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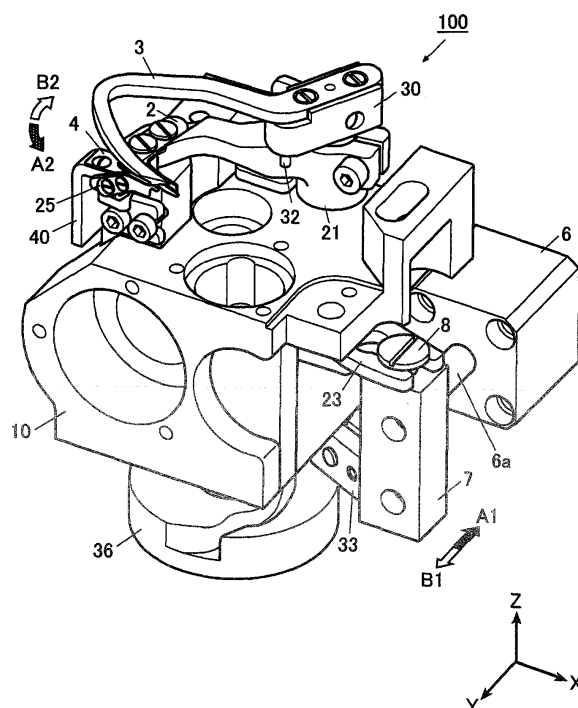
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(54) **Thread cutting device for sewing machine**

(57) The invention relates to a thread cutting device for a sewing machine. The thread cutting device includes: a cutting knife including a cutting edge and serving to carry out a rotation to an initial position and a thread cutting position advanced from the initial position to a stitch point side; a moving knife rotated to the initial position, a thread catching position advanced from the initial position and the thread cutting position retreated from the thread catching position in order and serving to cut a bobbin thread and a needle thread in cooperation with the cutting knife in the thread cutting position; and a clamp member for interposing and holding the bobbin thread between the clamp member and the moving knife by an elastic force applied through an elastic deformation, the clamp member including a first interposing portion for interposing the bobbin thread between the first interposing portion and the moving knife when the moving knife is returned from the thread cutting position to the initial position. The moving knife includes a catching portion for catching the bobbin thread in the thread catching position. The clamp member includes a second interposing portion for interposing the bobbin thread in abutment on a first abutting portion provided on a tip side of the moving knife from the catching portion when the moving knife is placed in the thread cutting position. The bobbin thread interposed by the second interposing portion in the thread cutting position is transferred to the first interposing portion and is held by the first interposing portion with a movement of the moving knife to the initial position.

Fig. 1



Description

[0001] The present invention relates to a thread cutting device for a sewing machine.

[0002] For example, Japanese Patent Application Publication No. JP-A-2008-68005 discloses a related-art thread cutting device of a sewing machine including a cutting knife having a cutting edge and supported on a shuttle shaft table (machine frame) rotatably, and serving to carry out a movement to an initial position and a thread cutting position which is advanced from the initial position to a stitch point side, a moving knife rotated over the shuttle shaft table to carry out a movement to the initial position, a thread catching position advanced from the initial position and the thread cutting position retreated from the thread catching position in order, and cutting a thread in cooperation with the cutting knife in the thread cutting position, and a clamp member fixed to the shuttle shaft table (the machine frame) and serving to hold a bobbin thread interposed between the clamp member and the moving knife by an elastic force applied through an elastic deformation.

As shown in Fig. 21, a groove portion 102 is formed on a moving knife 101 so as to be tilted slightly in a vertical direction, and a hook-shaped catching portion (not shown) for engaging a bobbin thread 112 is formed on a lower end of the groove portion 102. When the moving knife 101 is retreated from a thread catching position, a needle thread 111 is inserted into the groove portion 102 and the bobbin thread 112 is engaged with the catching portion.

A slit-shaped thread scooping portion 104 is formed on a tip of a clamp member 103 and a thread can be scooped by the thread scooping portion 104. Moreover, the clamp member 103 is provided with a clamp portion 105 so as to be protruded toward the moving knife 101 side. The bobbin thread 112 can be interposed between the clamp portion 105 and the moving knife 101.

With such structure, it is possible to enhance reliability when catching the bobbin thread 112.

[0003] However, the bobbin thread is engaged with the catching portion in a stretching state. Therefore, the bobbin thread is stretched and extended by cutting, and the bobbin thread tries to be returned into an original state and is thus contracted. The bobbin thread slips from the thread scooping portion of the clamp member and is thus removed from the moving knife completely by a power for the return.

It is also possible to propose a regulation of a length of the thread scooping portion, that is, a length of a forked slit, thereby preventing the slip of the bobbin thread. However, it is also necessary to exchange the clamp member every time the bobbin thread to be used for a sewing work is varied. Therefore, the number of components is increased and a working efficiency is reduced.

[0004] It is an object of the present invention to provide a thread cutting device for a sewing machine which can suppress a removal of a bobbin thread from a moving

knife, thereby preventing an increase in the number of components and a reduction in a working efficiency.

[0005] According to a first aspect of the present invention, a thread cutting device for a sewing machine includes:

a cutting knife including a cutting edge and serving to carry out a rotation to an initial position and a thread cutting position advanced from the initial position to a stitch point side;

a moving knife rotated to the initial position, a thread catching position advanced from the initial position and the thread cutting position retreated from the thread catching position in order and serving to cut a bobbin thread and a needle thread in cooperation with the cutting knife in the thread cutting position; and

a clamp member for interposing and holding the bobbin thread between the clamp member and the moving knife by an elastic force applied through an elastic deformation, the clamp member including a first interposing portion for interposing the bobbin thread between the first interposing portion and the moving knife when the moving knife is returned from the thread cutting position to the initial position,

characterized in that the moving knife includes a catching portion for catching the bobbin thread in the thread catching position,

wherein the clamp member includes a second interposing portion for interposing the bobbin thread in abutment on a first abutting portion provided on a tip side of the moving knife from the catching portion when the moving knife is placed in the thread cutting position, and

wherein the bobbin thread interposed by the second interposing portion in the thread cutting position is transferred to the first interposing portion and is held by the first interposing portion with a movement of the moving knife to the initial position.

[0006] According to a second aspect of the present invention, the moving knife includes one of ends linked to the catching portion and the other end placed on a tip end side of the moving knife from the one of the ends in an inner side face of the moving knife opposed to the clamp member.

[0007] According to a third aspect of the present invention, a depth of the guide groove is smaller than a thickness of the bobbin thread.

According to a fourth aspect of the present invention, the guide groove is formed in a longitudinal direction of the moving knife between the thread catching portion and a second abutting portion which is provided on the moving knife and abuts on a tip end of the clamp member when the moving knife is placed in the initial position.

[0008] According to the first aspect of the present invention, in the case in which the moving knife is placed in the thread cutting position, the bobbin thread engaged with the catching portion is always pressed by the second

interposing portion of the clamp member and is thus interposed between the second interposing portion and the moving knife. Therefore, it is not necessary to carry out an exchange for a corresponding clamp member every change in a thickness of the bobbin thread.

Moreover, the bobbin thread interposed by the second interposing portion in the thread cutting position is transferred to the first interposing portion and is held therein with the movement of the moving knife to the initial position. Therefore, a seam is formed more reliably at a start of a sewing work.

Furthermore, it is possible to prevent an increase in the number of components and a reduction in a working efficiency.

[0009] According to the second aspect of the present invention, the guide groove is provided. Even if the moving knife is moved, therefore, the bobbin thread is fitted in the guide groove and is thus removed from the moving knife with difficulty. Accordingly, the bobbin thread can be held by the clamp member more reliably.

[0010] According to the third aspect of the present invention, the depth of the guide groove is smaller than the thickness of the bobbin thread. Therefore, the bobbin thread is protruded from the guide groove. Therefore, the bobbin thread is pressed against the clamp member. Consequently, the bobbin thread can be interposed by the clamp member.

According to the fourth aspect of the present invention, it is possible to prevent the bobbin thread from being removed from the moving knife and to guide the bobbin thread along the guide groove in the movement of the moving knife.

[0011] The following description of a preferred embodiment of the present invention serves to explain the invention in greater detail in conjoint with the drawings. These show:

Fig. 1: a perspective view showing a schematic structure of a thread cutting device provided in a sewing machine;

Fig. 2: a side view showing a shuttle mechanism provided in the sewing machine;

Fig. 3: a perspective view showing a structure of a main part in the thread cutting device;

Fig. 4: a perspective view showing a schematic structure of a periphery of a cutting knife;

Fig. 5: a perspective view showing a schematic structure of a periphery of a moving knife;

Fig. 6: a plan view showing an operation (an initial position) of the thread cutting device;

Fig. 7: a plan view showing the operation (a knife waiting position) of the thread cutting device;

Fig. 8: a plan view showing the operation (a thread catching position) of the thread cutting device;

Fig. 9: a plan view showing the operation (a thread cutting position) of the thread cutting device;

Fig. 10: a side view showing a thread guide;

Fig. 11: a perspective view showing the thread guide;

Fig. 12: a plan view showing the thread guide;

Fig. 13: a perspective view showing a thread catching operation through the moving knife (a needle thread relief portion);

Fig. 14: an explanatory view showing a thread interposing operation (when cutting) through the moving knife and a clamp spring;

Fig. 15: an explanatory view showing the thread catching operation (after cutting) through the moving knife and the clamp spring;

Fig. 16: a perspective view showing a tip portion of the moving knife;

Fig. 17: an explanatory view showing the thread catching operation through the moving knife;

Fig. 18: a side view showing a guide groove formed on the moving knife;

Fig. 19: a plan view showing a positional relationship with the clamp spring in the case in which the moving knife is placed in the thread cutting position;

Fig. 20: a plan view showing the positional relationship with the clamp spring in the case in which the moving knife is placed in the initial position; and

Fig. 21: an explanatory view showing a thread interposing operation (when cutting) through a moving knife and a clamp spring in a thread cutting device provided in a conventional sewing machine.

[0012] An embodiment of a sewing machine according to the present invention will be described below in detail with reference to the drawings.

<Structure of Sewing Machine>

[0013] In the embodiment, description will be given by taking a union-feed sewing machine as an example of a sewing machine. The union-feed sewing machine (hereinafter referred to as a sewing machine) serves to synchronize a needle feeding operation with a feeding operation carried out by an upper feeding mechanism and a lower feeding mechanism, thereby performing a feed with a needle stuck into a thick workpiece (for example, a leather article) in order to prevent a shift of the workpiece with the feeding operation, for example. The needle feeding operation serves to synchronize a vertical motion of a needle through a needle vertical moving mechanism with a needle oscillation through a needle oscillating mechanism.

The sewing machine includes a sewing machine frame serving as a housing, a needle driving mechanism for giving a reciprocating vertical motion and a needle oscillating operation to the needle at a tip of an arm portion of the sewing machine frame, a shuttle mechanism 1 (see Fig. 2) for forming a seam in cooperation with the needle driving mechanism, and a thread cutting device 100 (see Fig. 1) for cutting a needle thread and a bobbin thread after an end of a sewing work. Although the sewing machine includes other various mechanisms which are required for the sewing work, they will not be described

in detail in the embodiment because they have the same structures as the conventionally well-known structures.

<Sewing Machine Frame>

[0014] The sewing machine frame includes a bed portion (a sewing machine bed) having a horizontal bed face for mounting a cloth to be a workpiece thereon, a vertical drum portion erected upward from one of ends of the bed portion, and an arm portion (a sewing machine arm) extended in almost parallel with the bed portion from an upper part of the vertical drum portion. The sewing machine frame takes a well-known almost U shape as seen from a front side. The needle driving mechanism is provided in the tip of the arm portion, and the shuttle mechanism 1 and the thread cutting device 100 are provided in the bed portion.

<Needle Driving Mechanism>

[0015] The needle driving mechanism includes an upper shaft to be a sewing machine main shaft (not shown) which is extended rotatably in the arm portion and is coupled to a sewing machine motor, a rotating weight fixed to a tip of the upper shaft, a crank rod having an upper end coupled rotatably to an eccentric portion of the rotating weight, a needle bar coupled to a lower end of the crank rod, and a needle supported on the lower end. When the upper shaft is rotated by a driving operation of the sewing machine motor, a rotation of the upper shaft is converted into a vertical motion through the rotating weight and the crank rod, and furthermore, the rotation is converted into an oscillating motion through a needle oscillating mechanism which is not shown and the oscillating motion is transmitted to the needle bar. Consequently, the needle bar carries out a needle feeding operation obtained by combining a reciprocating vertical motion and a needle oscillation, thereby feeding a cloth in a feeding direction in synchronization with a feed dog (not shown) in a downward movement of the needle. In the embodiment, the needle carries out a stitch toward an inner part of an eye of the feed dog through the reciprocating vertical motion of the needle bar so that a stitch point and a stitch point core to be a center thereof are positioned on an inside of the eye.

<Shuttle Mechanism>

[0016] As shown in Figs. 1 and 2, the shuttle mechanism 1 includes a shuttle shaft table 10 of which position can be adjusted in a horizontal direction and which is fixed into the bed portion, a shuttle shaft 11 supported in a Z-axis direction (a vertical direction of the sewing machine) in the shuttle shaft table 10, and a horizontal shuttle 12 attached to a tip of the shuttle shaft 11 and rotated with a rotation of the shuttle shaft 11. The shuttle shaft 11 is provided on the shuttle shaft table 10 rotatably around a shaft center of the shuttle shaft 11.

The horizontal shuttle 12 includes an outer shuttle 13 which is pivoted on the shuttle shaft 11 and is thus supported rotatably in a horizontal face, and a middle shuttle 14 supported rotatably in the outer shuttle 13.

5 A hook is formed on the outer shuttle 13 and can scoop a needle thread loop formed below a throat plate 15 through a rotation of the outer shuttle 13 when the needle is moved upward from a bottom dead center.

A bobbin having a bobbin thread wound therearound is provided into the middle shuttle 14. A part of an outer peripheral edge of an upper portion in the middle shuttle 14 is provided with a middle shuttle protruded portion 14a for controlling a rotation of the middle shuttle 14 in engagement with a middle shuttle guide 15a disposed on a lower face of the throat plate 15.

10 When the lower shaft is rotated interlockingly with the upper shaft, the shuttle shaft 11 and the outer shuttle 13 are rotated so that a seam is formed in cooperation of the rotated outer shuttle 13 with the needle carrying out a vertical motion.

<Thread Cutting Device>

[0017] As shown in Figs. 1, 3 and 4, the thread cutting device 100 includes a cutting knife 2 for cutting a thread, a moving knife 3 for catching the thread and cutting the thread in cooperation with the cutting knife 2, and a clamp spring 4 fixed to the shuttle shaft table 10 and capable of holding a bobbin thread T2 obtained after the cutting operation.

(Cutting Knife)

[0018] As shown in Fig. 4, the cutting knife 2 has a cutting edge 2a on a tip (one of ends) thereof and is attached to one of ends of a cutting knife table 21 with a base end (the other end) removable by a screw. In the cutting knife table 21, a support portion 21a provided on a tip thereof is extended to the vicinity of a bottom of the cutting knife 2.

The other end of the cutting knife table 21 is fixed to an upper end of a cutting knife shaft 22 which is hollow. The cutting knife shaft 22 is supported on the shuttle shaft table 10 rotatably.

45 As shown in Fig. 3, a moving knife shaft 31 to be a rotating center of the moving knife 3 is inserted in the cutting knife shaft 22 rotatably in a Z-axis direction. In other words, the cutting knife 2 and the moving knife 3 are disposed on a reverse side to a stitch point with rotating centers thereof interposing a rotating center of the outer shuttle 13 therebetween.

A cutting knife driving arm 23 has one of ends surrounded and fixed to a lower end of the cutting knife shaft 22.

50 A cylinder coupling member 7 attached to a rod 6a of an air cylinder 6 fixed to the shuttle shaft table 10 is coupled to the other end of the cutting knife driving arm 23 through a step screw 8. When the rod 6a is moved in a direction of an arrow A1 or B1 shown in Fig. 3, the cutting knife

table 21 is oscillated around the cutting knife shaft 22 so that the cutting knife 2 provided on a tip thereof is moved in a direction of an arrow A2 or B2.

At this time, the cutting knife 2 can be moved to an initial position (see Fig. 6) and a thread cutting position (see Fig. 9) advanced from the initial position to a stitch point P side.

When the cutting knife 2 is moved to the thread cutting position through a driving operation of the air cylinder 6, the cutting edge 2a to be the tip is extended to the vicinity of the stitch point P below the throat plate 15 (see Fig. 9). The driving operation of the air cylinder 6 is controlled by a control device provided in the sewing machine.

[0019] As shown in Figs. 10 to 12, a thread guide 25 is removably attached to the vicinity of the cutting edge 2a of the cutting knife 2 with a screw. The thread guide 25 serves to prevent a needle thread T1 and the bobbin thread T2 from being cut in positions other than the thread cutting position. The thread guide 25 is attached to the cutting knife 2 from an opposite side to the moving knife 3 with the cutting knife 2 interposed therebetween, and has one end side (a right side in Figs. 10 and 11) which is bent toward the moving knife 3 so as to cover the whole cutting edge 2a of the cutting knife 2 and is extended to a forward side (the right side in Figs. 10 and 11) from the cutting edge 2a. The one end side of the thread guide 25 is extended with an upper end further extended along an outside face of the moving knife 3 (see Figs. 10 and 11) and forms a thread hooking portion 25a for preventing the needle thread T1 and the bobbin thread T2 to be sewn onto a cloth from a thread catching portion 3d via an eye 26b of a feed dog 26 from coming in contact with an edge 3e on an upper side of a groove portion of a needle and bobbin thread relief portion 3b. In other words, the thread guide 25 can hook the needle thread T1 and the bobbin thread T2 in the vicinity of a tip of the cutting edge 2a of the cutting knife 2 and guides the needle thread T1 and the bobbin thread T2 which are caught by the moving knife 3 in the thread catching position so as not to come in contact with the edge 3e, thereby preventing the needle thread T1 and the bobbin thread T2 from being guided to a portion between the edge 3e and the cutting edge 2a of the cutting knife 2.

(Moving Knife)

[0020] As shown in Fig. 5, the moving knife 3 has a base end (one of ends) attached to a moving knife table 30 removably with a screw. The moving knife 3 is extended in a horizontal direction with a middle part thereof having a curved portion, and a tip portion (the other end) thereof is caused to take a sharp shape.

The moving knife 3 is provided oscillatably around the moving knife shaft 31 in the directions of the arrows A2 and B2 and avoids an upper part of the middle shuttle 14 through the whole oscillating operation, and furthermore, the tip of the moving knife 3 passes through the stitch point P side from an outer periphery of the middle shuttle

14 (see Figs. 6 to 9). The moving knife 3 can pass through a space provided below the throat plate 15 and can be thus moved forward and backward.

As shown in Figs. 13 to 16, the thread catching portion 3d, a cutting edge 3c, the needle and bobbin thread relief portion 3b and a needle thread relief portion 3a are provided in the vicinity of the tip portion of the moving knife 3. The thread catching portion 3d serves as a catching portion for catching the bobbin thread T2 in a backward movement. The cutting edge 3c is provided on the tip side of the moving knife 3 and serves to cut the thread in cooperation with the cutting edge 2a of the cutting knife 2. The needle and bobbin thread relief portion 3b takes a shape of a groove and serves to relieve the needle thread T1 and the bobbin thread T2 from the thread catching position to the cutting portion at an outside face of the cutting edge 3c. The needle thread relief portion 3a serves to prevent the needle thread T1 cut in the thread cutting position from being held by the moving knife 3 and the clamp spring 4.

[0021] As shown in Fig. 13, the thread catching portion 3d is provided on an inner peripheral face side of the moving knife 3 which is curved in a horizontal face in the vicinity of the tip portion of the moving knife 3, that is, a lower end of a side face which is close to an outer periphery of the middle shuttle 14. The thread catching portion 3d is slightly protruded in a backward moving direction of the moving knife 3 which carries out the forward and backward movements, and the needle thread relief portion 3a is formed from the thread catching portion 3d to an upper face of the moving knife 3.

As shown in Fig. 13, the needle thread relief portion 3a serves as a retreating space in which only the needle thread T1 among the needle and bobbin threads T1 and T2 caught by the thread catching portion 3d in the thread catching position can be retreated, and can easily pull the needle thread T1 remaining on a needle side out upward from the cloth after the moving knife 3 is retreated to the thread cutting position and the needle thread T1 and the bobbin thread T2 are thus cut.

As shown in Figs. 10 to 12, 16 and 17, the needle and bobbin thread relief portion 3b is formed toward a tip side on the outer periphery of the moving knife 3 through a lower part of the moving knife 3 from the thread catching portion 3d. The needle and bobbin thread relief portion 3b serves as a retreating space in which the needle and bobbin threads T1 and T2 caught by the thread catching portion 3d can be retreated to an inside from the outside face of the moving knife 3. A boundary portion between an inner part of the groove portion of the needle and bobbin thread relief portion 3b and the outside face of the moving knife 3 serves as the edge 3e.

As shown in Figs. 10 to 12 and 16, the cutting edge 3c is provided on the outer peripheral face side in the vicinity of the tip portion of the moving knife 3 so as to be linked to the needle and bobbin thread relief portion 3b. The cutting edge 3c is formed to penetrate from the outside face of the moving knife 3 to an inside face thereof.

The cutting edge 3c serves to cut the needle thread T1 and the bobbin thread T2 in cooperation with the cutting edge 2a of the cutting knife 2 in the thread cutting position when the moving knife 3 is moved backward from the thread catching position in the forward and backward movements of the moving knife 3. As shown in Fig. 8, the cutting edge 3c has a moving track passing through the stitch point P of the needle.

[0022] As shown in Fig. 18, moreover, a guide groove 3g is formed on the inside face of the moving knife 3 which is opposed to the clamp member 4. The guide groove 3g has one of ends communicating with the thread catching portion 3d and the other end placed on the tip end side of the moving knife 3 from the one of the ends in the opposed face to the clamp spring 4.

More specifically, the guide groove 3g has one of the ends communicating with the needle thread relief portion 3a and the thread catching portion 3d and the other end communicating with a hole in a formation of the cutting edge 3c.

In other words, the guide groove 3g may be formed in an extending direction of the moving knife 3 between a portion communicating with the needle thread relief portion 3a and the thread catching portion 3d and a portion in which the tip of the clamp member 4 is provided in contact with the moving knife 3 when the moving knife 3 is placed in the initial position.

By setting the guide groove 3g, it is possible to prevent the bobbin thread T2 from being removed from the moving knife 3, and furthermore, to guide the bobbin thread T2 along the guide groove 3g in the movement of the moving knife 3.

The guide groove 3g is formed in such a manner that a depth thereof is smaller than a thickness of the bobbin thread T2 to be used for a sewing work. The reason is that the bobbin thread T2 is to be reliably interposed between the clamp member 4 and the moving knife 3 to prevent the bobbin thread T2 from slipping off by always protruding a part of the bobbin thread T2 from the guide groove 3g.

[0023] The moving knife 3 is rotated over the shuttle shaft table 1 and is thus moved to the initial position (see Fig. 6), the thread catching position (see Fig. 8) advanced from the initial position, and the thread cutting position (see Fig. 9) which is retreated from the thread cutting position, and cuts the needle thread T1 and the bobbin thread T2 in cooperation with the cutting knife 2 in the thread cutting position.

As shown in Fig. 5, the moving knife shaft 31 has a smaller diameter than that of the cutting knife shaft 22 and is longer than the cutting knife shaft 22, and vertically penetrates through the hollow cutting knife shaft 22 and is thus inserted rotatably. In other words, the cutting knife 2 and the moving knife 3 are supported on the shuttle shaft table 10 in a state in which each of the cutting knife 2 and the moving knife 3 is separately rotatable around a concentric axis by means of the cutting knife shaft 22 and the moving knife shaft 31 which have a double shaft

structure.

One of the ends of the moving knife table 30 is fixed to an upper end of the moving knife shaft 31 orthogonally to the moving knife shaft 31. The base end of the moving knife 3 is fixed to an upper part of the moving knife table 30 removably with a screw, and a moving knife driving pin 32 is protruded downward from a lower face of the other end of the moving knife table 30.

When the cutting knife 2 and the cutting knife table 21 are rotated in the direction of the arrow A2 by the driving operation of the air cylinder 6 so that one of ends of the cutting knife table 21 is caused to abut on the moving knife driving pin 32 provided on the moving knife table 30, the cutting knife 2 and the moving knife 3 are coupled to each other so that both of the cutting knife 2 and the moving knife 3 are rotated integrally in the direction of the arrow A2 (see Fig. 3). In other words, the moving knife 3 is oscillated around the moving knife shaft 31 in the direction of the arrow A2 with the oscillation of the cutting knife 2.

[0024] As shown in Figs. 3 and 5, moreover, one of ends of a moving knife driving arm 33 is fixed to a lower end of the moving knife shaft 31. The moving knife driving arm 33 is extended in a horizontal direction which is orthogonal to the moving knife shaft 31, and a cam roller 34 is rotatably coupled to a lower side of the other end of the moving knife shaft 33 through a cam roller shaft 35 provided in the Z-axis direction. After the rod 6a is moved in the direction of the arrow A1 by the driving operation of the air cylinder 6, the cam roller 34 is moved along a cam portion of a thread cutting cam 36 to oscillate the other end of the moving knife driving arm 33 in a direction of an arrow A3 or B3, thereby giving a rotating force to the moving knife shaft 31 and the moving knife 3. Then, the moving knife 3 is moved to the thread cutting position of the cutting knife 2 together with the cutting knife 2 by a driving force of the air cylinder 6, and thereafter, carries out a reciprocating movement to the thread catching position advanced from the initial position and the thread cutting position retreated from the thread catching position by the rotating force given from the thread cutting cam 36.

(Clamp Member)

[0025] As shown in Figs. 6 to 9, 13 to 15, 19 and 20, the clamp spring 4 to be a clamp member is formed by a metallic spring material which is elastically deformable, and has a base end fixed to an upper face of a clamp spring table 40 with a screw. The clamp spring table 40 is attached to the shuttle shaft table 10 so as to be disposed between the moving knife 3 and the cutting knife 2 in a vertical direction (the Z-axis direction).

A sliding contact portion 41 is formed on a tip side of the clamp spring 4. The sliding contact portion 41 is extended in the forward moving direction of the moving knife 3 along the inside face of the tip of the moving knife 3 and is bent to come in sliding contact with the inside face of

the moving knife 3.

As shown in Figs. 19 and 20, the sliding contact portion 41 presses the inside face of the tip of the moving knife 3 by its own elastic force and presses and holds the bobbin thread T2 caught by the thread catching portion 3d during at least a movement of the moving knife 3 from the thread cutting position to the initial position.

More specifically, as shown in Fig. 20, a first interposing portion 41a on a base end side of the sliding contact portion 41 interposes the bobbin thread T2 engaged with the thread catching portion 3d at a tip side from the thread catching portion 3d of the moving knife 3 when the moving knife 3 is placed in the initial position. As shown in Fig. 19, moreover, the second interposing portion 41b on a tip side of the sliding contact portion 41 interposes the bobbin thread T2 engaged with the thread catching portion 3d at the tip side from the thread catching portion 3d of the moving knife 3 when the moving knife 3 is placed in the thread cutting position.

In other words, a length of the sliding contact portion 41 in the moving direction of the moving knife 3 is set to be greater than a moving distance from the thread cutting position to the initial position in the moving knife 3. Furthermore, the sliding contact portion 41 is provided in a position in which a whole area of a moving range of the thread catching portion 3d in the movement of the moving knife 3 from the thread cutting position to the initial position can be covered. As a matter of course, the sliding contact portion 41 covers at least the whole area of the moving range of the thread catching portion 3d, and the sliding contact portion 41 may be set to have a greater size. The bobbin thread T2 held by the second interposing portion 41b in the thread cutting position is transferred to the first interposing portion 41a and is maintained therein with the movement of the moving knife 3 to the initial position. Therefore, a seam is formed more reliably at a start of a sewing work.

<Thread Cutting Operation>

[0026] During the sewing work, the rod 6a of the air cylinder 6 is protruded in the direction of the arrow B1 and the cylinder coupling member 7 is disposed in the initial position. For this reason, the cutting knife 2 and the moving knife 3 are brought into a state in which both of the cutting knife 2 and the moving knife 3 are disposed in the initial position to be a most retreating position in the direction of the arrow B2 (see Fig. 6).

When a thread cutting signal is input to a control portion by backward stepping of a sewing machine pedal, air is injected into the air cylinder 6 so that the rod 6a is moved in the direction of the arrow A1. Consequently, the cylinder coupling member 7 is moved in the direction of the arrow A1 so that the cutting knife table 21 is rotated in the direction of the arrow A2 through the cutting knife driving arm 23 and the cutting knife shaft 22 (see Fig. 4). When the sewing machine pedal is subjected to the backward stepping, furthermore, a sewing machine motor

starts a rotation.

When the cutting knife table 21 is rotated in the direction of the arrow A2, the cutting knife table 21 is engaged with the moving knife driving pin 32 fixed to the lower face of the moving knife table 30 so that the moving knife table 30 is also rotated in the direction of the arrow A2. By the rotation of the cutting knife 2 to the thread cutting position in the direction of the arrow A2, the moving knife driving arm 33 is rotated in the direction of the arrow A3 shown in Fig. 5 through the moving knife table 30 and the moving knife shaft 31 to bring a state in which the rotation of the cutting knife table 21 is once stopped. In the meantime, the moving knife 3 and the cutting knife 2 are maintained to stand by in the vicinity of the stitch point (see Fig. 7).

[0027] Then, the cam roller 34 is guided along the thread cutting cam 36 so that the moving knife driving arm 33 is oscillated in the direction of the arrow A3 and the moving knife 3 is further moved forward in the direction of the arrow A2. When the cam roller 34 is guided to a given position of the thread cutting cam 36, moreover, the cutting knife table 21 starts the rotation again. When a stopper bolt 27 attached to the cutting knife table 21 is engaged with a stopper plate 28, the rotation of the cutting knife table 21 is controlled so that the cutting knife 2 is disposed in the thread cutting position (see Fig. 7). In this state, the cutting edge 2a to be the tip of the cutting knife 2 is extended to the vicinity of the stitch point P placed below the throat plate 15.

At this time, as shown in Figs. 7 and 8, the tip of the moving knife 3 is moved to pass through a space provided below the throat plate 15 and the feed dog 26 at the stitch point P side from the middle shuttle protruded portion 14a and the middle shuttle guide 15a, and enters a triangle of the needle thread T1.

[0028] When the thread cutting cam 36 is further rotated so that the cam roller 34 is moved to a given position of the thread cutting cam 36, the moving knife 3 is returned to the thread catching position which is retreated slightly from a most advancing position shown in Fig. 8. Thereafter, the moving direction of the moving knife driving arm 33 is inverted into the direction of the arrow B3, and the needle and bobbin threads T1 and T2 are caught by the thread catching portion 3d of the moving knife 3 which is moved backward in the direction of the arrow B2 (see Figs. 13 and 17).

At this time, the needle thread T1 and the bobbin thread T2 are maintained to be hooked on the thread hooking portion 25a of the thread guide 25 at the outer peripheral side of the moving knife 3. At the inner peripheral side of the moving knife 3, moreover, the needle thread T1 is maintained to be retreated to the needle thread relief portion 3a of the moving knife 3 as shown in Figs. 13 and 17.

[0029] When the thread cutting cam 36 is further rotated, the moving knife 3 is moved backward to the thread cutting position (see Fig. 9). Then, the bobbin thread T2 is scooped by a thread scooping portion 4b (not shown) of the clamp spring 4, and thereafter, the needle thread T1 and the bobbin thread T2 are cut in cooperation of

the cutting edge 2a of the cutting knife 2 and the cutting edge 3c of the moving knife 3.

After the needle thread T1 and the bobbin thread T2 are cut, the needle thread T1 slips out of the needle thread relief portion 3a and is thus brought into a free state and the bobbin thread T2 is held by a bobbin thread clamp portion 4a (not shown) as shown in Fig. 15.

As shown in Fig. 9, when the moving knife 3 passes through the thread cutting position, the sewing machine motor is stopped by the control portion so that the needle is stopped in an upper position (an upper stopping position). At the same time, a thread cutting return signal is output from the control portion and the rod 6a of the air cylinder 6 is moved in the direction of the arrow B1 in response to the output signal. Consequently, the cutting knife 2 and the moving knife 3 are returned to the initial position shown in Fig. 6.

<Function and Effect>

[0030] According to the sewing machine 100, there is employed the structure in which at least a part of the clamp spring 4 abuts on the tip side of the moving knife 3 in place of the thread catching portion 3d when the moving knife 3 is placed in the thread cutting position. Therefore, the bobbin thread T2 engaged with the thread catching portion 3d after cutting the thread is always pressed by the clamp spring 4 and is interposed between the clamp spring 4 and the moving knife 3. In the section, furthermore, the bobbin thread T2 is always pressed by the clamp spring 4. For this reason, it is not necessary to carry out an exchange for the corresponding clamp spring 4 every change in the bobbin thread T2. Accordingly, it is possible to suppress a removal of the bobbin thread T2 from the moving knife 3 and to prevent an increase in the number of components and a reduction in a working efficiency.

[0031] Furthermore, the moving knife 3 has the guide groove 3g. Even if the moving knife 3 is moved, therefore, the bobbin thread T2 is fitted in the guide groove 3g and is thus removed from the moving knife 3 with difficulty. Accordingly, it is possible to hold the bobbin thread T2 through the clamp spring 4 more reliably.

[0032] Moreover, the depth of the guide groove 3g is smaller than the thickness of the bobbin thread T2. Therefore, the bobbin thread T2 is protruded from the guide groove 3g. For this reason, the bobbin thread T2 is pressed against the clamp spring 4. Consequently, the bobbin thread T2 can be interposed by the clamp spring 4.

In addition, changes can be properly made without varying the essential parts of the invention.

Claims

1. A thread cutting device for a sewing machine comprising:

a cutting knife including a cutting edge and serving to carry out a rotation to an initial position and a thread cutting position advanced from the initial position to a stitch point side;

a moving knife rotated to the initial position, a thread catching position advanced from the initial position and the thread cutting position retreated from the thread catching position in order and serving to cut a bobbin thread and a needle thread in cooperation with the cutting knife in the thread cutting position; and

a clamp member for interposing and holding the bobbin thread between the clamp member and the moving knife by an elastic force applied through an elastic deformation, the clamp member including a first interposing portion for interposing the bobbin thread between the first interposing portion and the moving knife when the moving knife is returned from the thread cutting position to the initial position,

characterized in that the moving knife includes a catching portion for catching the bobbin thread in the thread catching position,

wherein the clamp member includes a second interposing portion for interposing the bobbin thread in abutment on a first abutting portion provided on a tip side of the moving knife from the catching portion when the moving knife is placed in the thread cutting position, and

wherein the bobbin thread interposed by the second interposing portion in the thread cutting position is transferred to the first interposing portion and is held by the first interposing portion with a movement of the moving knife to the initial position.

2. The thread cutting device according to claim 1, wherein the moving knife includes one of ends linked to the catching portion and the other end placed on a tip end side of the moving knife from the one of the ends in an inner side face of the moving knife opposed to the clamp member.
3. The thread cutting device according to claim 2, wherein a depth of the guide groove is smaller than a thickness of the bobbin thread.
4. The thread cutting device according to claim 2 or 3, wherein the guide groove is formed in a longitudinal direction of the moving knife between the thread catching portion and a second abutting portion which is provided on the moving knife and abuts on a tip end of the clamp member when the moving knife is placed in the initial position.

Fig. 1

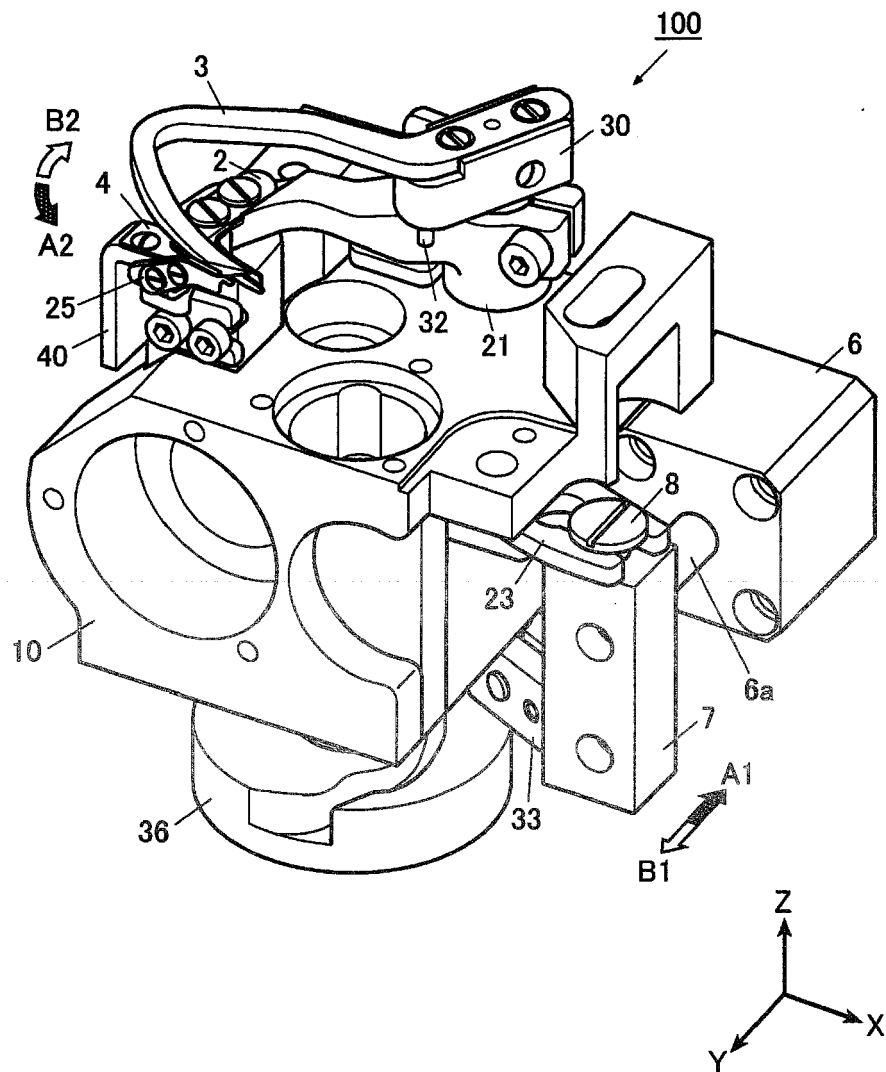


Fig. 2

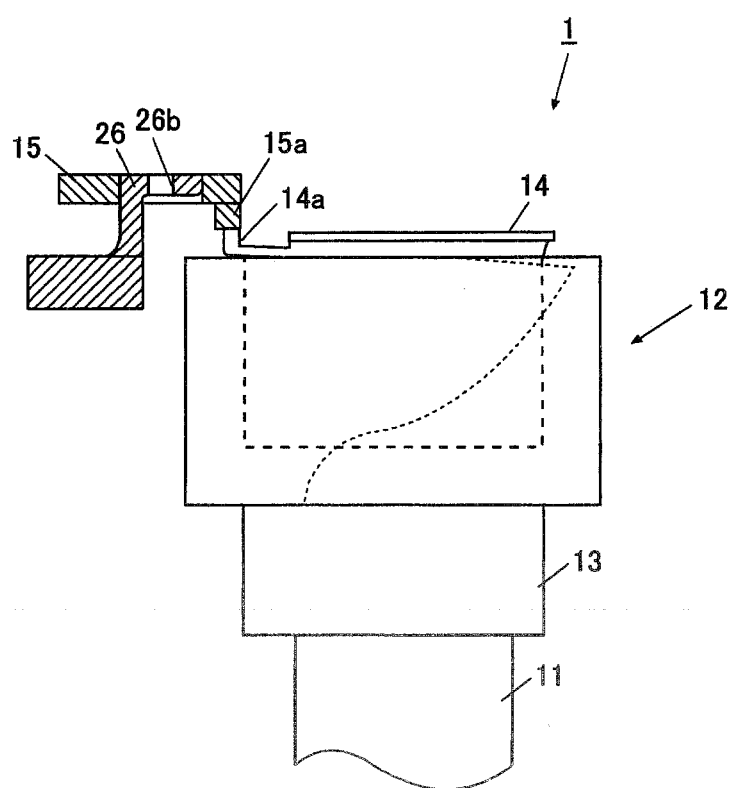


Fig. 3

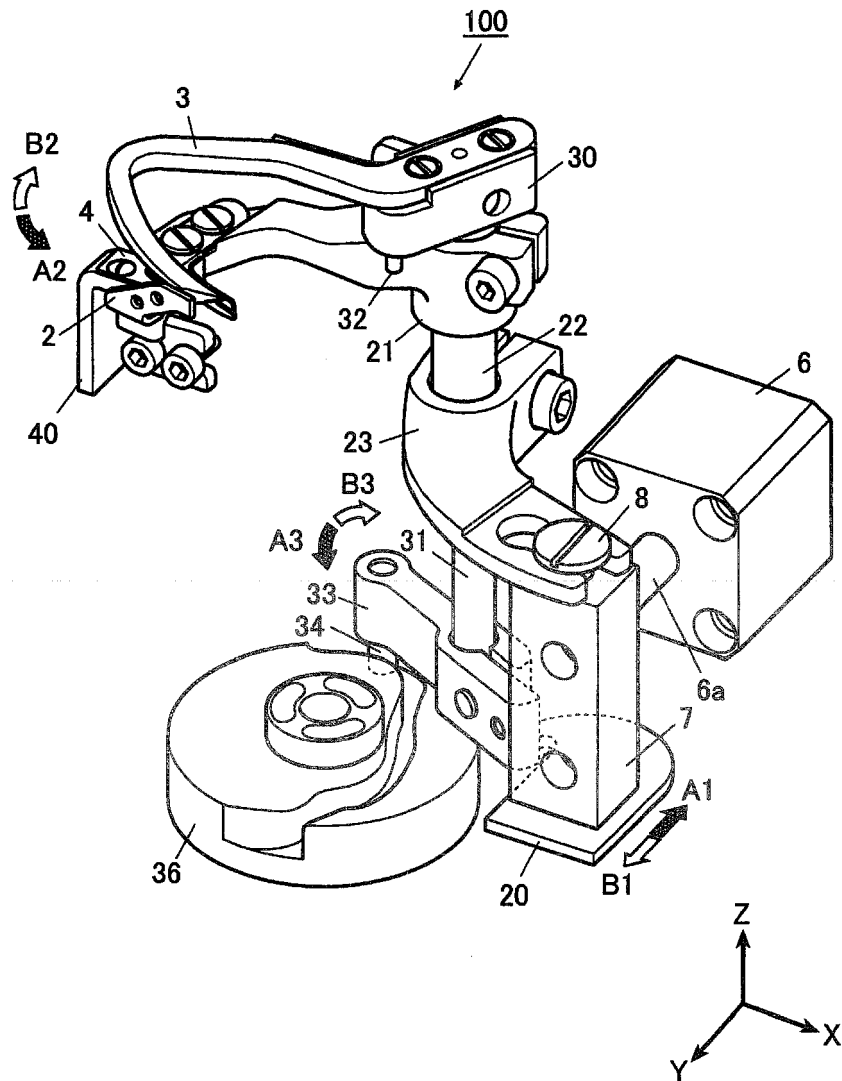


Fig. 4

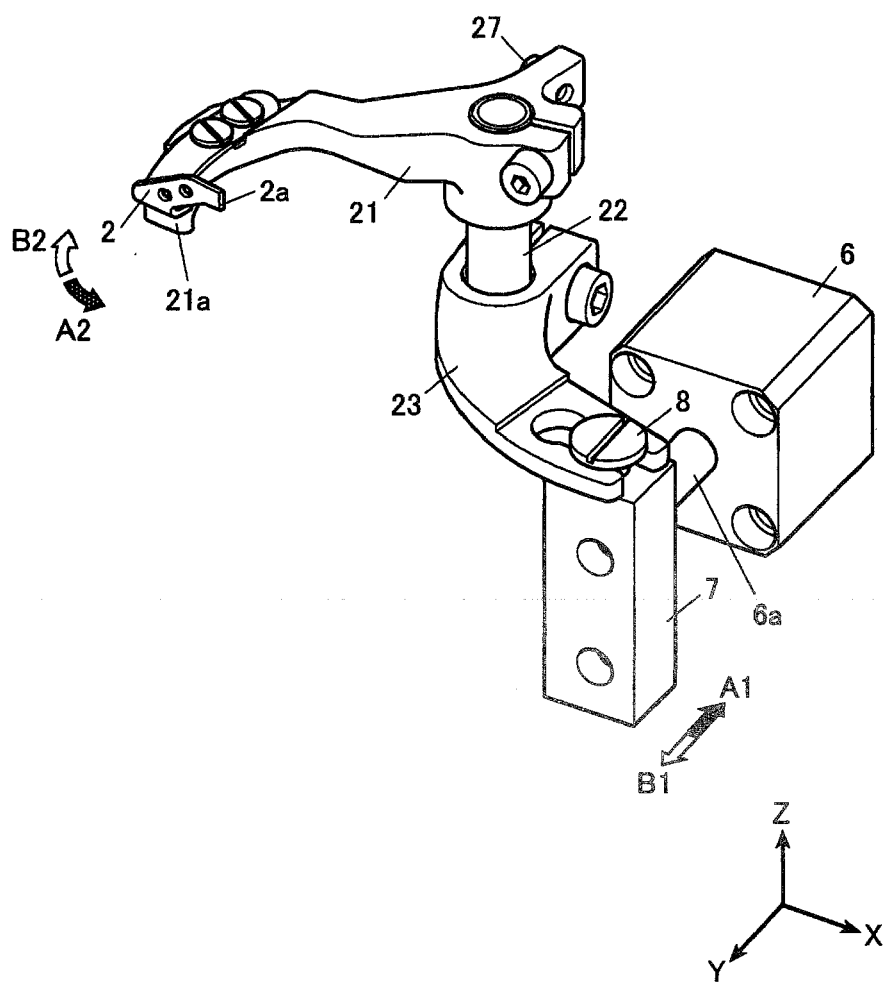


Fig. 5

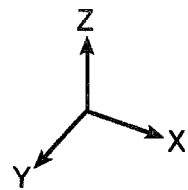
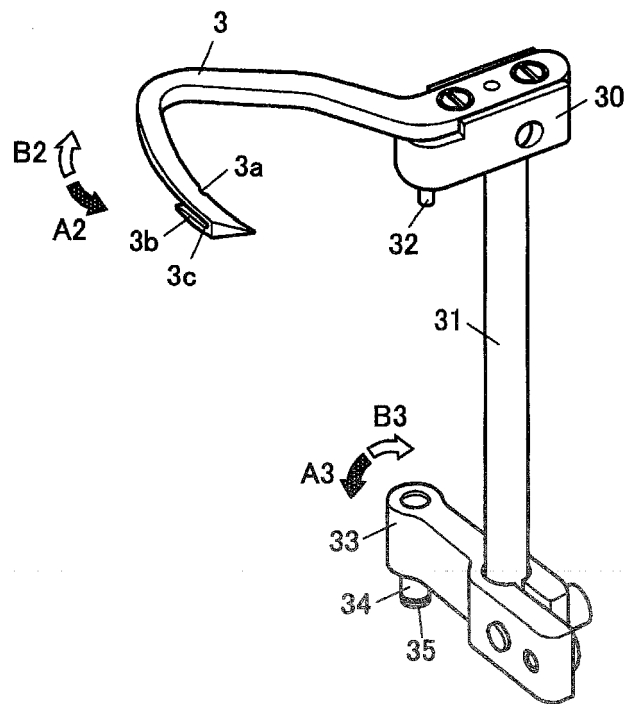


Fig. 6

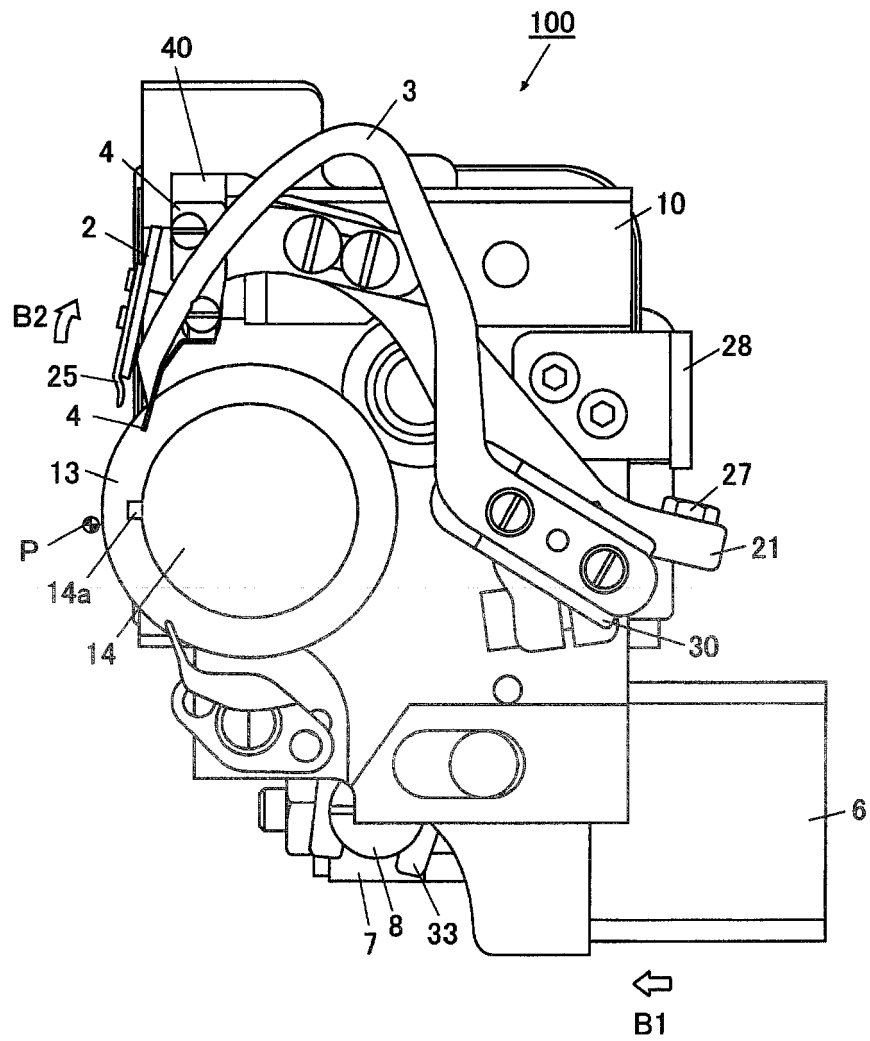


Fig. 7

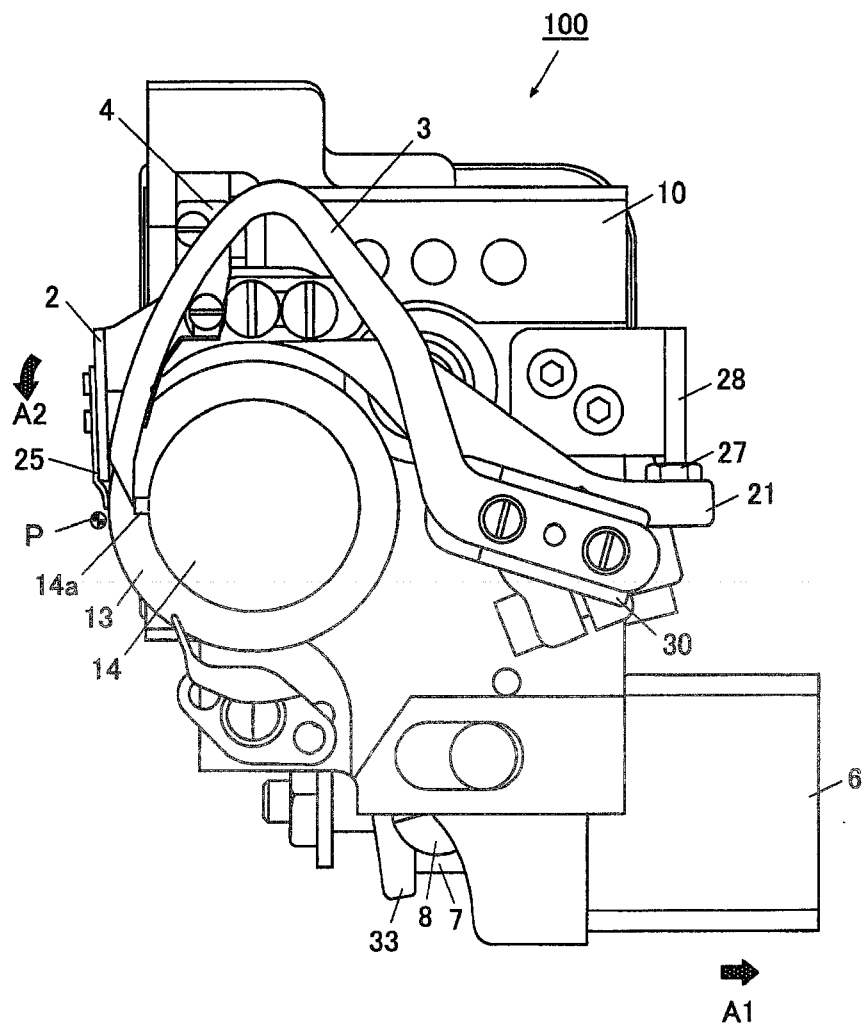


Fig. 8

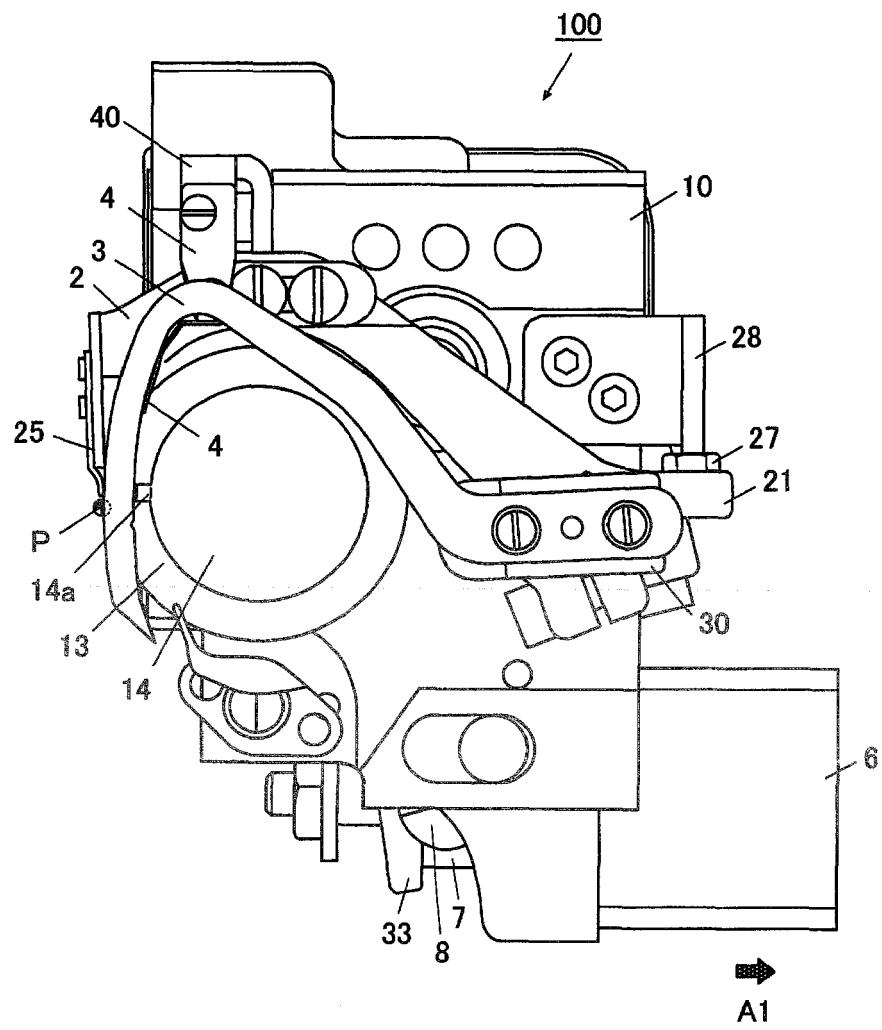


Fig. 9

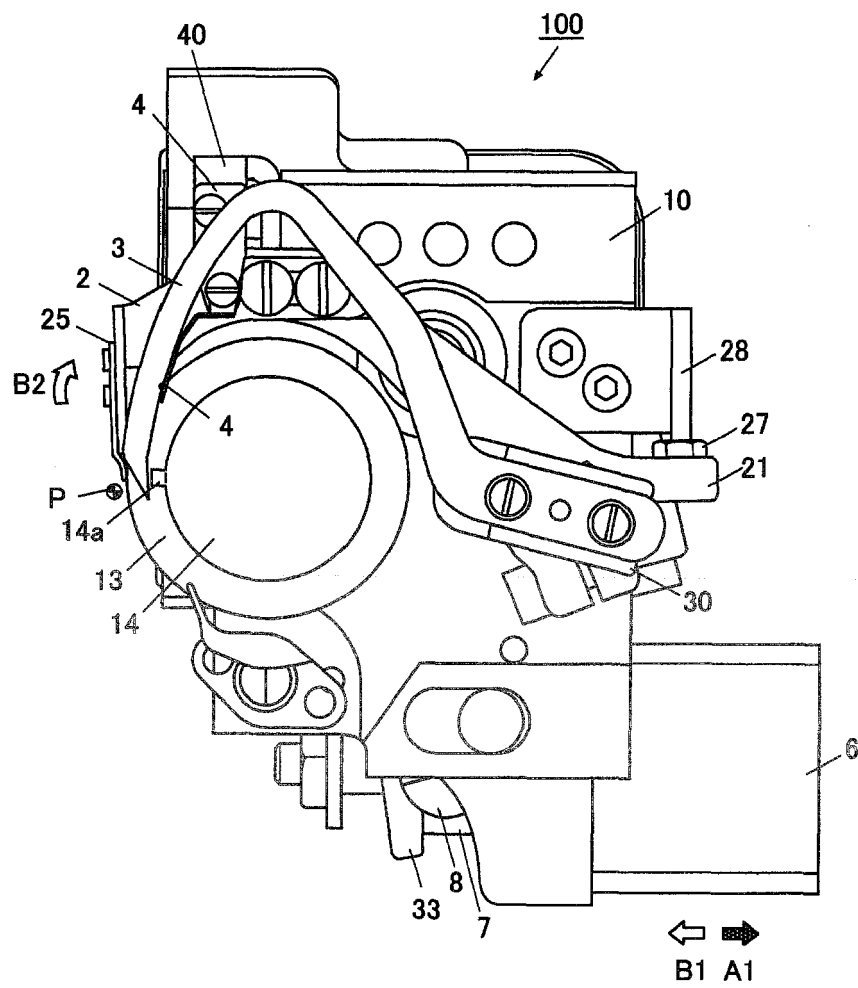


Fig. 10

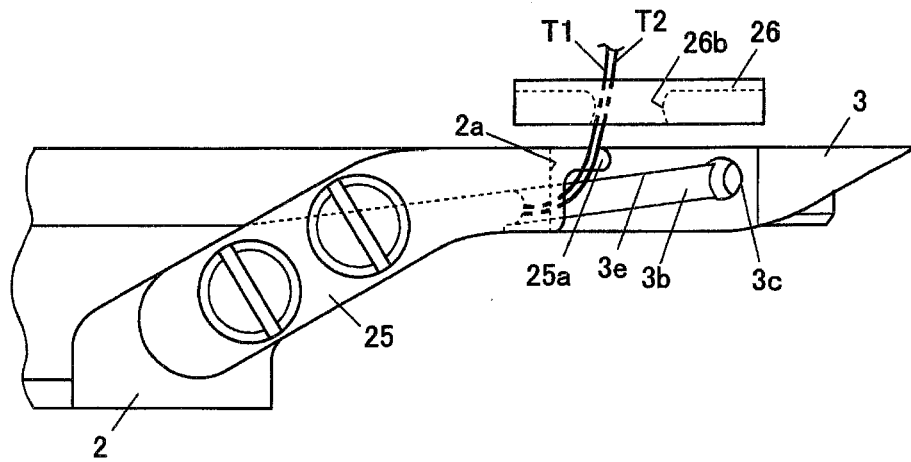


Fig. 11

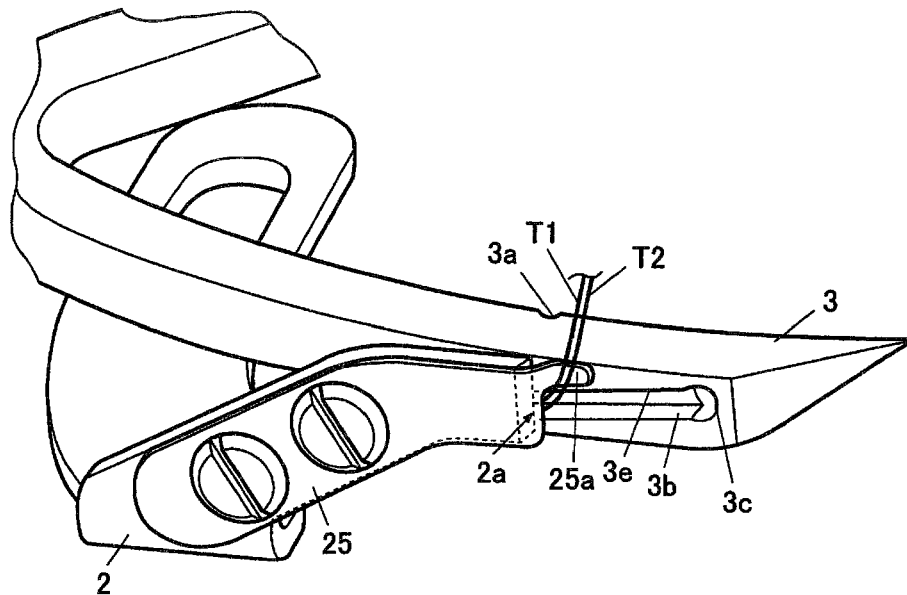


Fig. 12

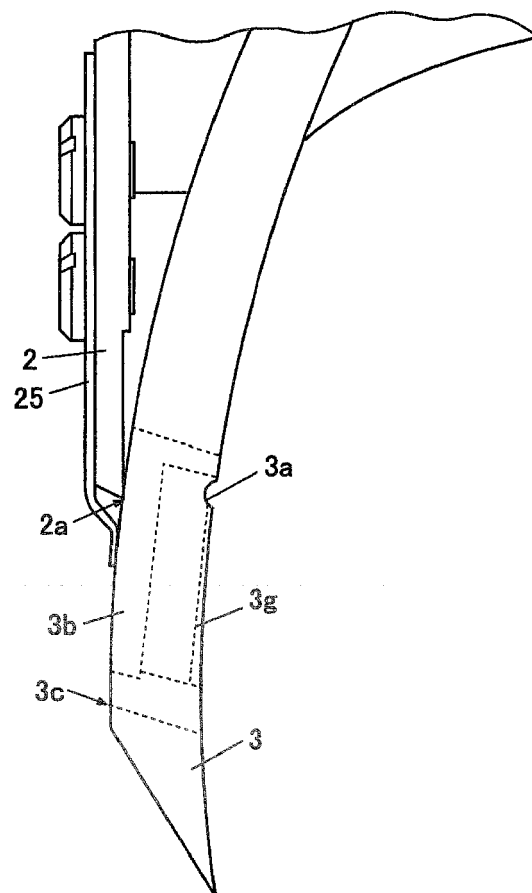


Fig. 13

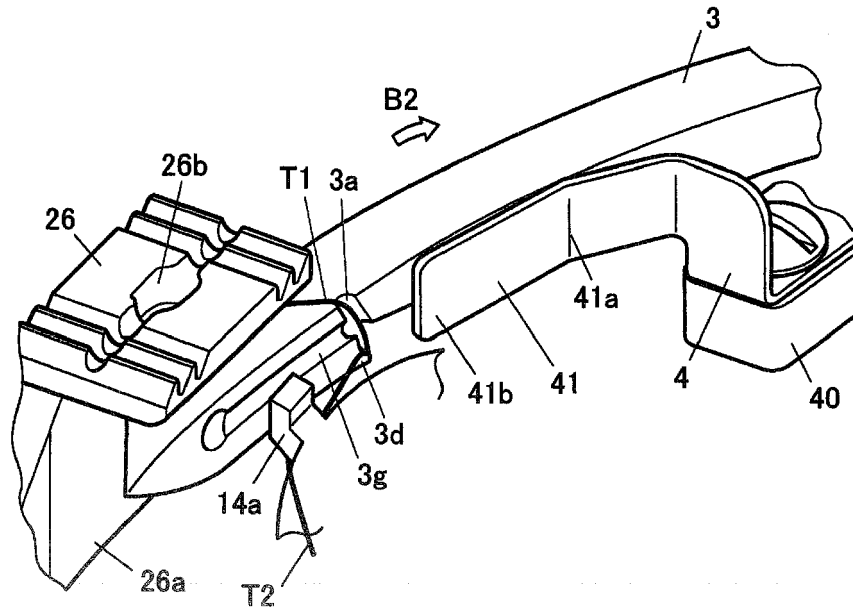


Fig. 14

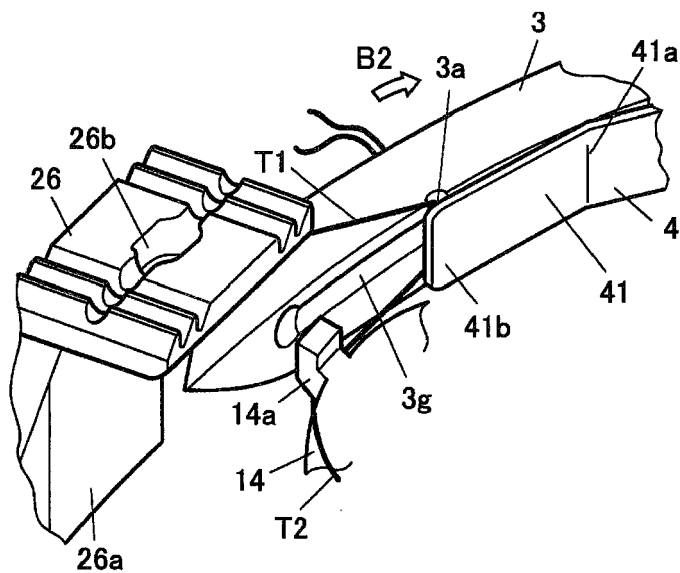


Fig. 15

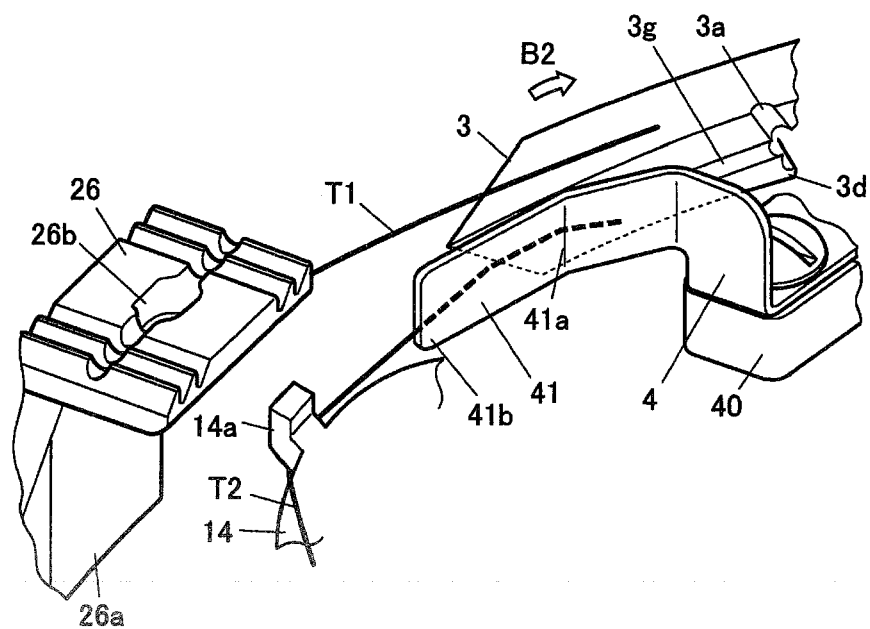


Fig. 16

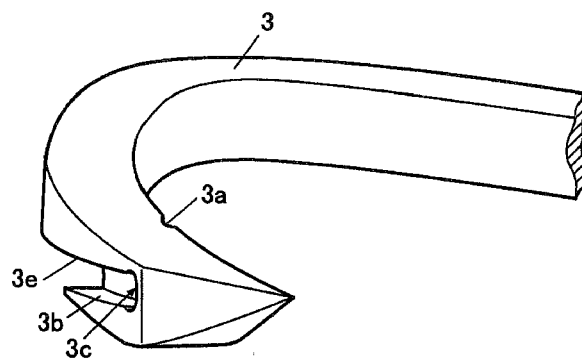


Fig. 17

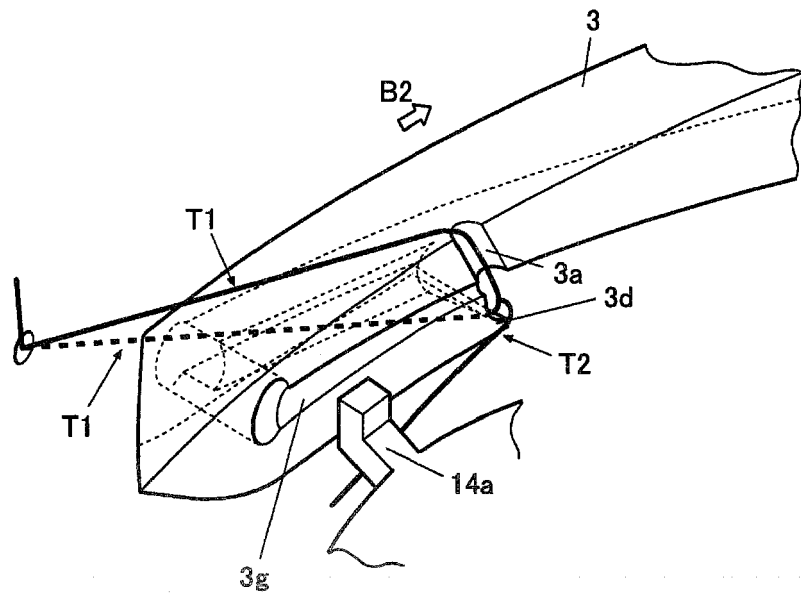


Fig. 18

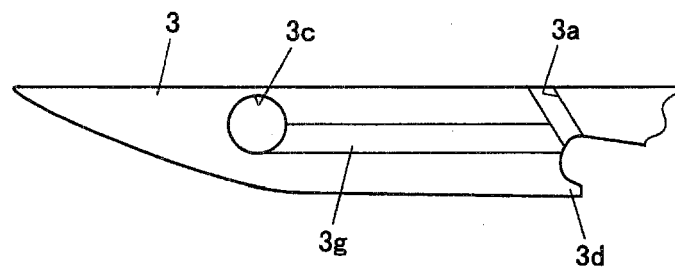


Fig. 19

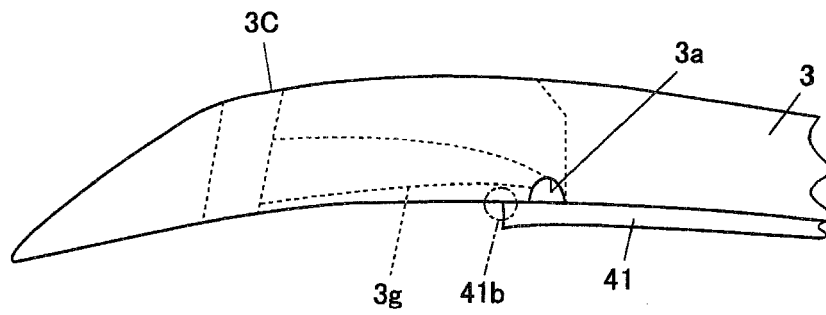


Fig. 20

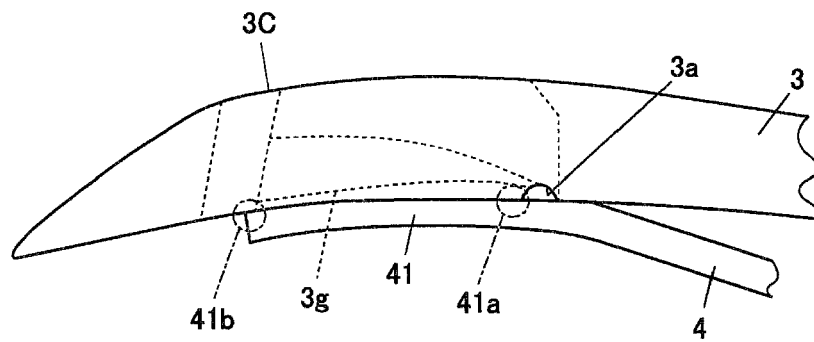
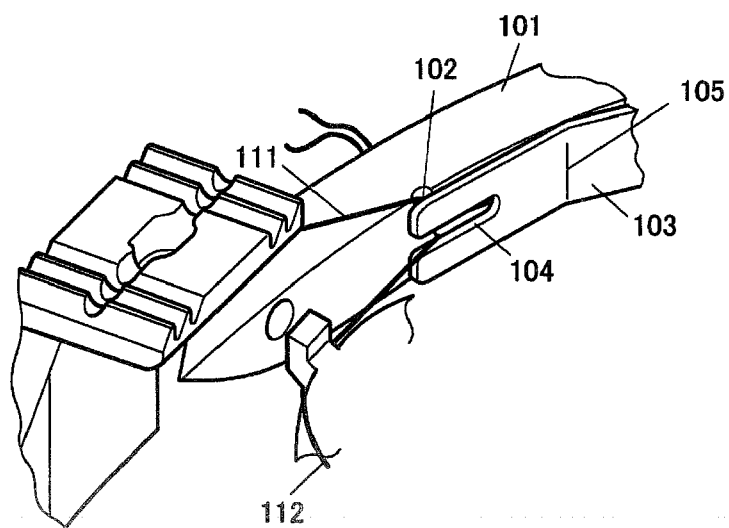


Fig. 21



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2008068005 A [0002]