reduce an amount of load, which is generated due to warp tension or cloth tension, acting on each of driving means provided for driving a corresponding one of feeding-side and take-up-side terry motion members in order to prevent the driving means, for example, from being damaged at an early stage of use.

[0010] According to an aspect of the present invention, a pile loom is provided with a driving system that includes a first driving mechanism for driving a first terry motion member disposed at a feeding side of the pile loom, and a second driving mechanism for driving a second terry motion member disposed at a take-up side of the pile loom. The driving system further includes a connection member disposed between a rocking lever provided in the first driving mechanism and a rocking lever provided in the second driving mechanism such that the connection member connects the two rocking levers.

[0011] Furthermore, the connection member may be an elastically deformable member that is elastically deformed when receiving forces that bias the two rocking levers toward and away from each other. Moreover, the connection member may be a compression spring attached between the two rocking levers.

[0012] In the driving system for the terry motion members in the cloth-shifting-type pile loom according to the present invention, since the two rocking levers are linked with each other via the connection member, the forces applied to the rocking levers in response to the warp tension and the cloth tension counterbalance each other. Thus, the load acting on the driving means corresponds only to inertia forces and frictional forces of, for example, the levers and the rollers, and is therefore significantly small. Moreover, even when different driving amounts are set for the two terry motion members such that the warp tension and the cloth tension become different temporarily, the load acting on each driving means corresponds only to the difference in magnitude of the these tensions. Consequently, such a load is significantly small in comparison with a case where the load generated in response to the warp tension or the cloth tension is applied directly to each driving means. Furthermore, since the rocking levers of the corresponding driving mechanisms are linked with each other via, for example, a spring member as the connection member, none of the spring force of the spring member acts as driving resistance during the terry motion. Even if such a spring force were to act as driving resistance, the magnitude of the driving resistance is significantly small. As a result, the amount of load acting on each driving means during the terry motion is accordingly small.

[0013] Moreover, since the connection member may be an elastically deformable member that can be elastically deformed when receiving forces that bias the two rocking levers toward and away from each other, the advantage in individually driving the two terry motion mem-

bers with the corresponding driving means can be maintained. Furthermore, since the connection member may be a compression spring attached between the two rocking levers, such an advantage can be achieved more readily.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

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

Fig. 2 is a lateral view illustrating relevant components included in the first embodiment of the present invention; and

Fig. 3 is a lateral view illustrating relevant components included 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 and 2 illustrate a first embodiment of the present invention. A pile loom 1 shown in Fig. 1 according to the present invention 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 warp beam 2 around which a plurality of pile warp yarns 4 are wound in a sheet-like manner, and a lower 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 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 woven cloth 8 and a cloth fell 9 via a heald (not shown) and a reed 10.

[0018] On the other hand, the ground warp yarns 5 are fed from the warp beam 3, and are wound around a ground-warp tension roller 15, which defines a feeding-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 woven cloth 8 and the cloth fell 9 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 woven cloth 8. The woven 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, a guide roller 12, and a guide roller 13 so as to be finally taken up by a cloth roller 14.

[0020] In Figs. 1 and 2, a pair of driving motors M1, M2 defining driving means is provided such that the two driving motors M1, M2 respectively correspond to the two rollers 15 and 16 defining the terry motion members. The two driving motors M1, M2 are fixed to one of side frames

(not shown) of the pile loom 1 via, for example, brackets (not shown) such that output shafts m1, m2 of the respective driving motors M1, M2 are disposed perpendicular to the traveling direction of the warp yarns. The driving motor M1 is linked with the ground-warp tension roller 15 defining the feeding-side terry motion member via a first driving mechanism 20, whereas the driving motor M2 is linked with the cloth guide roller 16 defining the take-up-side terry motion member via a second driving mechanism 30.

[0021] The first and second driving mechanisms 20, 30 will now be described in detail with reference to Fig. 2.

[0022] The first driving mechanism 20 includes a rocking lever 22 that can be driven in a rocking motion by the driving motor M1; a supporting lever unit 24 for supporting the tension roller 15; and a linking rod 26 for linking the rocking lever 22 and the supporting lever unit 24. The rocking lever 22 is supported in a rocking manner by a stationary section of the pile loom 1, such as the side frame, via a spindle 22a. Moreover, the rocking lever 22 is linked with the output shaft m1 of the driving motor M1 via a crank lever 42 attached to the output shaft m1 and via a link component 28.

[0023] The supporting lever unit 24 includes a pair of levers for respectively supporting two opposite ends of the ground-warp tension roller 15. Each lever of the supporting lever unit 24 is supported in a rocking manner by a stationary section of the pile loom 1, such as the corresponding side frame, via a spindle 24a. Specifically, one of the levers of the supporting lever unit 24 is shown in the drawing (i.e. a lever disposed at a side provided with the driving motor M1). The lever supports the tension roller 15 at an intermediate section of the lever, and moreover, is connected with a first end of the linking rod 26 at an end portion of the lever opposite to the end portion supported by the spindle 24a. Furthermore, since a second end of the linking rod 26 is connected with the rocking lever 22, the tension roller 15 and the driving motor M1 are linked with each other via the first driving mechanism 20 defined by the rocking lever 22, the linking rod 26, and the supporting lever unit 24.

[0024] Similarly, the second driving mechanism 30 includes a rocking lever 32 which is supported in a rocking manner by a spindle 32a and is linked with the output shaft m2 of the driving motor M2 via a crank lever 44 and a link component 38; a supporting lever unit 34 which is supported in a rocking manner by a spindle 34a and which supports the cloth guide roller 16; and a linking rod 36 connected to the rocking lever 32 and to an end portion of one of levers of the supporting lever unit 34, the end portion of the lever being opposite to the end portion supported by the spindle 34a. The second driving mechanism 30 link the cloth guide roller 16 to the driving motor M2.

[0025] The crank levers 42 and 44 are attached in a manner such that end portions of the crank levers 42 and 44 respectively connected with the link components 28 and 38 are directed toward the feeding side of the pile

loom 1 with respect to the corresponding output shafts m1 and m2 of the driving motors M1 and M2. This means that when the output shafts m1 and m2 of the respective driving motors M1 and M2 are rotated by a predetermined angle, the corresponding rocking levers 22 and 32 are driven in a rocking motion respectively around the spindles 22a and 32a in the same direction by an amount corresponding to the rotational angle of the output shafts m1 and m2. Furthermore, in response to this rocking motion, the supporting lever units 24 and 34 are also rocked by the same amount in the same direction as the rocking direction of the respective rocking levers 22 and 32. Thus, the tension roller 15 and the cloth guide roller 16 are rocked in the same rocking direction around the respective spindles 24a and 34a, whereby the cloth fell 9 of the woven cloth 8 is shifted.

[0026] In a driving system including the first and second driving mechanisms 20, 30 for the terry motion members 15, 16 shown in the drawing, the rocking levers 22 and 32 have a compression spring 46 attached therebetween, which defines a connection member. Specifically, two opposite ends of the compression spring 46 are respectively attached to end portions of the rocking levers 22 and 32 that are opposite to the end portions supported by the spindles 22a and 32a.

[0027] According to this structure, the tension of the ground warp yarns 5 acts as a force that rocks the rocking lever 22 in the clockwise direction in the drawing via the tension roller 15. On the other hand, the tension of the woven cloth 8 acts as a force that rocks the rocking lever 32 in the counterclockwise direction in the drawing via the cloth guide roller 16. In other words, these forces bias the rocking levers 22 and 32 towards each other, but since the two rocking levers 22 and 32 are linked with each other via the compression spring 46, the forces acting on the rocking levers 22 and 32 are applied back to themselves via the compression spring 46 such that a balanced state is maintained. Accordingly, a load acting on each of the driving motors M1, M2 in response to the corresponding tension is extremely small.

[0028] Specifically, when the rocking levers 22 and 32 are in a resting state or are rocked by the same amount at the same timing, the forces acting on these rocking levers 22 and 32 due to the warp tension and the cloth tension are substantially the same since these tensions are balanced. Consequently, these oppositely-directed forces counterbalance each other. Accordingly, the load acting on each of the driving motors M1, M2 due to the warp tension or the cloth tension is extremely small (nearly zero).

[0029] On the other hand, when the rocking levers 22 and 32 are rocked by different amounts and/or at different timings, the magnitudes of the warp tension and the cloth tension temporarily become different. Even in such a case, the load acting on each of the driving motors M1, M2 corresponds only to the difference in magnitude of these tensions. For this reason, in comparison with a typical device in which the load generated in response

to each tension is applied directly to the corresponding motor, the load acting on each of the driving motors M1, M2 in the present invention is extremely small.

[0030] Furthermore, the compression spring 46 provided between the rocking levers 22 and 32 for connecting the two levers and for receiving the corresponding tensions applies hardly any driving resistance or only a significantly small amount of driving resistance to the rocking levers 22 and 32 during terry motion. Accordingly, this means that a load acting on each of the driving motors M1, M2 due to the compression spring 46 during the terry motion is extremely small.

[0031] Moreover, since the compression spring 46 is provided as the connection member for connecting the rocking levers 22 and 32, the distance between the rocking levers 22 and 32 is adjustable. This means that the rocking levers 22 and 32 can be adjustably rocked by different amounts and at different timings. Consequently, even if such a connection member is applied, an advantage in individually driving the feeding-side terry motion member and the take-up-side terry motion member with corresponding dedicated driving means can still be maintained.

[0032] According to the first embodiment, the rocking levers 22 and 32 and the corresponding driving motors M1, M2 are respectively linked with each other via the crank levers 42, 44 and the link components 28, 38. On the other hand, the present invention is not limited to this link structure between the rocking levers 22 and 32 and the respective driving motors M1, M2. For example, as an alternative to the example shown in Fig. 2, the spindles 22a and 32a of the respective rocking levers 22 and 32 may be driven directly by the corresponding driving motors M1, M2.

[0033] Furthermore, although the first embodiment describes an example in which the driving motors M1, M2 are provided as driving means for the corresponding terry motion members, the present invention is not limited to such a structure. For example, as in the previously-mentioned conventional art, the rocking levers 22, 32 of the respective driving mechanisms 20, 30 may alternatively be driven in a rocking motion by cam mechanisms provided for the corresponding rocking levers 22, 32. Such a structure will be described below in detail as a second embodiment of the present invention with reference to Fig. 3. In Fig. 3, components equivalent to those in the first embodiment are given the same reference numerals, and descriptions of those components will thus be omitted.

[0034] Fig. 3 illustrates the second embodiment of the present invention. In the second embodiment, a pair of cam mechanisms 50, 60 is respectively provided for the rocking levers 22, 32, and defines driving means for driving the corresponding rocking levers 22, 32 in a rocking motion. The cam mechanisms 50, 60 respectively include cams 52, 62 driven by a main shaft 18 of the loom; and cam levers 54, 64 whose front end portions support cam followers 56, 66.

[0035] The cam levers 54, 64 are respectively fixed to the spindles 22a, 32a that securely support the rocking levers 22, 32. When the cam levers 54, 64 are respectively rocked by the cams 52 and 62, the spindles 22a and 32a are rotated so that the rocking levers 22, 32 are driven in a rocking motion. Furthermore, the cam mechanisms 50, 60 are passive cam mechanisms in which the cam levers 54, 64 are respectively biased toward the cams 52, 62 with springs 58, 68 so that the cam followers 56, 66 disposed at the front end portions of the cam levers 54, 64 are constantly in contact with the cams 52, 62.

[0036] In this type of driving system including the driving mechanisms 20, 30 for the terry motion members 15, 16, the tension of the ground warp yarns acts as a force that biases the rocking lever 22 in the clockwise direction in the drawing via the ground-warp tension roller 15, and the supporting lever unit 24 and the linking rod 26 of the first driving mechanism 20. Furthermore, this force acts on the cam lever 54 via the spindle 22a such that the cam follower 56 tries to move away from the cam 52. For this reason, the strength of the biasing force of the spring 58 must be determined in view of the warp tension such that the cam follower 56 is prevented from moving away from the cam 52. However, if the biasing force of the spring 58 is large, a large amount of load may be applied to a camshaft 52a of the cam 52 and to contact surfaces of the cam follower 56 and the cam 52 when the cam lever 54 is to be rocked by the cam 52. This may possibly cause the cam 52 and the camshaft 52a to become damaged.

[0037] On the other hand, the tension of the woven cloth acts as a force that biases the rocking lever 32 in the counterclockwise direction in the drawing via the cloth guide roller 16, and the supporting lever unit 34 and the linking rod 36 of the second driving mechanism 30. Furthermore, this force acts on the cam lever 64 such that the cam follower 66 presses against the cam 62. For this reason, similar to the case described above in which the spring 58 is given a large biasing force, a large amount of load may be applied to a camshaft 62a of the cam 62 and to contact surfaces of the cam follower 66 and cam 62 when the cam lever 64 is to be rocked. Similarly, this may possibly cause the cam 62 and the camshaft 62a to become damaged.

[0038] In order to prevent such damages, the second embodiment of the present invention is provided with a connection member for connecting the rocking levers 22 and 32. In Fig. 3, the connection member is defined by the compression spring 46 as in the first embodiment. Accordingly, the warp tension or the cloth tension is prevented from acting directly on each driving means provided for the corresponding terry motion member. As a result, even if the tensions act on the corresponding rocking levers 22, 32 so as to generate forces that bias the rocking levers 22, 32 towards each other, these forces acting on the rocking levers 22, 32 are applied back to themselves via the compression spring 46, whereby a balanced state can be maintained. Accordingly, this re-

duces the load acting on each driving means, and therefore, prevents the problems mentioned above.

[0039] Although the compression spring 46 is provided as the connection member in the above embodiments, the connection member according to the present invention is not limited to a compression spring. For example, as an alternative to the compression spring, the connection member may be, for example, a leaf spring. If a leaf spring is to be used as the connection member, the leaf spring is preferably given a size such that the leaf spring bends when the rocking levers 22 and 32 are most distant from each other.

[0040] Although the connection member is preferably a spring member that receives the forces that bias the two rocking levers 22 and 32 toward each other and that also allows the rocking levers 22 and 32 to move away from each other as described above, the connection member may alternatively be a rigid member if only the load acting on the driving means is taken into consideration. In a case where such a rigid member is used as the connection member, both driving means must be driven in exact synchronization with each other. Moreover, if the two rocking levers 22 and 32 are linked with each other via the rigid member, although the two terry motion members cannot be driven by different driving amounts and at different timings, the load acting on each of the two driving means during the terry motion is less than in a case where only a single driving means is used. For this reason, small-size motors can be used as the driving means. Accordingly, this is still advantageous in view of power consumption and costs.

[0041] Furthermore, the connection member may be attached to the rocking levers 22 and 32 in a detachable and a replaceable manner. In this case, the connection member may be removed or may be replaced with another connection member depending on the weaving conditions. Specifically, the connection member may be removed if a weaving operation is to be performed in a state where the warp tension and the cloth tension are set low such that the load acting on the driving means in response to the tensions is small. In this case, when the connection member becomes necessary again, the same connection member may be reattached. Alternatively, if the subsequent weaving operation is directed to weaving another type of fabric after performing a weaving operation using a spring member as the connection member, the connection member may be changed from the spring member to the rigid member if the driving amounts and the driving timings of the terry motion members do not need to be changed for the subsequent weaving operation. Furthermore, the warp tension and/or the cloth tension could possibly change when, for example, fabric to be woven is switched to another type or when adjustments are made in other mechanisms. In such cases, the spring member may be replaced with another type that has, for example, a different spring constant and/or different length.

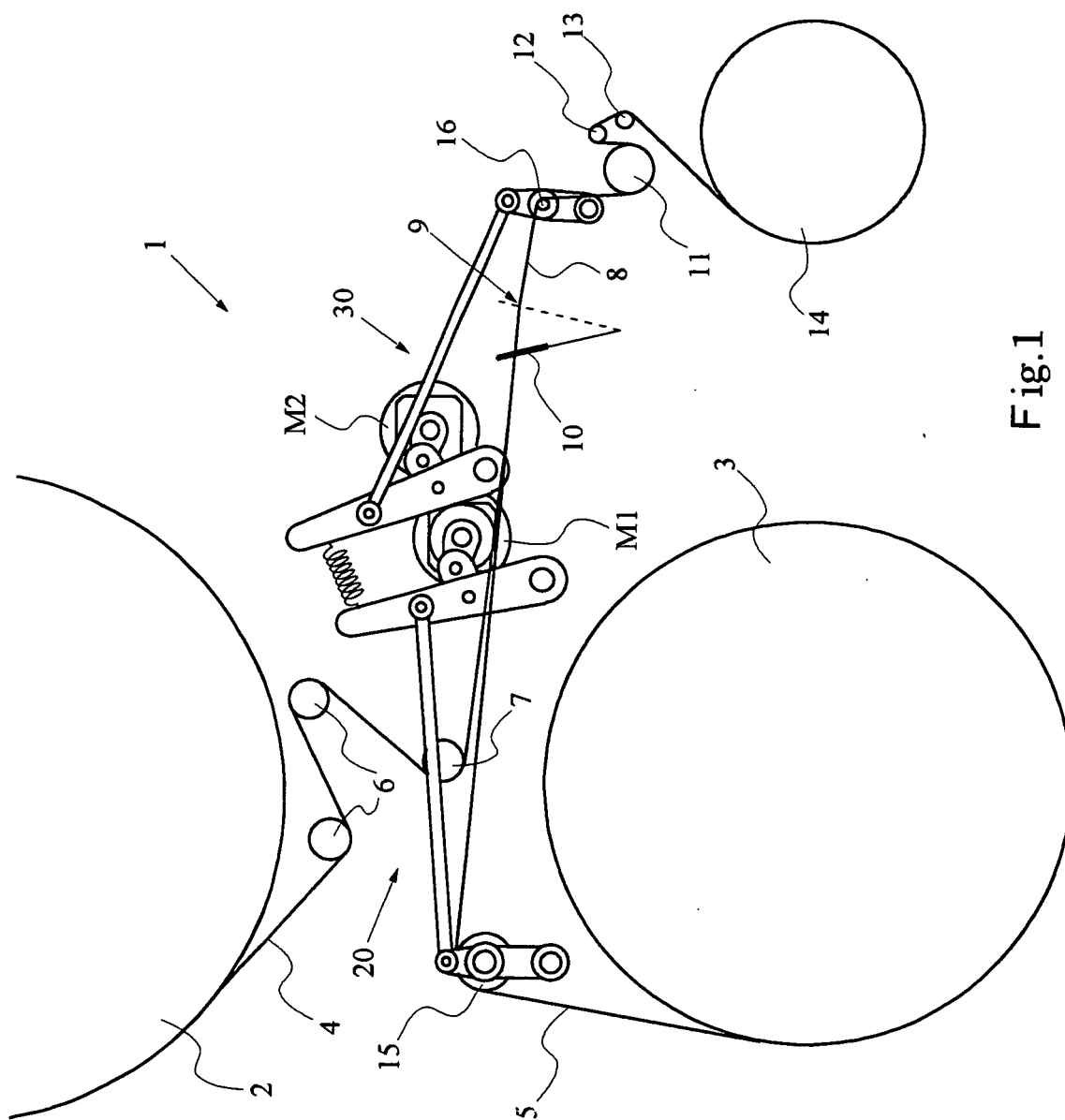
[0042] Furthermore, although the two driving means

are disposed close to each other in a central section of the loom with respect to the traveling direction of the warp yarns, the positioning of the driving means is not limited. In the present invention, the structure of the driving mechanisms and the positioning of the driving means, for example, may be changed in any desired manner as long as the connection member can be attached between the pair of rocking levers that are driven in a rocking motion by the corresponding driving means in the displacement direction of the terry motion members.

[0043] 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 system for first and second terry motion members (15, 16) in a cloth-shifting-type pile loom (1), the first terry motion member (15) being disposed at a feeding side of the pile loom (1) and the second terry motion member (16) being disposed at a take-up side of the pile loom (1), the driving system including a first driving mechanism (20) for driving the first terry motion member (15) and a second driving mechanism (30) for driving the second terry motion member (16), each driving mechanism (20, 30) including a rocking lever (22, 32) that is driven in a rocking motion in a displacement direction of the corresponding terry motion member (15, 16) by a corresponding one of driving means (M1, M2, 50, 60), wherein the driving system comprises a connection member (46) disposed between the rocking lever (22) of the first driving mechanism (20) and the rocking lever (32) of the second driving mechanism (30) such that the connection member connects the two rocking levers (22, 32).
2. The driving system according to Claim 1, wherein the connection member (46) comprises an elastically deformable member that is elastically deformed when receiving forces that bias the two rocking levers (22, 32) toward and away from each other.
3. The driving system according to one of Claims 1 and 2, wherein the connection member (46) comprises a compression spring attached between the two rocking levers (22, 32).



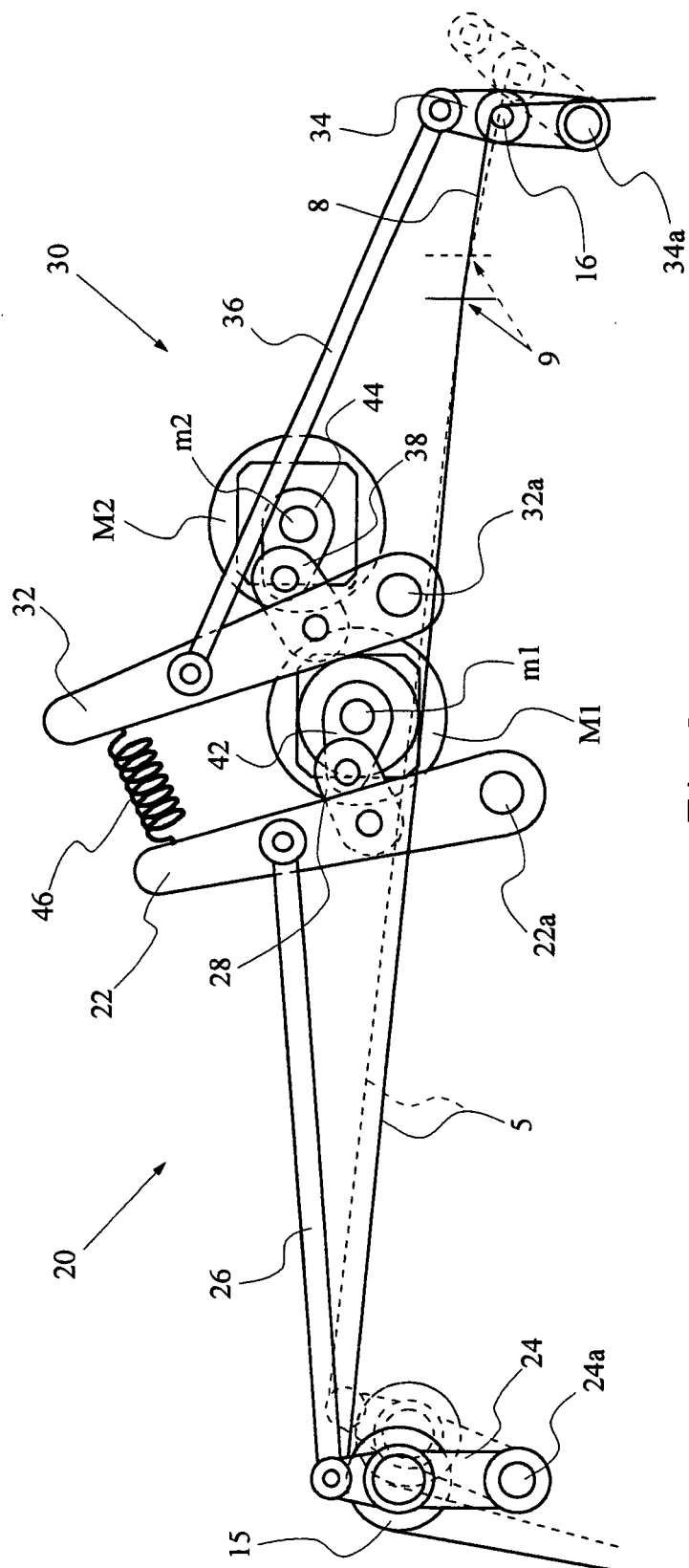


Fig. 2

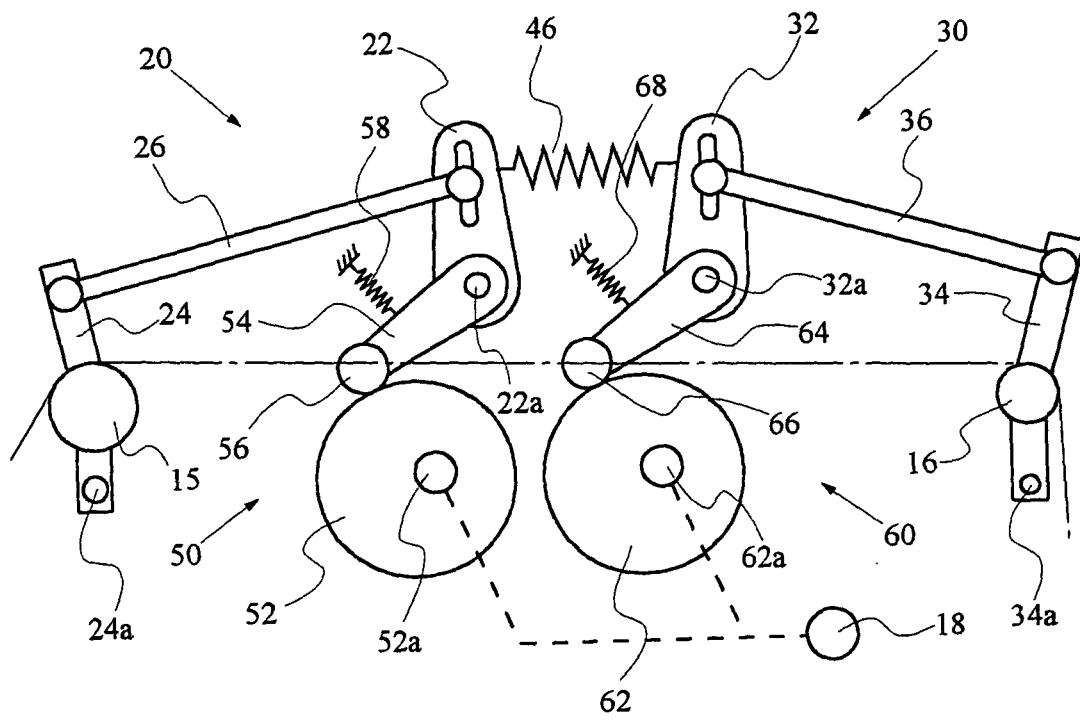


Fig. 3