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(54) **Full rotary hook**

(57) A full rotary hook unit is provided below a needle plate of a sewing machine and is provided with an outer hook having a beak rotating integrally with a lower shaft in synchronization with a vertical movement of a sewing needle and a middle hook rotatably supported by the outer hook. A needle guide element that guides the sewing needle as well as adjusting the clearance between the sewing needle and the beak is formed independent of the outer hook and the middle hook. A position adjustment mechanism is provided that mounts the needle guide element on the outer hook or an element rotating integrally with the outer hook so as to allow adjustment of the positioning of the needle guide element in an axial direction of the lower shaft, thus allowing the clearance between the sewing needle and the beak to be readily adjusted.

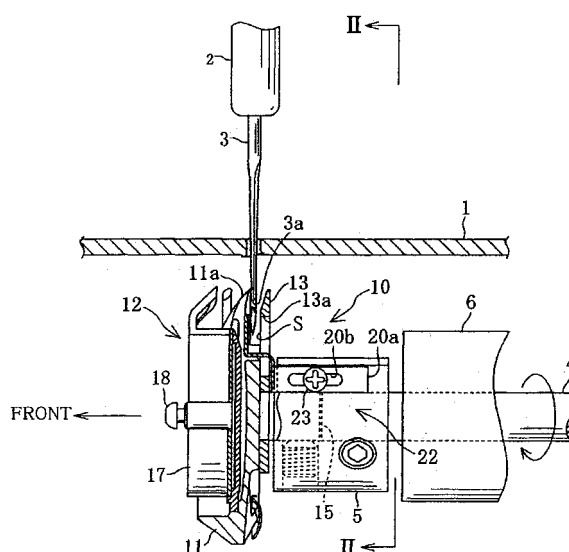


FIG. 1

Description

FIELD

[0001] The present disclosure is directed to a full rotary hook unit having a needle guide element provided in an outer hook of a full rotary hook rotating in synchronization with vertical movement of a sewing needle, which needle guide element allows adjustment of clearance between a beak and the sewing needle.

BACKGROUND

[0002] Sewing machines having a vertical full rotary hook inside a sewing machine bed have been reduced to practice. The vertical full rotary hook includes an outer hook provided rotatably about a horizontal rotational shaft, a middle hook supported rotatably by the outer hook, and a bobbin case attached to the middle hook.

[0003] JP S57-13017 Y (hereinafter referred to as reference document 1) discloses a needle guide mechanism for a full rotary hook of a sewing machine in which a substantially semicircular needle guide plate (presser plate) is screw fastened from the rear side of the outer hook. A portion of the needle guide plate is curved in L-shape in side view, whereby a needle groove and a static needle guide element are formed. Further, the needle guide plate has a circumferential adjustable needle guide element secured thereto by an adjustable screw. When using a thin sewing needle, the sewing needle can be moved in close proximity of the beak by tightening the adjustment screw and reducing the clearance between the adjustable needle guide element and the static needle guide element. When using a thick sewing needle, the sewing needle can be moved away from the beak by loosening the adjustment screw and increasing the clearance between the adjustable needle guide element and the static needle guide element.

[0004] The needle guide mechanism for a full rotary hook of a sewing machine described in reference document 1 allows the adjustment screw to be manually tightened and loosened depending on the thickness of the sewing needle to be used. Thus, excessive tightening of the adjustment screw results in insufficient clearance between the adjustable needle guide element and the static needle guide element, in which state the descending sewing needle collides with the rotating beak, leading to bending and damaging of the sewing needle.

[0005] Generally, a hook shaft of the full rotary hook and the lower shaft are connected by a coupling element disposed in the immediate rear side of the full rotary hook. The needle guide plate is screw fastened from the rear side of the outer hook and the adjustment screw is mounted on the rear side (coupling element side) of the needle guide plate. Thus, adjustment of adjustment screw is hindered by the coupling element resulting in poor workability.

SUMMARY

[0006] An object of the present disclosure is to provide a full rotational hook unit capable of easily adjusting the clearance between the sewing needle and the beak when using sewing needles of different thickness.

[0007] A full rotary hook unit of the present disclosure is provided below a needle plate of a sewing machine and includes an outer hook having a beak rotating integrally with a lower shaft in synchronization with a vertical movement of a sewing needle, and a middle hook rotatably supported by the outer hook, the full rotary hook characterized by a needle guide element that is formed independent of the outer hook and the middle hook, and that guides the sewing needle at least for a predetermined time period immediately before the beak encounters the sewing needle to adjust clearance between the sewing needle and the beak; and a position adjustment mechanism that mounts the needle guide element on the outer hook or an element rotating integrally with the outer hook so as to allow adjustment of the needle guide element in a axial direction of the lower shaft.

[0008] According to such configuration, when the user changes the sewing needle to a sewing needle of different thickness, the user is allowed to adjust the positioning of the needle guide element in the axial direction of the lower shaft by the position adjustment mechanism. The clearance between the sewing needle and the beak can be readily adjusted since the needle guide plate rearwardly guides the sewing needle at least for a predetermined time period immediately before the beak encounters the sewing needle.

[0009] The element rotating integrally with the outer hook may be a coupling element connecting the lower shaft and the outer hook. According to such configuration, no additional parts are required for attachment of the position adjustment mechanism.

[0010] A needle guide portion in plate-form that confronts the sewing needle may be provided in the needle guide element and a proximal end relative to the beak of the needle guide portion may be configured to be higher than the distal end relative to the beak.

[0011] When the distal end relative to the beak of the needle guide portion is situated at the needle drop point, the sewing needle assumes the substantial lowermost position. Thus, the greater the height of the needle guide portion, greater the area of contact between the sewing needle and the needle guide portion. Greater area of contact between the sewing needle and the needle guide portion increases frictional heat, consequently deforming the sewing needle.

[0012] Thus, lowering the height of the needle guide reduces the area of contact between the sewing needle and the needle guide portion. However, in the proximal end relative to the beak of the needle guide portion, lowering the height disables the guidance of the sewing needle due to the elevation of the sewing needle. Thus, the sewing needle can be guided reliably by increasing the

height at the proximal end relative to the beak of the needle guide portion.

[0013] The proximal end relative to the beak of the needle guide portion may be situated in substantially the same position as the beak in the axial direction of the lower shaft and the distal end relative to the beak may be situated in the middle hook side relative to the beak in the axial direction of the lower shaft.

[0014] According to such configuration, the sewing needle can be guided gradually to the position substantially the same as the beak in the axial direction of the lower shaft (which is a desirable position for the beak to seize the needle thread) by being moved along from the distal end relative to the beak of the needle guide portion to the proximal end relative to the beak of the needle guide portion. When the sewing needle is situated in the proximity of distal end relative to the beak of the needle guide portion, the sewing needle can be easily moved along the needle guide portion since marginal space can be secured between the sewing needle and the needle guide portion.

[0015] A presser plate having a notch is provided integrally with the rear side of the outer hook, and the needle guide portion may be passed through the notch from the rear side.

[0016] Such configuration renders a compact needle guide element.

[0017] The position adjustment mechanism may be provided with a connection mechanism capable of connecting and disconnecting a securing portion defined in the needle guide element and the coupling element.

[0018] According to such configuration, the securing portion formed in the needle guide element and the coupling element may be disconnected to change the positioning of the needle guide element relative to the coupling element. Thereafter, the needle guide element can be secured to the coupling element at the changed position.

[0019] The connection mechanism may establish its connection by an long hole defined in the securing portion and formed in the axial direction of the lower shaft, a screw passed through the long hole, and a screw hole defined in the coupling element.

[0020] Such configuration renders a simple connection mechanism.

[0021] When using a sewing needle of different thickness, the user is allowed to readily adjust the positioning of the securing portion in the axial direction of the lower shaft which is the direction in which the long hole is oriented. The workability of tightening and loosening of the screw can be improved since the screw is screwed into the screw hole of the coupling element.

[0022] A cut is defined in the coupling element by cutting along the axial direction of the lower shaft, and the connection mechanism may secure the securing portion to the cut by a screw so as to allow adjustment of the securing portion in the axial direction.

[0023] According to such configuration, the screw can

be readily tightened and loosened from the lateral direction of the coupling element.

[0024] The needle guide element may guide the sewing needle in a predetermined time period immediately after the beak has encountered the sewing needle in addition to the predetermined time period immediately before the beak encounters the sewing needle.

[0025] According to such configuration, oscillation of the sewing needle before and after the beak seizes the needle thread can be prevented, thereby allowing reliable seize of the needle thread.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Other objects, features and advantages of the present disclosure will become clear upon reviewing the following description of the illustrative aspects with reference to the accompanying drawings, in which,

FIG. 1 is a right side view of a full rotary hook unit of the present disclosure;

FIG. 2 is a rear view of a vertical cross section taken along line II-II of FIG. 1 in which the sewing needle is slightly elevated from the lowermost position;

FIG. 3 is a plan view of the full rotary hook unit;

FIG. 4 is a perspective view of the needle guide plate;

FIG. 5 corresponds to FIG. 2 in which the sewing needle is in the lowermost position; and

FIG. 6 corresponds to FIG. 2 in which the sewing needle is in a position immediately after encountering the beak after starting its elevation.

DETAILED DESCRIPTION

[0027] Embodiment of the present disclosure will be described with reference to the drawings. A vertical full rotary hook unit of the present embodiment is provided with a vertical full rotary hook 10, a lower shaft 4, and a coupling element 5 connecting the lower shaft 4 and the vertical full rotary hook 10. The vertical full rotary hook 10 is provided below a needle plate 1 of a pattern sewing machine (not shown).

[0028] Referring to FIGS. 1 to 3, the vertical full rotary hook 10 is provided with an outer hook 11 rotated by the lower shaft 4, a middle hook 12 rotatably supported by the outer hook 11, and a loop presser plate 13 provided integrally with the rear side of the outer hook 11.

[0029] The outer hook 11 is provided with an outer hook body 14 and a hook shaft 15 connecting to the outer hook body 14. Rotational force of the lower shaft 4 rotating in synchronization with a main shaft (not shown) is transmitted to the hook shaft 15 via the coupling element 5. Thus, the outer hook 11 and the coupling element 5 are rotated integrally. Transmission of rotational force to the hook shaft 15 causes the outer hook 11 to be rotated clockwise in front view (assuming that the left side of FIG. 1 and the lower side of FIG. 3 indicate the front direction respectively) about the hook shaft 15 in synchronization

with the vertical movement of the sewing needle 3. The outer hook body 14 has a beak 11a formed thereto which is directed toward the clockwise rotational direction.

[0030] The middle hook 12 is provided with a middle hook body 17 and a shaft 18, and is fitted co-axially with the outer hook body 14. The middle hook 12 and the outer hook 14 support each other rotatably. The shaft 18 is provided so as to project from the bottom of the middle hook body 17 to the opened end side of the middle hook body 17 and supports a bobbin case (not shown) that contains a bobbin (not shown) in a rotatable manner. The lower shaft 4 is supported rotatably to the bed frame (not shown) by a bearing 6.

[0031] When rotational force is transmitted to the vertical full rotary hook 10 by the rotation of the lower shaft 4, the outer hook 11 is rotated clockwise in front view in synchronization with the vertical movement of the sewing needle 3, with the middle hook 12 and the bobbin case in unrotatable state. The rotation of the outer hook 11 causes a needle thread (not shown) extending from an eye 3a of the sewing needle 3 penetrating the workpiece cloth to be seized by the beak 11a and carried around the middle hook 12. Then, the needle thread extending from the eye 3a of the sewing needle 3 is intertwined with the bobbin thread (not shown) extending from the bobbin. Thereafter, the needle thread loop is tightened by a thread take-up (not shown) to form a stitch.

[0032] Referring to FIG.2, the loop presser plate 13 is composed of a plate element taking a substantially semicircular form that surrounds the lower shaft 4 and is secured to the rear side of the outer hook 11 by a fastening screw 19 from the coupling element 5 side (rear side). Referring to FIG. 1, a needle passage S allowing passage of the sewing needle 3 is defined between the rear surface of the outer hook 11 and the loop presser plate 13. As illustrated in FIG.2, the loop presser plate 13 has a notch 13a in predetermined width defined thereto. The notch 13a confronts the distal end of the sewing needle 3 during the time period in which the outer hook 11 rotates from a position immediately before the lowermost rotational position (rotational position of the outer hook 11 in which the sewing needle 3 is in a position immediately before the lowermost position) to a post-encounter rotational position (rotational position immediately after the beak 11a encounters the sewing needle 3).

[0033] A description will be given on a needle guide plate 20 provided in outer hook 11 as the needle guide element hereinafter.

[0034] Referring to FIG.4, the needle guide plate 20 takes a stepped form in side view (assuming that the left side in FIG.4 indicates the front side) made of plate material, and a securing portion 20a oriented in the longitudinal direction is formed integrally with the right end of the thread guide plate 20. A needle guide portion 20c is formed in the upper front end portion of the needle guide plate 20. The lateral width of the thread guide portion 20c is configured slightly narrower than the notch 13a of the loop presser plate 13. The securing portion 20a has a

longitudinally long hole 20b defined thereto.

[0035] Referring to FIGS.2 and 4, the height of the needle guide portion 20c is formed in a substantially curved profile such that distal end relative to the beak 11a is lower than the proximal end relative to the beak 11a. The needle guide plate 20 guides the distal end (lower end) of the sewing needle 3 during a predetermined time period (at least the sum of the predetermined time period immediately before the beak 11a encounters the sewing needle 3 and the predetermined time period immediately after the sewing needle 3 encounters the beak 11a) in which the sewing needle 3 in the lowermost position (refer to FIG. 5) is elevated (refer to FIG.2) to the position immediately after encountering the beak 11a (refer to FIG. 6). In the state illustrated in FIG. 5 (when the sewing needle 3 is in the lowermost position), the rotational angle taken by the outer hook 11 until the beak 11a encounters the sewing needle 3 is approximately 50 degrees.

[0036] The needle guide plate 20 is formed so as to be sloped relative to the plane perpendicular to the axial direction of the lower shaft 4. As illustrated in FIGS.3 and 4, the distal end relative to the beak 11a of the needle guide portion 20c is positioned in the middle hook 12 side (front side) relative to the beak 11a in the axial direction of the lower shaft 4. The proximal end relative to the beak 11a of the needle guide portion 20c is positioned in substantially the same position as the beak 11a in the axial direction of the lower shaft 4. As illustrated in FIGS. 1 and 2, the needle guide portion 20c is positioned in the needle passage S by passing through the notch 13a of the loop presser plate 13 from the rear side. The proximal end relative to the beak 11a of the needle guide portion 20c being positioned in substantially the same position as the beak 11a denotes that the proximal end relative to the beak 11a may be positioned slightly in the middle hook 12 side (front side) relative to the beak 11a and that the proximal end relative to the beak 11a may be positioned slightly in the lower shaft 4 side (rear side) relative to the beak 11a.

[0037] Next, a description will be given on a position adjustment mechanism 22. The position adjustment mechanism 22 is mounted on the coupling element 5 so that its positioning is adjustable in the longitudinal direction (axial direction of the lower shaft 4) within the needle passage S.

[0038] Referring to FIG.2, an orthogonal cut 5a is defined along the shaft direction (longitudinal direction) of the lower shaft 4 in a portion slightly in the right side of the upper end of the coupling element 5. The securing portion 20a of the needle guide plate 20 assumes a vertical disposition and is arranged in the longitudinal direction along the vertical wall of the cut 5a. The needle guide plate 20 is mounted on the coupling element 5 so as to allow adjustment in its longitudinal positioning relative to the coupling element 5 by screwing the fastening screw 23 inserted in the long hole 20b into the vertical wall of the cut 5a. The securing portion 20a, the long hole 20b, the fastening screw 23, and the screw hole 25 of the

coupling element 5 constitute the connection mechanism allowing connection and disconnection of the securing portion 20a formed in the needle guide plate 20 and the coupling element 5. The angle in which the cut 5a is cut off is not limited to 90 degrees.

[0039] The operation of the above configured vertical full rotary hook 10 will be described hereinafter.

[0040] Before starting a sewing operation, the user is to attach a sewing needle 3 which is suitable for the thickness and the type of workpiece cloth to be sewn on the needle bar 2. Then, a hand pulley (not shown) of the pattern sewing machine is manually operated to lower the sewing needle 3 to a state immediately after encountering the beak 11a (refer to FIG.6). Under such state, the fastening screw 23 is loosened with a tool and positioning of the needle guide plate 20 is adjusted so as to provide a predetermined clearance between the sewing needle 3 and the beak 11a (so that the distal end side relative to the beak 11a of the needle guide portion 20c rearwardly guides the distal end of the sewing needle 3). The fastening screw 23 is tightened after adjusting the positioning of the needle guide plate 20.

[0041] After adjustment of the positioning of the needle guide plate 20, the distal end of the needle guide portion 20c is positioned in the middle hook 12 side (front side) relative to the beak 11a in the longitudinal direction (axial direction of the lower shaft 4). The proximal end relative to the beak 11a of the needle guide portion 20c is situated in substantially the same position as the beak 11a in the longitudinal direction (axial direction of the lower shaft 4).

[0042] After adjustment of longitudinal positioning of the needle guide plate 20, sewing operation is started after the user places the workpiece cloth on a needle plate 1. When sewing operation is started, the needle guide portion 20c of the needle guide plate 20 rearwardly guides the distal end of the sewing needle 3 for a predetermined time period (time period in which the sewing needle 3 in the lowermost position (refer to FIG.5) is elevated to the position immediately after encountering the beak 11a (refer to FIG.6)) in each sewing cycle. Thus, the sewing needle 3 is able to avoid colliding with the beak 11a.

[0043] As described above, according to the present embodiment, when changing the sewing needle 3 to a sewing needle of different thickness, the user is allowed to adjust the positioning of the needle guide plate 20 in the axial direction of the lower shaft 4 via the position adjustment mechanism 22. The clearance between the sewing needle 3 and the beak 11a can be readily adjusted by providing the needle guide plate 20 that rearwardly guides the sewing needle 3 at least for a predetermined time period immediately before the beak 11a encounters the sewing needle 3.

[0044] The securing portion 20a for mounting the needle guide plate 20 has been formed integrally with the needle guide plate 20 and the long hole 20b elongated in the axial direction of the lower shaft 4 has been defined in the securing portion 20a.

[0045] The position adjustment mechanism 22 secures the needle guide plate 20 to the coupling element 5 connecting the lower shaft 4 and the outer hook 11 by the fastening screw 23 inserted in the securing portion 20a and the long hole 20b so that the positioning of the needle guide plate 20 is adjustable relative to the coupling element 5. Thus, the configuration of the position adjustment mechanism 22 can be simplified.

[0046] When using sewing needles 3 of different thickness, the user is allowed to readily adjust the positioning of the needle guide plate 20 in the axial direction of the lower shaft 4, which is the direction in which the long hole 20b is oriented, by merely loosening the fastening screw 23. The fastening screw 23 can be tightened and loosened with improved workability since the fastening screw 23 is screw fastened to the coupling element 5.

[0047] The heights at both ends of the needle guide portion 20c are configured to define a substantially curved profile, in which the distal end relative to the beak 11a is lower than the proximal end relative to the beak 11a, and the needle guide portion 20c is arranged to guide the distal end of the sewing needle 3. The needle guide portion 20c guides the distal end of the elevating sewing needle 3 for at least a predetermined time period immediately before the beak 11a encounters the sewing needle 3. Thus, the beak 11a is allowed reliably seize the needle thread extending from the eye 3a of the sewing needle 3 with no interference of the needle guide portion 20c, thereby forming neat continuous stitches without skipped stitches.

[0048] An orthogonal cut 5a has been defined in the coupling element 5 along the axial direction of the lower shaft 4. The position adjustment mechanism 22 is secured to the cut 5a of the needle guide 20 so as to allow the adjustment of the positioning of the needle guide plate 20. Thus, the fastening screw 23 can be readily tightened and loosened from the lateral direction of the coupling element 5.

[0049] A loop presser plate 13 having a notch 13a is provided integrally with the rear side of the outer hook 11 and the needle guide portion 20c of the needle guide plate 20 is passed through the notch 13a from the rear side, thereby, allowing compact configuration of the needle guide plate 20.

[0050] The present disclosure is not limited to the above described embodiment, but may be modified as follows.

[0051] The time period in which the needle guide portion 20c of the needle guide plate 20 guides the sewing needle 3 may be arranged at a predetermined time period immediately before the beak 11a encounters the sewing needle 3 (the time period in which the outer hook 11 has traveled the rotational angle of approximately 10 degrees until the beak 11a encounters the sewing needle 3) and a predetermined time period immediately after the beak 11a has encountered the sewing needle 3 (the time period in which the outer hook 11 has traveled the rotational angle of approximately 10 degrees after the beak 11a

has encountered the sewing needle 3).

[0052] The present embodiment defines the starting point of the predetermined time period at the lowermost position of the sewing needle 3, however the starting point may be defined at a position immediately before the lowermost position of the sewing needle 3 or the position immediately after the lowermost position of the sewing needle 3.

[0053] A scale may be marked on either one of the securing portion 20a of the needle guide plate 20 or the coupling element 5 on which the needle guide plate 20 is mounted and a baseline may be marked on the other of the securing portion 20a or the coupling element 5. Such configuration provides better clarity in the dimension of clearance between the sewing needle 3 and the beak 11a, and thus, the baseline may be aligned with the optimal scale for the thickness of the sewing needle 3 to be used among plurality types of sewing needles 3.

[0054] The securing portion 20a of the needle guide plate 20 may be attached on the outer hook 11.

[0055] The needle guide plate 20 may be formed in a curved form in plan view so as to curve along the periphery of the loop presser plate 13 so as to be positioned in the needle passage S by making a U-turn around the outer side of the loop pressing plate 13 from the securing portion 20a.

[0056] The connection mechanism of the present embodiment is constituted by the securing portion 20a, the long hole 20b, the fastening screw 23, and the screw hole 25 of the coupling element 5; however, any configuration may be employed if the securing portion 20a and the coupling element 5 can be connected or disconnected.

[0057] For example, a male-threaded screw may be formed in the coupling element 5, which male-threaded screw is passed through the long hole 20b of the securing portion 20a, and a female-threaded nut may be tightened over the securing portion 20a.

[0058] Further, the securing portion 20a may be secured on the coupling element 5 by a magnet placed over the securing portion 20a.

[0059] Further, the securing portion 20a may be formed in a notched annular shape (C-shape) and fitted with the coupling element 5 by coupling the notched ends by screws.

[0060] The foregoing description and drawings are merely illustrative of the principles of the present disclosure and are not to be construed in a limited sense. Various changes and modifications will become apparent to those of ordinary skill in the art. All such changes and modifications are seen to fall within the scope of the disclosure as defined by the appended claims.

Claims

1. A full rotary hook unit provided below a needle plate of a sewing machine and including an outer hook having a beak rotating integrally with a lower shaft

in synchronization with

a vertical movement of a sewing needle, and a middle hook rotatably supported by the outer hook, the full rotary hook unit **characterized by:**

a needle guide element that is formed independent of the outer hook and the middle hook, and that guides the sewing needle at least for a predetermined time period immediately before the beak encounters the sewing needle to adjust clearance between the sewing needle and the beak; and

a position adjustment mechanism that mounts the needle guide element on the outer hook or an element rotating integrally with the outer hook so as to allow adjustment of the needle guide element in a axial direction of the lower shaft.

2. The unit of claim 1, **characterized in that** the element rotating integrally with the outer hook is a coupling element that connects the lower shaft and the outer hook.
3. The unit of claim 1 or 2, **characterized in that** the needle guide element includes a needle guide portion in plate form that confronts the sewing needle, and heights at both ends of the needle guide portion is arranged so that a proximal end relative to the beak is higher than a distal end relative to the beak.
4. The unit of claim 3, **characterized in that** the proximal end relative to the beak of the needle guide portion is in substantially same position as the beak in the axial direction of the lower shaft and the distal end relative to the beak of the needle guide portion is positioned in a middle hook side relative to the beak in the axial direction of the lower shaft.
5. The unit of claims 3 or 4, further **characterized by** a presser plate that is provided integrally with a rear side of the outer hook and that has a notch defined thereto through which the needle guide portion is passed from a rear side.
6. The unit of any of claims 2 to 5, **characterized in that** the position adjustment mechanism includes a connection mechanism capable of connecting and disconnecting a securing portion formed on the needle guide element and the coupling element.
7. The unit of claim 6, **characterized in that** the connection mechanism includes a long hole defined in the securing portion and elongated in the axial direction of the lower shaft, a screw passed through the long hole, and a screw hole defined in the coupling element.
8. The unit of claim 6 or 7, **characterized in that** the

coupling element has a cut that is defined by cutting along the axial direction of the lower shaft, and the connection mechanism secures the securing portion to the cut by screw so that the securing portion is adjustable in the axial direction of the lower shaft. 5

9. The unit of any of claims 1 to 8, **characterized in that** the needle guide element guides the sewing needle for a predetermined time period immediately after the beak has encountered the sewing needle in addition to the predetermined time period immediately before the beak encounters the sewing needle. 10

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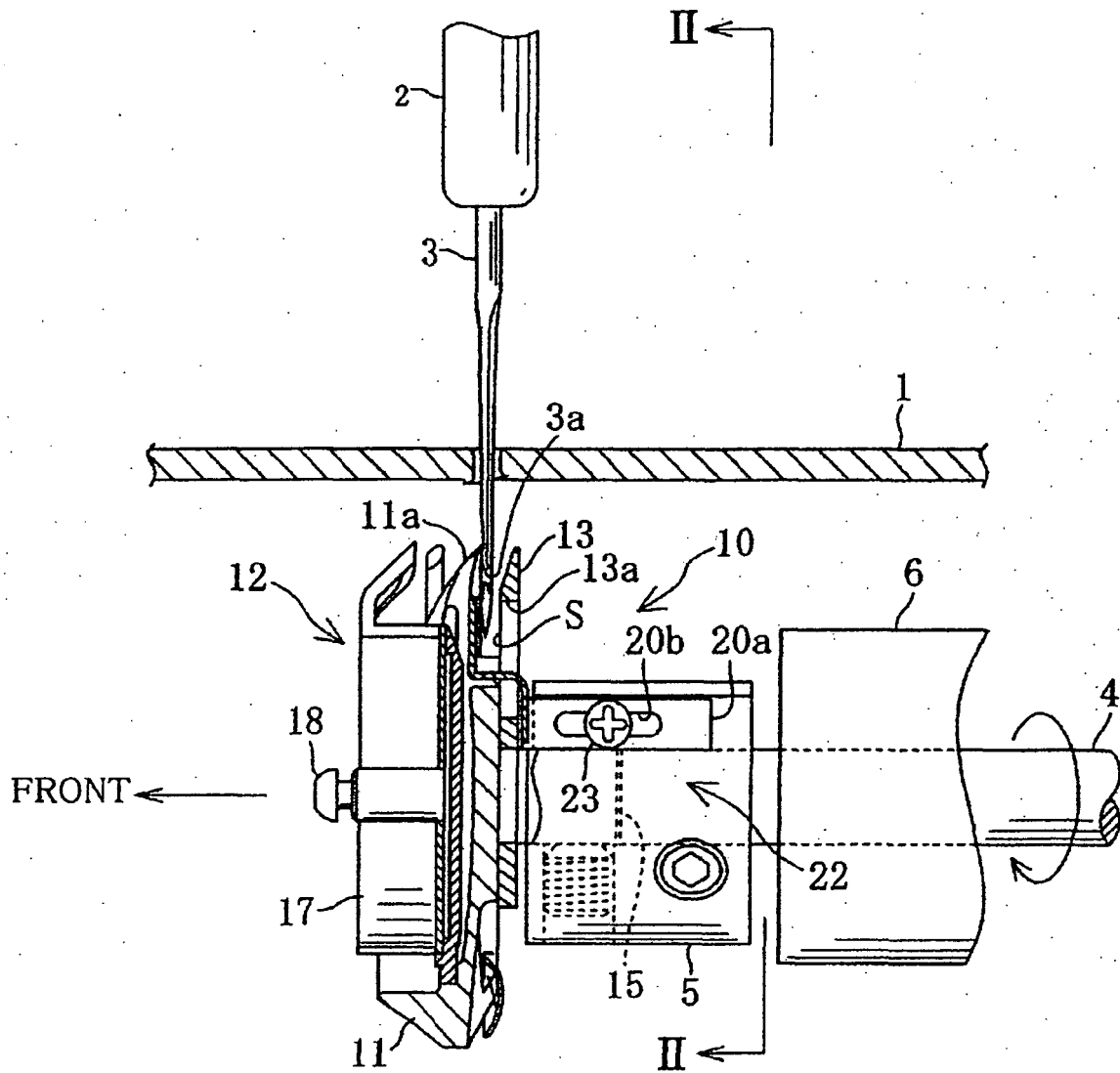


FIG. 1

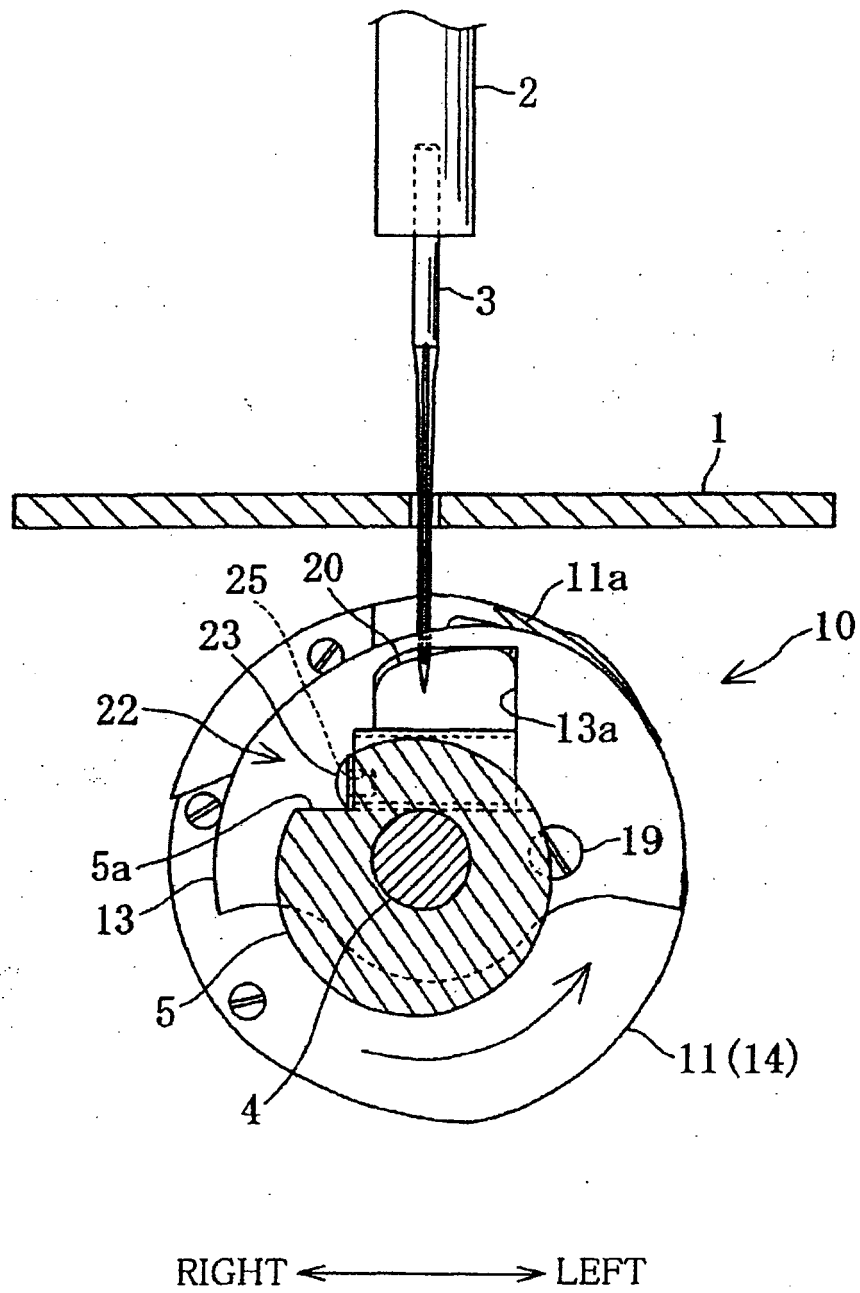


FIG. 2

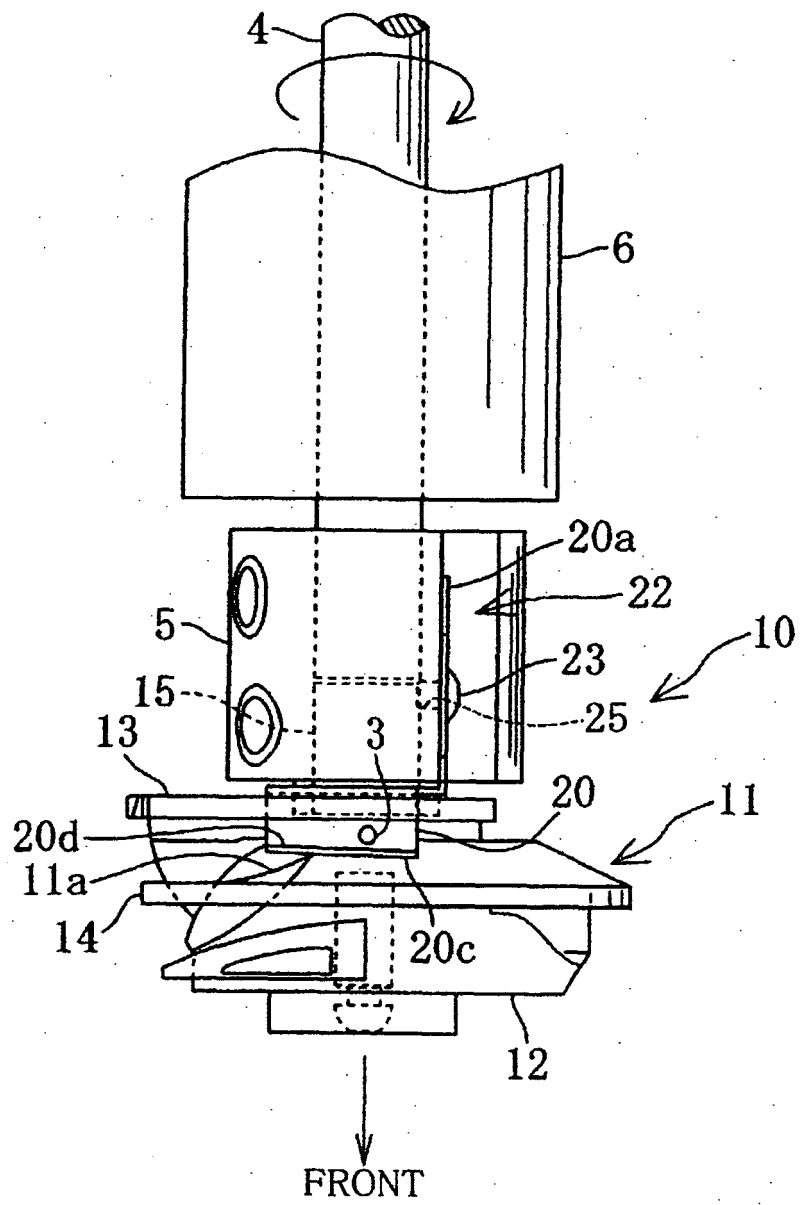


FIG. 3

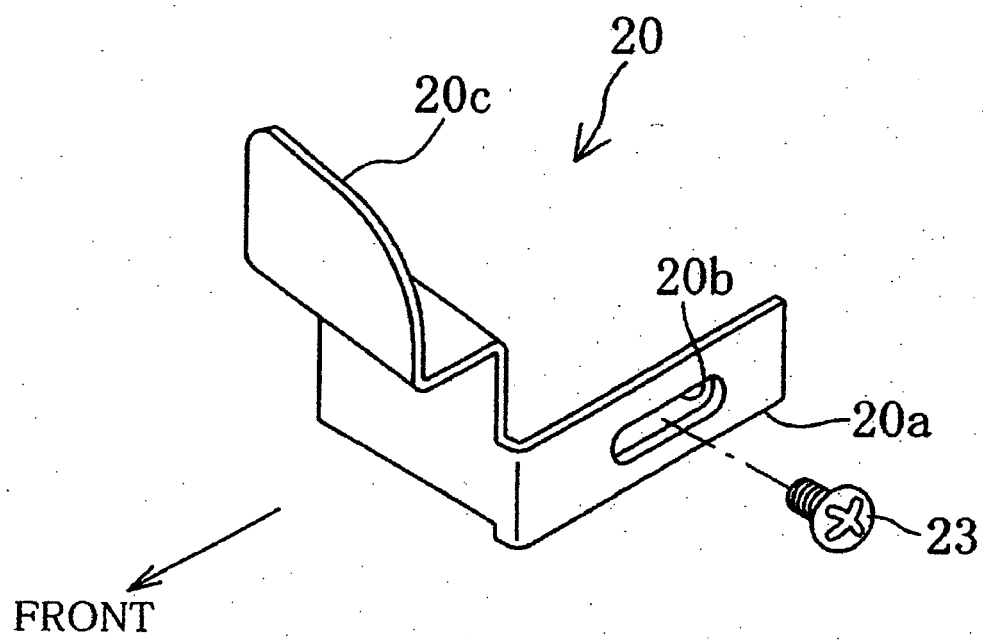


FIG. 4

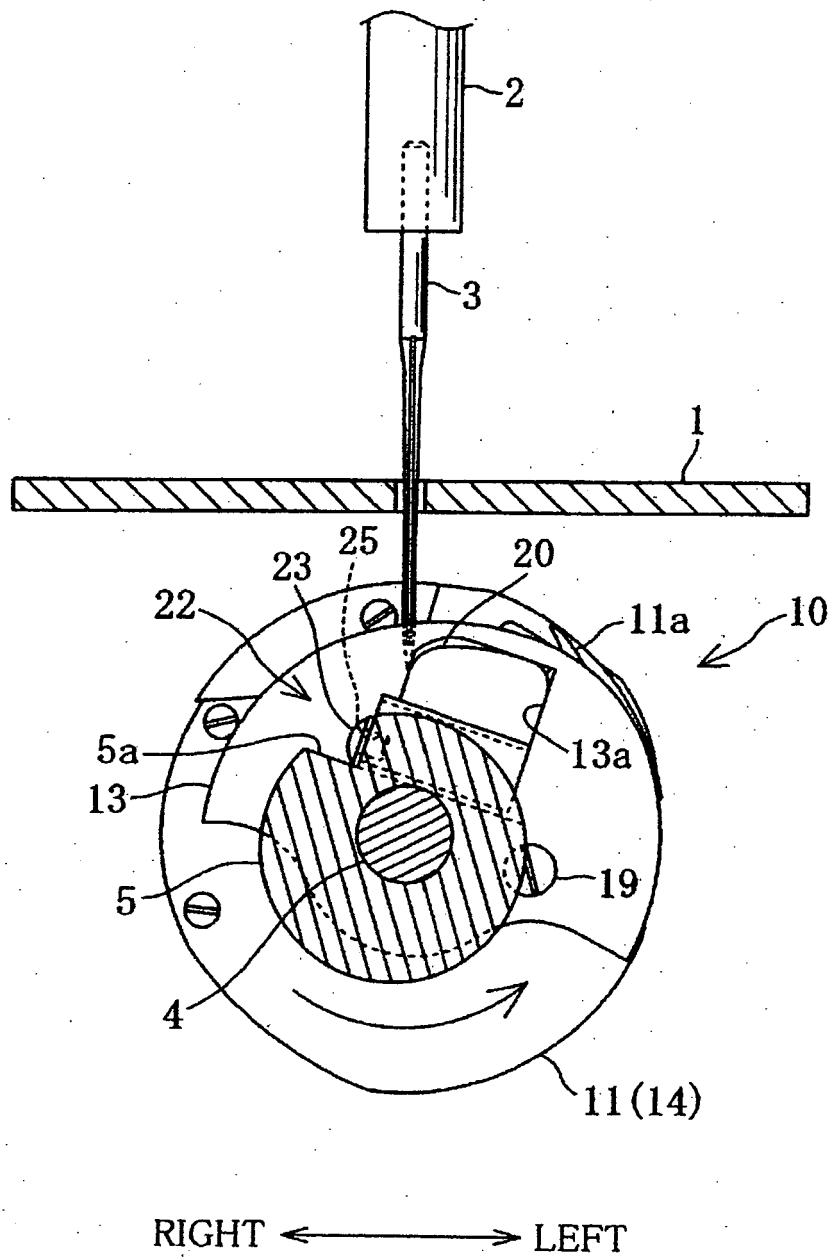


FIG. 5

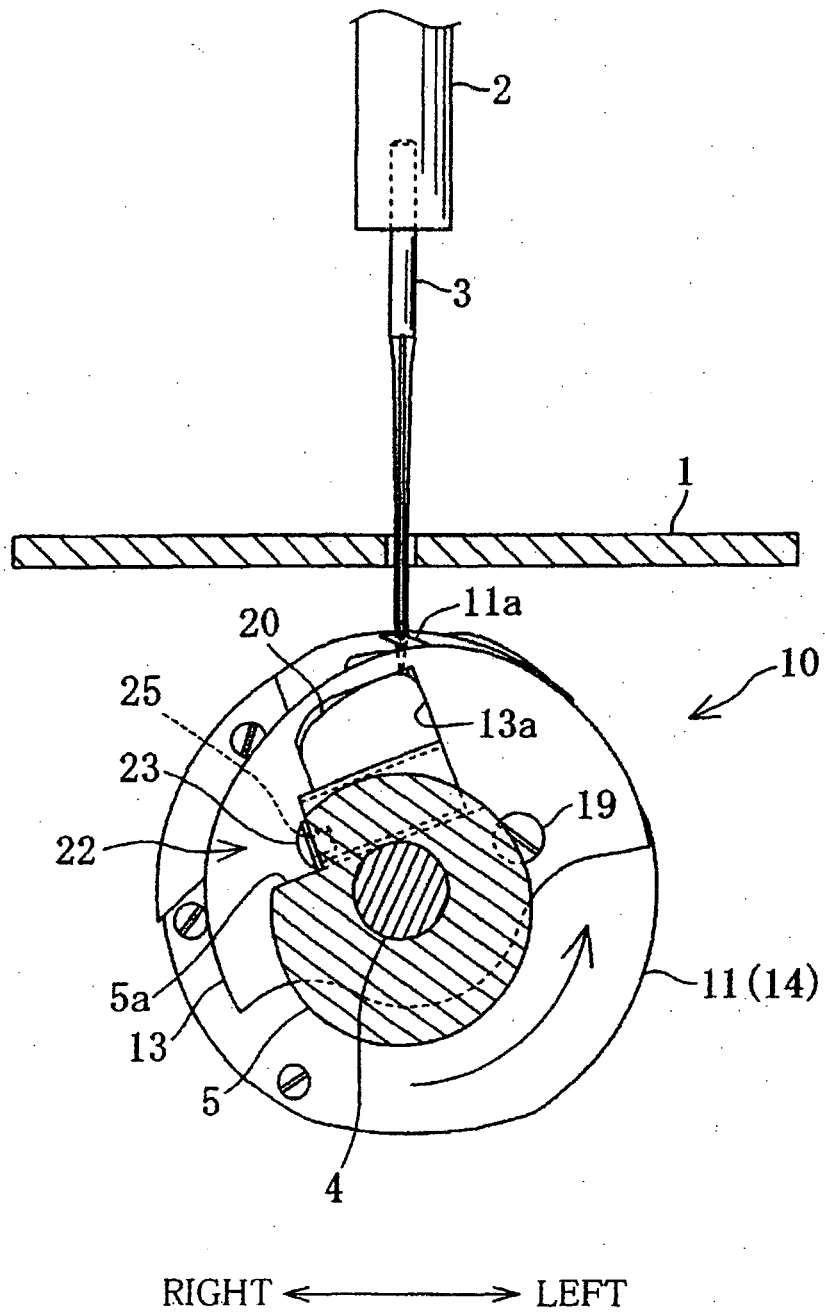


FIG. 6



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 01 5968

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 215 105 A (KUCHAR LUDWIG J) 2 November 1965 (1965-11-02) * the whole document *	1,2,6-8	INV. D05B55/06 D05B57/14
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 25 October 2007	Examiner Debard, Michel
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 01 5968

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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25-10-2007

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REFERENCES CITED IN THE DESCRIPTION

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