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(71) Applicant: **Aisin Seiki Kabushiki Kaisha**
Kariya-shi
Aichi-ken,
448-8650 (JP)

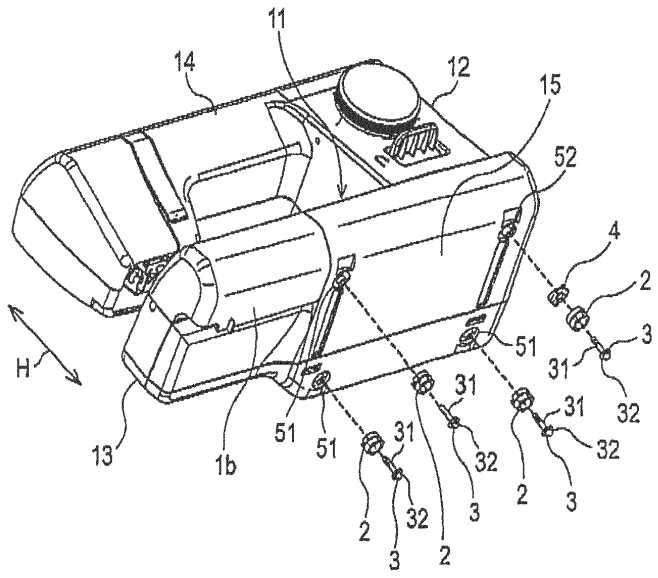
(72) Inventors:
- **Suzuki, Tatsuya**
  Aichi-ken, 448-8650 (JP)
- **Kai, Akihiro**
  Aichi-ken, 448-8650 (JP)

(74) Representative: **Albutt, Anthony John**
D Young & Co LLP
120 Holborn
London EC1N 2DY (GB)

(54) Sewing machine

(57) A sewing machine includes: four or more supporting legs (2) having a shape replaceable with each other; and a bottom portion (15) including a mounting portion (52) with a height adjustment mechanism on which at least part of the supporting legs is mounted and mounting portions (51) on which the rest of the supporting legs are mounted, wherein the mounting portion with the height adjustment mechanism and the supporting leg to be mounted on the mounting portion with the height adjustment mechanism constitute a spiral contact engagement structure configured to allow an adjustment of the height of the contact engagement between two or more members in the height direction by rotating the mounted supporting leg about an axis extending substantially in the height direction.

FIG.2



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Description

TECHNICAL FIELD

[0001] This disclosure relates specifically to a sewing machine including four supporting legs arranged on a bottom surface of the sewing machine, and configured to allow a height adjustment.

BACKGROUND DISCUSSION

[0002] A sewing machine is subject to vibrations because a needle bar moves upward and downward during a sewing operation. Therefore, resilient supporting legs may be mounted on a bottom surface of the sewing machine in order to suppress the vibrations. The number of the supporting legs to be mounted may be four or more in terms of a functional requirement or outward appearances. Simply mounting four or more supporting legs leaves a problem of a so-called rattle due to unbalanced height.

[0003] In such circumstances, there is a sewing machine having at least one supporting leg configured to be adjustable in height at the time of installation of the sewing machine to avoid the rattle. For example, a sewing machine disclosed in JP 2007-111234A has five or more supporting legs, and one of the supporting legs have a function of allowing the height adjustment, and one of the rest four supporting legs is formed of a resilient material which is compressed easier than other three supporting legs. The sewing machine disclosed in JP 2007-111234A is configured in such a manner that the height is adjusted by the supporting leg having the function of allowing the height adjustment, and the supporting legs formed of the resilient material which is easily compressed are compressed upon being placed on an installation surface, so that other supporting legs come into contact with the installation surface and hence the stable installation of the sewing machine is achieved.

[0004] However, since the sewing machine disclosed in JP 2007-111234A has three types of the supporting legs having different configurations, a mounting operation is complicated because these supporting legs are to be mounted by using different methods or mounted at specific positions. In addition, since the supporting legs having different configurations are used, the number of components is large, and hence a supply or management of the components are complicated. Furthermore, two or more types of the supporting legs are used solely on the single sewing machine, a cost increase may result.

SUMMARY

[0005] Thus, a need exists for a height-adjustable sewing machine easy to assemble, and achieves a reduction of costs required for components.

[0006] (1) An aspect of this disclosure is directed to a sewing machine including: four or more supporting legs having a shape replaceable with each other; and a bottom portion including a mounting portion with a height adjustment mechanism on which at least part of the supporting legs is mounted and mounting portions on which the rest of the supporting legs are mounted, wherein the mounting portion with the height adjustment mechanism and the supporting leg to be mounted on the mounting portion with the height adjustment mechanism constitute a spiral contact engagement structure configured to allow an adjustment of the height of the contact engagement between two or more members in the height direction by rotating the mounted supporting leg about an axis extending substantially In the height direction.

[0007] By employing the supporting legs replaceable with each other, the types of the supporting legs do not have to be considered at the time of mounting, and control of the types is not necessary. Here, the term "replaceable with each other" means that the supporting legs are mountable without drawing a distinction of the type, and includes not only the case of having a perfectly identical shape, but also the case where the structure of a portion that comes into contact when being mounted and the height therefrom are the same.

[0008] The aspect of this disclosure described in (1) may be combined with any one of (2) to (6) arbitrarily.

[0009] (2) The spiral contact engagement structure is a staircase pattern. With the staircase pattern, a probability of slippage of the contact engagement structure which leads to a displacement of the supporting leg in height is reduced.

[0010] (3) The spiral contact engagement structure Includes a spiral contact surface on one side and a rib structure extending from a center of rotation of the supporting leg outward and projecting toward the contact surface on the other side. Thus, the height of the intermediate member can be adjusted by the rotation, and the projecting amount (height) of the supporting leg can be adjusted by rotating the supporting leg.

[0011] (4) A bottom of the mounting portion with the height adjustment mechanism is located at a position relatively higher than a portion where the mounting portion comes into contact with the supporting leg, and an intermediate member having a height so substantially align in height with a portion where the mounting portion comes into contact with the supporting leg is provided between the the bottom and the supporting leg to be mounted thereon, and the bottom of the mounting portion with the height adjustment mechanism and the intermediate member constitute the spiral contact engagement structure. Thus, the height of the intermediate member can be adjusted by the rotation, and the projecting amount (height) of the supporting leg can be adjusted by rotating the supporting leg.

[0012] (5) The supporting leg is formed of a resilient member and includes a center hole formed in a substantially height direction, the mounting of the supporting leg is achieved by a screw member that penetrates through the center hole. Even when the supporting leg is moved

in the height direction during the adjustment step, the movement may be absorbed by the resilient deformation of the supporting leg, so that the adjustment of the height of the supporting leg is easily achieved. In particular, by tightening the screw a bit harder than the degree of tightening required for achieving an ideal height, a probability of loosening the tightness of mounting by a subsequent adjustment of the supporting leg is reduced.

[0013] (6) At least part of the supporting member in the height direction is not a circular shape in cross section. Ease of the rotation of the supporting leg is achieved.

[0014] (7) Another aspect of this disclosure is directed to a method of adjusting the mounting height of the supporting leg of the sewing machine according to the aspect of this disclosure including a supporting leg mounting step of mounting the supporting legs to the mounting portion and the mounting portion with the height adjustment mechanism respectively, and a height adjusting step of placing the sewing machine so that the supporting legs to face a horizontal surface, and then rotating the supporting leg mounted on the mounting portion with the height adjustment mechanism so that a distal end of the supporting leg comes into contact with the horizontal surface.

[0015] Since the sewing machine of this disclosure has the configuration described above, a height-adjustable sewing machine easy to assemble, and achieves a reduction of costs required for components is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] 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 illustrates a configuration of a sewing machine of a first embodiment;
Fig. 2 illustrates a configuration of the sewing machine of the first embodiment;
Fig. 3 is a schematic cross-sectional view illustrating a portion in the vicinity of a height adjustment mechanism of a supporting leg of the sewing machine of the first embodiment;
Fig. 4 is a front view illustrating an outward appearance of the supporting leg of the first embodiment;
Fig. 5 is a perspective view illustrating an outward appearance of the supporting leg of the first embodiment;
Fig. 6 is a top view illustrating an outward appearance of the supporting leg of the first embodiment;
Fig. 7 is a front view illustrating an outward appearance of an intermediate member of the first embodiment;
Fig. 8 is a perspective view illustrating an outward appearance of the intermediate member of the first embodiment;
Fig. 9 is a top view illustrating an outward appearance of the intermediate member of the first embodiment;
Fig. 10 is a schematic front view schematically illustrating a height adjustment of the supporting leg of the first embodiment;
Fig. 11 is a schematic view schematically illustrating the supporting leg at the time of height adjustment of the supporting leg of the first embodiment;
Fig. 12 is a front view illustrating an outward appearance of the supporting leg of a second embodiment;
Fig. 13 is a top view illustrating an outward appearance of the supporting leg of the second embodiment;
Fig. 14 is a perspective view illustrating an outward appearance of the supporting leg of the second embodiment;
Fig. 15 is a top view illustrating an outward appearance of a second mounting portion of the second embodiment;
Fig. 16 is a cross-sectional view taken along the line XVI-XVI in Fig. 15;
Fig. 17 is a partial perspective view illustrating an outward appearance of the second mounting portion of the second embodiment;
Fig. 18 is a top view illustrating an outward appearance of a first mounting portion of the second embodiment; and
Fig. 19 is a cross-sectional view taken along the line XIX-XIX in Fig. 18.

DETAILED DESCRIPTION

[0017] Referring now to the drawings, representative embodiments of this disclosure will be described. A sewing machine of the embodiments includes a bed portion 11, a machine body 12, a free arm portion 13, and an arm portion 14 as illustrated in Fig. 1. The bed portion 11 is located on the lower portion of the sewing machine, and supporting legs 2, which will be described later, are mounted on a bottom surface (bottom portion) 15 thereof. The machine body 12 extends upward from one (right in the drawing) end portion of the bed portion 11, and includes a drive motor (which is not illustrated) arranged therein. The free arm portion 13 is a portion extending from the other (left in the drawing) of the bed portion 11 and functions as a sewing space. The free arm portion 13 is provided with an auxiliary cover 16 mounted thereon. The bed portion 11, the free arm portion 13, and the auxiliary cover 16 form a continuous plane to allow fabric to move smoothly during the sewing operation. The arm portion 14 extends in substantially parallel to the bed portion 11 from an upper portion of the machine body 12.

First Embodiment

[0018] A supporting structure of the sewing machine of a first embodiment is as follows. As illustrated in Fig. 2, four supporting legs 2 (rubber made) are mounted on

first and second mounting portions 51 and 52 on the bottom surface 15 located below the bed portion 11, respectively by screw members 3. Four supporting legs 2 have the same shape. One of the four supporting legs 2 is mounted on the second mounting portion 52 located on the bottom surface 15 so as to place an intermediate member 4, which will be described later, therebetween, and the rest three supporting legs 2 are mounted on first mounting portions 51 located on the bottom surface 15 without placing the intermediate members 4 therebetween. Among the four supporting legs 2, the supporting leg 2 to be mounted on the second mounting portion 52 with the intermediary of the intermediate member 4 and the supporting legs 2 mounted on the first mounting portions 51 without the intermediary of the intermediate members 4 have the same material and the same configuration. In other words, the four supporting legs 2 are the same members replaceable with each other.

[0019] As illustrated in Fig. 2 and Fig. 3, the bottom surface 15 opposes an Installation surface (not illustrated) with a gap therebetween, and includes a basal seat 150 substantially parallel to the installation surface, three first mounting portions 51 on which the three supporting legs 2 can be mounted directly respectively, and the second mounting portion 52 on which the one supporting leg 2 can be mounted with the intermediary of the intermediate member 4. The intermediate member 4 and the second mounting portion 52 constitute a mounting portion with a height adjustment mechanism in combination.

[0020] The first mounting portions 51 includes a depressed portion 511 depressed in a cylindrical shape upward from the basal seat 150 of the bottom surface 15, and the outer diameter thereof are substantially the same as that of the supporting legs 2. The depressed portion 511 includes a cylindrical screw fixing portion 510 extending upright, having an axial line extending in the height direction (a direction indicated by an arrow H: a perpendicular direction with respect to the basal seat 150) and formed with a screw hole 510a which allows insertion and screw-in of a screw portion 31 of a screw member 3 from below at a position of the axial line at a center of the bottom surface thereof.

[0021] The screw fixing portion 510 is connected to the depressed portion 511 by an upper end portion thereof, and has a lower end portion slightly projecting downward in the axial direction with respect to the basal seat 150. The supporting leg 2 is fitted to the screw fixing portion 510 when being inserted into the depressed portion 511. Specifically, an insertion hole 20 to which the screw fixing portion 510 is fitted is formed (Figs. 5 and 6).

[0022] As illustrated In Fig. 4 to Fig. 6, the inner diameter of the insertion hole 20 of the supporting leg 2 is on the order of the outer diameter of the screw fixing portion 510, and knurling processing is applied on an outer peripheral surface 510b of the screw fixing portion 510. Consequently, the supporting leg 2 is fitted into the screw fixing portion 510 while increasing in diameter by means of resiliency of rubber, and is prevented from coming apart by the knurling processing applied thereto.

[0023] The second mounting portion 52 has a depressed portion 521 having a different depth from the first mounting portions 51, and the intermediate member 4 is interposed in the deeper portion as illustrated in Fig. 3. A bottom surface of the depressed portion 521 is provided with upright wall-shaped projections 522 so as to extend in two directions from the outer peripheral portion of the screw fixing portion 520, which are directions 180° opposite from each other. THE intermediate member 4 may be fitted to the screw fixing portion 520 when being inserted into the depressed portion 521. Specifically, an insertion hole 40 to which the screw fixing portion 520 is fitted is formed (Figs. 7 to 9).

[0024] As illustrated in Figs. 7 to 9, the intermediate member 4 is a substantially ring shaped member having a thickness corresponding to the difference in depths between the depressed portion 521 and the depressed portion 511. The insertion hole 40 to which a screw fixing portion 520 provided upright at a center of the second mounting portion 52 is inserted is formed at a center of the ring. A side of the intermediate member 4 opposing the supporting leg 2 has a shape which fits the supporting leg 2 in a substantially complementary style (in other words, substantially the same shape as the first mounting portions 51). Specifically, a projection 44 having a shape engageable with a notched engaging portion 211 of the supporting leg 2 is formed.

[0025] The side of the intermediate member 4 opposing the second mounting portion 52 has a shape in linear symmetry with respect to a center axis of the ring as an axis of symmetry and has a contact engagement portion 42 configured to increase the projecting height in a spiral shape and in a staircase pattern toward the second mounting portion 52, In other words, the contact engagement portion 42 realizes a spiral contact engagement structure with the projection 522 of the second mounting portion 52. In other words, a portion of the contact engagement portion 42 coming into contact with the projection 522 is determined depending on a change of a relative angle with respect to the projection 522. For example, referring to Figs. 7 and 8, the height of the intermediate member 4 is higher In the case where the contact engagement portion 42 and the projection 522 come into contact with each other at a position B than a case of coming into contact with each other at a position A (the height is increased as it goes downward with reference to the bottom surface 15). The contact position may be adjusted by changing the relative angle with respect to the projection 522 by rotating the intermediate member 4. Therefore, since the projecting height of the intermediate member 4 is changed depending on the angle, the height of the intermediate member 4 can be adjusted by the rotation thereof. Since the intermediate member 4 is rotated with the supporting leg 2 that engages the projection 44 by the notched engaging portion 211, the projecting amount (height) of the supporting leg 2 can be adjusted by rotating the supporting leg 2.

[0026] Since the height of the supporting leg 2 can be adjusted by an amount of the change in height of the contact engagement portion 42, the degree of the spiral inclination is determined within a supposed range of height adjustment. Too large spiral inclinations make an adjustment operation difficult, and too small spiral inclination makes height adjustment difficult.

[0027] As illustrated in Fig. 2 to Fig. 6, the supporting leg 2 has a cylindrical shape having a hexagonal column 22 on the side coming into contact with the installation surface, and the insertion hole 20 which the screw member 3 can be inserted in and engaged with in the height direction is formed at a portion of the center axis. A side 21 coming into contact with the first and second mounting portions 51 and 52 is formed with the notched engaging portion 211 in the direction perpendicular to the center axis. The notched engaging portion 211 engages with the projection 44 of the intermediate member 4 as described above to restrict the movement in the direction of rotation.

[0028] A preferable method of adjusting the height will be described in detail. First of all, the supporting leg 2 is mounted on each of the three first mounting portions 51 (Figs. 2, 3, and 10). Mounting of the supporting legs 2 is performed by the screw member 3. The supporting leg 2 is mounted on the second mounting portion 52 via the intermediate member 4. Mounting of the supporting leg 2 on the second mounting portion 52 is also performed by using the screw member 3. Here, mounting of the supporting leg 2 on the second mounting portion 52 is adjusted to be slightly lower (the height is increased as it goes downward with respect to the bottom surface 15). The sewing machine is placed on a horizontal reference plane 90 with the four supporting legs 2 being mounted. Then, the supporting leg 2 mounted on the second mounting portion 52 which is mounted to be slightly lower floats upward from the reference plane 90 (upward by a gap t). Here, a wrench 9 is fitted to the hexagonal column 22 of the supporting leg 2 mounted on the second mounting portion 52 and the supporting leg 2 is rotated (for example, rotated from a position S to a position T), whereby the height of the supporting leg 2 is adjusted by changing the portion of the contact engagement portion 42 coming into contact with the projection 522 (Fig. 11). The supporting leg 2 can be adjusted in height by rotating in a range of 180°. Here, the shape of the surface of the contact engagement portion 42 coming into contact with the projection 522 is a staircase pattern, a person who makes an adjustment feels a tactile response in association with the rotation of the supporting leg 2, so that the easiness of figuring out of the extent of adjustment (information indicating how much the height can be adjusted with one click is accumulated from an experience. In this case, how much the supporting leg 2 needs to be rotated can be determined when the person who makes an adjustment looks at the gap t), and an improvement of stability after the adjustment (since the staircase pattern is employed, a probability of displacement from the state of being in contact and engagement with the projection 522) is achieved. In this manner, the height adjustment can be achieved without increasing the type of the supporting leg 2 to be used.

Modification of First Embodiment

[0029] In the first embodiment, the intermediate member 4 and the supporting leg 2 are separate members. However, both may be integrated. In this case, the shape of the first mounting portions 51 needs to be deeper by an amount corresponding to the height of the intermediate member 4 integrated thereto and formed in conformity with the shape of the surface of the contact engagement portion 42 of the intermediate member 4. For example, a shape complementary with the contact engagement portion 42 may be employed, or the depressed portion having a height corresponding to the highest portion of the contact engagement portion 42 may be formed, In this case, some baffle mechanism other than the notched engaging portion 211 may preferably be provided.

Second Embodiment

[0030] A supporting structure of the sewing machine of a second embodiment has approximately the same configuration as the first embodiment. Therefore, description of part having the same configuration will be omitted. A supporting device of the second embodiment includes four supporting legs 3, three first mounting portions 61, and one second mounting portion 62.

[0031] The supporting leg 3 has a substantially cylindrical shape as illustrated in Fig.12 to Fig. 14, and includes a hexagonal column 32 that comes into contact with an installation surface (not illustrated), and a projection 311 formed on a surface that comes into contact with a side 31 that comes into contact with the first or second mounting portions 61 and 62. An insertion hole 30 with which the screw member 3 can be inserted in and engaged with in the height direction is formed at a center.

[0032] The first mounting portion 61 is different from the form of the first mounting portions 51 in the first embodiment in that a notched engaging portion 612a is formed on a bottom surface 612 which corresponds to the bottom surface of the depressed portion 521 as illustrated in Figs. 18 and 19. The notched engaging portion 612a fits the projection 311 of the supporting leg 3. The forms of the projection 311 and the notched engaging portion 612a may be of any shape as long as these members have shapes that allow fitting or engagement with respect to each other.

[0033] The second mounting portion 62 is different from the form of the first mounting portions 51 in the first embodiment in that a shape corresponding to the contact engagement portion 42 of the intermediate member 4 (a contact engagement portion 622) in the first embodiment is employed as the form of the bottom surface 612 which corresponds to the bottom surface of the depressed por-

tion 521 as illustrated in Figs. 15 to 17. Forms of a screw fixing portion 621 which corresponds to other screw fixing portions 510 and a screw hole 621a formed at a center thereof are almost the same.

[0034] The contact engagement portion 622 has a shape In linear symmetry with respect to a center axis (the screw hole 621a) as an axis of symmetry, and the depth (height) increasing upward is increased in a spiral shape and in a staircase pattern. In other words, the contact engagement portion 622 realizes a spiral contact engagement structure with the projection 311 of the supporting leg 3. A portion of the contact engagement portion 622 coming into contact with the projection 311 is determined depending on a change of a relative angle with respect to the projection 311. For example, referring to Figs. 15 and 17, the height of the supporting leg 3 is higher in the case where the contact engagement portion 622 and the projection 311 come into contact with each other at a position B than in a case of coming into contact with each other at a position A (the height is increased as it goes downward with reference to the bottom surface 15). The contact position may be adjusted by changing the relative angle with respect to the projection 311 by rotating the supporting leg 3. Therefore, the projecting amount (height) of the supporting leg 3 can be adjusted by rotating the supporting leg 3. In addition to advantages achieved by the first embodiment, the supporting structure of the second embodiment is superior in that the intermediate member may be omitted.

Third Embodiment

[0035] A configuration of the supporting leg in which a spiral groove (screw thread) is formed in the periphery of a portion to be mounted on the mounting portion of the bottom surface, a portion corresponding to the first mounting portion is formed into a hole to which the screw groove can be inserted as-is (the inner diameter is formed to be larger than the diameter of the crest of the screw thread), and a portion which constitutes the mounting portion with the height adjustment mechanism which corresponds to the second mounting portion is replaced by a screw thread formed on an inner periphery to engage the screw thread formed on the supporting leg may be employed. The screw thread formed on the supporting leg and the screw thread formed on the second mounting portion constitute a spiral contact engagement structure. The height of the supporting leg may be adjusted by rotating the supporting leg mounted on the mounting portion having a screw thread formed thereon.

[0036] 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. Variations and changes may be made by others, and equivalents employed, without departing from the spirit of the present invention. Accordingly, it is expressly intended that all such variations, changes and equivalents which fall within the spirit and scope of the present invention as defined in the claims, be embraced thereby.

Claims

1. A sewing machine comprising:

   four or more supporting legs (2) having a shape replaceable with each other; and
   a bottom portion (15) including a mounting portion (52) with a height adjustment mechanism on which at least part of the supporting legs is mounted and mounting portions (51) on which the rest of the supporting legs are mounted, wherein
   the mounting portion with the height adjustment mechanism and the supporting leg to be mounted on the mounting portion with the height adjustment mechanism constitute a spiral contact engagement structure configured to allow an adjustment of the height of the contact engagement between two or more members in the height direction by rotating the mounted supporting leg about an axis extending substantially in the height direction.

2. The sewing machine according to Claim 1, wherein the spiral contact engagement structure is a staircase pattern,

3. The sewing machine according to Claim 1 or 2, wherein the spiral contact engagement structure includes a spiral contact surface on one side and a rib structure extending from a center of rotation of the supporting leg radially outward and projecting toward the contact surface on the other side.

4. The sewing machine according to any one of Claims 1 to 3, wherein a bottom of the mounting portion with the height adjustment mechanism is located at a position relatively higher than a portion where the mounting portion comes into contact with the supporting leg, and an intermediate member having a height so substantially align in height with a portion where the mounting portion comes into contact with the supporting leg is provided between the bottom and the supporting leg to be mounted thereon, and the bottom of the mounting portion with the height adjustment mechanism and the intermediate member constitute the spiral contact engagement structure.

5. The sewing machine according to any one of Claims 1 to 4, wherein the supporting leg is formed of a re-

silient member and includes a center hole formed in a substantially height direction, the mounting of the supporting leg is achieved by a screw member (3) that penetrates through the center hole.

6. The sewing machine according to any one of Claims 1 to 5, wherein at least part of the supporting member in the height direction is not a circular shape in cross section.

7. A method of adjusting a mounting height of the supporting leg of the sewing machine according to any one of Claims 1 to 6, comprising:

a supporting leg mounting step of mounting the supporting legs to the mounting portion and the mounting portion with the height adjustment mechanism respectively, and
a height adjusting step of placing the sewing machine so that the supporting legs to face a horizontal surface, and then rotating the supporting leg mounted on the mounting portion with the height adjustment mechanism so that a distal end of the supporting leg comes into contact with the horizontal surface.

FIG.1

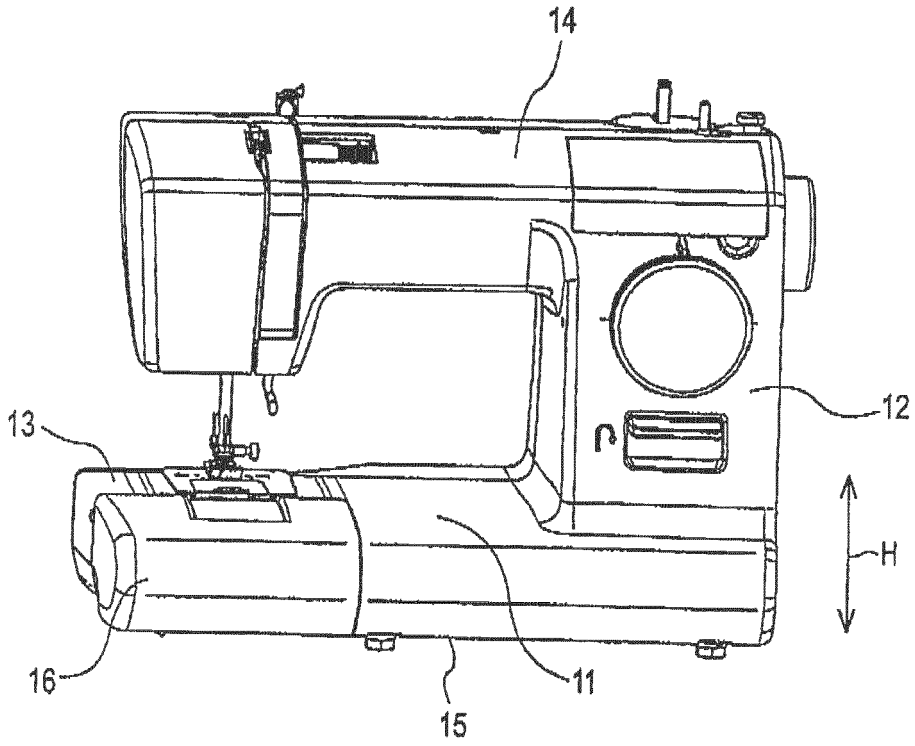

FIG.2

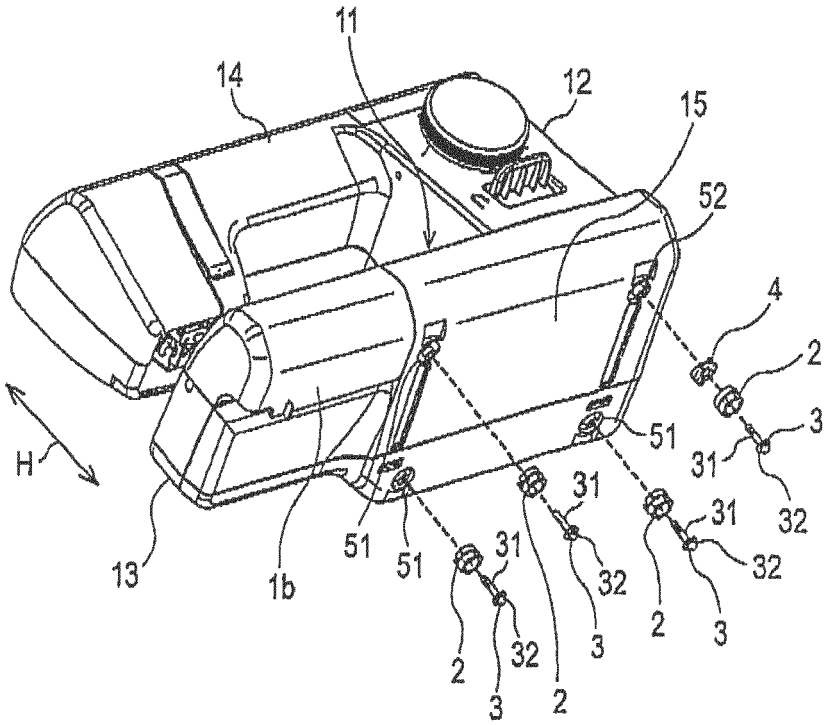
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FIG.3

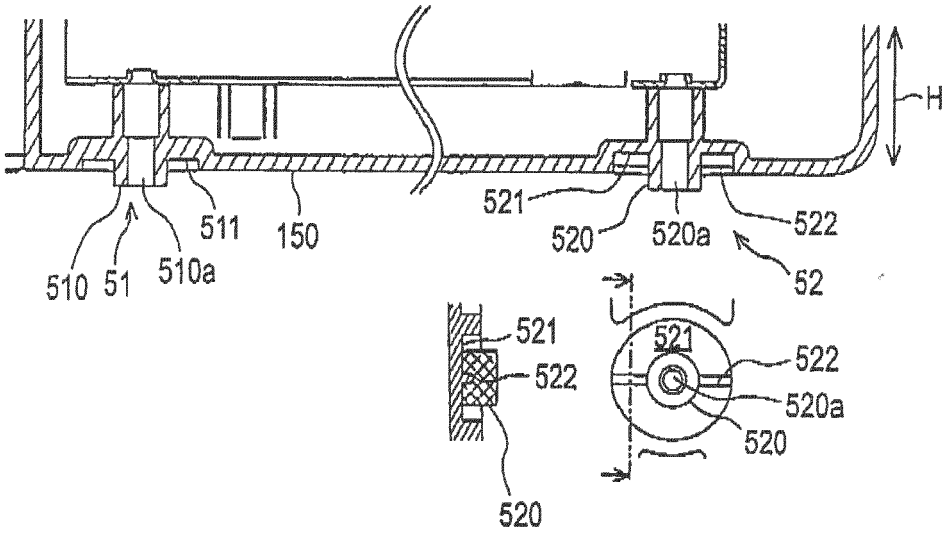
H
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FIG.4

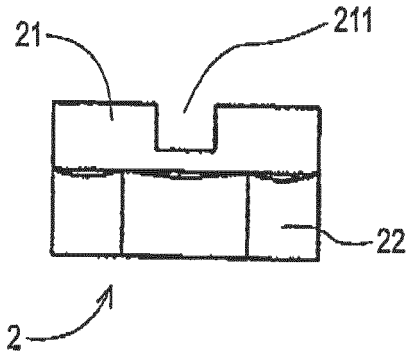


FIG.5

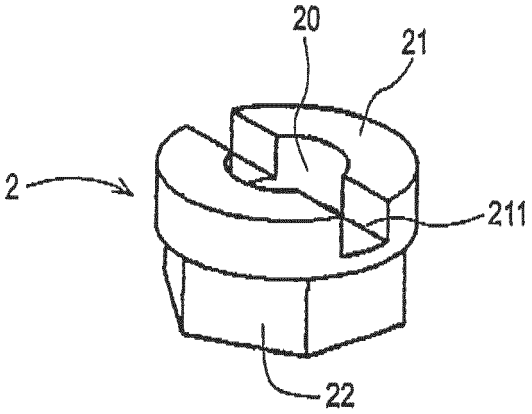


FIG.6

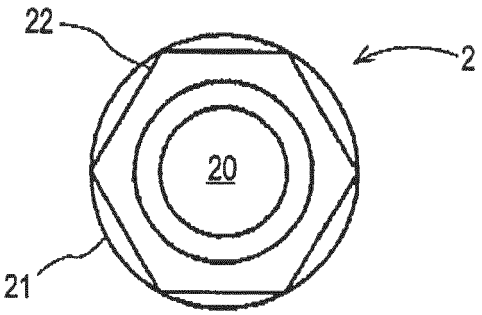


FIG.7

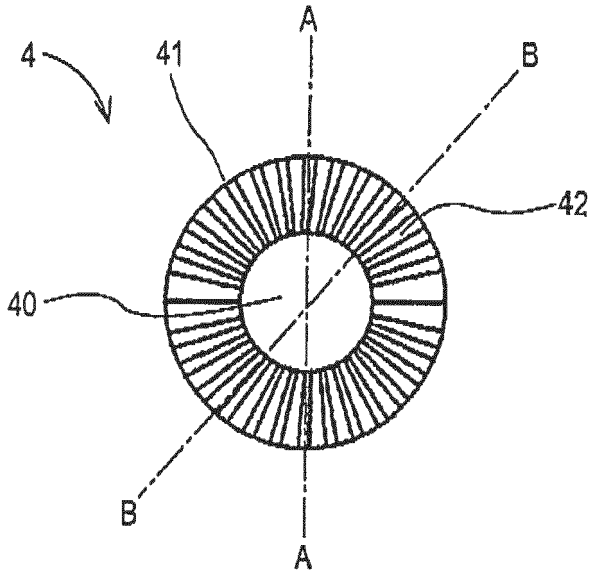


FIG.8

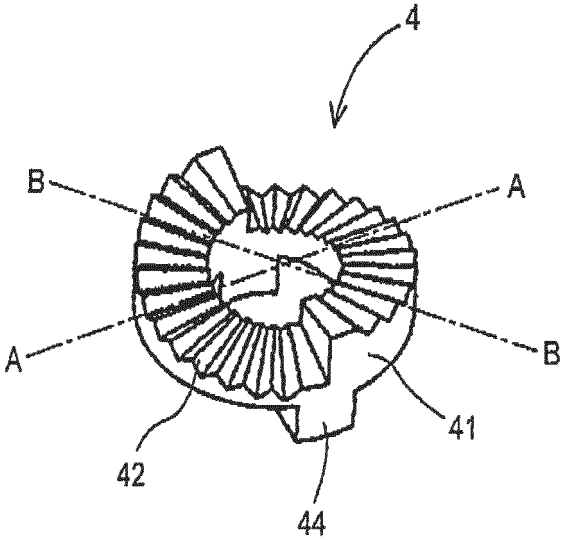


FIG.9

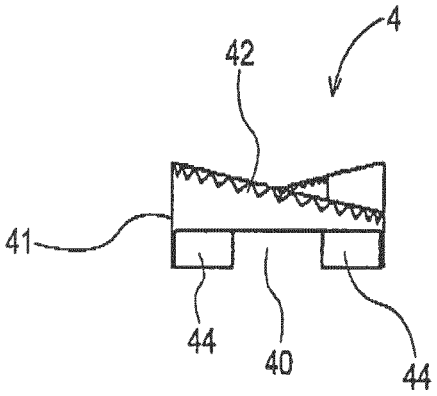


FIG.10

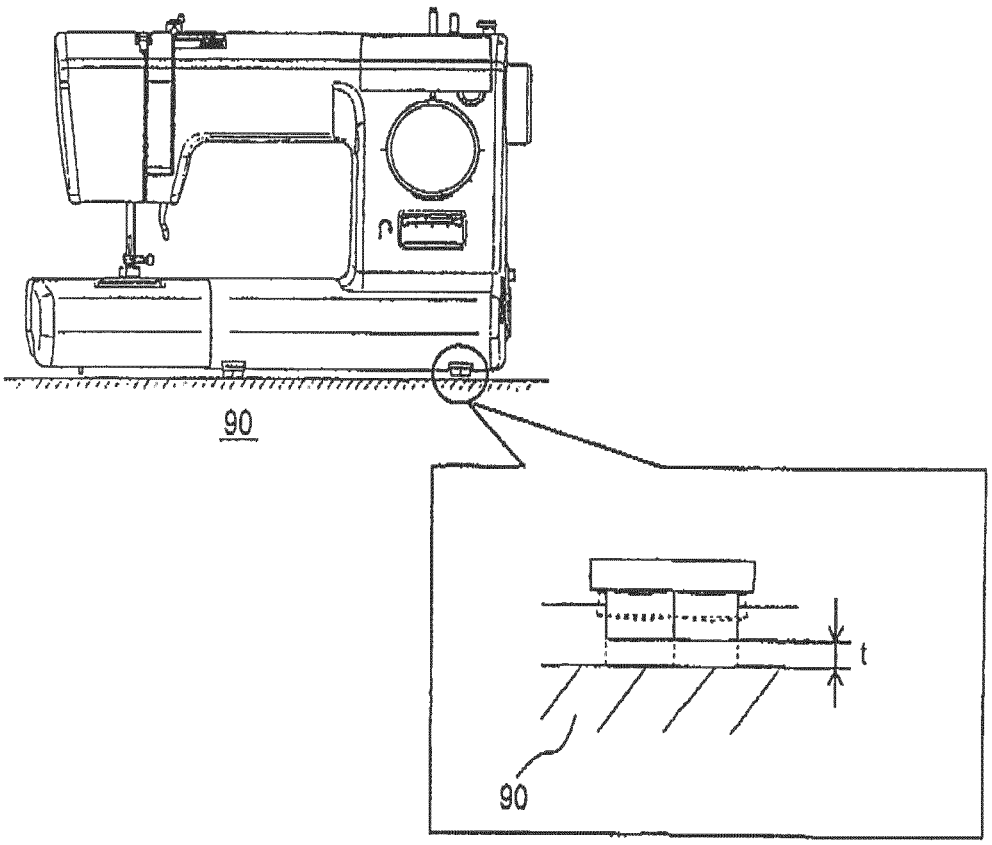


FIG.11

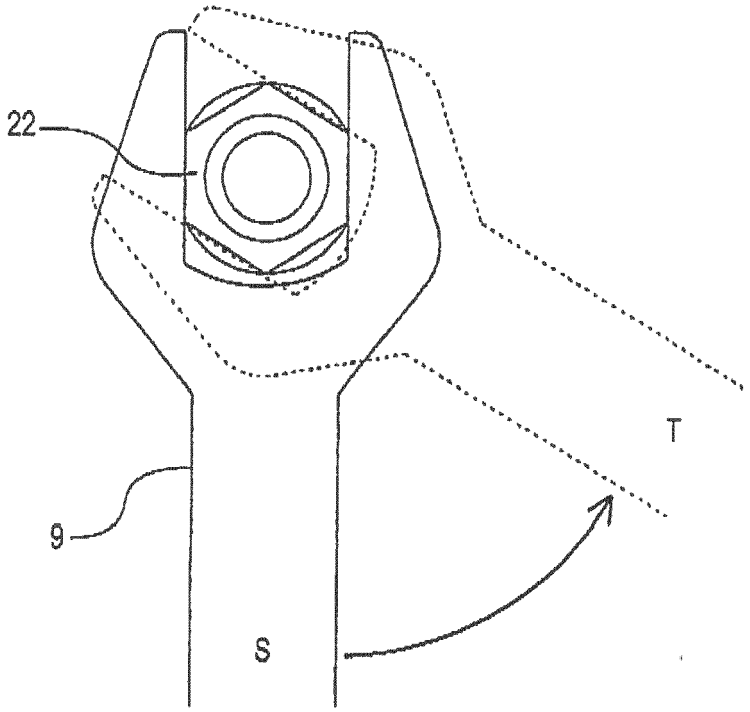


FIG.12

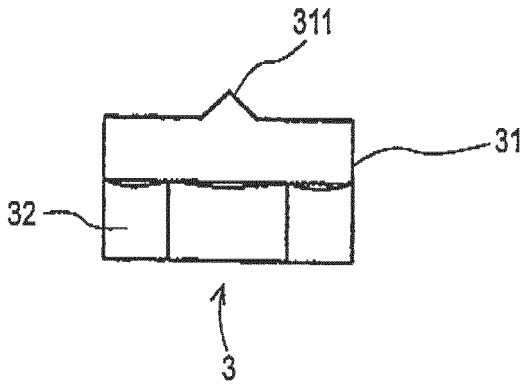


FIG.13

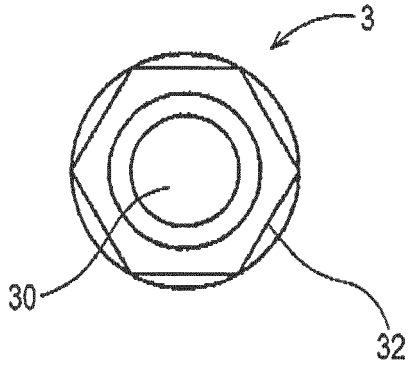


FIG.14

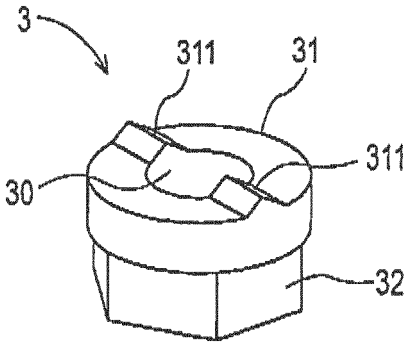


FIG.15

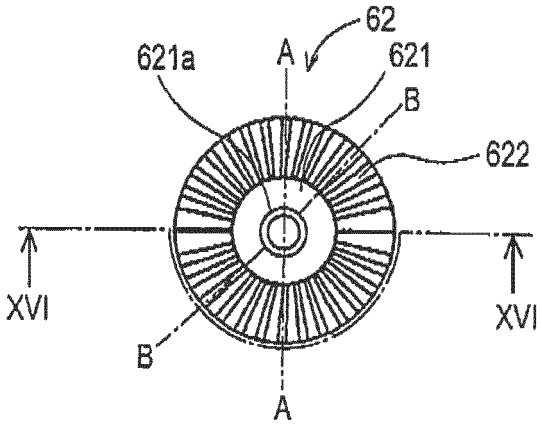


FIG.16

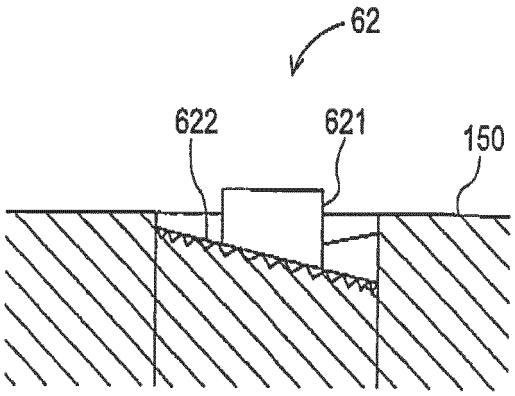


FIG.17

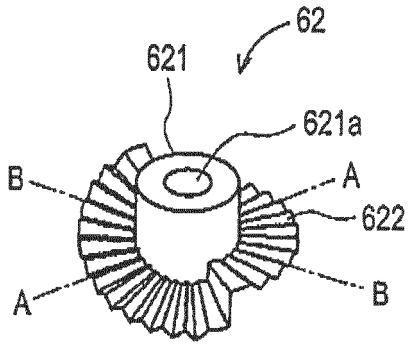


FIG.18

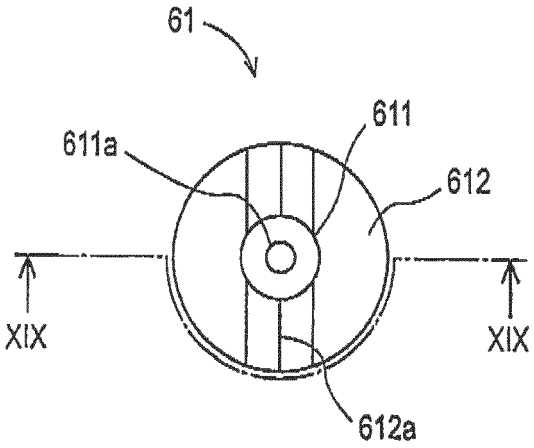
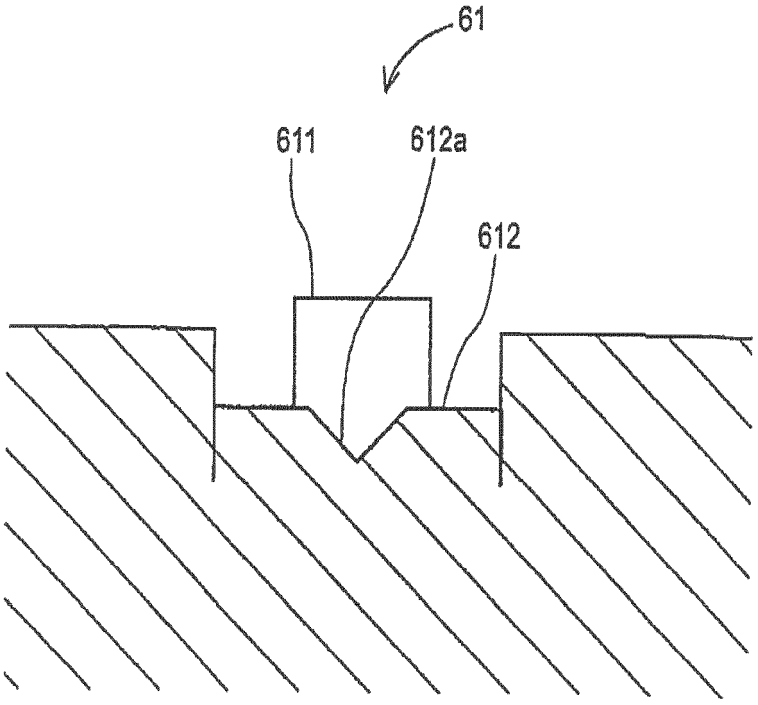


FIG.19



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Place of search	Date of completion of the search	Examiner
Munich	22 May 2014	Herry-Martin, D

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