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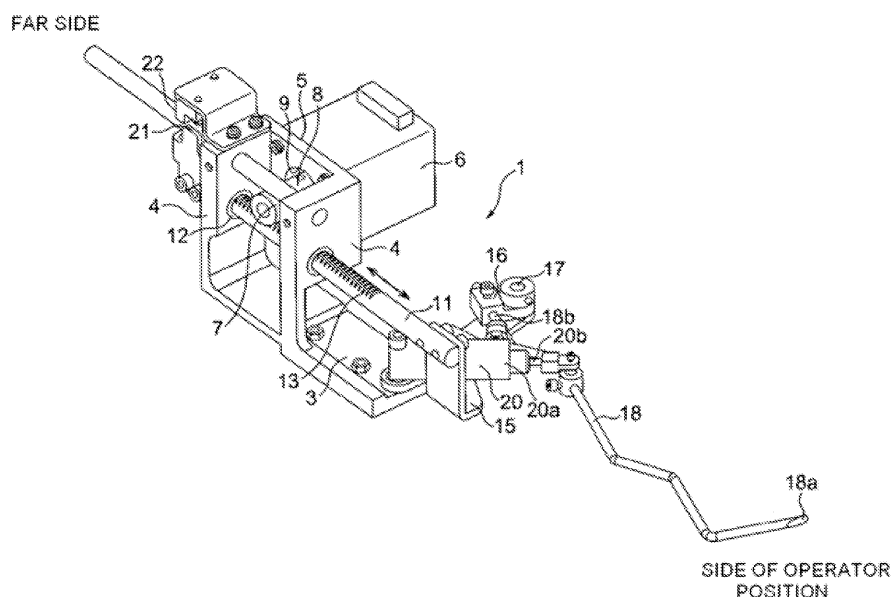
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(54) **Belt loop slackening apparatus**

(57) A belt loop slackening apparatus 1 includes: a moving member 11 disposed laterally of a main body of a sewing machine and movable reciprocatingly along a transporting direction of a member to be sewn in a sewing operation of the sewing machine; a drive cylinder 20 supported on the moving member such that the drive cylinder can be expanded and contracted; a slackening member 18 having one end supported on the drive cylinder, and the other end being movable forward and backward internally of the member to be sewn; a loop slackening

motor 6 connected to the moving member and capable of moving the slackening member along the transporting direction; input set means 35 for inputting a set value of a slackening amount of the member to be sewn; and drive control means 36 for controlling the loop slackening motor in such a manner that, when sewing the member to be sewn to a body cloth, in order to slacken the member to be sewn by a given amount, the slackening member can be moved to a folded position of the slackening member according to the set value.

Fig. 1



Description

Technical Field

[0001] The present invention relates to a belt loop slackening apparatus for use in a sewing operation of an industrial sewing machine.

Background Art

[0002] Conventionally, there is known such a sewing machine as shown in Fig. 11 which is designed such that three bartacks are formed in a body cloth such as a waist band of trousers.

[0003] To sew a belt loop having such specifications as shown in Fig. 11, firstly, as shown in Fig. 12 (1), there is formed a first bartack X in a longitudinal-direction one end portion of a tape member T which is to be delivered from a belt loop tape member transporting apparatus (not shown) such that the tape member T has been cut to a long and narrow dimension, and the tape member T is then sewn to a member to be sewn. Next, as shown in Fig. 12 (2), the other end of the tape member T is clamped by a loop clamp (not shown) serving as a tape member supply apparatus and the tape member T is folded in such a manner that it covers the first bartack X; and, after then, there is formed a second bartack Y at a position distant by a given distance from the first bartack X. Further, as shown in Fig. 12 (3), the tape member T is folded by the loop clamp in such a manner that the other end of the tape member T goes beyond the first bartack X, and there is formed a third bartack Z in the other end of the tape member T.

[0004] And, when folding the tape member T after the second bartack Y is formed, a slackening member S for slackening the belt loop is situated on the upper surface of the tape member T of the second bartack Y, and the tape member T is folded in such a manner that the tape member T winds around the slackening member S; and, after then, the slackening member S is moved together with a feed member included in a member-to-be-sewn transporting mechanism, whereby the thus sewn belt loop can be slackened to a proper degree.

[0005] The slackening member S is carried on the member-to-be-sewn transporting mechanism in such a manner that the slackening member S can be moved in forward and backward directions between a near side and a far side of an operator position of a machine main body due to the operation of a transporting cylinder included in the member-to-be-sewn transporting mechanism.

[0006] Here, conventionally, when the slackening amount of the belt loop is adjusted, there is employed a method in which the position of the slackening member is moved along a moving passage of the feed member while visually confirming a scale or the like cut formed in the sewing machine, thereby adjusting the slackening amount. Therefore, it takes time to adjust the slackening

amount of the belt loop; and, even in belt loops having the same specifications, the sewn belt loops are easy to be finished differently each time the sewn belt loops are set on the sewing machine or according to the adjusting degrees of the slackening amount by the operator, and the possibility of reproduction of the slackening amount is also low.

[0007] Also, as described above, since the slackening member is carried on the feed member and is situated near to the set position of the member to be sewn, the slackening member provides an obstacle when setting the member to be sewn, thereby raising a problem that the efficiency of the setting operation of the member to be sewn can be worsened.

Disclosure of the Invention

[0008] The invention aims at solving the above problems. Thus, it is an object of the invention to provide a belt loop slackening apparatus for use in a sewing machine which can facilitate the setting of the slackening amount and also cannot provide any obstacle to the operation of an operator when the operator sets a member to be sewn on the sewing machine, thereby being able to enhance the productivity and operation efficiency of the belt loop slackening apparatus.

[0009] In attaining the above object, according to the invention as set forth in Claim 1, there is provided a belt loop slackening apparatus, comprising: a moving member (11) disposed laterally of a main body of a sewing machine and movable reciprocatingly along a transporting direction of a member to be sewn in a sewing operation of the sewing machine; a drive cylinder (20) which is supported on the moving member and which is extendible and retractable; a slackening member (18) having one end supported on the drive cylinder, and the other end being movable forward and backward internally of the member to be sewn; a loop slackening motor (6) connected to the moving member and capable of moving the slackening member along the transporting direction; input set means (35) for inputting a set value of a slackening amount of the member to be sewn; and drive control means (36) for controlling the loop slackening motor in such a manner that, when sewing the member to be sewn to a body cloth, in order to form a given amount of slackening in the member to be sewn, the slackening member can be moved to a folded position of the slackening member according to the set value.

According to the invention as set forth in Claim 2, in addition to the invention as set forth in Claim 1, there are further included a moving base (15) fixed to the moving member, and a support member (16) supported such that the support member can be rotated on a horizontal surface of the moving base, wherein the other end of the slackening member is supported on the support member and, by driving the drive cylinder, the slackening member can be moved to the folded position where the slackening member is engaged with the member to be sewn.

According to the invention as set forth in Claim 3, in addition to the invention as set forth in Claim 1 or 2, there are further included a clamp member (33) for clamping the member to be sewn and, being movable along a horizontal plane, hold members (31, 34) for holding the body cloth to which the member to be sewn is to be sewn, and a transporting motor (32) for moving the hold members along the transporting direction of the member to be sewn, wherein the drive control means, after first and second bartacks are formed by driving a sewing machine needle, according to the set value, moves the slackening member to the folded position and, after then, moves the loop slackening motor and the transporting motor by a given amount in the same direction to thereby form a third bartack.

According to the invention as set forth in Claim 4, in addition to the invention as set forth in any one of Claims, there is further included initial point position detect means (21, 22) respectively for detecting an initial point position of the moving member, wherein according to a detect value of the initial point position detect means and the set value of the input means, the loop slackening motor is controlled so as to be able to move the slackening member to the folded position.

[0010] As has been described above, according to the invention, the setting of the slackening amount can be facilitated. Also, when setting the body cloth, a member to be sewn or the like on a sewing machine, the slackening member and the like can be made to retreat to a position where it cannot interfere with the operation of the operator. Therefore, the productivity and operation efficiency of the belt loop slackening apparatus can be enhanced, data can be managed according to the specifications of the belt loop, the possibility of the reproduction of the adjusting value of the slackening amount can be enhanced, and the quality of the product can be stabilized.

Brief Description of the Drawings

[0011]

Fig. 1 is a perspective view of the whole of a belt loop slackening apparatus according to the present embodiment.

Fig. 2 is a block diagram of the control system of the belt loop slackening apparatus according to the present embodiment.

Fig. 3 is an explanatory view of the driving operation of the belt loop slackening apparatus according to the present embodiment (1).

Fig. 4 is an explanatory view of the driving operation of the belt loop slackening apparatus according to the present embodiment (2).

Fig. 5 is an explanatory view of the driving operation of the belt loop slackening apparatus according to the present embodiment (3).

Fig. 6 is an explanatory view of the driving operation

of the belt loop slackening apparatus according to the present embodiment (4).

Fig. 7 is an explanatory view of the driving operation of the belt loop slackening apparatus according to the present embodiment (5).

Fig. 8 is an explanatory view of the driving operation of the belt loop slackening apparatus according to the present embodiment (6).

Fig. 9 is an explanatory view of the driving operation of the belt loop slackening apparatus according to the present embodiment (7).

Fig. 10 is a generally explanatory view of procedures (1) - (3) for forming a belt loop.

Fig. 11 is an explanatory view of a belt loop having the specifications in which three bartacks are formed.

Fig. 12 is a generally explanatory view of procedures (1) - (3) for forming a conventional belt loop.

20 Best Mode for Carrying Out the Invention

[0012] Now, description will be given below of an embodiment according to the invention with reference to Figs. 1 to 10. Here, in the following description, a side of an operator position with respect to a sewing machine main body 2 is referred to as a front, a far side of the main body of the sewing machine is referred to as a rear, and a direction going from the front to the rear is referred to as a front and rear direction. Also, a direction, which intersects with the front and rear direction in a horizontal plane, is referred to as a right and left direction. Further, a direction, which intersects with the front and rear direction and right and left direction, is referred to as a vertical direction.

Although not shown in the drawings, in the rear of the sewing machine main body 2 shown in Fig. 3, there is disposed the main body drive mechanism of a bartack sewing machine. Also, on the right of the sewing machine main body 2 shown in Fig. 3, there are disposed a clamp member X drive motor and a clamp member Y drive motor (neither of which are shown) serving as clamp member moving means, which are used to move a loop clamp 33 serving as a clamp member along a horizontal plane in the front and rear direction and in the right and left direction.

The loop clamp 33 can be moved along the horizontal plane while holding a tape member T serving as a member to be sewn.

[0013] A belt loop slackening apparatus 1 according to the present embodiment includes a motor base 3 which exists on the left side of the sewing machine main body 2 and is greatly spaced from the vertical moving position of the needle of the sewing machine main body 2.

The motor base 3 includes two plate-shaped support walls 4 and 4 which, as shown in Fig. 1, are respectively erected on the motor base 3 in such a manner that they are arranged parallel to each other in the transporting direction of a member to be sewn (that is, the same di-

rection as the front and rear direction) shown by a two-headed arrow in Fig. 1.

Between the side surfaces of the two support walls 4 and 4, there is formed a side wall 5 which is used to fix a feed motor 6 serving as a loop slackening motor. The feed motor 6 is a pulse motor including an encoder 6A (Fig. 3) and has a drive shaft 8 with a gear 7 formed thereon. The drive shaft 8 is fixed to the feed motor 6 in such a manner that it projects from a shaft hole 9 formed in the side wall 5 horizontally in a direction intersecting with the transporting direction of the member to be sewn.

[0014] In the mutually opposed positions of the two respective support walls 4 and 4, there are provided two bearings 12 and 12 through which a rod-shaped rack shaft 11 serving as a moving member can be inserted. The rack shaft 11 includes a gear 13 formed on the peripheral surface of the rack shaft 11, while the gear 13 can be meshingly engaged with the gear 7 of the motor 6. Also, the rack shaft 11 is supported parallel to the transporting direction of the member to be sewn in the sewing operation of the sewing machine.

Thus, when the forward and reverse rotation drive force of the feed motor 6 is transmitted to the rack shaft 11, the rack shaft 11 can be moved forwardly and reversely along the transporting direction of the thing to be sewn.

[0015] And, to the leading end portion of the rack shaft (moving member) 11, there is fixed a moving base 15. On the upper surface of the moving base 15, there are disposed a support member 16 and a cylinder 20 serving as a drive member.

[0016] The support member 16 is supported by an oscillating shaft 17 provided on and projected perpendicularly from the moving base 15 in such a manner that the support member 16 can be rotated on a horizontal surface. And, there is provided a wire-shaped slackening member 18 for slackening a belt loop, while the base end portion 18b of the slackening member 18 is fixed to the support member 16. The support member 16 supports the slackening member 18 with the opened leading end portion 18a thereof facing the sewing machine main body 2.

[0017] The cylinder (drive cylinder) 20 includes a cylinder main body 20a and a drive shaft 20b which can be moved back and forth from the cylinder main body 20a. The leading end of the drive shaft 20b is connected to the intermediate portion of the slackening member 18. Also, the cylinder main body 20a is disposed nearer to the counter side of the sewing machine main body 2 than the position on the upper surface of the moving base where the support member 16 is disposed. Owing to this, when the drive shaft 20b is expanded and contracted, the leading end portion 18a of the slackening member 18 is moved between a preparatory position and a folded position where a tape member T (a member to be sewn) is folded.

[0018] Also, on the rack shaft 11, there is disposed a sensor detect plate 21 having an initial point marked thereon. Also, on the support wall 4 of the motor base 3, there

is provided a sensor 22 which is capable of detecting the initial point of the sensor detect plate 21. The sensor detect plate 21 and sensor 22 cooperate together to constitute initial point detect means.

[0019] And, the belt loop slackening apparatus 1 includes input set means 35 which can also serve as the operation panel of the sewing machine and the like. The input set means 35, before the sewing operation is started, can input a length c from one end of the belt member T to the first bartack X, a length a from the first bartack X to the second bartack Y, a belt loop slackening amount d from the second bartack Y (d is equal to $\alpha/2$), a length b from the second bartack Y to the third bartack Z, a length e from the third bartack Z to the other end of the belt member T, and the like.

Also, the belt loop slackening apparatus 1 and moving means for moving a clamp member 33 are respectively controlled by drive control means 36 serving as a CPU. And, based on a set value given from the input set means 35, while observing a moving amount according to the output of the encoder 6A initial point detected by the sensor 22, the feed motor 6 is driven and rotated forwardly and reversely to thereby move the slackening member 18 in the front and rear direction. And, the cylinder 20 is moved forward to thereby move the slackening member 18 to the folded position existing inwardly of the member to be sewn.

By controlling the feed motor 6 according to the detect value of the encoder 6A of the feed motor 6, the moving amount (slackening amount) of the slackening member 18 can be controlled.

On the upper surface side of the sewing machine main body 2, there is provided a support plate 34. The support plate 34 supports the body cloth, to which the tape member T (member to be sewn) is to be sewn, from below.

Upwardly of the support plate 34, there is disposed a body holder 31. The body holder 31 can be moved up and down by a cylinder (not shown) and, when it is moved down, it cooperates with the support plate 34 to hold the body cloth between the body holder 31 and the support plate 34.

The support plate 34 and body holder 31 cooperate together in constituting a hold member for holding the main section.

The support plate 34 and body holder 31, which constitute the hold member, are both connected to the leading end side of a ball screw 40. The rear end side of the ball screw 40 is connected to a transporting motor 32. Therefore, when the transporting motor 32 is rotated, the support plate 34 and body holder 31 are moved along the front and rear direction. Here, as shown in Fig. 3 and the like, the ball screw 40 is disposed in such a manner that it is hidden downwardly of the initial point sensor 32a of the transporting motor 32.

The transporting motor 32 includes the encoder 32A (Fig. 2), and there is also disposed another sensor 32b (second initial point detect means) in the transporting motor 32 which is used to detect the initial point of the trans-

porting motor 32.

That is, when the transporting motor 32 is controlled according to the detect value of the encoder 32A of the transporting motor 32, the body cloth held by the hold member (that is, by and between the support plate 34 and body holder 31) can be moved in the front and rear direction, thereby being able to control the stop position (such as the sewing position) of the body cloth.

[0020] Now, description will be given below of a control system with reference to Fig. 2. To the CPU 36 serving as the drive control means, there is connected a ROM (not shown) or a RAM (not shown) which is well known as storage means. Also, to the drive control means 36, through an I/O interface (not shown), there are connected the input set means 35, feed motor 6 for moving the slackening member 18 in the front and rear direction, encoder 6A for detecting the rotation position of the feed motor 6, initial point sensor 22 for detecting the initial point of the feed motor 6, drive cylinder 20 for moving the slackening member 18 to the folded position, a transporting motor 32 for moving the loop clamp in the front and rear direction, encoder 32A for detecting the rotation position of the transporting motor 32, initial point sensor 32b for detecting the initial point position of the transporting motor 32, and a loop clamp drive mechanism 33A such as a pulse motor or the like provided on the loop clamp 33 for holding a loop in such a manner that the holding force thereof can be adjusted.

Here, the CPU 36 is connected to a CPU (not shown) which is provided on the sewing machine main body. And, when the body cloth reaches the respective sewing positions, the sewing machine is driven by a signal from the CPU 36 to form a seam.

[0021] Next, description will be given below of the driving operation of the belt loop slackening apparatus 1 according to the present embodiment with reference to Figs. 3 to 10.

[0022] Firstly, when the power of the sewing machine is turned on, as an initial movement, the drive control means 36 drives and rotates the feed motor 6 in the positive direction, thereby advancing the rack shaft 11 once. When the initial point position of the sensor detect plate 21 is detected by the sensor 22, the feed motor 6 is rotationally driven in the reverse direction to thereby move back the rack shaft 11 and keep it at a wait position not interfering with the operation of the operator (see Fig. 3). Here, after detection of the initial point position, the drive control means 36 calculates the moving amount of the rack shaft 11 with the detected initial point position as the reference.

[0023] In this state, the operator selects the specifications of a belt loop previously managed by the storage means of the sewing machine from the input set means 35 of the sewing machine and, according to the need, changes the numerical value (set value) such as the slackening amount d or the like set in the selected specifications and stores the changed value into the machine storage means. The present set value contains the length

c from one end of the belt member T to the first bartack X, length a from the first bartack X to the second bartack Y, belt loop slackening amount d from the second bartack Y ($d = \alpha/2$), length b from the second bartack Y to the third bartack Z, length e from the third bartack Z to the other end of the belt member T, and the like, which are shown in Fig. 10 respectively.

Here, the thus set numerical value should be stored in such a manner that it can be called up even when the power supply is put to work again, that is, it can be reproduced.

[0024] Firstly, the body cloth (not shown) is placed onto the support plate 34. Next, the body holder 32 moves down and cooperates together with the support plate 34 to hold the body cloth.

Next, the loop clamp (clamp member) 33 holding one end side of the tape member (member to be sewn) T feeds the tape member (member to be sewn) T from the initial point or through the initial point from the start position to the first sewing position which forms the first bartack existing upward of the body cloth.

Next, a sewing machine holder (not shown) moves down and presses against the tape member (member to be sewn) T.

Next, after the holding force of the loop clamp 33 is reduced, the loop clamp 33 is moved forwardly (rightward in Fig. 10) in the front and rear direction. In this case, since the rear end side of the tape member is pressed by the sewing machine holder, only the loop clamp 33 is moved.

Next, the sewing machine is driven to sew the tape member T to the body cloth to thereby form the first bartack X (see Figs. 4 and 10 (1)).

[0025] Next, the sewing machine holder is moved up and, after the holding force of the loop clamp 33 is increased, the tape member T is held by the loop clamp 33. After then, the tape member T is passed through under a sewing machine needle NP stopping at a needle upper position and is then moved rearward (leftward in Fig. 10), and the tape member T is folded in such a manner that it covers the upper portion of the first bartack X. Next, by driving the transporting motor 32, the body cloth is delivered forwardly (rightward in Fig. 10) to the side of the position of the operator in such a manner that, as shown by an arrow mark A (Fig. 10 (2)), the body cloth is returned by a given moving amount a, whereby the body cloth and tape member T are moved to a second sewing position respectively.

Next, the sewing machine is moved down and the needle NP is driven to sew the tape member T to the body cloth, thereby forming the second bartack Y (see Figs. 5 and 10 (2)).

[0026] While the second bartack Y is being sewn, the belt loop slackening apparatus 1 drives and rotates the feed motor 6 in the positive direction to move forward the rack shaft 11 to a position shown in Fig. 6, and it also keeps the leading end portion 18a of the slackening member 18 waiting near the needle NP (see Fig. 6).

The driving amount of the feed motor (loop slackening motor) 6, as described after, is set such that, the leading end portion 18a of the slackening member 18, at the folded position thereof, is situated by $d=\alpha/2$ backwardly of the second bartack Y position. Here, the position of the leading end portion 18a of the slackening member 18 is regarded as a preparatory position.

[0027] When the sewing operation of the second bartack Y is completed, the sewing machine holder is moved up.

Next, when the slackening cylinder 20 is driven and moved forward with respect to the slackening member 18 situated at the preparatory position, the slackening member 18 is rotated counterclockwise. Due to the counterclockwise rotation of the slackening member 18, the leading end portion 18a of the slackening member 18 is moved to the folded position that goes backward by $d=\alpha/2$ from the second bartack formation portion (see Fig. 7). The leading end portion 18a of the slackening member 18 moved to the folded position is slightly pressed from above against the tape member T with the second bartack Y formed thereon, and is thereby engaged with the tape member T.

[0028] Next, the loop clamp 33 is passed through under the needle NP stopping at the needle upper position and is moved forward (rightward in Fig. 10). Due to this, the tape member T is caused to turn around the periphery of the outside of the slackening member 18.

At the same time, the feed motor 6 is rotated in the reverse direction to move the slackening member 18 rearward (leftward in Fig. 10) by a given amount b. In this case, the feed motor 6 is controlled according to the detect value of the encoder 6A.

Also, at the same time, the transporting motor 32 is driven according to the detect value of the encoder 32A to move the body cloth and tape member T backward (leftward in Fig. 10) by the given amount b.

[0029] Next, since, simultaneously when the sewing machine holder moves down, the loop clamp 33 removes the holding of the tape member T, the tape member T is pressed against the upper surface of the body cloth.

Next, the loop clamp 33 is moved back to the initial position.

Next, the drive cylinder 20 is driven backward to remove the slackening member 18 from the tape member T (see Fig. 9). In this state, using the needle NP, the other end portion of the tape member T is sewn to the member to be sewn to thereby form the third bartack Z.

[0030] As described above, according to the belt loop slackening apparatus 1 of the present embodiment, the slackening amount of the belt loop is set by inputting the numerical value given from the input set means, the drive of the feed motor 6 is controlled according to the thus input numerical value to adjust the slackening amount. This can greatly reduce the time (down time) necessary for setting the slackening amount and thus can enhance the productivity of the belt loop slackening apparatus 1.

[0031] Also, the reproducibility of the adjust value of

the slackening amount can be enhanced, the data management according to the specifications of the belt loop can also be realized, and thus the quality of the product can be stabilized.

[0032] Further, when setting the member to be sewn or the like on the sewing machine, the slackening member 18 is retreated to the position where it is prevented from interfering with the operator, specifically, the lateral side of the far side of the sewing machine main body 2 (wait position) with respect to the position of the operator. This can enhance the efficiency of the setting operation.

[0033] Here, the present invention is not limited to the above embodiment but, as the need arises, it can be changed variously.

For example, the feed motor 6 and transporting motor 32 may not include the encoder 6A or 32A, but they may also be driven and controlled according to an open control system.

[0034] For example, the drive source of the feed motor of the belt loop slackening apparatus may be changed to a stroke adjustable type cylinder or a multi-stage type cylinder, while the rack shaft serving as the moving member can also be replaced with a drive shaft.

[0035] Also, the specifications of the belt loop, to which the belt loop slackening apparatus is applied, are not always limited to the specifications in which such three bartacks as shown in Fig. 11 are formed.

Claims

1. A belt loop slackening apparatus, comprising:

a moving member (11) disposed laterally of a main body of a sewing machine and movable reciprocatingly along a transporting direction of a member to be sewn in a sewing operation of the sewing machine;

a drive cylinder (20) which is supported on the moving member and which is extensible and retractable;

a slackening member (18) having one end supported on the drive cylinder, and the other end being movable forward and backward internally of the member to be sewn;

a loop slackening motor (6) connected to the moving member and capable of moving the slackening member along the transporting direction;

input set means (35) for inputting a set value of a slackening amount of the member to be sewn; and

drive control means (36) for controlling the loop slackening motor in such a manner that, when sewing the member to be sewn to a body cloth, in order to form a given amount of slackening in the member to be sewn, the slackening member can be moved to a folded position of the slacking

member according to the set value.

2. The belt loop slackening apparatus according to Claim 1, further including:

a moving base (15) fixed to the moving member; 5
and
a support member (16) supported such that the support member can be rotated on a horizontal surface of the moving base, wherein 10
the other end of the slackening member is supported on the support member and, by driving of the drive cylinder, the slackening member can be moved to the folded position where the slackening member is engaged with the member to be sewn. 15

3. The belt loop slackening apparatus according to Claim 1 or 2, further including:

a clamp member (33) for clamping the member to be sewn and, being movable along a horizontal plane; 20
hold members (31, 34) for holding the body cloth to which the member to be sewn is to be sewn; 25
and
a transporting motor (32) for moving the hold members along the transporting direction of the member to be sewn, wherein 30
the drive control means, after first and second bartacks are formed by driving a sewing machine needle, according to the set value, moves the slackening member to the folded position and, after then, moves the loop slackening motor and the transporting motor by a given amount 35
in the same direction to thereby form a third bartack.

4. The belt loop slackening apparatus according to any one of Claims 1 to 3, further including: 40

initial point position detect means (21, 22) respectively for detecting an initial point position of the moving member, wherein 45
according to a detect value of the initial point position detect means and the set value of the input means, the loop slackening motor is controlled so as to be able to move the slackening member to the folded position. 50

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Fig. 1

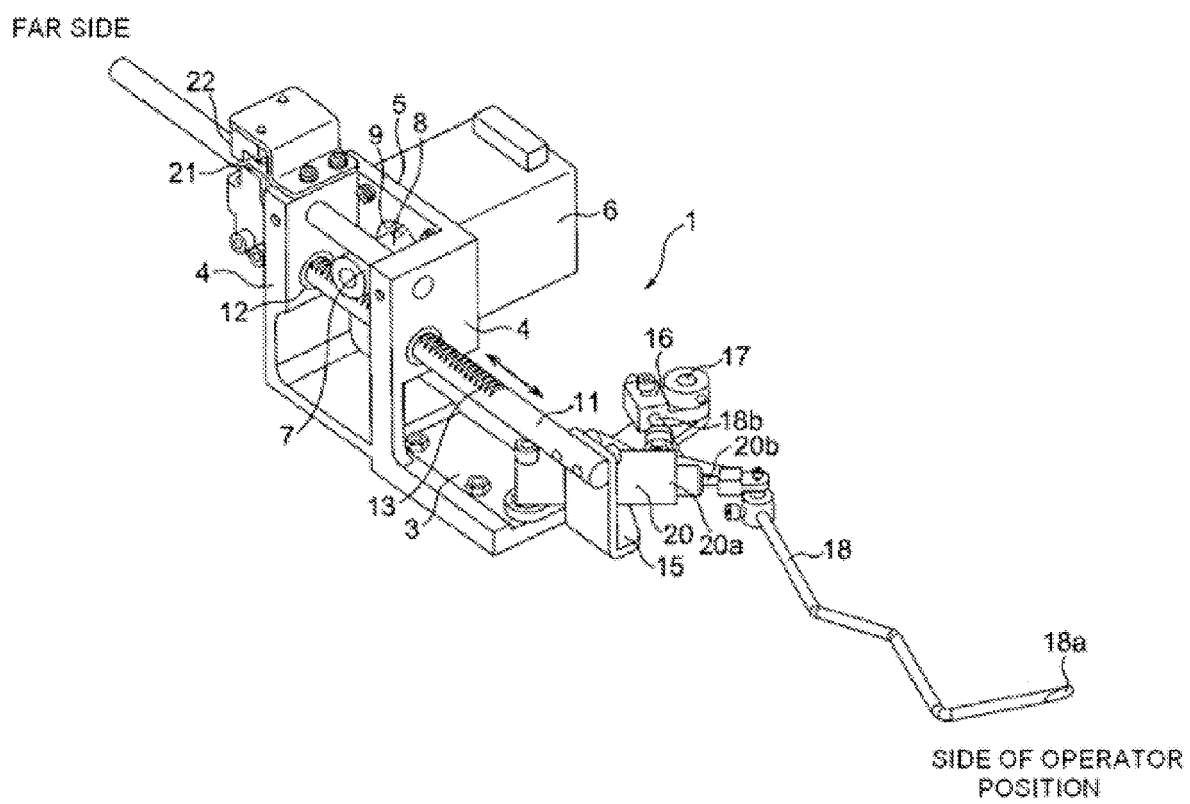


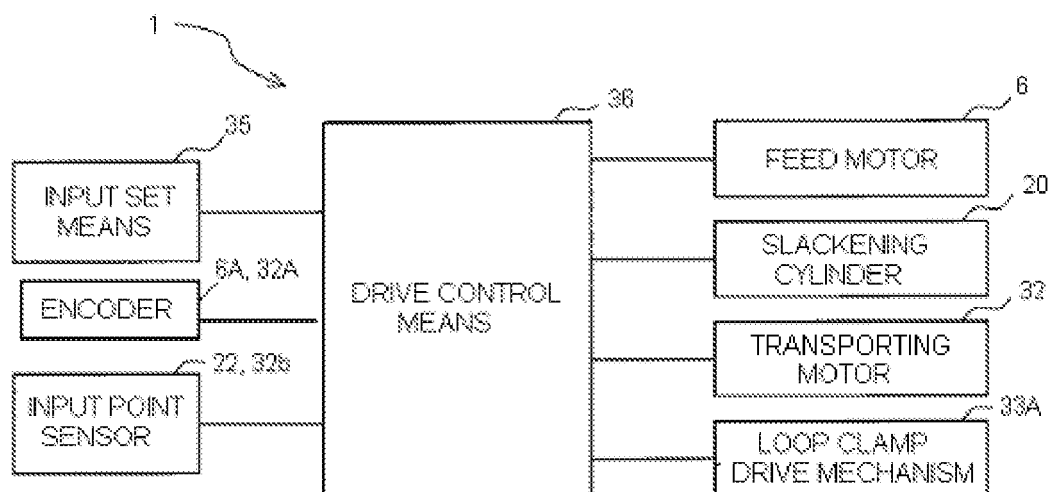
Fig. 2

Fig. 3

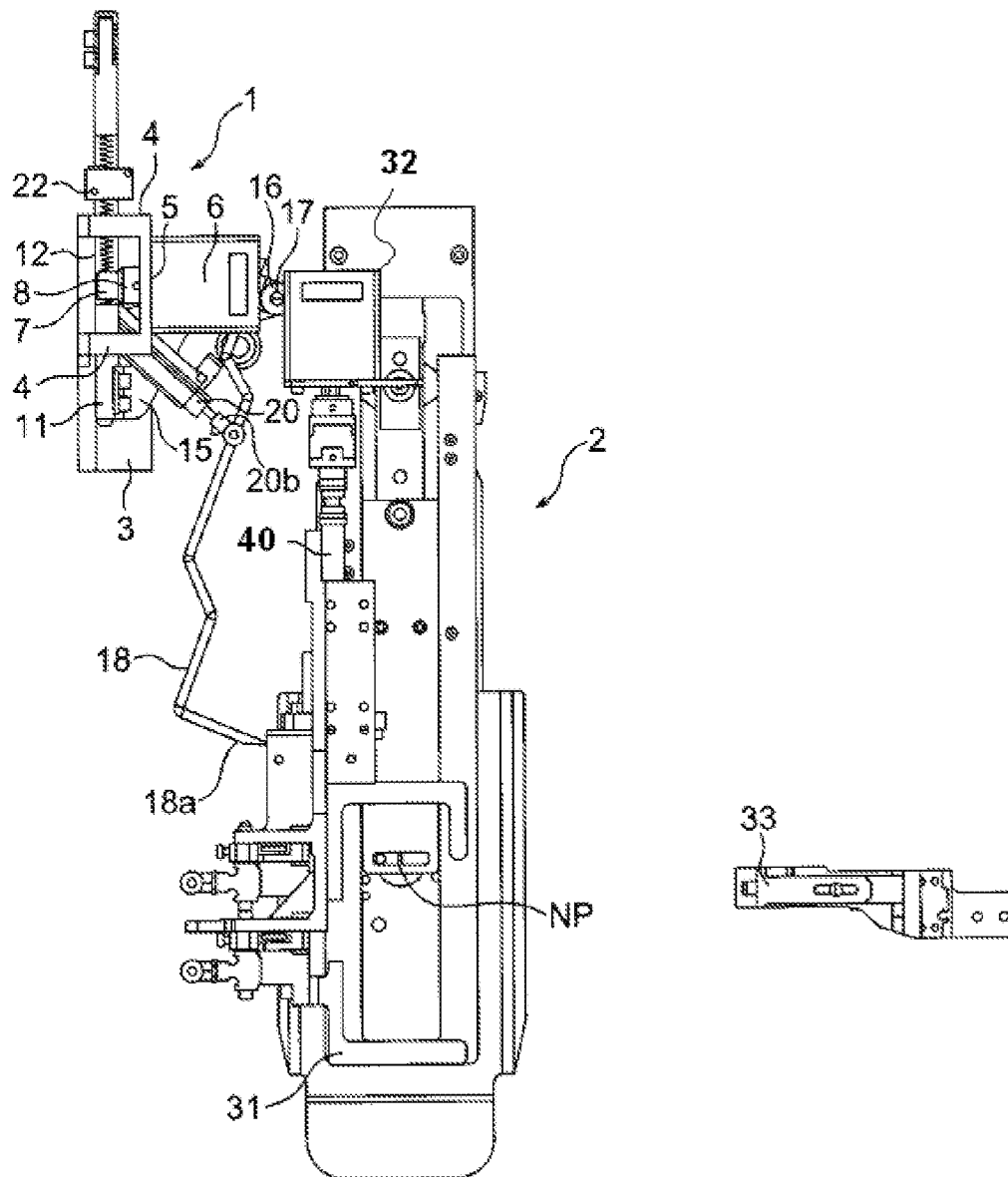


Fig. 4

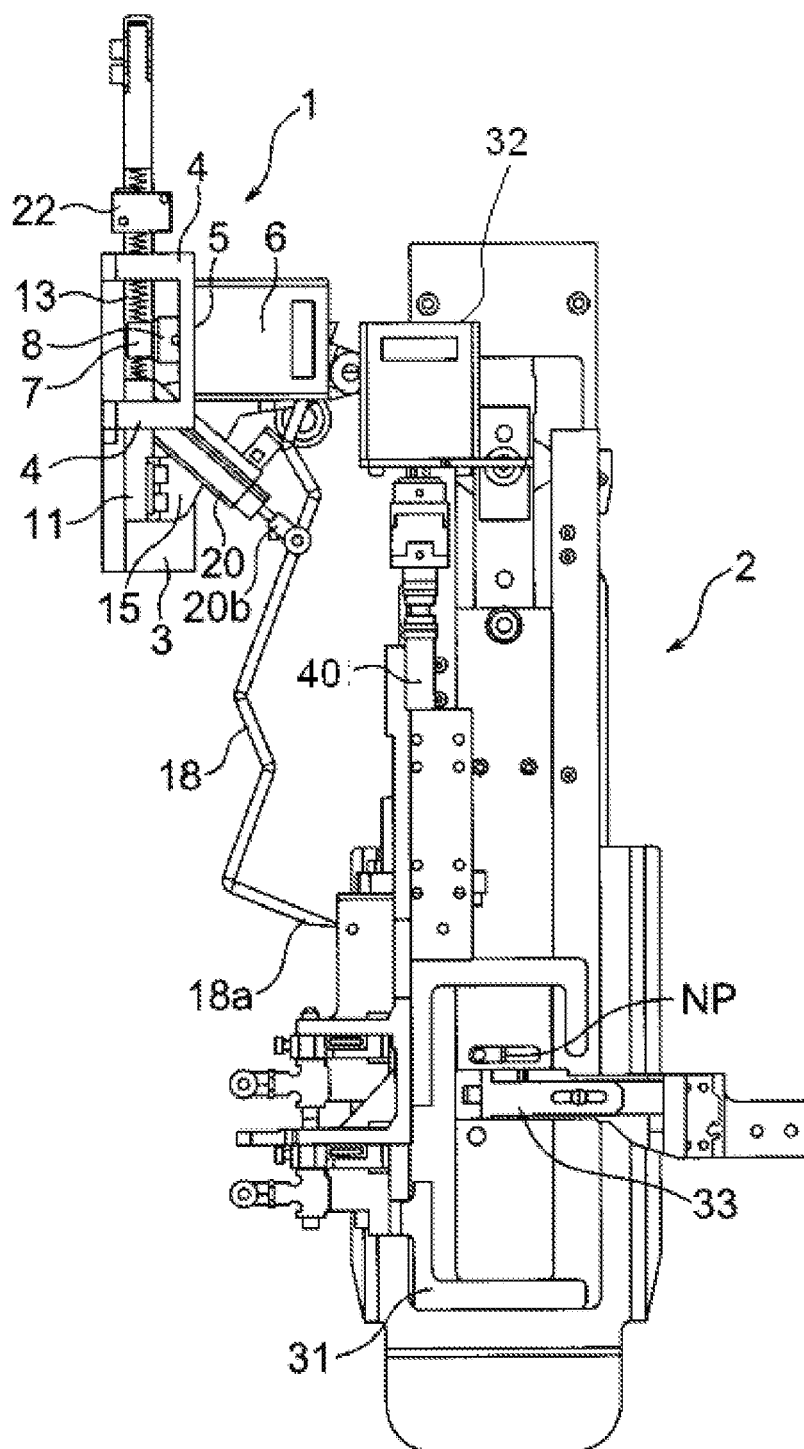


Fig. 5

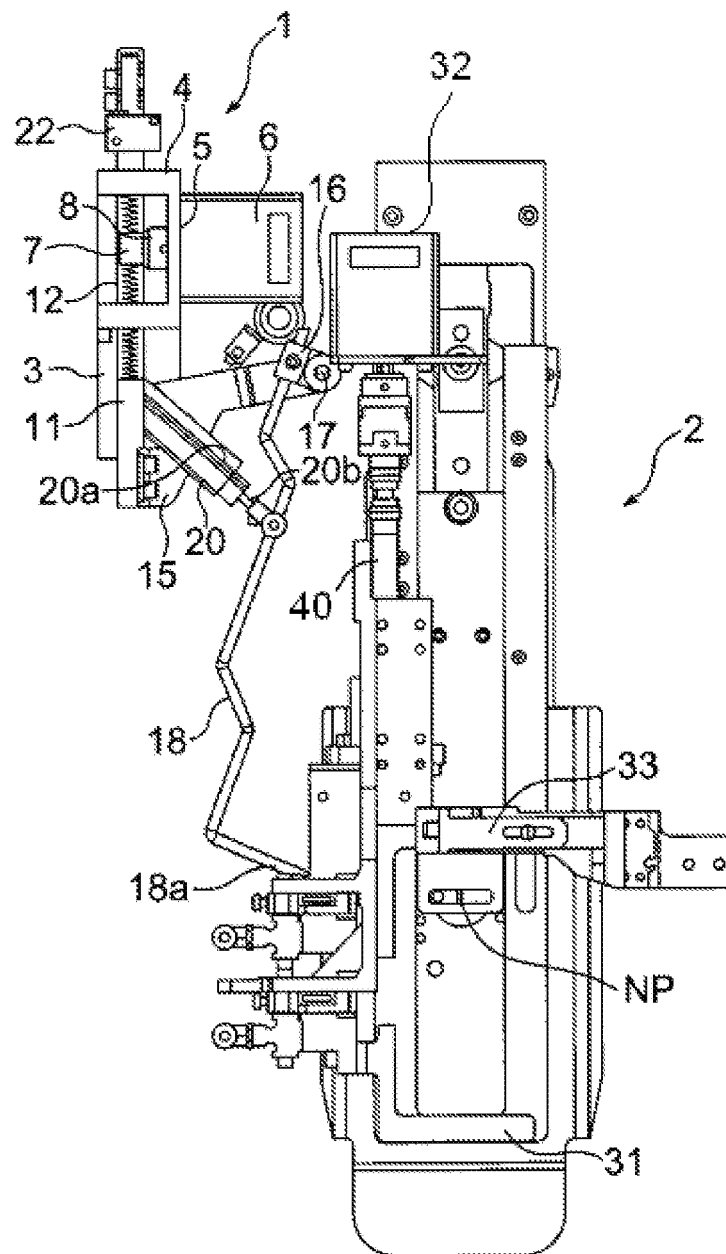


Fig. 6

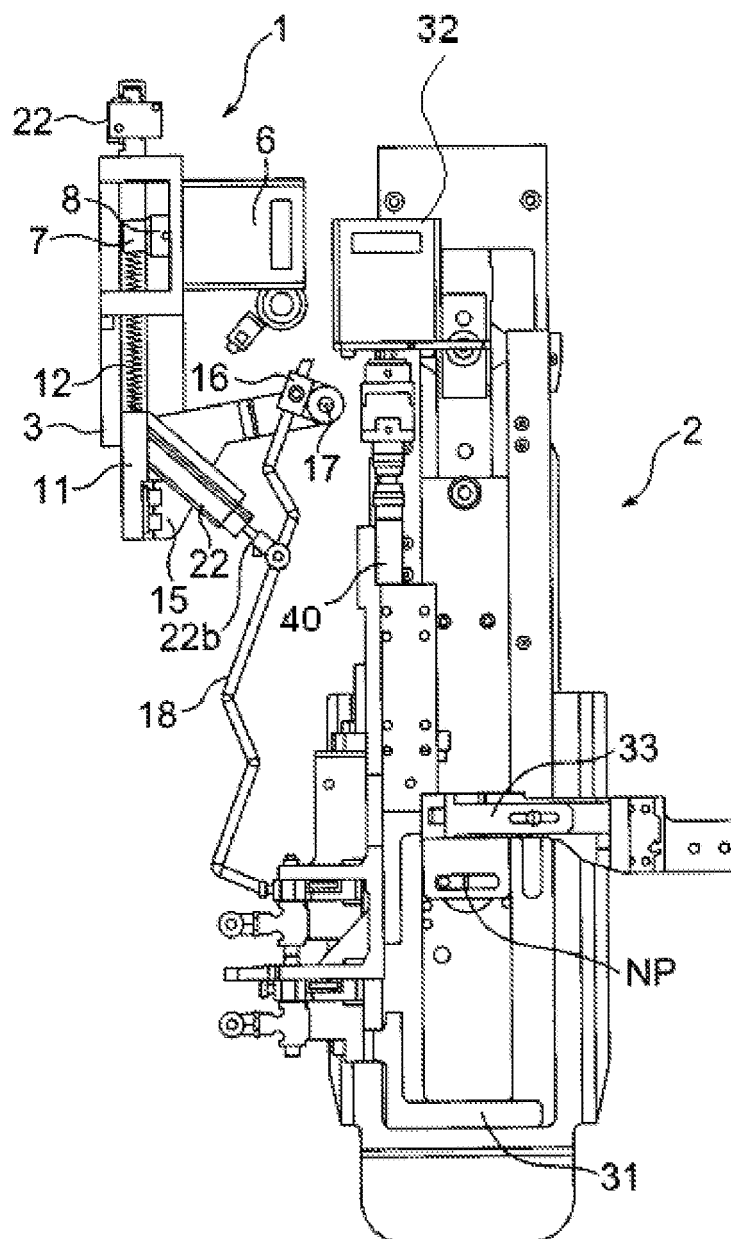


Fig. 7

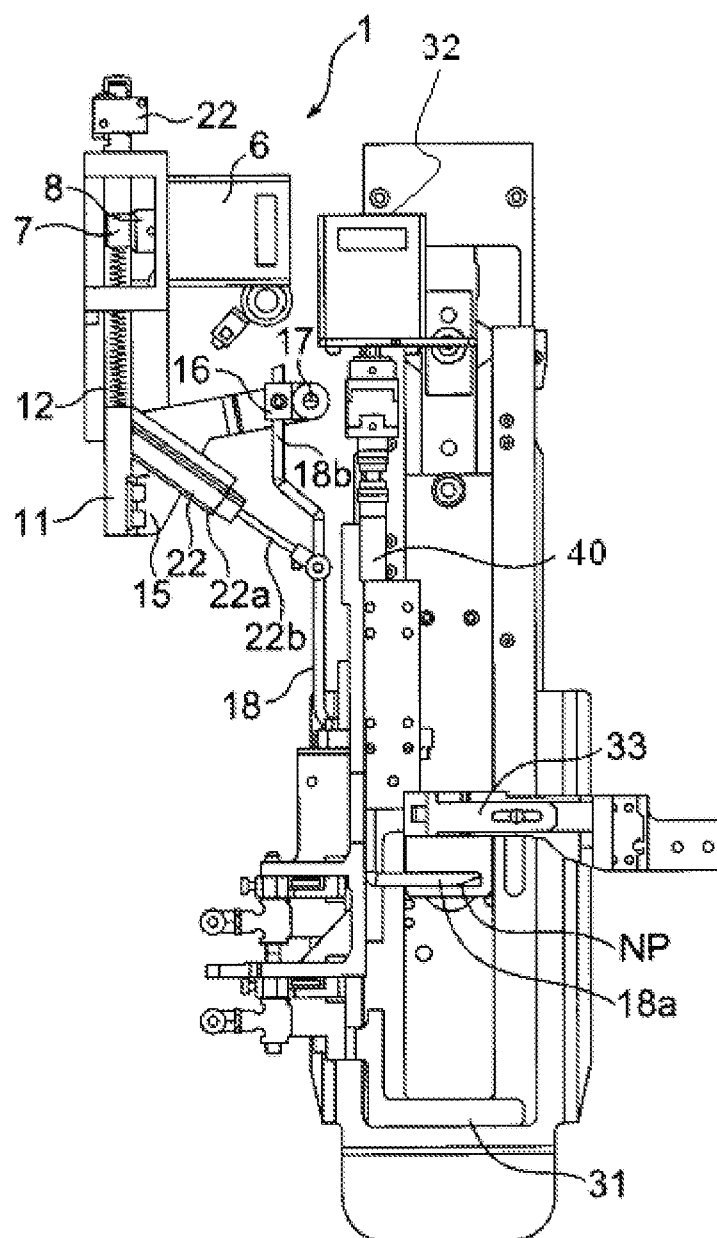


Fig. 8

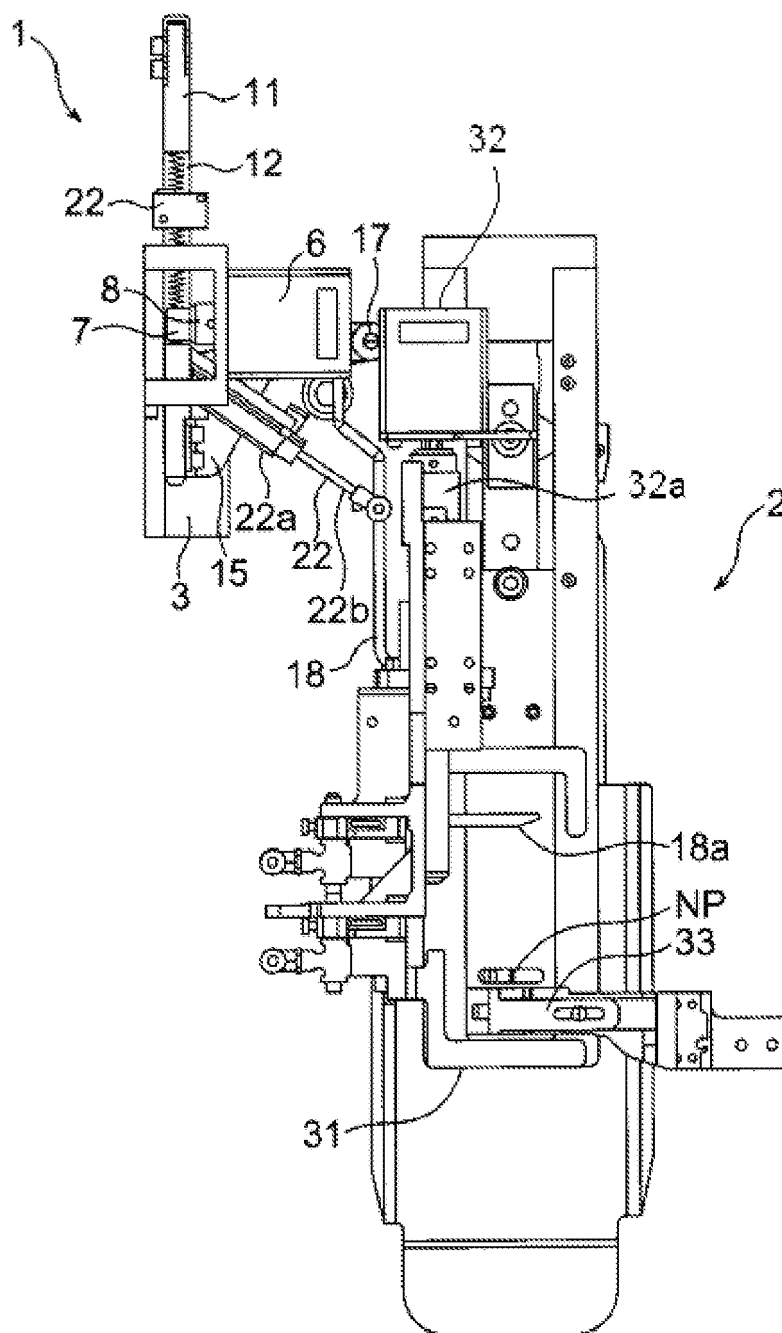


Fig. 9

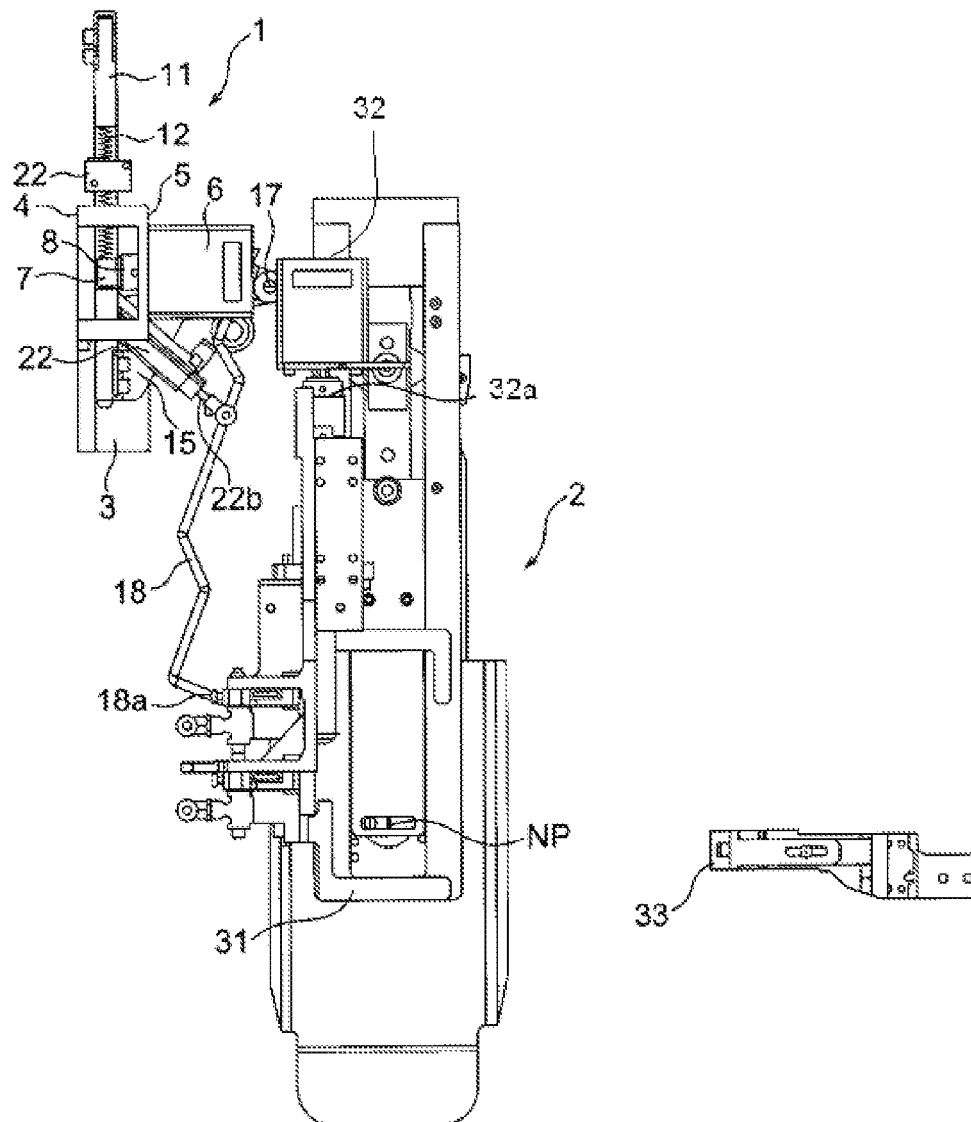


Fig. 10A

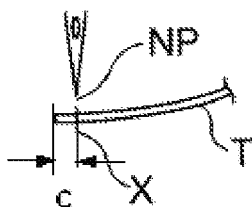


Fig. 10B

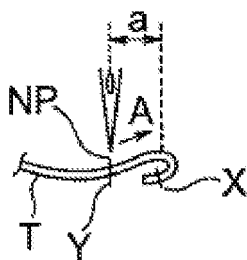


Fig. 10C

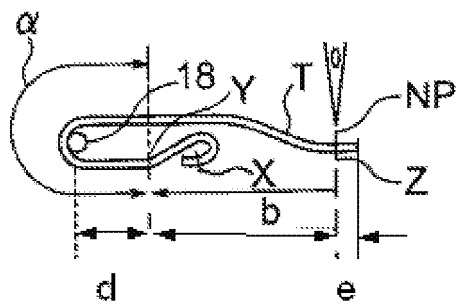


Fig. 11

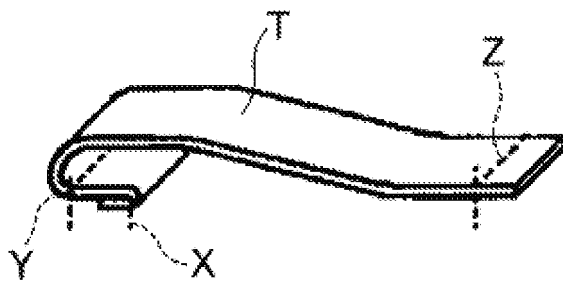


Fig. 12A

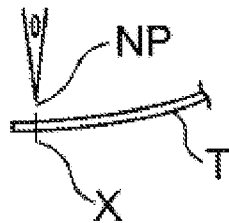


Fig. 12B

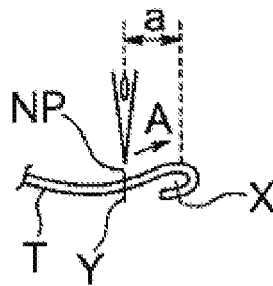
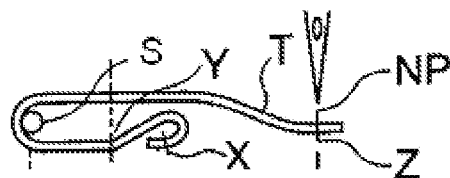


Fig. 12C





EUROPEAN SEARCH REPORT

Application Number
EP 09 15 6725

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	EP 0 697 480 A (HAMS CORP [JP]) 21 February 1996 (1996-02-21) * column 4, line 9 - column 10, line 46; figures 1-14 *	1-4	
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 July 2009	Examiner Herry-Martin, D
CATEGORY OF CITED DOCUMENTS 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		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	

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The members are as contained in the European Patent Office EDP file on
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