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

(11) EP 1 731 640 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.12.2006 Bulletin 2006/50

(51) Int Cl.:
D03C 11/00 *(2006.01)*

(21) Application number: **06010384.3**

(22) Date of filing: **19.05.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **06.06.2005 JP 2005164908**

(71) Applicants:
- **TSUDAKOMA KOGYO KABUSHIKI KAISHA**
Kanazawa-shi,
Ishikawa-ken 921-8650 (JP)
- **Takano Co., Ltd.**
Kamiina-gun,
Nagano 399-4301 (JP)

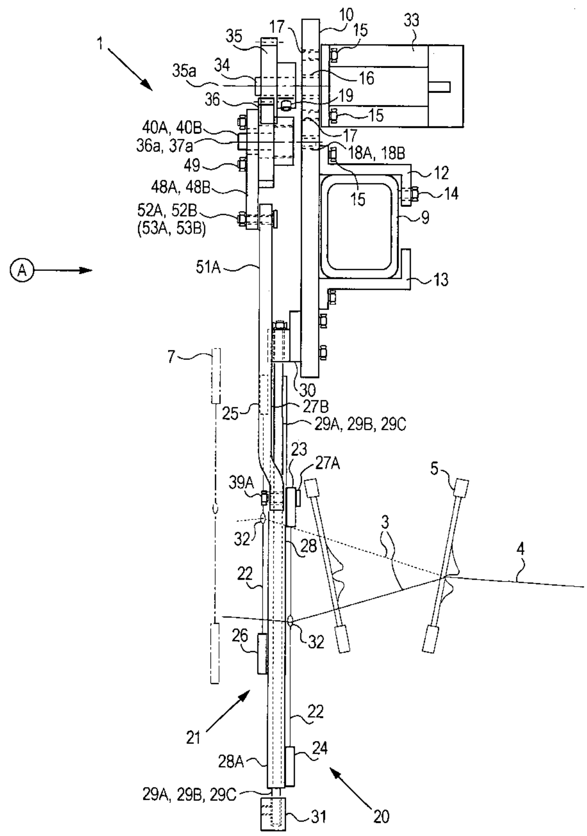
(72) Inventors:
- **Kakutani, Kazuto c/o TSUDAKOMA KOGYO K.K.**
Kanazawa-shi
Ishikawa-ken, 921-8650 (JP)
- **Kasuga, Hisao**
Nagano-ken,399-4301 (JP)

(74) Representative: **Samson & Partner**
Widenmayerstraße 5
D-80538 München (DE)

(54) **Selvage device**

(57) A selvage device (1) includes two supporters (20, 21) whose movements are restricted to a selvage-shedding direction and having thread guides (32) for guiding selvage threads (3), a driving motor (33) that is rotated in forward and reverse directions, and a motion-converting mechanism converting the rotation of the driving motor to reciprocating motions for the supporters. The motion-converting mechanism includes a first gear (35) attached to an output shaft (34) of the driving motor, a second gear (36) meshed with the first gear and having a first pivotal connecting section (53A) at a position distant from a center of rotation (36a) of the second gear in a radial direction thereof, a second pivotal connecting section (53B) which is provided in one of the first gear and a third gear (37) directly meshed or indirectly linked with the first gear and is positioned distant from a center of rotation (35a, 37a) of the first gear or the third gear in a radial direction thereof, and linking rods (51A, 51B) respectively provided for the two supporters, the linking rods having first ends respectively connected to the first pivotal connecting section and the second pivotal connecting section and second ends connected to the corresponding supporters.

FIG. 1



EP 1 731 640 A2

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a selvage device that forms a selvage on the basis of reciprocating motions of a first selvage heald frame and a second selvage heald frame in opposite directions from each other.

2. Description of the Related Art

[0002] PCT Japanese Translation Patent Publication No. 10-503563 (Figs. 2, 6, and 7) and Japanese Unexamined Patent Application Publication No. 2004-308064 (Fig. 1) discuss examples of such a selvage device that forms a selvage on the basis of reciprocating motions of a first selvage heald frame and a second selvage heald frame in opposite directions from each other.

[0003] A selvage device according to PCT Japanese Translation Patent Publication No. 10-503563 includes a two-dimensional crank mechanism that is driven by an electric motor. By driving the two-dimensional crank mechanism, a pair of thread guide units is driven linearly in a reciprocating fashion. The two-dimensional crank mechanism includes a lever attached to an output shaft of the electric motor, and a pair of links connected respectively to opposite ends of the lever. The pair of links is respectively connected to the pair of thread guide units in a one-to-one fashion. Furthermore, for mechanical adjustability of a shedding amount of selvage threads, Fig. 6 in PCT Japanese Translation Patent Publication No. 10-503563 illustrates a structure in which an angular range of the links is adjustable, and Fig. 7 therein illustrates a structure in which the radial length of cranks with respect to the links is adjustable.

[0004] A selvage device according to Japanese Unexamined Patent Application Publication No. 2004-308064 includes a first band supporting a first selvage heald frame and a second band supporting a second selvage heald frame. The first and second bands are provided with power-receiving holes. The power-receiving holes of the two bands are meshed with a gear that is rotated by an electric motor, thereby forming a so-called rack-pinion mechanism. Accordingly, in response to a rotation of the electric motor in forward and reverse directions, a selvage-shedding motion is implemented.

[0005] When a cloth being woven in a loom is to be switched to a different type of cloth, the settings for a standard height (i.e. frame height) and a warp-shedding amount of a warp shedding device may need to be changed depending on the type of cloth to be woven. In that case, the settings for a standard height and a shedding amount for the selvage-shedding motion may also need to be changed. However, whether PCT Japanese Translation Patent Publication No. 10-503563 applies the structure with the adjustable angular range of links or the structure with the adjustable radial length of cranks, the settings require high precision. Moreover, the work efficiency of the setting process is low.

[0006] On the other hand, Japanese Unexamined Patent Application Publication No. 2004-308064 has the rack-pinion mechanism, which means that in order to change the frame height and the shedding amount, the phase of the electric motor and the driving amount (i.e. the rotational amount of the electric motor) must be changed. Accordingly, the controlling of the electric motor is complicated, and an electric motor with a large output torque is necessary, thus leading to an increase in size of the entire device.

SUMMARY OF THE INVENTION

[0007] Accordingly, it is an object of the present invention to provide a selvage device that is driven with a designated driving motor and forms a selvage on the basis of reciprocating motions of a first selvage heald frame and a second selvage heald frame in opposite directions from each other, in which the frame height and the shedding amount for the selvage-shedding motion can be set properly without having to increase the dimension of the driving motor.

[0008] A selvage device according to the present invention includes two supporters whose movements are restricted to a selvage-shedding direction and having thread guides for guiding selvage threads; a driving motor that is independent of a main-shaft motor of the loom and is rotated in forward and reverse directions; and a motion-converting mechanism converting the rotation of the driving motor to reciprocating motions for the supporters. In the selvage device according to the present invention, the motion-converting mechanism includes a first gear attached to an output shaft of the driving motor; a second gear meshed with the first gear and having a first pivotal connecting section at a position distant from a center of rotation of the second gear in a radial direction thereof; a second pivotal connecting section provided in one of the first gear and a third gear directly meshed or indirectly linked with the first gear, the second pivotal connecting section being positioned distant from a center of rotation of the one of the first gear and the third gear in a radial direction thereof; and linking rods respectively provided for the supporters, the linking rods having first ends respectively connected to the first pivotal connecting section and the second pivotal connecting section and second ends connected to the corresponding supporters.

[0009] According to the present invention, the first pivotal connecting section and the second pivotal connecting section driven in response to the rotation of the output shaft of the driving motor function as crank pins; the first supporter and the second supporter whose movements are restricted to the selvage-shedding direction function as pistons; and the linking rods for respectively linking the first pivotal connecting section and the second pivotal connecting section to the first supporter and the second supporter function as crank rods. Consequently, the crank pins, the pistons, and the crank rods constitute a so-called piston-crank mechanism. The rotation of the output shaft of the driving motor is transmitted to the first pivotal connecting section and the second pivotal connecting section via the first gear and the driven gears included in the motion-converting mechanism. This moves the corresponding linking rods, by which the rotation is converted to reciprocating motions for the first supporter and the second supporter. Thus, the first supporter and the second supporter are reciprocated in opposite directions from each other, whereby a selvage-shedding motion is implemented.

[0010] In the present invention, since the rotation is transmitted via the plurality of meshed gears included in the motion-converting mechanism, in a case where the number of selvage threads or the selvage tension is increased due to a change in the cloth specification, for example, at least one of the first gear and the second gear included in the motion-converting mechanism may be replaced with an alternative gear having an appropriate number of gear teeth. Thus, a selvage-shedding motion can be implemented properly without having to increase the driving torque of the motor. Moreover, an adjustment of the standard height for a selvage-shedding motion, which is one of the selvage-shedding conditions, can be achieved by displacing the meshing position (phase) between the first gear of the driving side and the second gear of the driven side having a pivotal connecting section. Furthermore, in a driving system between the first gear of the driving side and the second gear of the driven side or between the first gear and the third gear, at least one of the gears may be replaced with another gear so as to change the gear ratio between the two gears. Thus, the shedding amount of selvage threads, which is another one of the selvage-shedding conditions, can be set differently between the two driving systems. Accordingly, the operating conditions for the selvage device can be set properly to desired conditions. The term "standard height for a selvage-shedding motion" refers to a relative distance between a position of the thread guides in a state where the selvage shed is closed and a position of a reference surface such as an upper surface of a loom frame. On the other hand, the term "shedding amount of selvage threads" refers to a relative distance between two sets of the thread guides in a state where the selvage shed is opened.

[0011] Furthermore, in the present invention, the second pivotal connecting section may be provided in the first gear. In this case, the first pivotal connecting section of the second gear and the second pivotal connecting section of the first gear are preferably disposed on the same side with respect to two corresponding imaginary lines extending respectively through the center of rotation of the second gear and the center of rotation of the first gear and extending parallel to each other in the selvage-shedding direction. Accordingly, the second gear is rotated in the reverse direction with respect to the rotational direction of the first gear. Thus, the first pivotal connecting section and the second pivotal connecting section move in opposite directions from each other, allowing the two supporters to reciprocate in opposite directions from each other. Moreover, since the number of gears to be driven by the driving motor is reduced, the driving load of the driving motor is reduced accordingly, thereby contributing to lower power consumption.

[0012] Furthermore, in the present invention, the second pivotal connecting section may be provided in the third gear. In this case, the first pivotal connecting section of the second gear and the second pivotal connecting section of the third gear are preferably disposed on opposite sides from each other with respect to two corresponding imaginary lines extending respectively through the center of rotation of the second gear and the center of rotation of the third gear and extending parallel to each other in the selvage-shedding direction. By directly meshing the third gear with the first gear, the second gear and the third gear are rotated in the reverse direction with respect to the rotational direction of the first gear. Consequently, in this structure, the first pivotal connecting section and the second pivotal connecting section move in the same direction, allowing the two supporters to reciprocate in opposite directions from each other.

[0013] In a case where the second pivotal connecting section is provided in the third gear, the second gear and the third gear may be disposed in a manner such that the center of rotation of the second gear and the center of rotation of the third gear are positioned within a range defined by two tangent lines tangent to an outer periphery of the first gear and extending parallel to each other in the selvage-shedding direction. Alternatively, the second gear and the third gear may be disposed in a manner such that the center of rotation of the second gear and the center of rotation of the third gear are positioned within a range defined by two imaginary lines each extending through the center of rotation of the first gear and forming a crossing angle of $\pm 45°$ with respect to an imaginary line extending through the center of rotation of the first gear in the selvage-shedding direction. As a further alternative, the second gear and the third gear may be arranged in a manner such that an imaginary line extending through the centers of rotation of the two respective gears extends crosswise with respect to the selvage-shedding direction. In that case, the first pivotal connecting section and the second pivotal connecting section are preferably positioned within a range defined by two imaginary lines extending respectively through the centers of rotation of the two gears and extending parallel to each other in the selvage-shedding direction.

[0014] By positioning the centers of rotation of the gears having the pivotal connecting sections closer to each other on the imaginary line extending crosswise with respect to the selvage-shedding direction, the first pivotal connecting section and the second pivotal connecting section can be relatively disposed closer to each other. Accordingly, by positioning the gears or the pivotal connecting sections so that the first pivotal connecting section and the second pivotal connecting section are relatively disposed close to each other indirectly or directly, the degree of change in the angle of the linking rods in response to the driving of the corresponding gears is reduced, thereby achieving an efficient conversion of the rotation of the driving motor (i.e. the rotation of the gears) to reciprocating motions for the supporters. In this case, the second and third gears defining the driven gears may be disposed in a manner such that the imaginary line connecting the centers of rotation of the second and third gears extends crosswise to an imaginary line extending in the selvage-shedding direction, or that the centers of rotation of the two gears having the pivotal connecting sections are collinear to the imaginary line extending in the selvage-shedding direction.

[0015] Furthermore, in the present invention, the third gear may be meshed with a fourth gear attached to the output shaft of the driving motor. In this case, of the two supporters having the thread guides, the supporter linked to the first pivotal connecting section will be defined as the first supporter, and the supporter linked to the second pivotal connecting section will be defined as the second supporter. Consequently, the gear ratio between the first gear and the second gear defining a driving system for the first supporter and the gear ratio between the fourth gear and the third gear defining a driving system for the second supporter can be set individually for the corresponding supporters. This means that different shedding amounts of selvage threads can be set between the supporters. Accordingly, high-precision settings can be achieved in the selvage device in accordance with a change in cloth specification, thereby enhancing the selvage quality.

[0016] Furthermore, in the present invention, the position of the center of rotation of at least one of the first gear, the second gear, and the third gear may be relatively adjustable with respect to the center of rotation of the remaining one or more gears meshed with the at least one of the first gear, the second gear, and the third gear. Accordingly, this allows for a wider variety of gears (in other words, more types of gears having different number of gear teeth and different outer diameters) to be installable in the selvage device so that the selvage-shedding conditions can be set with higher precision, thereby further enhancing the selvage quality.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a side view of a selvage device in a loom according to a first embodiment of the present invention, as viewed from the right side of the loom;

Fig. 2 illustrates the selvage device according to the first embodiment, as viewed from a direction indicated by an arrow A in Fig. 1;

Fig. 3 is a cross-sectional view taken along line X-X' in Fig. 2;

Fig. 4 is an enlarged view illustrating a relevant portion of one of shafts of gears 36, 37 respectively serving as second and third gears according to the first embodiment;

Fig. 5 illustrates a structural modification example of a first gear serving as a driving gear and driven gears having first and second pivotal connecting sections included in the selvage device according to the present invention;

Fig. 6 illustrates another structural modification example of the first gear and the driven gears having the first and second pivotal connecting sections;

Fig. 7 illustrates another structural modification example of the first gear and the driven gears having the first and second pivotal connecting sections;

Fig. 8 illustrates positional ranges for a center of rotation of the first gear and centers of rotation of second and third gears respectively having the first and second pivotal connecting sections according to the first embodiment;

Fig. 9 illustrates another structural modification example of the first gear and the driven gears having the first and second pivotal connecting sections;

Fig. 10 illustrates another structural modification example of the first gear and the driven gears having the first and second pivotal connecting sections;

Fig. 11 illustrates another structural modification example of the first gear and the driven gears having the first and second pivotal connecting sections;

Fig. 12 illustrates another structural modification example of the first gear and the driven gears having the first and second pivotal connecting sections;

Fig. 13 illustrates another structural modification example of the first gear and the driven gears having the first and second pivotal connecting sections;

Fig. 14 illustrates a structural example for changing the center distance between the gears in the selvage device according to the first embodiment of the present invention if at least one of the gears is replaced with an alternative gear having a different number of gear teeth; and

Fig. 15 is a cross-sectional view taken along line Y-Y' in Fig. 14.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] A selvage device in a loom according to a first embodiment of the present invention will now be described with reference to the drawings. Figs. 1 to 4 illustrate one of a pair of selvage devices 1 that perform a shedding operation of selvage threads 3, 3. The pair of selvage devices 1 is respectively disposed adjacent to opposite edges of a woven cloth 4. The one of selvage devices 1 shown in the drawings is disposed on the right side of the loom, as viewed from the front of the loom. Although not shown in the drawings, the other selvage device 1 on the left side, for example, is disposed symmetrical to the selvage device 1 on the right side. Therefore, in spite of the fact that there are actually two selvage devices 1 in the present invention, since only one of the selvage devices 1 is shown, the description below will refer to the one of the selvage devices 1 in order to provide an easier understanding of the description. In the selvage device 1, the selvage threads 3, 3 extend through selvage bobbins, tensers, and guides, which are disposed in the loom but are not shown in the drawings, and pass through thread guides 32, 32 included in the selvage device 1. After passing through a reed 5, the selvage threads 3, 3 reach a cloth fell so as to be interwoven into the woven cloth 4.

[0019] The selvage device 1 mainly includes a first supporter 20 and a second supporter 21 respectively having the thread guides 32, 32 through which the selvage threads 3, 3 extend; a pulse motor 33 serving as a driving motor; and a motion-converting mechanism that converts a rotary motion of the pulse motor 33 to a reciprocating motion. These components of the selvage device 1 are substantially mounted on a base plate 10 functioning as a mounting base of the selvage device 1.

[0020] Referring to Figs. 1 and 2, the base plate 10 is formed of a plate material and extends in a selvage-shedding direction and in a width direction of the woven cloth 4. A front face of the base plate 10 as viewed from a side of the cloth fell is provided with holder blocks 12, 13 functioning as attachment members attached to loom frames, and the pulse motor 33 functioning as the driving motor. On the other hand, a rear face of the base plate 10 is provided with a holder bracket 30 functioning as a supporting member for supporting the first supporter 20 and the second supporter 21, and a plurality of gears 35, 36, 37 included in the motion-converting mechanism.

[0021] The first supporter 20 mainly includes a plurality of healds 22, ..., 22 respectively having the thread guides 32, ..., 32 for the selvage threads 3, ..., 3; a pair of upper and lower carrier rods 23, 24 respectively disposed at upper and lower positions of the healds 22 to support the healds 22; and a slide guide 28A extending in the selvage-shedding direction. Similarly, the second supporter 21 mainly includes a plurality of healds 22, ..., 22 respectively having the thread guides 32, ..., 32 for the selvage threads 3, ..., 3; a pair of upper and lower carrier rods 25, 26 respectively disposed at upper and lower positions of the healds 22 to support the healds 22; and a slide guide 28b extending in the selvage-shedding direction. Opposite longitudinal ends of the slide guide 28A are respectively connected to the pair of upper and lower carrier rods 23, 24, and similarly, opposite longitudinal ends of the slide guide 28b are respectively connected to the pair of upper and lower carrier rods 25, 26.

[0022] The pair of carrier rods 23, 24 and the pair of carrier rods 25, 26 have attachment segments that are screwed to the corresponding slide guides 28A and 28B. Moreover, each of the carrier rods 23, 24, 25, 26 has an elongate segment extending in the width direction of the woven cloth 4. Upper and lower ends of each heald 22 are provided with holes. The upper and lower holes of one set of the healds 22 are respectively engaged to the elongate segments of the upper and lower carrier rods 23, 24, thereby forming a first heald frame that supports the set of healds 22. Similarly, the upper and lower holes of the other set of the healds 22 are respectively engaged to the elongate segments of the carrier rods 25, 26, thereby forming a second heald frame that supports the other set of healds 22. The upper carrier rod 23 and the upper carrier rod 25 are provided with connecting sections having pivotal connection holes for connecting a linking rod 51A and a linking rod 51B to the upper carrier rod 23 and the upper carrier rod 25, respectively.

[0023] Furthermore, slide rods 29A, 29B, 29C extending in the selvage-shedding direction are disposed adjacent to side surfaces of the slide guides 28A and 28B. In detail, referring to Fig. 3, slide rods 29A, 29B, 29C are formed of, for example, round bars extending longitudinally in the selvage-shedding direction, and are separated from each other by a predetermined distance in the width direction of the woven cloth 4. Each of the slide guides 28A and 28B has sliding portions that are semicircularly depressed in cross section and extend in the longitudinal direction of the slide rods 29A, 29B, 29C, such that the sliding portions correspond to the adjacent slide rods. The sliding portions of the slide guide 28A are slidably disposed between the adjacent slide rods 29A and 29B so that a moving direction of the first supporter 20 is restricted to the longitudinal direction of the slide guide 28A, that is, the selvage-shedding direction. Similarly, the sliding portions of the slide guide 28b are slidably disposed between the adjacent slide rods 29B and 29C so that a moving direction of the second supporter 21 is restricted to the longitudinal direction of the slide guide 28B, that is, the selvage-shedding direction. Upper and lower ends of each of the slide rods 29A, 29B, 29C are respectively housed in the holder bracket 30 attached to the base plate 10 and a holder bracket 31. Similar to a damper stay 9, which will be described below, a stay (not shown) for supporting the holder bracket 31 is bridged between the loom frames, so that the holder bracket 31 is stabilized with respect to the loom frames.

[0024] The pulse motor 33 is attached to the base plate 10 with bolts 15 engaged to threaded holes 17 provided in the base plate 10. An output shaft 34 of the pulse motor 33 extends from the front face towards the rear face of the base plate 10 so as to protrude outward from the rear face. The protruding portion of the output shaft 34 has an outer periphery provided with a predetermined number of gear teeth, and is engaged with the gear 35 corresponding to a first gear according to the present invention. The gear 35 has a hexagon socket head bolt 19 disposed in a base shaft portion thereof. Thus, the gear 35 is secured to the output shaft 34 in a relatively immovable fashion with the hexagon socket head bolt 19. On the other hand, two supporting shafts 40A, 40B are disposed distant from the output shaft 34 by predetermined center distances. An outer periphery of each of the supporting shafts 40A, 40B is provided with a predetermined number of gear teeth. The gear 36 corresponding to a second gear according to the present invention is attached to the outer periphery of the supporting shaft 40A and is meshed with the gear 35, and similarly, the gear 37 corresponding to a third gear according to the present invention is attached to the outer periphery of the supporting shaft 40B and is meshed with the gear 35.

[0025] The attachment of the supporting shafts 40A, 40B and the gears 36, 37 with respect to the base plate 10 will be described in detail with reference to Fig. 4. Each of the supporting shafts 40A, 40B includes a base portion 40, a reduced-diameter portion 42 defining a first axial half of the supporting shaft 40A or 40B and having a smaller diameter than the base 40, and a threaded portion 41 defining a second axial half of the supporting shaft 40A or 40B and having a smaller diameter than the base 40. The rear face of the base plate 10 is provided with threaded holes 18A, 18B that are distant from the output shaft 34 by predetermined center distances. The supporting shafts 40A, 40B are integrated with the base plate 10 by screwing the threaded portions 41, 41 into the corresponding threaded holes 18A, 18B.

[0026] Each of the gears 36, 37 is provided with a through hole that extends through the center of rotation thereof. Each through hole has a step so that the through hole is given a section with a larger inner diameter than the remaining section. In the through hole, a bearing 46 is fitted in the large-diameter section such that the bearing 46 abuts on the large-diameter section and the step. While the bearing 46 is set in the through hole of each of the gears 36, 37, a stopper ring 47 is fitted to an annular groove provided along the inner periphery of the gear 36 or 37. The stopper ring 47 prevents the bearing 46 from falling off the gear 36 or 37. Furthermore, an inner ring portion of the bearing 46 is fitted to the reduced-diameter portion 42 of the corresponding supporting shaft 40A or 40B so that the gear 36 or 37 is rotatable around the supporting shaft 40A or 40B. The supporting shafts 40A, 40B are respectively provided with annular stopper grooves 43. Stopper rings 44 are fitted to these annular stopper grooves 43 so as to prevent the gear 36 and the gear 37 from falling off the respective supporting shafts 40A, 40B.

[0027] One axial end of the gear 36 has an arm 48A attached thereto. Likewise, one axial end of the gear 37 has an arm 48B attached thereto. Each of the arms 48A, 48B has a circular hole that provides a working space for attachment and detachment of the corresponding stopper ring 44, and an arm segment extending outward from the center of the arm 48A or 48B in the radial direction. The arm segments of the arms 48A, 48B are provided with pivotal connection holes for connecting with the respective linking rods 51A, 51B. The arms 48A, 48B are respectively mounted to the gears 36, 37 with a plurality of bolts 49, 49 in a manner such that the centers of the arms 48A, 48B are respectively aligned with the centers of rotation of the gears 36, 37 and that first and second pivotal connecting sections 53A, 53B respectively provided in the arms 48A, 48B are positioned on opposite sides from each other with respect to two corresponding imaginary lines L1, L0 extending through an outer periphery of the gear 35 and extending parallel to each other in the selvage-shedding direction. Accordingly, the gear 36 is integrally provided with the first pivotal connecting section 53A at a position distant from the center of the gear 36 in the radial direction thereof. Similarly, the gear 37 is integrally provided with the second pivotal connecting section 53B at a position distant from the center of the gear 37 in the radial direction thereof.

[0028] The arm 48A and the upper carrier rod 23 are linked with each other with the linking rod 51A having pivotal connection holes at its opposite ends. In detail, a linking pin 52A functioning as a pivot shaft extends through the pivotal connection hole at a first end of the linking rod 51A and through the pivotal connection hole of the arm 48A so as to form the pivotal connecting section 53A of the arm 48A. Similarly, the arm 48B and the upper carrier rod 25 are linked with each other with the linking rod 51B having pivotal connection holes at its opposite ends. In detail, a linking pin 52B functioning as a pivot shaft extends through the pivotal connection hole at a first end of the linking rod 51B and through the pivotal connection hole provided in the arm 48B so as to form the pivotal connecting section 53B of the arm 48B.

[0029] On the other hand, second ends of the linking rods 51A, 51B are respectively linked to the pivotal connection holes of the upper carrier rods 23, 25. In detail, a linking pin 39A functioning as a pivot shaft extends through the pivotal connection hole at the second end of the linking rod 51A and through the pivotal connection hole of the upper carrier rod 23 so as to form a pivotal connecting section 27A of the first supporter 20. Similarly, a linking pin 39B functioning as a pivot shaft extends through the pivotal connection hole at the second end of the linking rod 51B and through the pivotal connection hole of the upper carrier rod 25 so as to form a pivotal connecting section 27B of the second supporter 21.

[0030] According to the first embodiment, the two supporters that have the thread guides 32, 32 guiding the selvage threads 3, 3 and whose movements are restricted to the selvage-shedding direction are defined by the first supporter 20 including the healds 22, the carrier rods 23, 24, and the slide guide 28A, and by the second supporter 21 including the healds 22, the carrier rods 25, 26, and the slide guide 28b. Moreover, the driving motor that is provided independent of a main-shaft motor of the loom and is driven in forward and reverse directions is defined by the pulse motor 33. The motion-converting mechanism that converts a rotary motion of the driving motor to reciprocating motions for the supporters 20, 21 includes the gear 35 serving as the first gear; the gear 36 serving as the second gear and having the first pivotal connecting section 53A at a position distant from the center of rotation of the gear 36 in the radial direction thereof; the second pivotal connecting section 53B provided in the third gear that is directly meshed with the first gear and disposed at a position distant from the center of rotation of the third gear in the radial direction thereof; and the linking rods 51A, 51B provided respectively for the two supporters 20, 21 such that the first ends of the linking rods 51A, 51B are respectively connected to the first pivotal connecting section 53A and the second pivotal connecting section 53B and the second ends are connected to the corresponding supporters 20, 21.

[0031] In the selvage device 1, the pulse motor 33 rotates its output shaft 34 alternately in the forward and reverse directions by a predetermined amount every time the main shaft (crank shaft) of the loom makes a predetermined number of rotations. The motion-converting mechanism transmits the forward and reverse rotation of the output shaft 34 to the second gear 36 and the third gear 37 through the first gear 35, which is attached to the output shaft 34 and is meshed with the gears 36, 37. Thus, the first pivotal connecting section 53A and the second pivotal connecting section 53B of the respective gears 36, 37 are rocked. The rocking motions of the pivotal connecting sections 53A, 53B are then transmitted respectively to the first supporter 20 and the second supporter 21 as reciprocating motions via the linking rod 51A and the linking rod 51B. Since the moving direction of the first supporter 20 and the second supporter 21 respectively connected to the linking rods 51A, 51B is restricted to the selvage-shedding direction, the rotation of the output shaft 34 of the pulse motor 33 is converted to a reciprocating motion for each of the first supporter 20 and the second supporter 21.

[0032] The pulse motor 33 may be, for example, a stepping motor having a step angle of several degrees or a typical rotation-controllable motor. The pulse motor 33 is connected to, for example, a control circuit, not shown, which counts the number of timing signals generated when the main shaft of the loom passes a predetermined angle and which alternately generates rotation command pulses for driving the pulse motor 33 in the forward and reverse directions on the basis of the counted number. Thus, the pulse motor 33 is driven in response to a command from the control circuit.

[0033] In Fig. 2, a moving range of the first pivotal connecting section 53A and a moving range of the second pivotal connecting section 53B in response to the forward and reverse rotation of the output shaft 34 are respectively indicated by reference characters P1 to P3 and reference characters Q1 to Q3. In the example shown in Fig. 2, an angle $\theta 1$ of the moving range of the first pivotal connecting section 53A in response to the driving of the pulse motor 33 is substantially 90°. Moreover, reference characters S1, S2, and S3 each indicate a position of the corresponding thread guides 32 when the first pivotal connecting section 53A is moved to one of the positions P1, P2, P3, respectively. Specifically, the position S1 of the thread guides 32 corresponds to an intermediate position in a selvage-shedding process and defines a standard height for the selvage-shedding motion. On the other hand, the distance between the position S2 and the position S3 of the thread guides 32 corresponds to a shedding amount of selvage threads.

[0034] In the selvage device 1, the selvage-shedding mode is reversed for every predetermined number of rotations of the loom. On the other hand, in the loom, weft threads are each inserted into a weft-traveling path formed in response to a warp-shedding motion, and a beating operation is subsequently performed. Accordingly, this forms the woven cloth 4 having selvage edges formed of the selvage threads 3, 3 and the inserted weft threads.

[0035] As viewed in a traveling direction of warp threads, the selvage device 1 may be disposed at a position so as not to interfere with the weft insertion process. In the drawings, the selvage device 1 is positioned in front of a first warp heald frame 7 of the frontmost row as viewed from the front of the loom in order to reduce the shedding amount of selvage threads to the minimum. Alternatively, the selvage device 1 may be positioned to the back of a warp heald frame of the rearmost row.

[0036] The selvage device 1 is positionally adjustable in the width direction of the woven cloth 4 depending on the cloth specification. The base plate 10 included in the selvage device 1 is attached to the damper stay 9 with the holder blocks 12, 13. The damper stay 9 is bridged between the pair of left and right loom frames, not shown. In detail, the holder blocks 12, 13 sandwich the damper stay 9 in the vertical direction. The holder blocks 12, 13 are fixed to the front face of the base plate 10 with the bolts 15. The holder block 12 is provided with a threaded hole extending towards the damper stay 9. A bolt 14 is screwed into this threaded hole so that the holder block 12 can be secured to the damper stay 9. Where necessary, an operator may loosen the bolt 14 and shift the base plate 10, i.e. the selvage device 1, along the damper stay 9 to a position corresponding to the width of the woven cloth 4.

Accordingly, the selvage device 1 is positionally adjustable in the width direction of the woven cloth 4.

[0037] In the first embodiment, the driven gears having the first pivotal connecting section 53A and the second pivotal connecting section 53B function as crank pins; the first supporter 20 and the second supporter 21 whose movements are restricted to the selvage-shedding direction function as pistons; and the linking rod 51A and the linking rod 51B respectively linking the first pivotal connecting section 53A and the second pivotal connecting section 53B to the first supporter 20 and the second supporter 21 function as crank rods. Consequently, the crank pins, the pistons, and the crank rods constitute a so-called piston-crank mechanism. The rotation of the driving motor is transmitted to the gears 36, 37 defining the driven gears via the first gear 35, and is converted to reciprocating motions for the first supporter 20 and the second supporter 21. Thus, the first selvage heald frame and the second selvage heald frame are reciprocated in opposite directions from each other, thereby implementing the selvage-shedding motion.

[0038] In the present invention, the meshing position (phase) between the first gear 35 of the driving side and the second gear 36 of the driven side having the pivotal connecting section 53A may be displaced so as to change the standard height for the selvage-shedding motion. In detail, by loosening the hexagon socket head bolt 19 securing the gear 35 in position and then shifting the gear 35 towards the axial end of the output shaft 34, the two gears can be disengaged from each other. Thus, the meshing phase can be displaced.

[0039] Furthermore, in order to change the shedding amount of selvage threads, at least one of the first gear of the driving side and the second gear of the driven side may be replaced with another gear so as to change the gear ratio between the two gears, and moreover, at least one of the first gear and the third gear may be replaced with another gear so as to change the gear ratio between the two gears. More specifically, when replacing the first gear 35, the gear 35 may be detached from the output shaft 34 by means of the above-mentioned method. On the other hand, when replacing the second and third gears 36, 37, the corresponding stopper rings 44 may be removed so that the gears 36, 37 can be detached from the supporting shafts 40A, 40B while the corresponding bearings 46 remain attached to the gears 36, 37.

[0040] In a case where the number of warp threads or the number of selvage threads is increased due to a change in the cloth specification, the gears may be replaced with alternative gears having an appropriate number of gear teeth using the above-mentioned method so as to increase the gear ratio between the gear 35 and the gear 36 and between the gear 35 and the gear 37 in correspondence to an increase in the selvage tension. Accordingly, the operating condition of the selvage device 1 can be set properly to a desired condition.

[0041] Furthermore, the following modifications are permissible in the first embodiment. In the drawings used as a reference for the modification examples described below, components that are substantially the same as those in the above-referenced drawings will be given the same reference numerals, and the descriptions of those components will not be repeated.

[0042] In the first embodiment described above, a first gear for transmitting the rotation of the output shaft 34 to the gear 36 and the gear 37 respectively functioning as the second gear and the third gear includes a single gear 35. As an alternative to such a structure in which a single driving gear is used in common between the two driven gears, a plurality of driving gears that transmits the rotation individually to the driven gears may be provided. In an example shown in Fig. 5, the gear 37 functioning as the third gear is axially supported by the gear 36 functioning as the second gear in a rotatable fashion such that the two gears share the same center of rotation. Moreover, a gear 55 functioning as a fourth gear is coaxially disposed on the output shaft 34, which protrudes outward from the gear 35 in the axial direction thereof, and is meshed with the gear 37. In this example, the first pivotal connecting section 53A and the second pivotal connecting section 53B are positioned on opposite sides from each other with respect to the two corresponding imaginary lines L1, L0 respectively extending through the centers of rotation 36a, 37a of the gears 36, 37 and extending parallel to each other in the selvage-shedding direction. Moreover, the gear 36 and the gear 37 are disposed in a manner such that the centers of rotation 36a, 37a of the gears 36, 37 are positioned within a range defined by two tangent lines L5, L6 tangent to the outer periphery of the gear 35 and extending parallel to each other in the selvage-shedding direction. (More specifically, the centers of rotation 36a, 37a of the gears 36, 37 are collinear to an imaginary line extending through the center of rotation 35a of the gear 35 in the selvage-shedding direction.)

[0043] In this example, the pair of gears 35, 55 has the same diameter and the same number of gear teeth, and likewise, the pair of gears 36, 37 has the same diameter and the same number of gear teeth. Alternatively, each pair of gears may include a combination of gears having different outer diameters with a different number of gear teeth. In that case, the shedding amount of selvage threads of the first supporter 20 can be set at a value different from that of the second supporter 21.

[0044] In the example shown in Fig. 5, the center distance between the output shaft 34 of the pulse motor 33 and the center of rotation of at least one of the gears 36, 37 serving as the second and third gears is preferably adjustable. Fig. 14 illustrates a typical example of such an adjustable feature provided in the first embodiment. Specifically, the base plate 10 is given a structure such that the attachment position of the pulse motor 33 and the positions of the supporting shafts 40A and 40B are adjustable in a direction for changing the center distance therebetween. In Fig. 14, the base plate 10 is provided with a cutout 62 in a range in which the base plate 10 does not interfere with the positional adjustment of the output shaft 34 of the pulse motor 33, and slots 60 extending in the positional adjustment direction in place of threaded holes 17 shown in Fig. 1 for securing the pulse motor 33 to the base plate 10. While the gears, not shown, attached to the output shaft 34 are meshed with each other, the pulse motor 33 is mounted to the base plate 10 by inserting bolts 63 through the slots 60 and then fastening the bolts 63 to nuts, not shown.

[0045] On the other hand, as a structure for changing the center distance for the supporting shaft 40A and the supporting shaft 40B, the base plate 10 is provided with positional-adjustment slots 61A, 61B in place of the threaded holes 18A, 18B provided respectively for the attachment of the supporting shaft 40A and the supporting shaft 40B to the base plate 10. The slots 61A, 61B extend longitudinally along lines extending through the centers of the respective gears 36, 37. In detail, referring to Fig. 15, with respect to the first embodiment, each of the supporting shafts 40A, 40B is provided with the threaded portion 41 that extends through and protrudes from the base plate 10. While the gears 36, 37 are meshed with each other, the supporting shafts 40A, 40B are respectively inserted through the slots 61A, 61B. The threaded portions 41 of the supporting shafts 40A, 40B are then fastened to corresponding nuts 64 so that the base plate 10 is tightly pressed from opposite directions. Accordingly, the supporting shafts 40A, 40B are secured to the base plate 10. As an alternative to this example in which the attachment positions of the pulse motor 33 and the supporting shafts 40A, 40B are adjustable, the base plate 10 may be given a structure such that the positional adjustment feature is given only to the pulse motor 33 or to the supporting shafts 40A, 40B.

[0046] In the first embodiment, in order to rotate the gear 37 having the second pivotal connecting section 53b, the gear 35 transmits the rotation of the output shaft 34 to the gear 37. Alternatively, the gear 37 to which the rotation is transmitted does not necessarily have to be provided. For example, referring to Fig. 6, the gear 35 functioning as the first gear and the gear 36 functioning as the second gear may have substantially the same diameter (with substantially the same number or similar number of gear teeth). Moreover, the gear 35 may be provided with the second pivotal connecting section 53B at a position distant from the center of rotation of the gear 35, and the linking rod 51B may be connected to the pivotal connecting section 53B. Since this reduces the amount of inertia of the driving system due to the reduced number of gears, the driving torque of the pulse motor 33 can be reduced, thereby contributing to lower power consumption. In this example, the first pivotal connecting section 53A and the second pivotal connecting section 53B are positioned on the same side with respect to the two imaginary lines L1, L0 respectively extending through the centers of rotation 36a, 35a of the gears 36, 35 and extending parallel to each other in the selvage-shedding direction (in other words, the two pivotal connecting sections 53A, 53B are both positioned on the right side in Fig. 6 with respect to the imaginary lines L1, L0 as a boundary line). Moreover, the gear 36 is positioned within a range defined by two tangent lines L5, L6 tangent to the outer periphery of the gear 35 and extending parallel to each other in the selvage-shedding direction. (More specifically, the center of rotation 36a of the gear 36 is collinear to the imaginary line L0 extending through the center of rotation 35a of the gear 35 in the selvage-shedding direction.)

[0047] In the first embodiment shown in Figs. 1 and 2, the centers of rotation 36a, 37a of the gears 36, 37 and the center of rotation of the pulse motor 33 are arranged in a manner such that the centers of rotation are positioned at apexes of a triangle. Alternatively, the pulse motor 33, the gear 36, and the gear 37 may be disposed in a collinear fashion such that the center of rotation of the pulse motor 33, the center of rotation 36a of the gear 36, and the center of rotation 37a of the gear 37 are arranged in a single line. In detail, Fig. 7 shows an example in which the gear 36, the gear 37, and the gear 35 are arranged in a meshing fashion along an imaginary line extending vertically in the selvage-shedding direction with respect to the gear 35. The first and second pivotal connecting sections 53A, 53B are positioned on opposite sides from each other with respect to the two corresponding imaginary lines L1, L0 extending respectively through the centers of rotation 36a, 37a of the gears 36, 37 and extending parallel to each other in the selvage-shedding direction. Moreover, the gear 36 and the gear 37 are disposed in a manner such that the centers of rotation 36a, 37a of the gears 36, 37 are positioned within a range defined by two tangent lines L5, L6 tangent to the outer periphery of the gear 35 and extending parallel to each other in the selvage-shedding direction. (More specifically, the centers of rotation 36a, 37a of the gears 36, 37 are collinear to an imaginary line extending through the center of rotation 35a of the gear 35 in the selvage-shedding direction.) According to this configuration, the first pivotal connecting section 53A and the second pivotal connecting section 53B are disposed relatively closer to each other.

[0048] In contrast to the example shown in Fig. 7, Fig. 8 illustrates an example in which the gear 36 and the gear 37 are meshed with the outer periphery of the gear 35 and are disposed at an angle with respect to the center of rotation 35a of the gear 35. In detail, while being meshed with the gear 35, the gear 36 and the gear 37 are respectively positioned at an angle θ1 and an angle θ2 in the counterclockwise direction with respect to the center of rotation 35a of the gear 35. In other words, the gear 36 and the gear 37 are disposed in a manner such that the centers of rotation 36a, 37a of the gears 36, 37 are positioned within a range defined by two imaginary lines L8, L9 each extending through the center of rotation 35a of the gear 35 and forming a crossing angle θ3 with respect to an imaginary line L7 that extends through the center of rotation 35a of the gear 35 in the selvage-shedding direction. (More specifically, the imaginary line L7 and an imaginary line L21 extending through the center of rotation 35a and the center of rotation 36a of the gear 36 form a crossing angle θ1 therebetween, and the imaginary line L7 and an imaginary line L22 extending through the center of rotation 35a and the center of rotation 37a of the gear 37 form a crossing angle θ2 therebetween. The gears 36, 37 are disposed at positions where the crossing angles θ1 and θ2 are smaller than the angle θ3.) For example, the angle θ3 is preferably set at 45°. Furthermore, the first pivotal connecting section 53A and the second pivotal connecting section 53B are positioned on opposite sides from each other with respect to the two corresponding imaginary lines L1, L0 extending respectively through the centers of rotation 36a, 37a of the gears 36, 37 and extending parallel to each other in the selvage-shedding direction. Moreover, the center of rotation 37a of the gear 37 and the pivotal connecting section 53B are disposed on opposite sides of the imaginary line L7. Accordingly, this reduces the degree of change in the angle of the linking rod 51B when the gear 37 is driven, thereby achieving an efficient conversion to a reciprocating motion.

[0049] Furthermore, Fig. 9 illustrates another example in which the gear 36 and the gear 37 are disposed in a manner such that an imaginary line L10 extending through the centers of rotation 36a, 37a of the gears 36, 37 extends crosswise with respect to the selvage-shedding direction. In this case, the first pivotal connecting section 53A and the second pivotal connecting section 53B are positioned within a range defined by two imaginary lines L11, L12 extending respectively through the centers of rotation 36a, 37a of the gears 36, 37 and extending parallel to each other in the selvage-shedding direction. Furthermore, the first pivotal connecting section 53A and the second pivotal connecting section 53B are positioned on opposite sides from each other and at inner sides of the imaginary lines L11, L12, which extend respectively through the centers of rotation 36a, 37a and parallel to each other in the selvage-shedding direction. Accordingly, this reduces the degree of change in the angle of the linking rods 51A, 51B when the gears 36, 37 are rotated, thereby achieving an efficient conversion to reciprocating motions.

[0050] Furthermore, Fig. 10 illustrates another example in which the gear 36 and the gear 37 are arranged in a rotary-axis direction thereof with a predetermined distance therebetween so as to share a common center of rotation. Moreover, the tooth surface of the gear 35 functioning as the first gear extends in an axial direction thereof so that the gear 35 is meshed with both the gear 36 and the gear 37. In this example, the first pivotal connecting section 53A and the second pivotal connecting section 53B are positioned on opposite sides from each other with respect to the two corresponding imaginary lines L1, L0 extending respectively through the centers of rotation 36a, 37a of the respective gears 36, 37 and extending parallel to each other in the selvage-shedding direction. Moreover, the gear 36 and the gear 37 are disposed in a manner such that the centers of rotation 36a, 37a of the gears 36, 37 are positioned within a range defined by two tangent lines L5, L6 tangent to the outer periphery of the gear 35 and extending parallel to each other in the selvage-shedding direction.

[0051] Although the gears provided in the above-described embodiment and examples are defined by spur gears, other types of gears are permissible. Fig. 11 shows an example in which the output shaft 34 of the pulse motor 33 is oriented in the selvage-shedding direction, and the output shaft 34 is provided with a bevel gear 35, which is three-dimensional. The bevel gear 35 is disposed such that its tooth surface faces downward. Moreover, the gear 36 and the gear 37 are defined by the same bevel gears as the gear 35, and have their rotary axes aligned with each other so that the gear 36 and the gear 37 share a common center of rotation. Consequently, similar to the above, since the gears that have the pivotal connecting sections share a common center of rotation (rotary axis), the degree of change in the angle of the linking rods 51A, 51B is reduced, whereby the rotation of the pulse motor 33 is efficiently converted to reciprocating motions for the supporters 20, 21 having the thread guides 32. Accordingly, the pulse motor 33 requires a less amount of driving torque, thereby contributing to lower power consumption.

[0052] In the first embodiment shown in Figs. 1 and 2, the gear 37 functioning as the third gear is driven by the gear 35 functioning as the first gear, which is used in common between the gear 37 and the gear 36 functioning as the second gear. Alternatively, for example, referring to Fig. 12, a gear 56 serving as a fourth gear may be provided. Specifically, the gear 56 is meshed with the gear 37 and is attached to a rotary shaft 59, which is rotated together with the gear 36. Consequently, when the gear 56 is rotated in response to the rotation of the output shaft 34, the gear 37 is driven. As a further alternative, referring to Fig. 13, in addition to such an indirect transmission gear 56, another indirect transmission gear 57 may be provided. In this case, the rotation of the output shaft 34 is transmitted to the gear 37 integrated with the gear 57.

[0053] In the above-described embodiment and examples, the linking pins 52A, 52B, the connection holes, and the like are used for the pivotal connecting sections 53A and 53B and the pivotal connecting sections 27A and 27B that link together the linking rods 51A, 51B, the arms 48A, 48B, and the upper carrier rods 23, 25, respectively. Alternatively, other known pivotal connecting structures are also permissible. For example, one set of components that are to be linked to the other set of components may be provided with pivot shafts so that the one set can be linked to the other set.

[0054] The present invention is not limited to fluid-jet looms, such as air-jet looms, and is widely applicable to other shuttleless looms, such as rapier looms and projectile looms.

Claims

1. A selvage device (1) in a loom, comprising:

two supporters (20, 21) whose movements are restricted to a selvage-shedding direction and having thread guides (32) for guiding selvage threads (3);

a driving motor (33) that is independent of a main-shaft motor of the loom and is rotated in forward and reverse directions; and

a motion-converting mechanism converting the rotation of the driving motor (33) to reciprocating motions for the supporters (20, 21),

wherein the motion-converting mechanism includes:

a first gear (35) attached to an output shaft (34) of the driving motor (33),

a second gear (36) meshed with the first gear (35) and having a first pivotal connecting section (53A) at a position distant from a center of rotation (36a) of the second gear (36) in a radial direction thereof,
a second pivotal connecting section (53B) provided in one of the first gear (35) and a third gear (37) directly meshed or indirectly linked with the first gear (35), the second pivotal connecting section (53B) being positioned distant from a center of rotation (35a, 37a) of said one of the first gear (35) and the third gear (37) in a radial direction thereof, and
linking rods (51A, 51B) respectively provided for the supporters (20, 21), the linking rods (51A, 51B) having first ends respectively connected to the first pivotal connecting section (53A) and the second pivotal connecting section (53B) and second ends connected to the corresponding supporters (20, 21).

2. The selvage device according to Claim 1, wherein the second pivotal connecting section (53B) is provided in the first gear (35), and
wherein the first pivotal connecting section (53A) of the second gear (36) and the second pivotal connecting section (53B) of the first gear (35) are disposed on the same side with respect to two corresponding imaginary lines (L1, L0) extending respectively through the center of rotation (36a) of the second gear (36) and the center of rotation (35a) of the first gear (35) and extending parallel to each other in the selvage-shedding direction.

3. The selvage device according to Claim 1, wherein the second pivotal connecting section (53B) is provided in the third gear (37), and
wherein the first pivotal connecting section (53A) of the second gear (36) and the second pivotal connecting section (53B) of the third gear (37) are disposed on opposite sides from each other with respect to two corresponding imaginary lines (L1, L0) extending respectively through the center of rotation (36a) of the second gear (36) and the center of rotation (37a) of the third gear (37) and extending parallel to each other in the selvage-shedding direction.

4. The selvage device according to Claim 3, wherein the second gear (36) and the third gear (37) are disposed in a manner such that the center of rotation (36a) of the second gear (36) and the center of rotation (37a) of the third gear (37) are positioned within a range defined by two tangent lines (L5, L6) tangent to an outer periphery of the first gear (35) and extending parallel to each other in the selvage-shedding direction.

5. The selvage device according to Claim 3, wherein the second gear (36) and the third gear (37) are disposed in a manner such that the center of rotation (36a) of the second gear (36) and the center of rotation (37a) of the third gear (37) are positioned within a range defined by two imaginary lines (L8, L9) each extending through the center of rotation (35a) of the first gear (35) and forming a crossing angle of ±45° with respect to an imaginary line (L7) extending through the center of rotation (35a) of the first gear (35) in the selvage-shedding direction.

6. The selvage device according to Claim 3, wherein the second gear (36) and the third gear (37) are arranged in a manner such that an imaginary line (L10) extending through the centers of rotation (36a, 37a) of the two respective gears (36, 37) extends crosswise with respect to the selvage-shedding direction, and wherein the first pivotal connecting section (53A) and the second pivotal connecting section (53B) are positioned within a range defined by two imaginary lines (L11, L12) extending respectively through the centers of rotation (36a, 37a) of the two gears (36, 37) and extending parallel to each other in the selvage-shedding direction.

7. The selvage device according to one of Claims 3 to 6, wherein the third gear (37) is meshed with a fourth gear (55) attached to the output shaft (34) of the driving motor (33).

8. The selvage device according to one of Claims 1 to 6, wherein the position of the center of rotation (35a, 36a, 37a) of at least one of the first gear (35), the second gear (36), and the third gear (37) is relatively adjustable with respect to the center of rotation (35a, 36a, 37a) of the remaining one or more gears (35, 36, 37) meshed with said at least one of the first gear (35), the second gear (36), and the third gear (37).

FIG. 1

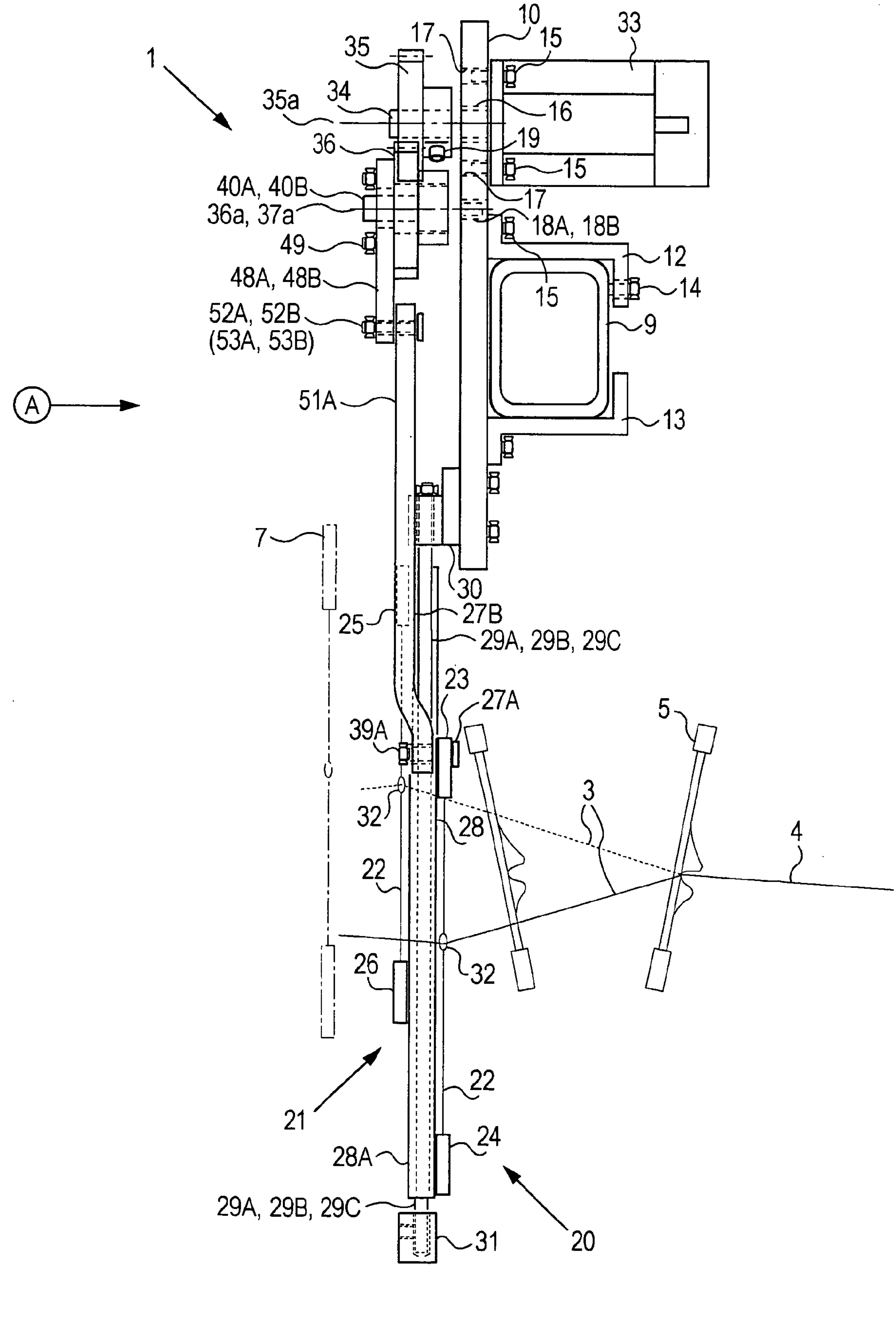

1
35
17
10
15
33
35a
34
16
36
19
15
40A, 40B
36a, 37a
17
18A, 18B
49
12
15
14
48A, 48B
52A, 52B
(53A, 53B)
9
A
51A
13
7
30
25
27B
29A, 29B, 29C
23
27A
5
39A
3
32
28
4
22
32
26
22
21
24
28A
29A, 29B, 29C
31
20

FIG. 2

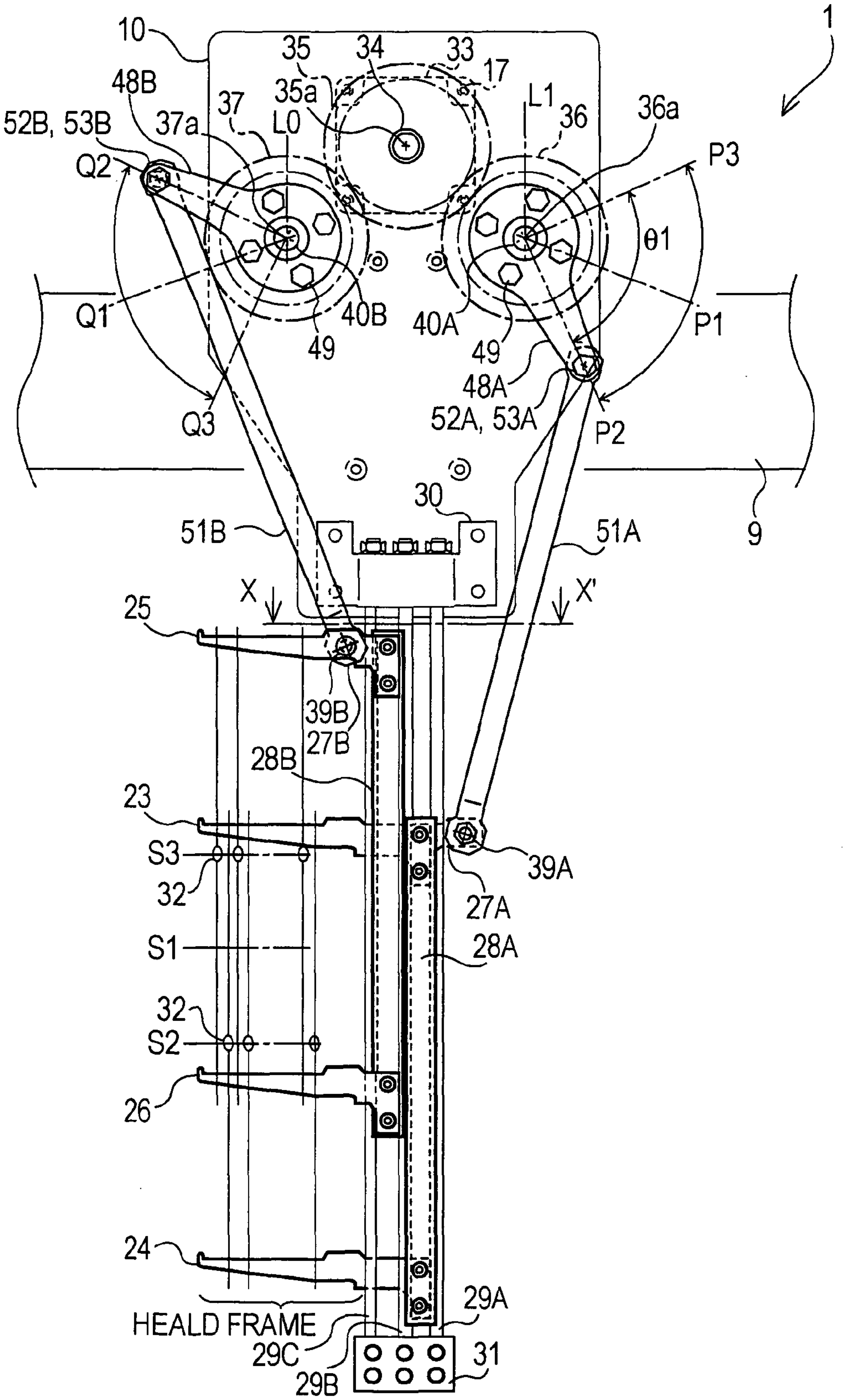

1
10
35
34
33
17
35a
48B
37
37a
L0
L1
36
36a
52B, 53B
Q2
P3
θ1
Q1
40B
40A
49
P1
48A
52A, 53A
Q3
P2
30
9
51B
51A
X
X'
25
39B
27B
28B
23
S3
32
39A
27A
28A
S1
32
S2
26
24
29A
HEALD FRAME
29C
29B
31

FIG. 3

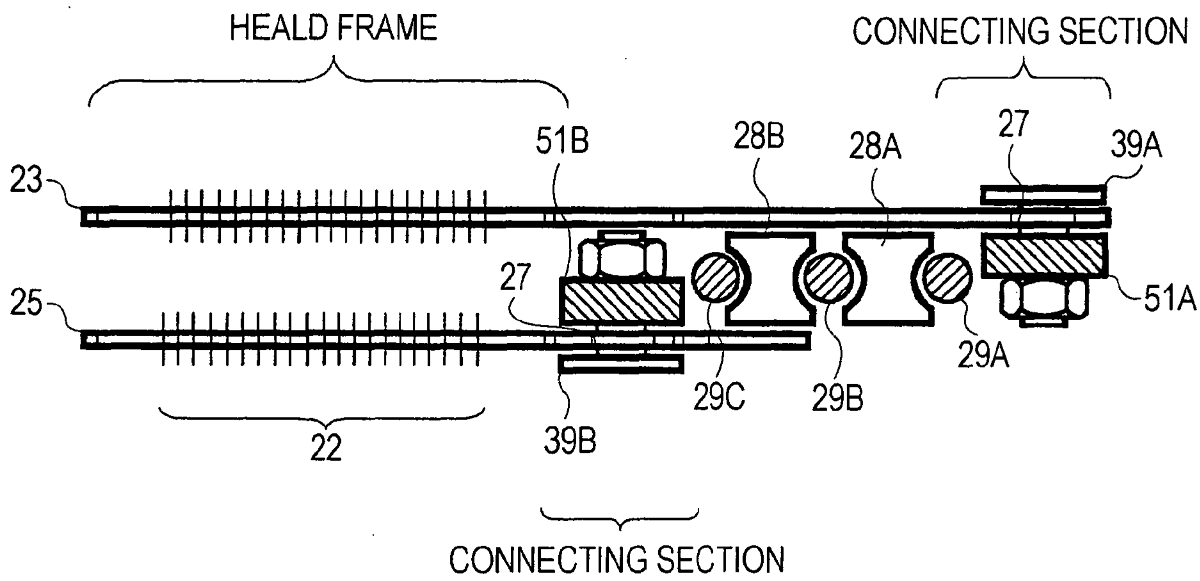

HEALD FRAME
CONNECTING SECTION
23
25
22
51B
27
28B
28A
27
39A
51A
29A
29B
29C
39B
CONNECTING SECTION

FIG. 4

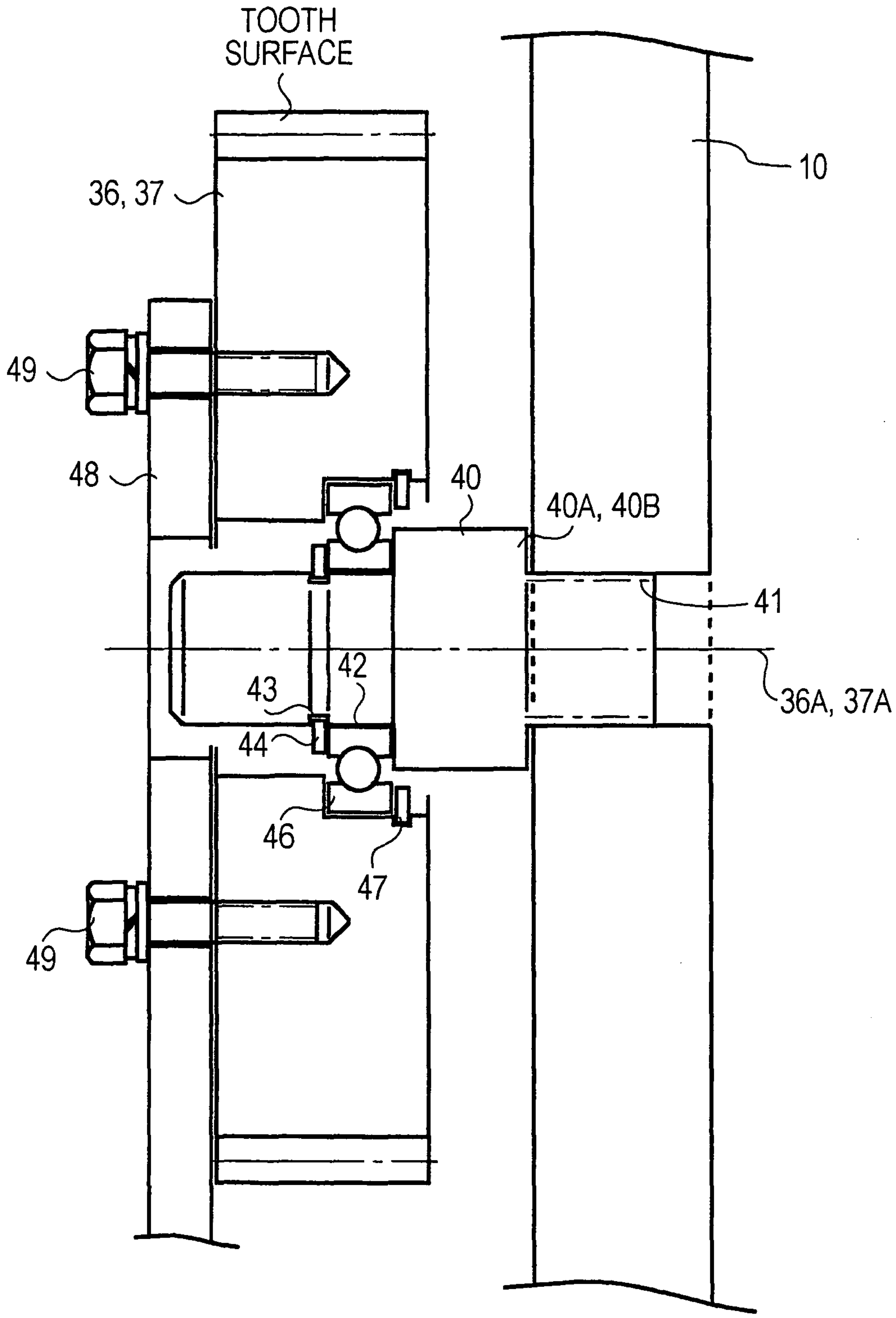

TOOTH
SURFACE
10
36, 37
49
48
40
40A, 40B
41
42
43
36A, 37A
44
46
47
49

FIG. 5

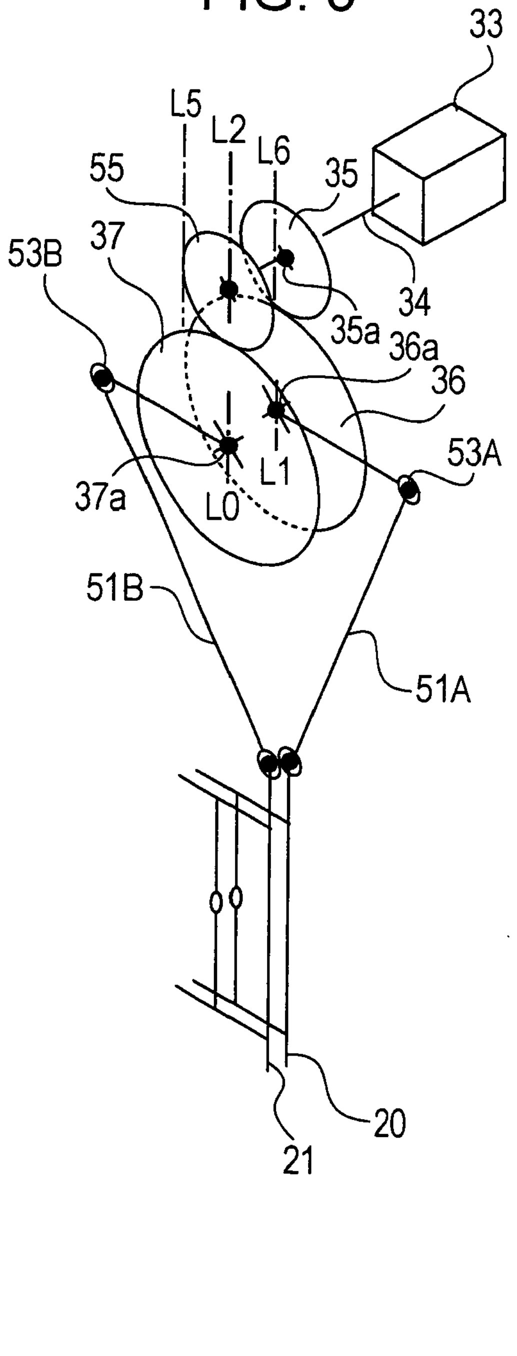


FIG. 6

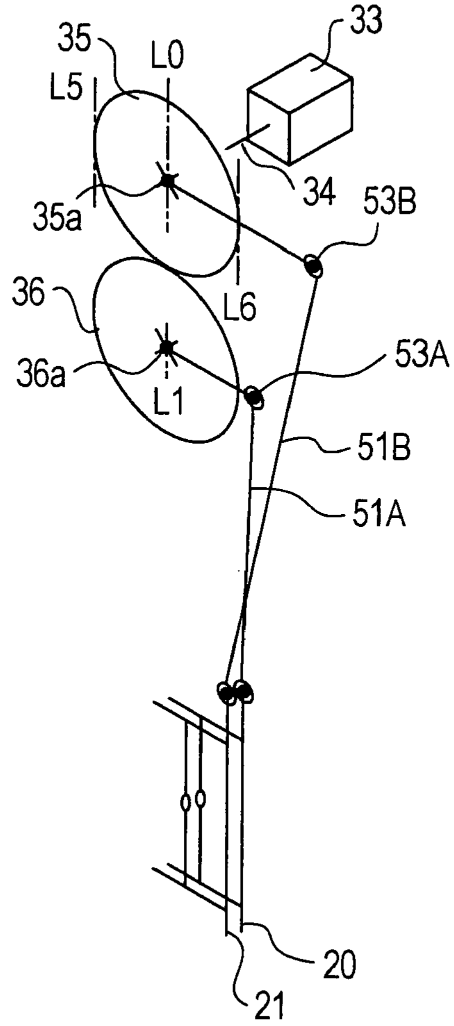


FIG. 7

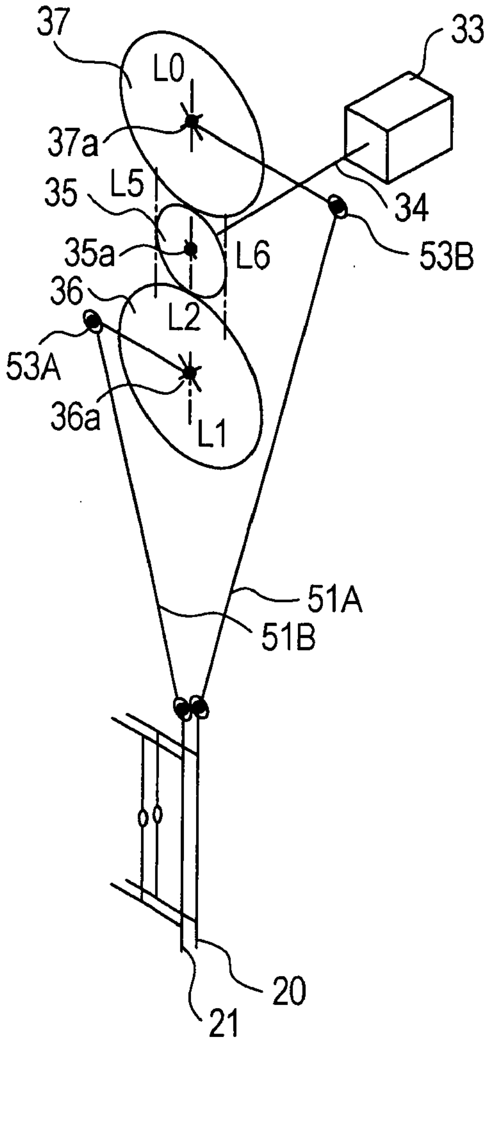


FIG. 8

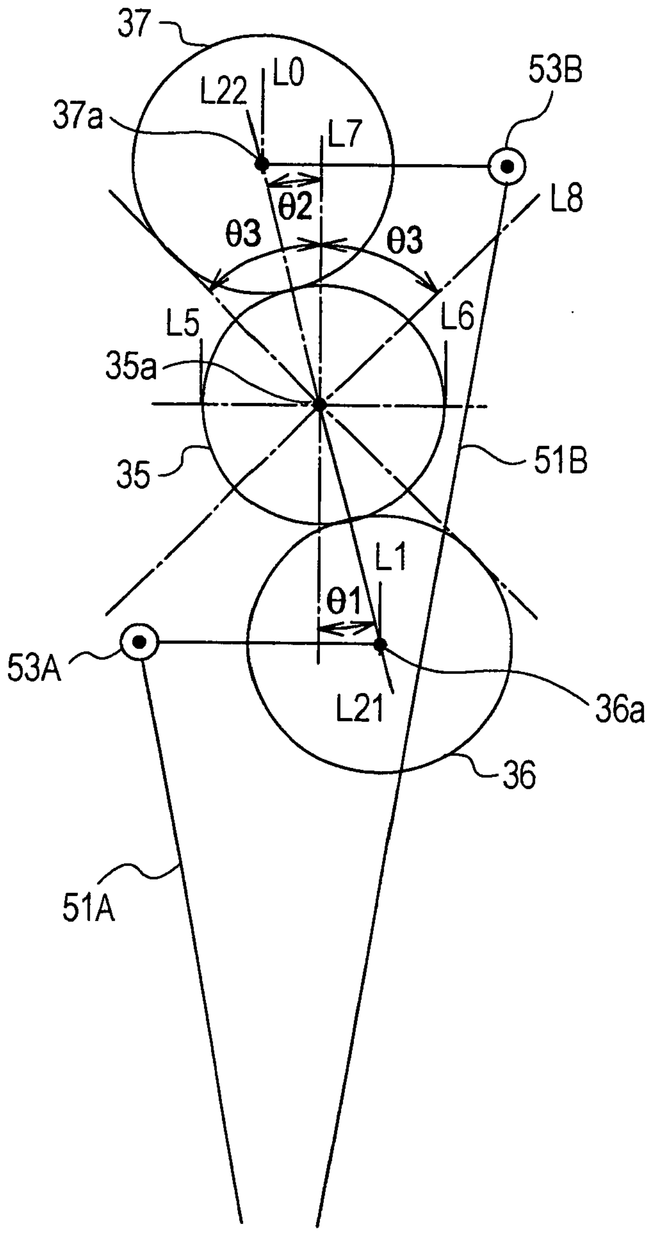

37
L22
L0
37a
L7
53B
θ2
L8
θ3
θ3
L5
L6
35a
35
51B
L1
θ1
53A
36a
L21
36
51A

FIG. 9

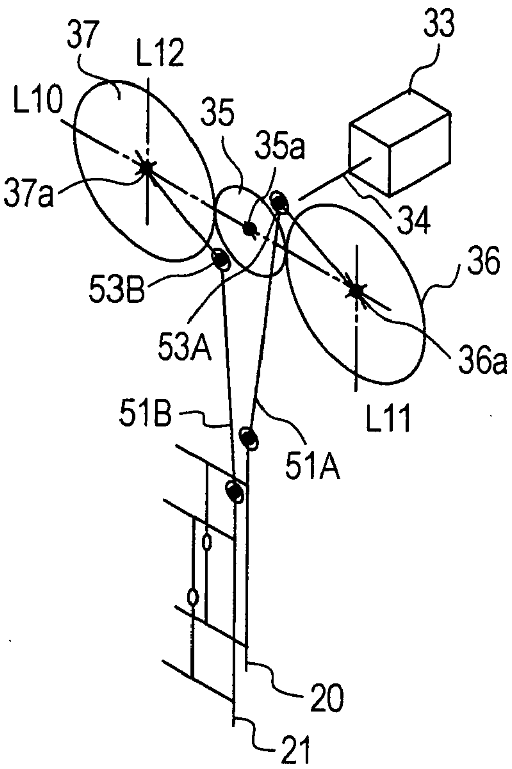


FIG. 10

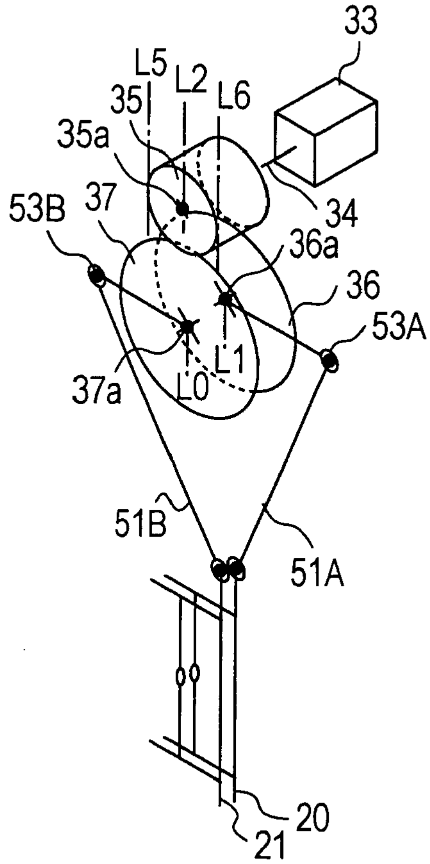


FIG. 11

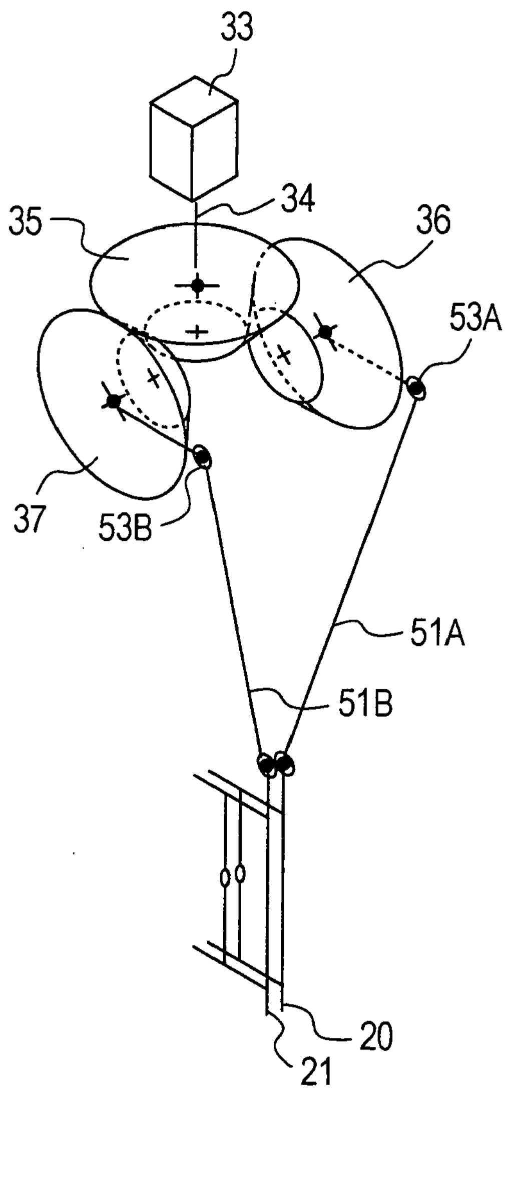


FIG. 12

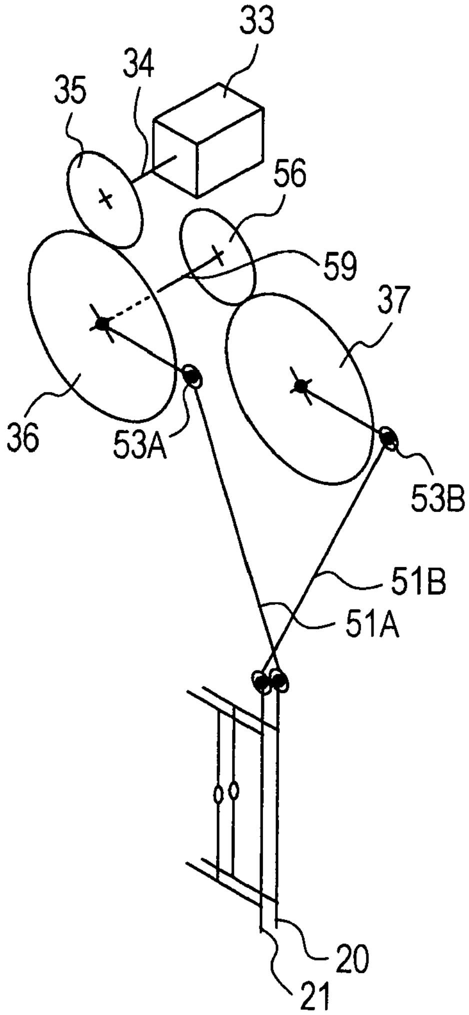


FIG. 13

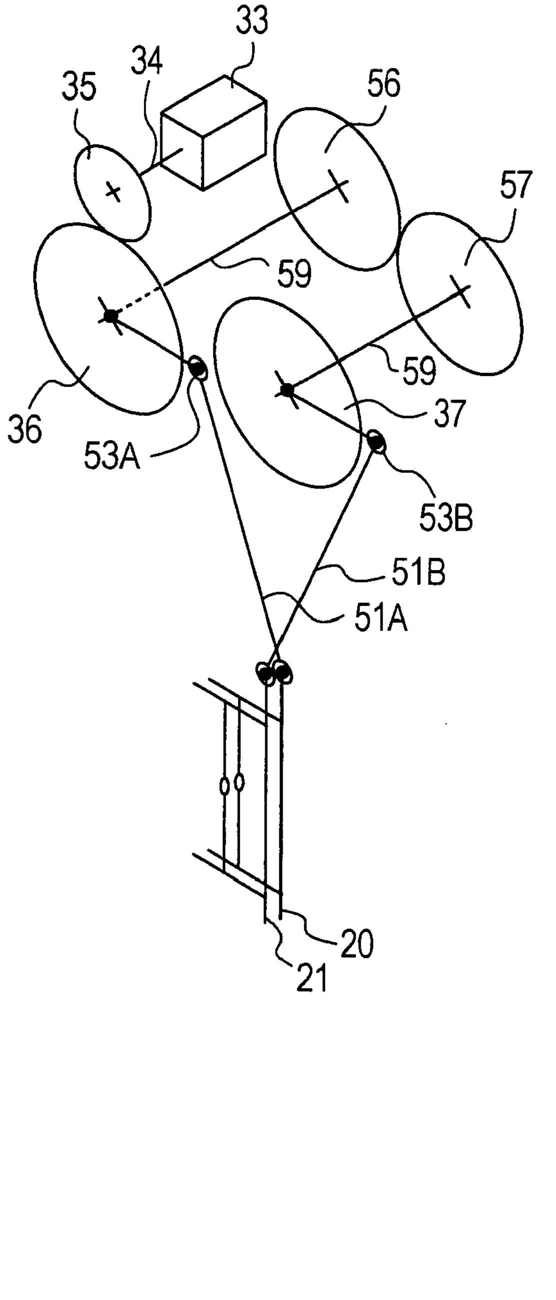


FIG. 14

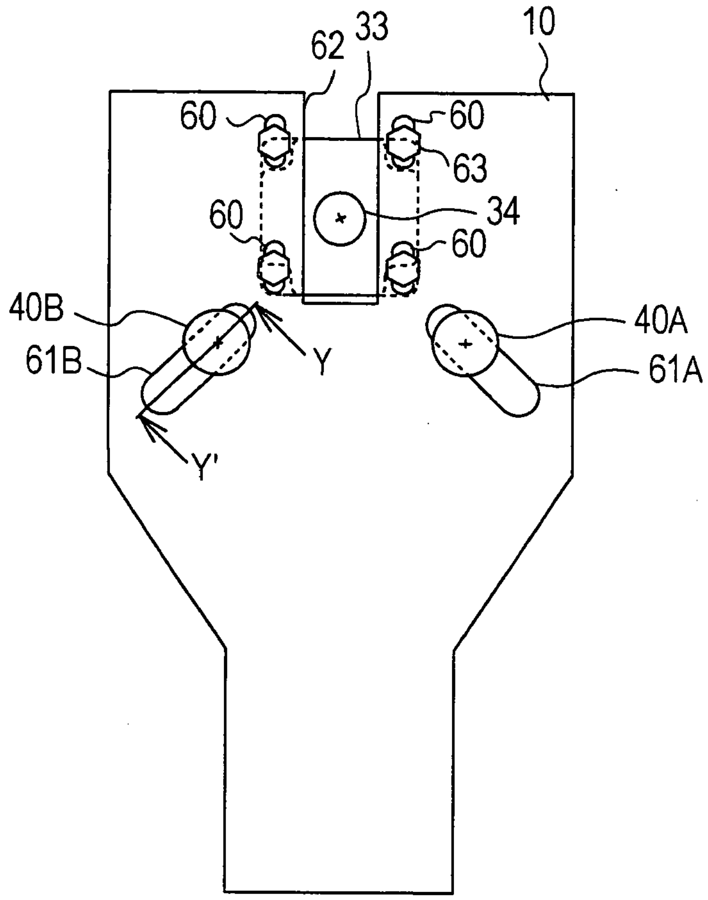
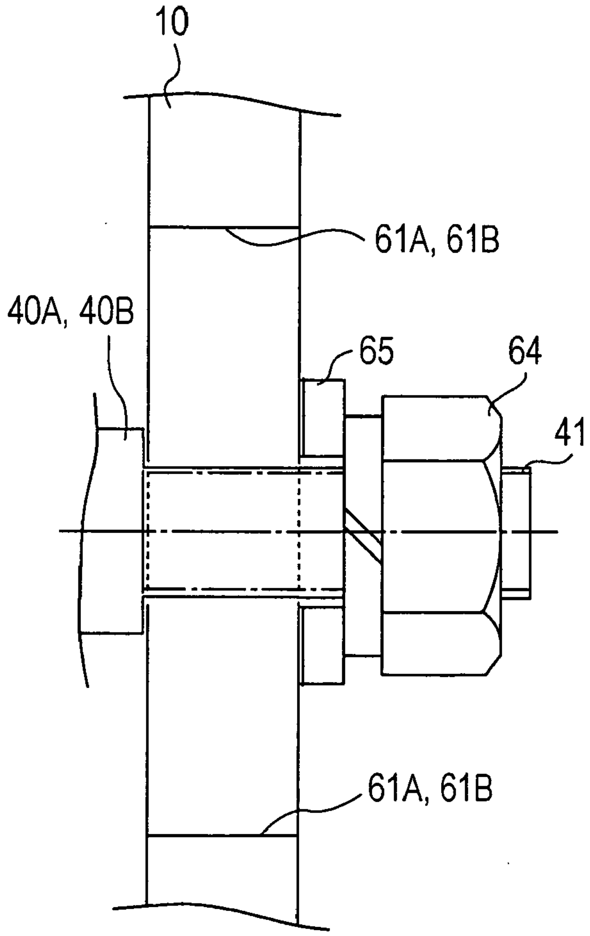


FIG. 15



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 10503563 W **[0002] [0003] [0003] [0005]**
- JP 2004308064 A **[0002] [0004] [0006]**