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(54) **Sewing machine**

Nähmaschine

Machine à coudre

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EP 2 642 010 B1

Description

TECHNICAL FIELD

[0001] This disclosure relates to a sewing machine.

BACKGROUND DISCUSSION

[0002] As this type of background discussion, a sewing machine shown in JP 2008-245728A (Reference 1) is known. This sewing machine includes two or more variable resistors having characteristics in which the relationship between the stepping amount of a stepping plate provided inside a pedal formed by a foundation and the stepping plate, and a resistance value varies, and switching means for alternatively switching a variable resistor to be connected to a control device of the sewing machine out of the two or more variable resistors. Moreover, link that comes into slidable contact with a variable resistor, and a tension spring coupled to one end of the link and the other and of the link are provided. The link is moved upward by the tension spring. Additionally, a compression spring that biases the stepping plate so as to be kept away from the foundation is provided inside the pedal. If the stepping plate is stepped on by an operator, the other end of the link moves, and the resistance value that determines the rotational frequency of a sewing machine motor changes so that sewing speed can be controlled.

[0003] Additionally, as the background discussion, a sewing machine shown in Japanese Utility Model Registration No. 1587171 (Reference 2) is known. This sewing machine is provided with a variable resistor provided inside a pedal formed by a foundation and a stepping plate, a link that comes into slidable contact with the variable resistor, and a tension spring coupled to one end of the link and the other end of the link. The link is moved upward by the tension spring. Additionally, a compression spring that biases the stepping plate so as to be kept away from the foundation is provided inside the pedal. If the stepping plate is stepped on by an operator, the other end of the link moves, and the resistance value that determines the rotational frequency of a sewing machine motor changes so that sewing speed can be controlled.

[0004] However, in the sewing machine of Reference 1, since a component force in an oblique direction is to be generated in a link mechanism that transmits a user's (also including a seller) foot controller stepping force to the variable resistor, and transmission efficiency becomes low, there is a problem in that a user's stepping force may become great and operativity may become poor.

[0005] Additionally, the same problem as the sewing machine of Reference 1 occurs also in the sewing machine of Reference 2. EP 0053938 relates to a speed setting arrangement for a sewing machine.

[0006] This disclosure has performed in view of the above problems, and a need thus exists for a sewing machine that can operate a variable resistor with a high transmission efficiency.

SUMMARY

[0007] In order to solve the above-described problems, according to a first aspect of this disclosure, there is provided is a sewing machine including a foot controller in which a stepping portion is displaceable according to a user's stepping amount; a moving device that is built in the foot controller and moves according to the displacement amount of the stepping portion; a variable resistor that is built in the foot controller and is capable of changing a resistance value according to the movement amount of the moving device; and a motor that causes to change a sewing speed according to the resistance value of the variable resistor. The moving device has a first movement member that is pressed by the stepping portion and moves in a stepping direction of the foot controller; a rotary body that engages the first movement member, and converts the movement amount of the first movement member into a rotational amount; and a second movement member that engages the rotary body, moves in a direction orthogonal to the movement direction of the first movement member by the movement amount according to the rotational amount of the rotary body, and changes the resistance value of the variable resistor according to the movement amount thereof.

[0008] According to the first aspect, the sewing machine of this disclosure is configured so that the moving device includes the first movement member that moves in the stepping direction of the foot controller, the rotary body that converts the movement amount of the first movement member into a rotational amount, and the second movement member that converts the rotational amount of the rotary body in a direction orthogonal to the movement direction of the first movement member and moves, and is configured to change the resistance value of the variable resistor when the second movement member moves in the direction orthogonal to the movement direction of the first movement member. Thereby, a component force in an oblique direction is not generated among the first movement member, the rotary gear, and the second movement member, and the variable resistor can be operated with a high transmission efficiency.

[0009] Additionally, a second aspect of this disclosure has a configuration in which the first movement member has a first rack that is pressed by the stepping portion and moves in the stepping direction of the foot controller, the rotary body has a gear that engages the first rack and converts the movement amount of the first rack into a rotational amount, the second movement member has a second rack that engages the rotary body, and converts the rotational amount of the gear in the direction orthogonal to the movement direction of the first rack so as to move, and the variable resistor includes a variable resistor lever that engages a variable resistor lever operating portion provided at one end of the second rack, moves together with the second rack, and changes the resistance value of the variable resistor.

[0010] According to the second aspecct, the sewing machine of this disclosure is configured so that the first movement member has the first rack, the rotary body has the gear that converts the movement amount of the first rack into a rotational amount, the second movement member has the second rack that converts the rotational amount of the gear in the direction orthogonal to the first movement direction and moves, and the resistance value of variable resistor is changed by the variable resistor lever of the variable resistor via the variable resistor lever operating portion provided at one end of the second rack. Thereby, the transmission efficiency of forces among the first rack, the gear, and the second rack can be further improved, and the variable resistor can be operated with a high transmission efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The foregoing and additional features and characteristics of this disclosure will become more apparent from the following detailed description considered with the reference to the accompanying drawings, wherein:

Fig. 1 is a perspective view of a sewing machine of an embodiment disclosed here;
Fig. 2 is an appearance view of the foot controller of the embodiment disclosed here as viewed from the oblique upward direction;
Fig. 3 is an appearance view of the foot controller of the embodiment disclosed here as viewed from the oblique downward direction;
Fig. 4 is an explanatory view of the foot controller of the embodiment disclosed here;
Figs. 5A and 5B are structural views of the moving device of the embodiment disclosed here, and Fig. 5A is a structural view of the overall moving device and Fig. 5B is a structural view of a movement direction changing mechanism portion in the moving device;
Figs. 6A and 6B are schematic views of the foot controller of the embodiment disclosed here, and a graph of the relationship between a stepping amount and load;
Fig. 7 is a cross-sectional view of a foot controller of the background discussion;
Figs. 8A and 8B are explanatory views of the force relationship of the foot controller of the background discussion, and Fig. 8A is an explanatory view of the stepping power and load of the foot controller and Fig. 8B is a graph of the relationship between the stepping amount and load of the foot controller; and
Fig. 9 is an explanatory view for the calculation based on a schematic view of the foot controller of the background discussion.

DETAILED DESCRIPTION

[0012] An embodiment disclosed here and an embodiment of the background discussion will be explained with reference to the attached drawings.

Embodiment Disclosed Here

[0013] Fig. 1 is a perspective view of a sewing machine 1 of an embodiment disclosed here. The sewing machine 1 is placed on a table 8, a foot controller 10 is placed on a floor surface 9, and the sewing machine 1 and the foot controller 10 are electrically connected by harness 2. The sewing machine 1 has a motor 6 and a board 5 built therein. The board 5 is electrically connected to the motor 6 via the harness 2 and an inner wire 7 via a connector 3 (refer to Fig. 2).

[0014] Fig. 2 is an appearance view of the foot controller 10 of the embodiment disclosed here as viewed from the oblique upward direction. The foot controller 10 includes a base casing 11 that comes into contact with the floor surface 9, a stepping casing 12 (stepping portion) that is turnably press-fitted to and engaged with the base casing 11 via a turning shaft 11a formed integrally with the base casing 11, and the harness 2 that passes through a first harness through hole 11b formed integrally in the rear surface of the base casing 11, and electrically transmits a signal generated in the foot controller 10 to a main body 1. The harness 2 has the connector 3 that electrically connects the main body 4 and harness 2 of the sewing machine 1 at one end thereof. The stepping casing 12 has a first harness escape recess 11c having an opening portion equal to or slightly larger than the first harness through hole 11b at a position that overlaps the first harness through hole 11b when being stepped.

[0015] In addition, the harness 2 can also be passed through a second harness through hole 11d or a third harness through hole 11f formed integrally in a side surface of the base casing 11, instead of the first harness through hole 11b. The stepping casing 12 has a second harness escape recess 11e and a third harness escape recess 11g similarly to the first harness recess 11c so that the harness is not disconnected even if the position where the harness 2 is taken out from the base casing 11 is changed.

[0016] Fig. 3 is an appearance view of the foot controller 10 of the embodiment disclosed here as viewed from the oblique downward direction. A harness through groove 11h that communicates with the first harness through hole 11b, a fourth harness through hole 11i that communicates with the harness through groove 11h, and a harness storage portion 11j that communicates with the fourth harness through hole 11i are formed integrally with the base casing 11 at the back of the base casing 11 of the foot controller 10. The harness storage portion 11j is provided with two harness presser guides 11k for preventing the harness 2 from jumping out of the harness storage portion 11j when the harness 2 is rounded into a small ring shape and stored in the harness storage portion 11j when the sewing machine 1 is not used. The harness through groove 11h is provided with four harness presser guides 11l for preventing the harness 2 from jumping out of the harness through groove 11h when the harness 2 is inserted therethrough.

[0017] Fig. 4 is an explanatory view of the foot controller 10 of the embodiment disclosed here. A mount 21 is attached to the back of the inside of the base casing 11, and a vertical rack 22 (a first movement member or a first rack) is attached into a vertical rack guide 21 a of the mount 21. The vertical rack 22 is attached so as to become substantially right-angled to the inner bottom surface of the base casing 11. An upper portion of the vertical rack 22 is formed so as to have a circular-arc cross-section.

[0018] Figs. 5A and 5B are structural views of the moving device 20 disclosed here. Fig. 5A is a structural view of the overall moving device 20, and Fig. 5B is a structural view of a movement direction changing mechanism portion 26 in the moving device 20. The vertical rack 22, a horizontal rack 24 (a second movement member or a second rack), a gear 23 (rotary body), and a variable resistor 25 are attached to the mount 21, and form the moving device 20. The vertical rack 22 is attached into the vertical rack guide 21a via a first mount slide groove 22b, the horizontal rack 24 is attached into a horizontal rack guide 21 b via a second mount slide groove 24b, the gear 23 is attached into a gear guide 21e via a gear turning shaft 23c (not shown), and the variable resistor 25 is attached below the horizontal rack 24. A first rack portion 22c of the vertical rack 22 engages a gear 23a of the gear 23. The gear 23a is formed integrally with a pinion 23b to form the gear 23. The pinion 23b engages a second rack portion 24a formed integrally with the horizontal rack 24. The horizontal rack 24 integrally forms a variable resistor lever operating portion 24c that operates a variable resistor lever 25a of the variable resistor 25 on the lower side thereof. A moving device return spring 22e is engaged between the mount 21 and the vertical rack 22. Here, in order to set the pushing force of the vertical rack 22 small, the diameter of the gear 23a is made larger than the diameter of the pinion 23b.

[0019] In addition, as the pushing force of the vertical rack 22 is set small, it is also possible to make the diameter of the gear 23a smaller than the diameter of the pinion 23b for a user who selects to keep the relationship between a stepping amount and sewing speed from being keen. Moreover, it is also possible to meet user’s demands by changing the module of the gear 23a and the pinion 23b instead of adjusting the diameter of the gear 23a and the pinion 23b.

[0020] The operation of the sewing machine of the embodiment disclosed here will be described below.

[0021] Figs. 6A and 6B are schematic views of the foot controller 10 of the embodiment disclosed here, and a graph of the relationship between stepping amount and load. The first rack portion 22c of the vertical rack 22, the gear 23a of the gear 23, the pinion 23b formed integrally with the gear 23, and the second rack portion 24a of the horizontal rack 24 form the mechanism portion 26. When a user or a worker (hereinafter unified as a user) steps on the stepping casing 12 with stepping power P, the vertical rack 22 can perform vertical adjustment movement within a range of a movement amount L1. The horizontal rack 24 can perform right and left adjustment movement within a range of a movement amount L2 in synchronization with the adjustment movement by the gear 23a. If the user makes the stepping power P to the stepping casing 12 large, the moving device return spring 22e is compressed and the horizontal rack 24 moves leftward in the drawing. If the user makes the stepping power P to the stepping casing 12 small, the moving device return spring 22e is extended and the horizontal rack 24 moves rightward in the drawing. The variable resistor lever operating portion 24c formed integrally with the horizontal rack 24 is engaged with the variable resistor lever 25a of the variable resistor 25, and performs right and left adjustment movement of the variable resistor lever 25a in accordance with the movement of the horizontal rack 24. The stepping amount L1 is movable from zero to Lmax. The movement amount of the variable resistor lever 25a of the variable resistor 25 can be adjusted from zero to L2 according to the stepping amount L1. The relationship between the stepping power P according to the stepping amount L1 and a compressive force F applied to the moving device return spring 22e becomes like the graph of Fig. 6B.

[0022] The effects of the sewing machine of the embodiment disclosed here will be described below.

[0023] According to first problem solving means, the sewing machine 1 of the embodiment is configured so that the moving device 20 includes the vertical rack 22 that moves in the stepping direction of the foot controller 10, the gear 23 that converts the movement amount L1 of the vertical rack 22 into a rotational amount, and the horizontal rack 24 that converts the rotational amount of the gear 23 in a direction orthogonal to the movement direction of the vertical rack 22 and moves by L2, and is configured to change the resistance value of the variable resistor 25 when the horizontal rack

24 moves in the direction orthogonal to the movement direction of the vertical rack 22. Thereby, a component force in an oblique direction is not generated among the vertical rack 22, the gear 23, and the horizontal rack 24, and the variable resistor 25 can be operated with a high transmission efficiency. That is, in the foot controller 110 of the background discussion, a maximum stepping force is required by about 3.57 times a compressive force (the setting value of a spring force) Fmax applied to the moving device return spring 122e (refer to Fig. 9). In contrast, in the foot controller 10 of the embodiment, the maximum stepping force is merely 0.87 times the compressive force (the setting value of the spring force) Fmax applied to the moving device return spring 22e so that easy operation can be made. This is based on the following three reasons. The first reason is that, in the foot controller 10 of the embodiment, meshing portions of a gear that is involved in the process in which the user's stepping power P is converted into the compressive force Fmax applied to the moving device return spring 22e are present in the mechanism portion 26 in only two places between the vertical rack 22 and the gear 23 and between the gear 23 and the horizontal rack 24. The second reason is that the conversion efficiency of the meshing portion of each gear is as high as about 98%. The third reason is that output is amplified to 1.2 times according to the amplification factor of the mechanism portion 26. (Since the detailed calculation of the stepping force in the foot controller 110 of the background discussion is described in the description of operation of the background discussion, refer to that). Moreover, it is also possible to make the stepping load to the user's stepping amount L1 linear like the graph of Fig. 6B. Thereby, the user easily catches the correlation between the stepping amount L1 and the sewing speed linearly, and can operate the sewing machine 1 with a high precision more closely to s natural feeling. In addition, since most of the mechanism portion 26 of the embodiment can be constituted from resin parts called polyoxymethylene (POM) with high strength and excellent lubricity, the user can be provided with cheap products. The foot controller 10 of the embodiment can be manufactured more cheaply than that of the background discussion in which two variable resistors, a changeover switch, and an accessory circuit are built. The foot controller 10 of the embodiment can realize functions equivalent to a multifunctional sewing machine having a computer built therein, with a configuration that is easier than that of the background discussion by preparing a plurality of microcomputer control patterns in combination with the multifunctional sewing machine.

[0024] According to second problem solving means, the sewing machine 1 of the embodiment is configured so that the moving device 20 includes the vertical rack 22 that moves in the stepping direction of the foot controller 10, the gear 23 that converts the movement amount L1 of the vertical rack 22 into a rotational amount, the horizontal rack 24 that converts the rotational amount of the gear 23 in the direction orthogonal to the stepping direction of the vertical rack 22 and moves by the movement amount L2, and the variable resistor lever 25a that changes the resistance value of the variable resistor 25 when the horizontal rack 24 moves. Thereby, the transmission efficiency of forces among the vertical rack 22, the gear 23, and the horizontal rack 24 can be further improved, and the variable resistor 25 can be operated with a high transmission efficiency.

Additional Item 1

[0025] In the sewing machine 1 of the embodiment, the movement direction of the moving device 20 is changed from the direction orthogonal to the turning shaft 11 a of the stepping portion of the foot controller 10 to a parallel direction. This is because the size of the moving device 20 can be reduced as the conversion efficiency of the mechanism portion 26 is improved. Thereby, it is possible to form the harness storage portion 11j at a position on the turning shaft 11 a side in the direction orthogonal to the turning shaft 11a of the stepping portion of the foot controller 10. By forming the harness storage portion 11j, it is possible to round the harness 2 into, for example, a small ring shape to store the harness to the harness storage portion 11j when the sewing machine 1 is not used, and organizing of the sewing machine 1 can be made easier.

Embodiment of the Background Discussion

[0026] Fig. 7 is a cross-sectional view of a foot controller 110 of the background discussion. The foot controller 110 is provided with a base casing 111 (foundation) that comes into contact with a floor surface 109, a stepping casing 112 (stepping plate) that is turnably born about a base casing turning shaft 111a (fulcrum shaft E) provided at one end of the base casing 111, a variable resistor 125 that is provided inside the foot controller 110 (pedal) formed by the stepping casing 112 and the base casing 111, a front arm 111b (link) that has one end turnably coupled to a mount 121 (link foundation), a rear arm 111c (link) that has one end turnably coupled to the other end of the front arm 111b and the other end coming into a slidable contact with a variable resistor lever 125a of the variable resistor 125, and a moving device return spring 122e (tension spring) that is coupled to one end of the front arm 111b and the other end of the rear arm 111c. A coupling portion between the front arm 111b and the rear arm 111c moves upward as one end of the front arm 111b and the other end of the rear arm 111c are drawn to each other by the moving device return spring 122e, and is brought into pressure contact with the rear surface of the stepping casing 112 via a roller 111d turnably provided at the coupling portion. Additionally, a second moving device return spring 122f that biases the stepping casing 112 so as to be kept away from the base casing 111 on the base casing turning shaft 111a is provided inside the foot controller 110, and the stepping casing 112 and the base casing 111 are locked to each other by convex portions provided at tips thereof, respectively, so as to approach and separate from each other within a predetermined range. Then, if the stepping casing 112 is stepped on by a user, the other end of the rear arm 111c moves, and the resistance value that determines the rotational frequency of the sewing machine motor 6 changes by the variable resistor 125 so that the sewing speed can be controlled.

[0027] The operation of the sewing machine of the background discussion will be described below.

[0028] Figs. 8A and 8B are explanatory views of the force relationship of the foot controller of the background discussion. Fig. 8A is an explanatory view of the stepping force and load of the foot controller and Fig. 8B is a graph of the relationship between the stepping amount and load of the foot controller. Fig. 9 is an explanatory view for the calculation based on a schematic view of the foot controller of the background discussion. If a user steps on the stepping casing 112 and applies stepping power P to the coupling portion between the front arm 111b and the rear arm 111c, the rear arm 111c is pushed out backward by a movement amount L4 against the resultant force F of the moving device return spring 122e and the second moving device return spring 122f. The stepping amount L3 is movable from zero to Lmax. The movement amount of the variable resistor lever 125a of the variable resistor 125 can be adjusted from zero to L4 according to the stepping amount L3. If the user makes the stepping power P to the stepping casing 112 large, the moving device return spring 122e and the second moving device return spring 122f are compressed and the variable resistor lever 125a moves leftward in the drawing. If the stepping power P to the stepping casing 112 is made small, the moving device return spring 122e and the second moving device return spring 122f are extended by the resultant force of the moving device return spring 122e and the second moving device return spring 122f, and the variable resistor lever 125a moves rightward in the drawing. The relationship among the stepping power P, the resultant force F, and the stepping amount L3 in this case becomes like the graph of Fig. 8B. That is, in the foot controller 10 of the background discussion, the maximum stepping force is required to be about 3.57 times the resultant force (the setting value of a spring force) Fmax of the moving device return spring 122e and the second moving device return spring 122f. If the frictional resistance force of the sliding portion is included in this calculation value, it is expected that a force of 4 times or more the force of the embodiment is required. Additionally, the stepping load to the user's stepping amount L3 increases abruptly from a certain point like the graph.

[0029] Here, a calculation example of the graph of Fig. 8B will be described. In Fig. 9, it is assumed that A=20 mm is established and Θ1 changes within a range from 50 ° to 5°.

[0030] First, the relationship among angles is clarified as follows.

$$(1)\ \Theta 2=180-90-\Theta 1=90-\Theta 1$$

$$(2)\ \sin\Theta 3=(C-B\cos\Theta 1)/A\ \Theta 3=\sin^{-1}((C-B\cos\Theta 1)/A)\ \text{from}\ (C-B\cos\Theta 1)/\sin\Theta 3=A/\sin 90°$$

$$(3)\ \Theta 4=180-\Theta 2-\Theta 3=180-(90-\Theta 1)-(\sin^{-1}((C-B\cos\Theta 1)/A))=90+\Theta 1-\sin^{-1}((C-B\cos\Theta 1)/A)$$

$$(4)\ \Theta 5=180-90-\Theta 3=90-\sin^{-1}((C-B\cos\Theta 1)/A)$$

[0031] It is easy to calculate the stepping amount from these angles. Next, the relationship among forces is clarified as follows.

(5) "$F2=(P\sin\theta 3/\sin\theta 4)=(P(C-B\cos\theta 1))/(A\cdot\sin(90+\theta 1-\sin\text{-}1((C-B\cos\theta 1)/A)))$ from $F2/\sin\theta 3=P/\sin\theta 4$",

(6) "$F4=(((C-B\cos\theta 1)\cdot P\cos\theta 1)/(A\cdot\sin(90+\theta 1-\sin\text{-}1((C-B\cos\theta 1)/A))))=(((C-B\cos\theta 1)\cdot P\cos\theta 1)/A\cos(\theta 1-\sin\text{-}1((C-B\cos\theta 1)/A))$ from $F4=F2\cos\theta 1$".

$$(7)\ F1=(P\sin(90-\Theta1))/(\sin(90+\Theta1-\sin^{-1}((C-B\cos\Theta1)/A)))\ \text{from}\ F1/\sin\Theta2=P/\sin\Theta4$$

$$(8)\ F3=F1\cos\Theta5=(P\sin(90-\Theta1)\cdot\cos(90-\sin^{-1}((C-B\cos\Theta1))/A))/(\sin(90+\Theta1-\sin^{-1}((C-B\cos\Theta1)/A)))=P\cos\Theta1\cdot\sin(\sin^{-1}((C-B\cos\Theta1)/A))/(\cos(\Theta1-\sin^{-1}((C-B\cos\Theta1/A)))=((C-B\cos\Theta1)\cdot P\cos\Theta1)/(A\cos(\Theta1-\sin^{-1}((C-B\cos\Theta1)/A)))$$

$$(9)\ P=2F3=2((C-B\cos\Theta1)\cdot P\cos\Theta1)/(A\cos(\Theta1-\sin^{-1}((C-B\cos\Theta1)/A)))\ \text{from}\ F3=F4$$

The graph of Fig. 8B can be derived from the relationship among the angles, stepping amounts, and forces that are shown above.

[0032] The principles, preferred embodiment and mode of operation of the present invention have been described in the foregoing specification. However, the invention which is intended to be protected is not to be construed as limited to the particular embodiments disclosed. Further, the embodiments described herein are to be regarded as illustrative rather than restrictive.

[FIG. 1]

UP
RIGHT
FRONT
DOWN
LEFT
REAR

[FIG. 2]

UP
LEFT
REAR
DOWN
RIGHT
FRONT

[FIG. 3]

RIGHT
REAR
DOWN
LEFT
FRONT
UP

[FIG. 4]

RIGHT
REAR
DOWN
LEFT
FRONT
UP

[FIG. 5A]

UP
REAR
RIGHT
DOWN
FRONT
LEFT

[FIG. 6A]

UP
RIGHT
DOWN
LEFT

[FIG. 6B]

LOAD
STEPPING AMOUNT

[FIG. 7]

UP
REAR
DOWN
FRONT

[FIG. 8B]

LOAD
STEPPING AMOUNT

Claims

1. A foot controller (10) for a sewing machine in which a stepping portion (12) is displaceable according to a user's stepping amount;
a moving device (20) that is built in the foot controller and moves according to the displacement amount of the stepping portion;
a variable resistor (25) that is built in the foot controller and is capable of changing a resistance value according to the movement amount of the moving device; and
a motor (6) that causes to change a sewing speed according to the resistance value of the variable resistor;
wherein the moving device (20) includes:

a first movement member that is pressed by the stepping portion and moves in a stepping direction of the foot controller;
a rotary body that engages the first movement member, and converts the movement amount of the first movement member into a rotational amount;
said controller **characterised in that** it further comprises
a second movement member that engages the rotary body, moves in a direction orthogonal to the movement direction of the first movement member by the movement amount according to the rotational amount of the rotary body, and changes the resistance value of the variable resistor according to the movement amount thereof;
wherein the first movement member has a first rack that is pressed by the stepping portion and moves in the stepping direction of the foot controller,
the rotary body has a gear that engages the first rack and converts the movement amount of the first rack into a rotational amount,
the second movement member has a second rack that engages the rotary body, and converts the rotational amount of the gear in the direction orthogonal to the movement direction of the first rack and move, and
the variable resistor includes a variable resistor lever that engages a variable resistor lever operating portion

provided at one end of the second rack, moves together with the second rack, and changes the resistance value of the variable resistor.

2. A sewing machine comprising a foot controller (10) according to Claim 1.

Patentansprüche

1. Fußsteuerungseinrichtung (10) für eine Nähmaschine, bei der ein Tretabschnitt (12) in Übereinstimmung mit einem Tretumfang eines Benutzers verlagerbar ist; mit

   einer Bewegungsvorrichtung (20), die in der Fußsteuerungseinrichtung eingebaut ist und in Übereinstimmung mit dem Verlagerungsumfang des Tretabschnitts bewegbar ist;
   einem Regelwiderstand (25), der in der Fußsteuerungseinrichtung eingebaut ist und imstande ist, einen Widerstandswert in Übereinstimmung mit dem Bewegungsumfang der Bewegungsvorrichtung zu ändern; und
   einem Motor (6), der eine Änderung einer Stichgeschwindigkeit in Übereinstimmung mit dem Widerstandswert des Regelwiderstands bewirkt;
   wobei die Bewegungsvorrichtung (20) umfasst:

      ein erstes Bewegungselement, das durch den Tretabschnitt drückbar ist und in einer Tretrichtung der Fußsteuerungseinrichtung bewegbar ist;
      einen Drehkörper, der mit dem ersten Bewegungselement in Eingriff ist und den Bewegungsumfang des ersten Bewegungselements in einen Drehumfang umwandelt;
      die Steuerungseinrichtung ist **dadurch gekennzeichnet, dass** sie ferner aufweist:

         ein zweites Bewegungselement, das mit dem Drehkörper in Eingriff ist, in einer zu der Bewegungsrichtung des ersten Bewegungselements senkrechten Richtung um den Bewegungsumfang in Übereinstimmung mit dem Drehumfang des Drehkörpers bewegbar ist, sowie den Widerstandswert des Regelwiderstands in Übereinstimmung mit seinem Bewegungsumfang ändert;
         wobei das erste Bewegungselement eine erste Zahnstange hat, die durch den Tretabschnitt drückbar ist und in der Tretrichtung der Fußsteuerungseinrichtung bewegbar ist,
         der Drehkörper ein Zahnrad hat, das mit der ersten Zahnstange in Eingriff ist und den Bewegungsumfang der ersten Zahnstange in einen Drehumfang umwandelt,
         das zweite Bewegungselement eine zweite Zahnstange hat, die mit dem Drehkörper in Eingriff ist und die den Drehumfang des Zahnrads in der zu der Bewegungsrichtung der ersten Zahnstange senkrechten Richtung umwandelt, um bewegbar zu sein, und
         wobei der Regelwiderstand einen Regelwiderstandshebel umfasst, der mit einem Regelwiderstandshebelbetätigungsabschnitt in Eingriff ist, der an einem Ende der zweiten Zahnstange vorgesehen ist, zusammen mit der zweiten Zahnstange bewegbar ist und den Widerstandswert des Regelwiderstands ändert.

2. Nähmaschine mit einer Fußsteuerungseinrichtung (10) nach Anspruch 1.

Revendications

1. Pédale de commande (10) pour une machine à coudre dans laquelle une partie de pression de pied (12) est déplaçable selon une quantité de pression de pied de l'utilisateur ;
   un dispositif mobile (20) qui est intégré dans la pédale de commande et se déplace selon la quantité de déplacement de la partie de pression de pied ;
   une résistance variable (25) qui est intégrée dans la pédale de commande et peut modifier une valeur de résistance selon la quantité de mouvement du dispositif mobile ; et
   un moteur (6) qui amène à modifier une vitesse de couture selon la valeur de résistance de la résistance variable ;
   dans laquelle le dispositif mobile (20) comprend :

   un premier élément de déplacement qui est enfoncé par la partie de pression de pied et se déplace dans une direction de pression de pied de la pédale de commande ;
   un corps rotatif qui met en prise le premier élément de déplacement, et convertit la quantité de déplacement

du premier élément de déplacement en une quantité de rotation ;
ladite pédale étant **caractérisée en ce qu'**elle comprend en outre :

un second élément de déplacement qui met en prise le corps rotatif, se déplace dans une direction orthogonale à la direction de déplacement du premier élément de déplacement selon la quantité de déplacement d'après la quantité de rotation du corps rotatif et modifie la valeur de résistance de la résistance variable selon sa quantité de déplacement ;
dans laquelle le premier élément de déplacement a une première crémaillère qui est enfoncée par la partie de pression de pied et se déplace dans la direction de pression de pied de la pédale de commande,
le corps rotatif a un pignon qui met en prise la première crémaillère et convertit la quantité de déplacement de la première crémaillère en une quantité de rotation,
le second élément de déplacement a une seconde crémaillère qui met en prise le corps rotatif, et convertit la quantité de rotation du pignon dans la direction orthogonale à la direction de déplacement de la première crémaillère et se déplace, et
la résistance variable comprend un levier de résistance variable qui met en prise une partie de commande de levier de résistance variable prévue au niveau d'une extrémité de la seconde crémaillère, se déplace conjointement avec la seconde crémaillère et modifie la valeur de résistance de la résistance variable.

2. Machine à coudre comprenant une pédale de commande (10) selon la revendication 1.

FIG.1

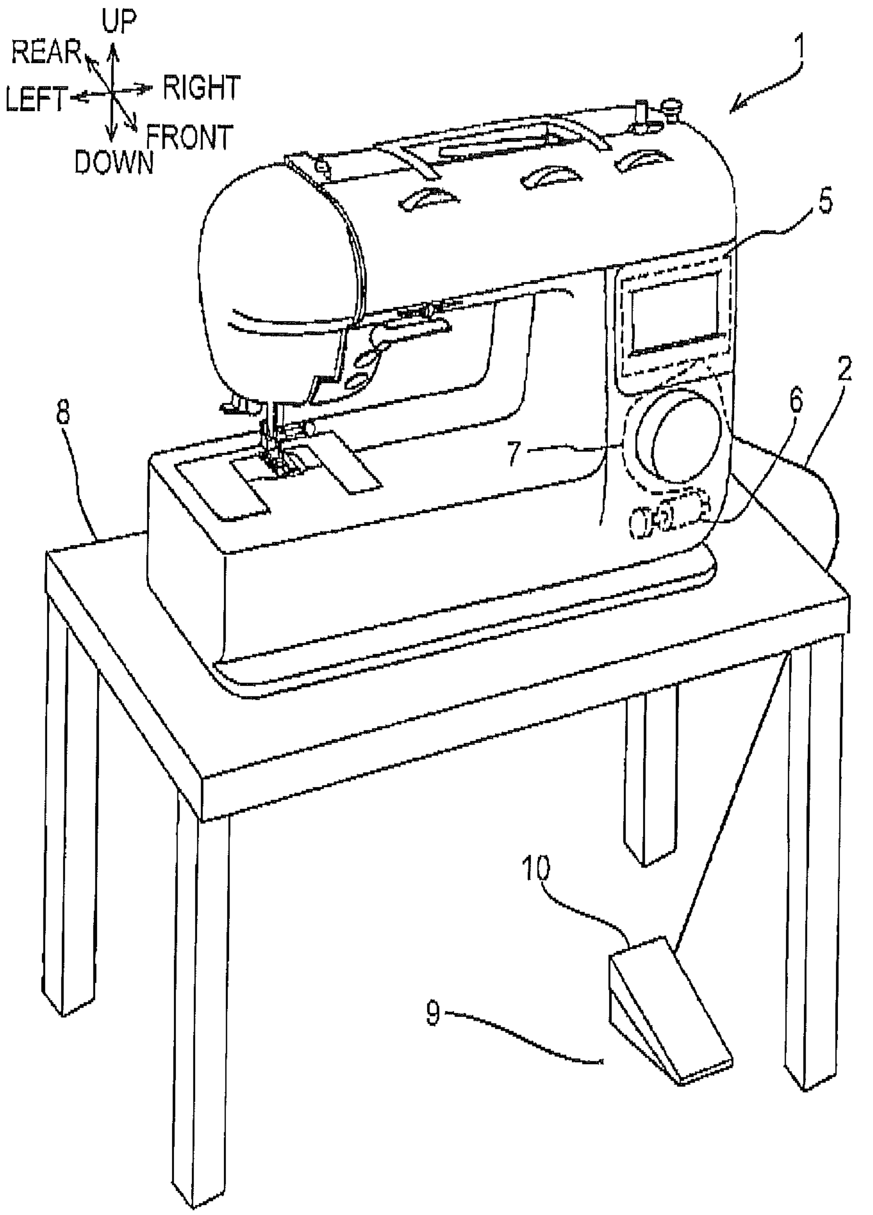


FIG.2

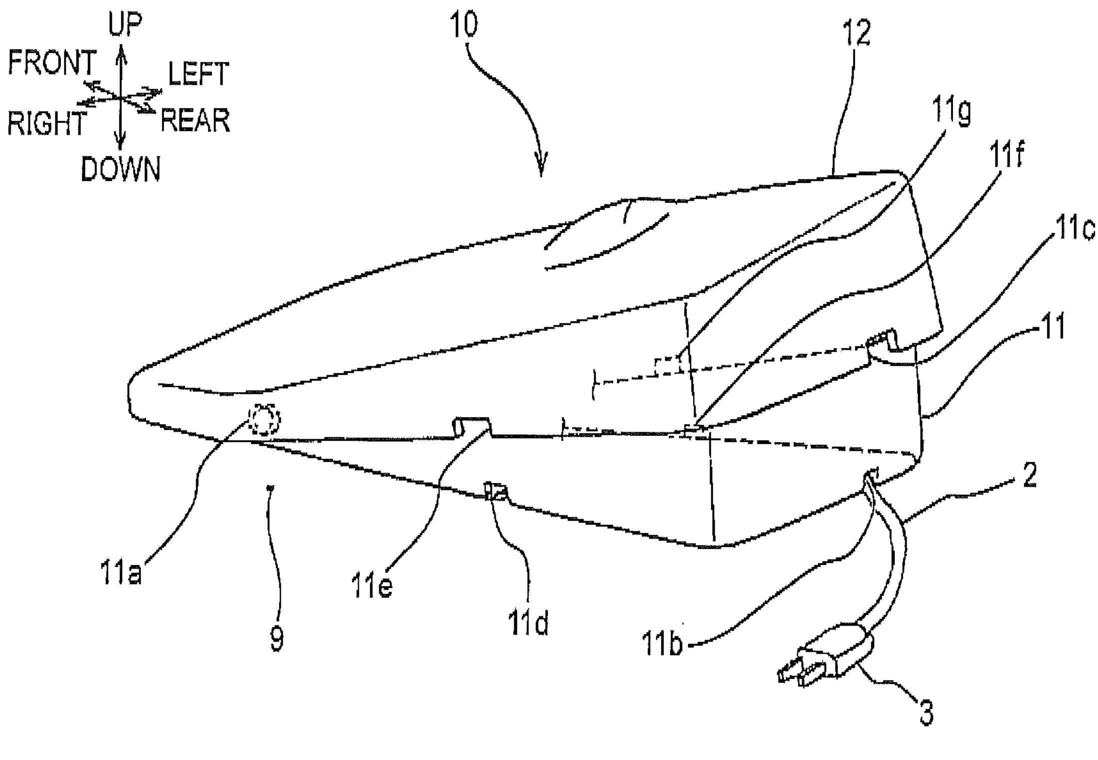

UP
FRONT
LEFT
RIGHT
REAR
DOWN
10
12
11g
11f
11c
11
2
11a
11e
9
11d
11b
3

FIG.3

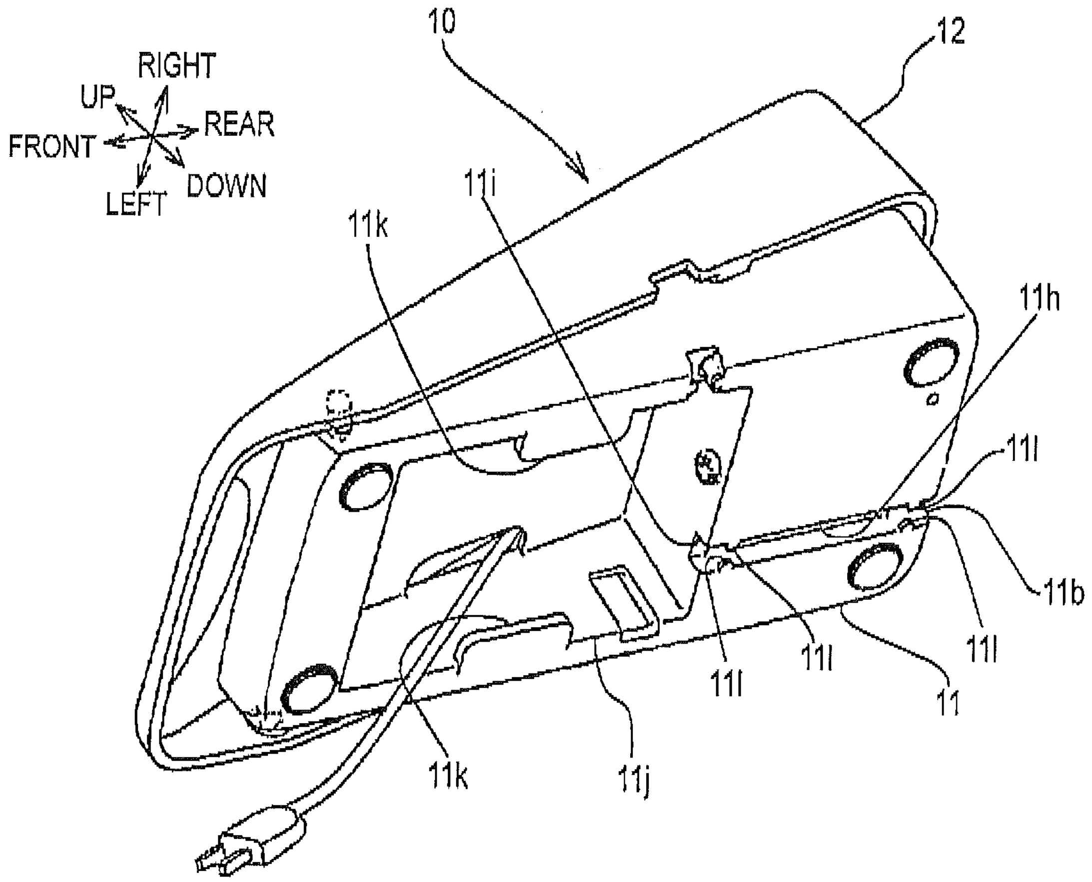

10
12
RIGHT
UP
REAR
FRONT
DOWN
LEFT
11i
11k
11h
11l
11b
11l
11l
11l
11
11k
11j

FIG.4

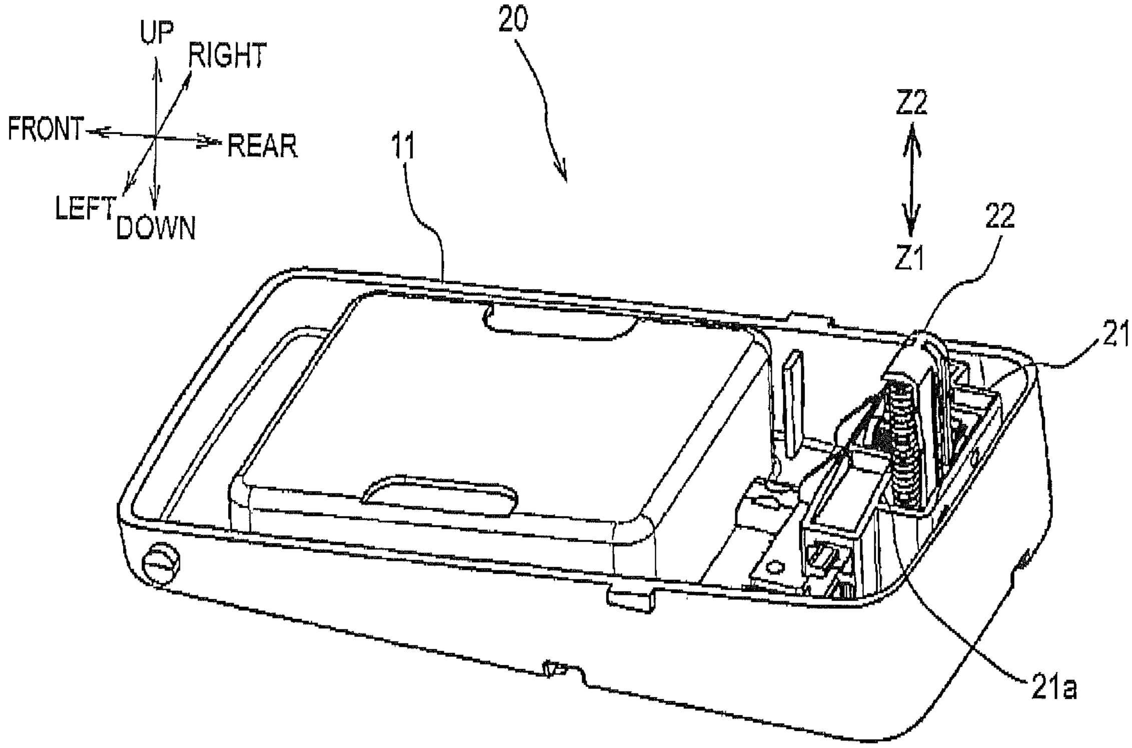


FIG.5A

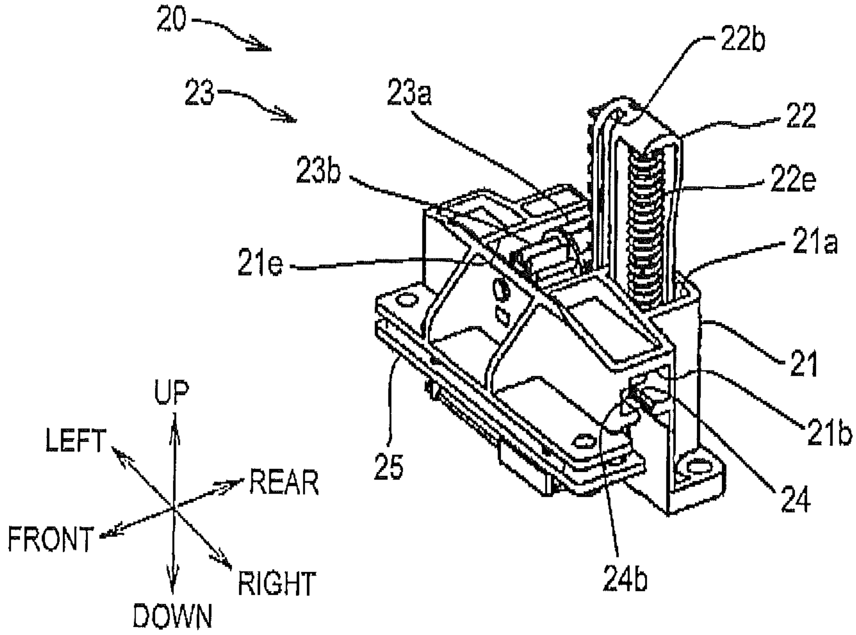

20
23
23a
23b
21e
22b
22
22e
21a
21
21b
24
24b
25
UP
LEFT
REAR
FRONT
RIGHT
DOWN

FIG.5B

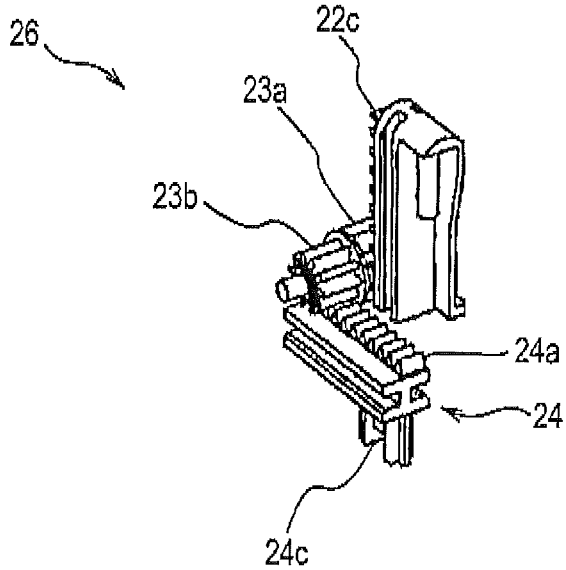

26
22c
23a
23b
24a
24
24c

FIG.6A

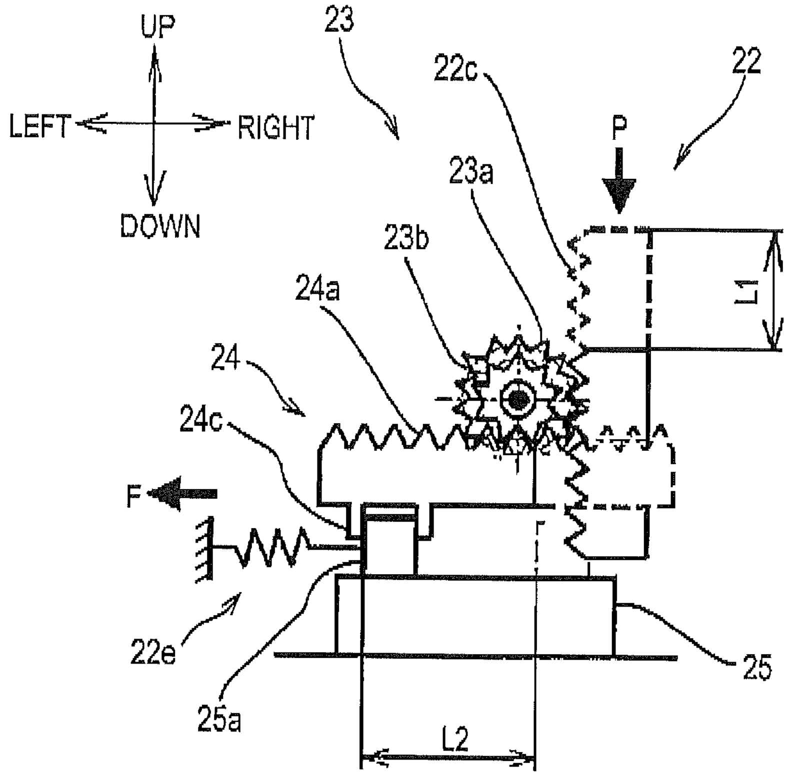

UP
LEFT
RIGHT
DOWN
23
22c
22
P
23a
23b
24a
L1
24
24c
F
22e
25a
25
L2

FIG.6B

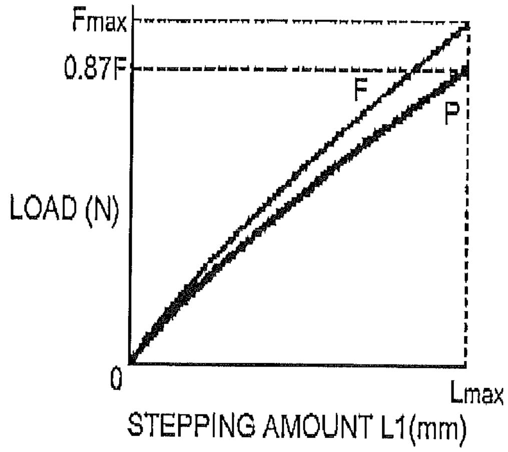

Fmax
0.87F
F
P
LOAD (N)
0
Lmax
STEPPING AMOUNT L1(mm)

FIG.7

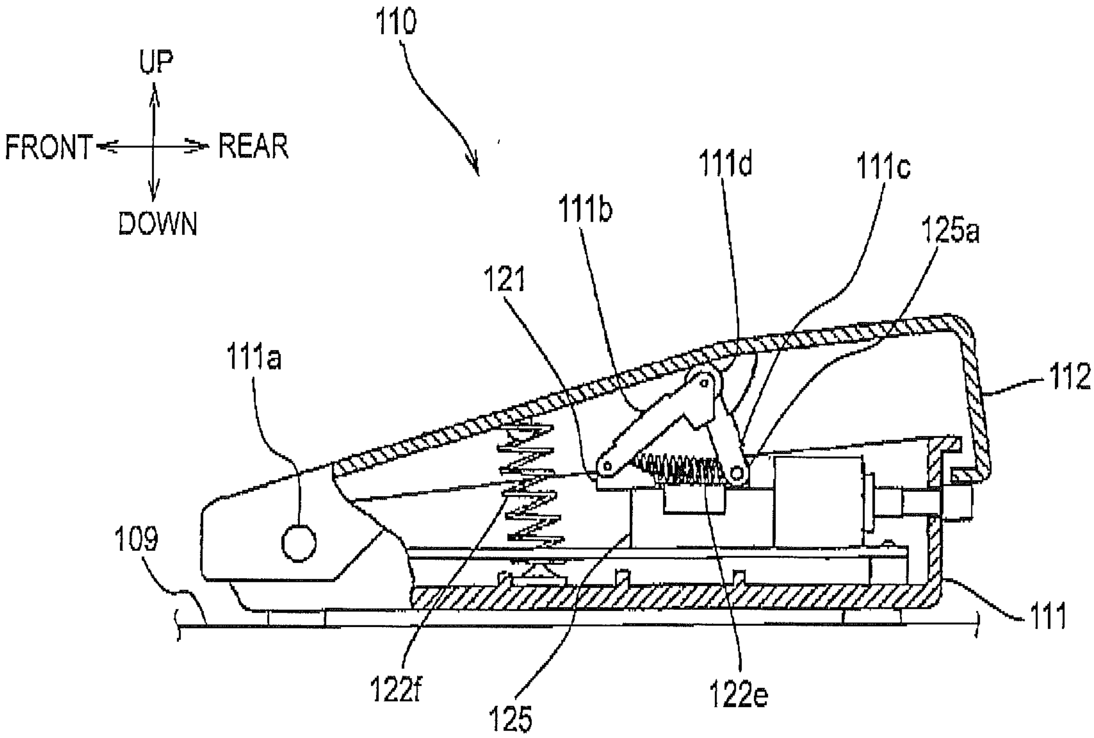

110
UP
FRONT
REAR
DOWN
111d
111c
111b
125a
121
112
111a
109
111
122f
125
122e

FIG.8A

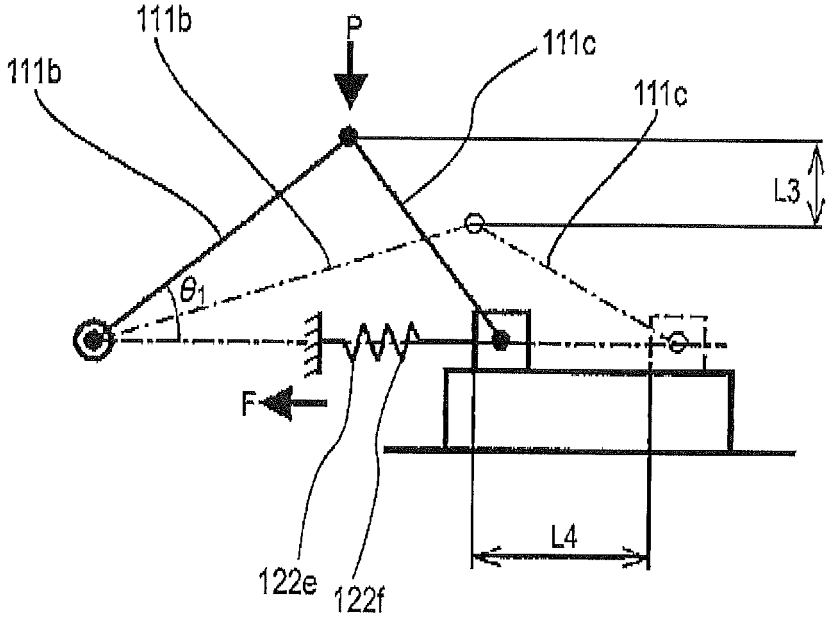

111b
111b
P
111c
111c
L3
θ1
F
122e
122f
L4

FIG.8B

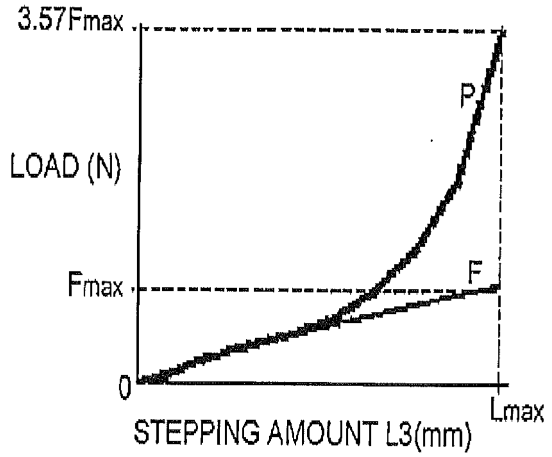
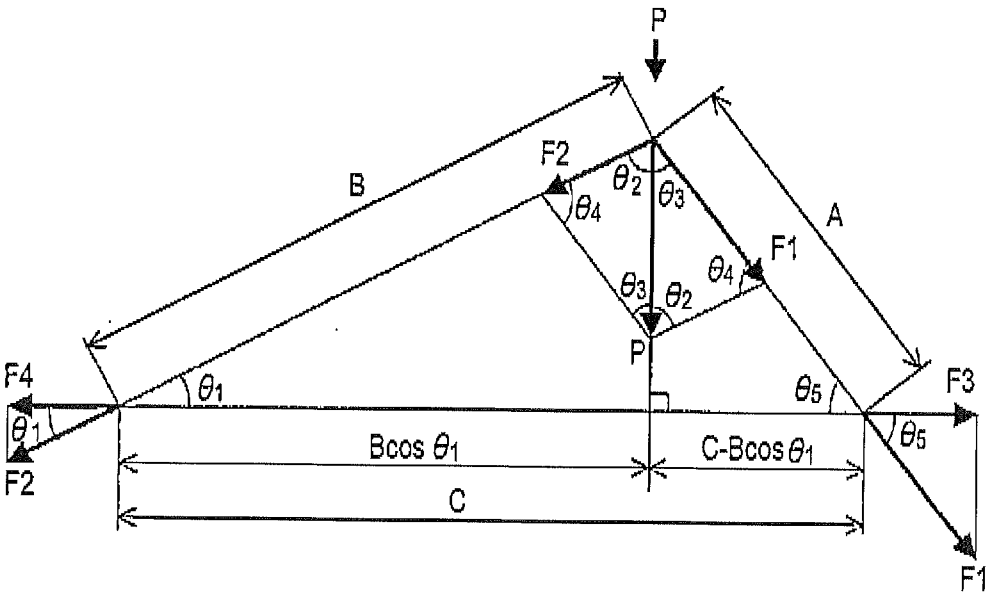

3.57Fmax
LOAD (N)
P
Fmax
F
0
Lmax
STEPPING AMOUNT L3(mm)

FIG.9


P
B
F2
θ_2
θ_3
θ_4
A
F1
θ_4
θ_3
θ_2
P
F4
θ_1
θ_5
F3
θ_1
θ_5
F2
Bcos θ_1
C-Bcos θ_1
C
F1

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2008245728 A **[0002]**
- JP 1587171 A **[0003]**
- EP 0053938 A **[0005]**