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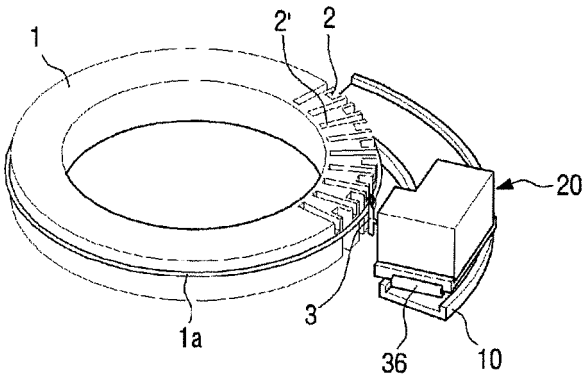
(54) NEEDLE INSERTION APPARATUS FOR A KNITTING MACHINE

(57) The present invention discloses a needle insertion apparatus for automatically inserting and mounting hundreds to thousands of needles into the slots of the cylinder of a knitting machine, thereby improving the operation rate of the knitting machine. The present invention includes: a guide rail detachably mounted adjacent to the periphery of the cylinder having a plurality of slots arranged at a given pitch, the needles being slidably mounted in the slots; and a needle insertion device mounted on the guide rail so as to move along the slots to automatically insert the needles into the slots. The needle insertion device includes: a casing unit for receiving a plurality of needles; a needle guide unit for guiding the foremost one of the needles held in the casing unit from the discharge position to the insertion position; and a needle push unit for pushing the needle guided by the needle guide unit into one of the slots of the cylinder.

[Fig. 1]



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Description

TECHNICAL FIELD

[0001] The present invention relates to a knitting machine, and more particularly, a needle insertion apparatus for a knitting machine which automatically inserts needles into slots formed on a cylinder of the knitting machine.

BACKGROUND ART

[0002] In general, a circular knitting machine, which is a type of knitting machine, includes a cylinder with a plurality of slots formed at constant pitch intervals and needles mounted so as to be slidable along the slots of the cylinder. The plurality of slots are formed on side surface and/or upper surface of the cylinder. Yarns fed from yarn-feeding device form loops by means of the needles and these loops are woven, whereby knitted fabric is woven.

[0003] Conventionally, in the knitting machine as described above, hundreds to thousands of the needles are manually inserted by a person one by one in a case where a plurality of needles are inserted and set in the slots of the cylinder due to of purchasing and installing of a new knitting machine or decrepitness of the needles and change of the knitted fabric etc.. Such a needle insertion operation requires skill and patience and is a very time-consuming operation, and thus remarkably decreases operation rate of the knitting machine.

SUMMARY OF THE INVENTION

Technical problem

[0004] The present invention was made in view of the above matter, and its object is to provide a needle insertion apparatus for a knitting machine which can automatically insert and mount hundreds to thousands of needles into the slots of the cylinder, thereby improving the operation rate of the knitting machine.

Solution to the problem

[0005] A needle insertion apparatus for a knitting machine according to the present invention for achieving the above object comprises a guide rail detachably installed around a cylinder having a plurality of slots formed at constant pitch intervals, the needles being slidably mounted in the slots; and a needle insertion device mounted on the guide rail so as to be movable by the constant pitch interval to automatically insert the needles into the slots.

[0006] According to a preferred embodiment of the present invention, the guide rail may be formed in the shape of circular arc with an angle of 70 or 90° so that, dividing the cylinder into four or five sections, a needle insertion operation is performed for each section.

[0007] Furthermore, the needle insertion device may comprise a main body unit for accommodating a plurality of the needles; a needle guide unit for guiding the foremost needle of the needles accommodated in the main body unit from a discharge position to an insertion posture; and a needle pusher unit for pushing the needle guided by the needle guide unit toward one slot of the slots of the cylinder to insert the needle into the slot.

[0008] Furthermore, the main body unit may comprise a main body which has a needle loading part where the plurality of needles are loaded while being arrayed in a row and a needle discharge part from which the needles are discharged; a sloped plate which is installed on the needle loading part of the main body to maintain the needles in an inclined posture of predetermined angle; a spring which positions the needles in the needle discharge part in order from the foremost needle to be on standby for discharge by resiliently supporting the plurality of needles loaded in the needle loading part toward the needle discharge part; feed rollers installed on a bottom of the main body; and a motor for rotationally driving the feed rollers.

[0009] Furthermore, the needle guide unit may comprise a first guide plate which is installed inward of the needle discharge part of the main body and has a needle passage groove through which the foremost needle passes; and a second guide plate which is installed outward of the needle discharge part while facing the first guide plate and positions, in the needle discharge part, the needle which has passed through the needle passage groove and which has first and second guide grooves which provide a movement path for the needle pusher unit, the needle discharge part being interposed between the two guide plates.

[0010] Furthermore, the needle pusher unit may comprise a pusher piece which has a first guide pin and a second guide pin inserted in the first guide groove and the second guide groove of the second guide plate and is installed to be movable forward and backward in the needle discharge part and which pushes out the needle positioned in the needle discharge part in the direction of the slot; a guide piece which guides movement of the needle under the needle when the needle is moved by the pusher piece; a first actuator for moving the pusher piece forward and backward; and a second actuator for moving the guide piece forward and backward.

[0011] Furthermore, the pusher piece and the guide piece may be configured such that they move together forward and then move backward at the time when the hook portion of the needle enters the slot of the cylinder, thereby not hindering the insertion of the needle into the slot.

[0012] Meanwhile, in one embodiment of the present invention, the needles accommodated in the needle loading part of the main body unit may be arrayed so as to be inclined upward in a needle discharge direction with their hook portions being oriented in the needle discharge direction, and thus the needle insertion apparatus may

be configured to insert the needles into the slots formed on an outer circumferential surface of the cylinder.

[0013] Furthermore, in another embodiment of the present invention, the needles accommodated in the needle loading part of the main body unit may be arrayed so as to be inclined downward in a needle discharge direction with their hook portions being oriented in a direction opposite the needle discharge direction, and thus the needle insertion apparatus may be configured to insert the needles into the slots formed on an upper surface of the cylinder.

[0014] Furthermore, in the embodiments of the present invention, the pusher piece may move the needle by contacting with a butt portion or rear end portion of the needle.

Effects of the invention

[0015] According to the present invention, hundreds to thousands of the needles can be manually inserted and set when the needles are replaced due to purchasing of a new knitting machine or decrepitness of the needles and change of the knitted fabric, and thus the needles can be more quickly inserted with accuracy, whereby the operation rate of the knitting machine can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig.1 is a view showing a state where a needle insertion apparatus for a knitting machine according to one embodiment of the present invention is installed around a cylinder;

Fig. 2 is a view schematically showing a needle insertion device extracted from Fig. 1;

Fig. 3 is a view schematically showing relationships among a main body unit, a needle guide unit and a needle pusher unit;

Fig. 4 is a view schematically showing relationship between the needle guide unit and the needle pusher unit;

Fig. 5 is a view where a second guide plate in Fig. 4 is shown in phantom line;

Fig. 6 is a view schematically showing a needle insertion process of the needle insertion apparatus according to the one embodiment of the present invention;

Fig. 7 is a view schematically showing a needle insertion device extracted from a needle insertion apparatus for a knitting machine according to another embodiment of the present invention;

Fig. 8 is a view schematically showing relationships among a main body unit, a needle guide unit and a needle pusher unit;

Fig. 9 is a view where a second guide plate in Fig. 8 is shown in phantom line; and

Fig. 10 is a view schematically showing a needle insertion process of the needle insertion apparatus according to the another embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

[0017] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the attached drawings. The present invention may apply various modifications and have various forms, and the embodiments will be described in detail. However, this is not intended to limit the present invention to disclosed specific embodiments, rather, should be understood to include all of modifications, equivalents and substitutes falling within the concepts and technical scope of the present invention.

[0018] Terms used in the specification are used only for the purpose of describing specific embodiments, and are not intended to limit the present invention. The expression in the singular form also includes the expression in the plural form, unless otherwise stated specifically in the context.

[0019] Furthermore, all terms used herein including technical or scientific terms have the same meaning as meaning generally understood by those skilled in the art, unless otherwise defined. Terms such as terms defined in dictionaries generally used should be interpreted to have meaning coinciding with meaning in the context for relevant art, and should not be interpreted as ideal or excessively formal meaning, unless clearly defined in the specification.

[0020] As shown in Fig. 1, a needle insertion apparatus for a knitting machine according to one embodiment of the present invention includes a guide rail (10) installed around a cylinder (1) and a needle insertion device (20) movably mounted on the guide rail (10) to automatically insert a plurality of needles (3) into slots (2, 2') of the cylinder (1).

[0021] A plurality of the slots (2) are formed at constant pitch intervals on an outer circumferential surface of the cylinder (1), and a plurality of the slots (2') are also formed at constant pitch intervals on an upper surface of the cylinder (1), wherein the slots (2, 2') are arranged to alternate with each other. Furthermore, a spring (1a) for holding positions of the needles inserted in the slots (2) is circumferentially installed approximately on the outer circumferential surface of the cylinder (1).

[0022] The needles (3) are slidably inserted and mounted in the respective slots (2, 2'), and yarns fed from a yarn-feeding device not illustrated are woven by the needles (3), and thus a predetermined knitted fabric is woven.

[0023] The guide rail (10) is detachably mounted around the cylinder (1). The guide rail (10) is formed in the shape of circular arc with an angle of approximately 70 to 90°. Therefore, the guide rail (10) is installed so as to cover a certain section of the cylinder (1), for example one-fourth or one-fifth section of the cylinder, when the needles (3) are inserted into the slots (2, 2') of the cylinder

(1). If the guide rail (10) is installed in a certain section as described above and then insertion of needles for the relevant section is completed, the guide rail (10) is moved to and installed in a next section and thereafter needle insertion operation for the slots of the cylinder is continued by continuously performing the needle insertion operation.

[0024] The needle insertion device (20) is mounted on the guide rail (10) so as to be movable by the pitch interval of the slots (2, 2') of the cylinder (1), and automatically inserts and mounts the needles (3) in the respective slots (2, 2').

[0025] Figs. 2 to 6 are views shown for describing the needle insertion device (20) for automatically inserting the needles (3) into the slots (2) formed on a side surface of the cylinder according to the one embodiment of the present invention.

[0026] As shown in Figs. 2 to 5, the needle insertion device (20) according to the one embodiment of the present invention includes a main body unit (30) for accommodating the plurality of needles (3), a needle guide unit (40) for guiding the foremost needle of the needles accommodated in the main body unit (30) from a needle discharge position to an insertion posture, and a needle pusher unit (50) for pushing the needle (3) guided by the needle guide unit (40) toward one slot of the slots (2) of the cylinder (1) to insert the needle into the slot.

[0027] The main body unit (30) includes a main body (33), which has a needle loading part (31) where the plurality of needles (3) are accommodated in a row and a needle discharge part (32) from which the needles (3) are discharged. The needle loading part (31) of the main body (33) is provided with a sloped plate (34) for maintaining the needles (3) in an inclined posture of predetermined angle. Furthermore, on the needle loading part (31), a spring (35) is installed which positions the needles in the needle discharge part (32) in order from the foremost needle, thereby causing the needles to be standby for discharge, by resiliently supporting the needles (3) arranged in the needle loading part in a row toward the needle discharge part (32).

[0028] The needles (3) accommodated in the needle loading part (31) are accommodated in a posture of being inclined upward in the needle discharge direction, with their hook portions being oriented in a needle discharge direction.

[0029] Furthermore, feed rollers (36) are installed on a bottom of the main body (33), and driving means (not illustrated in the drawings) such as motor for rotationally driving the feed rollers (36) is installed in the main body (33). As the driving means, a stepping motor may be preferably used. The needles (3) accommodated in the needle loading part (31) may be properly set from tens to hundreds as necessary.

[0030] As illustrated in Figs. 2 to 4, the needle guide unit (40) includes a first guide plate (41) and a second guide plate (42) facing each other with the needle discharge part (32) interposed between the two guide plates.

[0031] The first guide plate (41) is installed inward of the needle discharge part (32), and has a needle passage groove (43) through which the foremost needle (3) positioned in the needle loading part (31) passes.

[0032] The second guide plate (42) is installed outward of the needle discharge part (32) while facing the first guide plate (41), thereby defining the needle discharge part (32), and positions, in the needle discharge part (32), the needle (3) which has passed through the needle passage groove (43). Furthermore, in the second guide plate (42), first and second guide grooves (44, 45) are formed which provide a movement path for a needle pusher unit (50) described later.

[0033] Herein, the first guide groove (44) is formed to be inclined upward in the needle discharge direction, and the second guide groove (45) is formed to be almost linear or slightly inclined below the first guide groove (44).

[0034] The needle pusher unit (50) includes a pusher piece (51), a guide piece (52), a first actuator (53), and a second actuator (54).

[0035] The pusher piece (51) has a first guide pin (55) and a second guide pin (56) inserted in the first guide groove (44) and the second guide groove (45) of the second guide plate (42), and is installed to be movable forward and backward in the needle discharge part (32). When one needle (3) is positioned in the needle discharge part (32), a tip end of the pusher piece (51) contacts with a butt portion (3a) of the needle (3), and subsequently, when the first actuator (53) is driven, the pusher piece (51) moves forward along a path defined by the first guide groove (44) and the second guide groove (45). Since the butt portion (3a) of the needle (3) contacts with the tip end of the pusher piece (51) which thus moves forward, the needle (3) also moves in the direction of the slot (2).

[0036] Meanwhile, the illustrated case shows an example where the tip end of the pusher piece (51) pushes out the needle (3) by contacting with the butt portion (3a) of the needle (3), but the structure of the pusher piece (51) is not necessarily limited by the illustrated case; rather, for example a case may be envisaged where a protrusion is formed on the pusher piece (51) and this protrusion pushes out the needle (3) by contacting with a rear end portion of the needle (3).

[0037] The guide piece (52) serves to guide the movement of the needle (3) under the needle (3) when the needle (3) is moved by the pusher piece (51), and a connection pin (57) is formed on one side of the guide piece (52).

[0038] The first actuator (53) is connected to the second guide pin (56) of the pusher piece (51) and moves the pusher piece (51) forward and backward. Furthermore, the second actuator (54) is connected to the connection pin (57) of the guide piece (52) and moves the guide piece (52) forward and backward.

[0039] Herein, the pusher piece (51) and the guide piece (52) move forward together and then move back-

ward at the time when the hook portion of the needle (3) enters the slot (2) of the cylinder (1), thereby not hindering the insertion of the needle (3) into the slot (2), and the pusher piece (51) continues to move forward until the needle (3) is completely inserted in the slot (2) and thereafter move backward.

[0040] As the first actuator (53) and the second actuator (54), air cylinder or hydraulic cylinder etc. may be preferably used.

[0041] Hereinafter, with reference to Fig. 6, description will be made of a needle insertion process of the needle insertion apparatus for a knitting machine according to the present invention configured as above.

[0042] First, the needles mounted on the existing cylinder are entirely or partially removed in a case where it is necessary to newly mounted and reset the needles in the cylinder, for example, for the reason that the needles have to be mounted due to purchase of a new knitting machine or the needles used have to be replaced with new needles due to their decrepitness or knitted fabric has to be changed.

[0043] Next, the circular arc-shaped guide rail (10) is installed around the cylinder (1) in a certain section, and the needle insertion device (20) with a certain number of needles (3) accommodated is mounted on the guide rail (10). At this time, the needles may be mounted on the needle loading part of the needle insertion device in a cassette type.

[0044] The plurality of needles are accommodated in the needle loading part of the needle insertion device while being arrayed in a row. At this time, the plurality of arrayed needles are elastically biased toward the needle discharge part by the spring, and thus the foremost needle is positioned in the needle discharge part of the main body in a standby posture for discharge.

[0045] If the power is supplied to the needle insertion device, the position of the slot of the cylinder is aligned with the needle discharge part of the needle insertion device and thereafter the first and second actuators are driven by an optical sensor not illustrated etc., whereby the needle starts to move in the direction of the slot of the cylinder.

[0046] As shown in Fig. 6, the pusher piece (51) contacts with the butt portion (3a) of the needle (3) and the guide piece (52) supports the needle (3) under the needle (3).

[0047] In such a state, if the first actuator (53) and the second actuator (54) are driven, the pusher piece (51) and the guide piece (52) move forward, thereby starting to move the needle (3). At this time, the pusher piece (51) moves forward along the first inclined guide groove (44) of the second guide plate (42), and thus the needle (3) moves so that its hook portion first contacts with the slot (2) of the cylinder, as shown in the first figure.

[0048] Thereafter, as shown in the second figure, as the second actuator (54) is driven to be retracted at the time when the hook portion of the needle (3) contacts with the slot (2), the guide piece (52) moves backward, thereby not hindering the insertion of the needle (3) into the slot (2). While the first actuator (53) is continuously moving forward, the needle (3) continues to be pushed and inserted into the slot (3) by the pusher piece (51), as shown in the third figure, and finally, the first actuator (53) is retracted when the needle (3) has been inserted in the slot (2), and accordingly the pusher piece (51) moves backward to its original position, as shown in the fourth figure.

[0049] Meanwhile, the needle (2) inserted in the slot (3) finds its place by means of the spring (1a) etc. provided on the cylinder (1) when the hook portion of the needle is inserted into the slot to some extent.

[0050] If the insertion of one needle is completed in the process as described above, the needle insertion device moves by the pitch interval of the slots and thereafter inserts all the loaded needles into the slots of the cylinder by repeating the process as described above. Then, if the insertion of the needles for any one section of the cylinder is completed by the process as described above, the guide rail is moved to and installed in the next section to proceed with the insertion of the needles into the slots in another section of the cylinder.

[0051] As above, according to the present invention, hundreds to thousands of the needles can be automatically inserted into the slots of the cylinder and set; therefore, quicker correct insertion is possible without error, compared to a conventional method where the needles are manually inserted one by one.

[0052] Namely, the change of knitted fabric can be more flexibly handled because the time required for setting of the needles can be drastically reduced and labor can be also saved.

[0053] Figs. 7 to 10 are views for describing a needle insertion device according to another embodiment of the present invention, and show the structure and operation of a needle insertion device (120) for inserting the needles (3) into the slots (2') formed on the upper surface of the cylinder (1) at the constant pitch intervals.

[0054] As illustrated in Fig. 7, the needle insertion device (120) according to the another embodiment of the present invention is configured similarly to the needle insertion device (20) according to the one embodiment of the present invention previously described, but is different from the previous embodiment in position and posture of the needles (3) loaded on a needle loading part (131) of a main body (133) and in structure of a needle guide unit (140) since the needle insertion device is adapted to insert the needles (3) into the slots (2') formed on the upper portion of the cylinder (1).

[0055] The other configuration is similar to the one embodiment of the present invention previously described; therefore, detailed description thereof will be omitted if possible by imparting related reference numerals and characteristic configuration will be mainly described.

[0056] In the needle insertion device (120) according to the another embodiment of the present invention, the plurality of needles (3) loaded on the needle loading part

(131) of the main body (133) are arranged such that their hook portions are oriented in a direction opposite the needle discharge direction and opposite sides of the hook portions are oriented in the needle discharge direction. Furthermore, the needles (3) are inclined downward in the needle discharge direction in the needle loading part (131), and for maintaining the needles (3) in such a posture, the needle loading part (131) is provided with a sloped plate (134).

[0057] As shown in Figs. 8 and 9, the needle guide unit (140) includes a first guide plate (141) installed inward of the needle discharge part (32) and a second guide plate (142) installed outward of a needle discharge part (132) while facing the first guide plate (141), with the needle discharge part being interposed between the two plates.

[0058] The first guide plate (141) has a needle passage groove (143) formed therein through which the foremost needle positioned in the needle loading part (131) passes, and the second guide plate (142) positions, in the needle discharge part (132), the needle which has passed through the needle passage groove (143).

[0059] Furthermore, in the second guide plate (142), a guide groove (144) is formed which provides a movement path for a needle pusher unit (150). The guide groove (144) is formed to be inclined downward with a predetermined angle in a needle discharge direction.

[0060] The needle pusher unit (150) includes a pusher piece (151), a guide piece (152), a first actuator (153) and a second actuator (154), as in the one embodiment of the present invention previously described. The pusher piece (151) has a guide pin (155) inserted in the guide groove (144) of the second guide plate (142), and is installed to be movable forward and backward in the needle discharge part (132).

[0061] If the needle (3) is positioned in the needle discharge part (132), the pusher piece (151) contacts with the butt portion or hook portion of the needle (3). In such a state, if the first actuator (153) is driven, the pusher piece (151) moves forward along a path defined by the guide groove (144), whereby the needle positioned in the needle discharge part moves in the direction of the slot (2') of the cylinder.

[0062] The guide piece (152) serves to guide the movement of the needle under the needle when the needle is moved by the pusher piece (151). The first actuator (153) is connected to the guide pin of the pusher piece (151) and the second actuator (154) is connected to the guide piece (152).

[0063] Herein, the pusher piece (151) and the guide piece (152) move forward together, and when a tip end of the guide piece (152) moves forward to a position close to the slot (2'), the guide piece (152) stops and only the pusher piece (151) continues moving forward to insert the needle (3) into the slot (2').

[0064] Hereinafter, with reference to Fig. 10, description will be made of a needle insertion process of the needle insertion apparatus according to the another embodiment of the present invention as described above.

[0065] First, the needles mounted on the existing cylinder are entirely or partially removed in a case where it is necessary to newly mounted and reset the needles of the cylinder, for example, for the reason that a new knitting machine is purchased or the needles used have to be replaced with new needles due to their decrepitness deterioration or knitted fabric has to be changed.

[0066] Next, the circular arc-shaped guide rail (10) is installed around the cylinder (1) in a certain section, and the needle insertion device (120) with a certain number of needles (3) accommodated therein is mounted on the guide rail. At this time, the needles may be mounted on the needle loading part of the needle insertion device in a cassette type.

[0067] The plurality of needles are accommodated in the needle loading part of the needle insertion device while being arrayed in a row. At this time, the plurality of arrayed needles are elastically biased toward the needle discharge part by the spring, and thus the foremost needle is positioned in the needle discharge part in a standby posture for discharge.

[0068] Such a state is illustrated in the leftmost figure of Fig. 10. As illustrated, the needle (3) is positioned so as to be inclined downward in the needle discharge direction, with the side of the needle opposite the hook portion being oriented in the needle discharge direction. The pusher piece (151) contacts with the upper portion and hook portion of the needle (3) and the guide piece (152) supports the needle (3) under the needle.

[0069] In such a state, if the first actuator (153) and the second actuator (154) are driven, the pusher piece (151) and the guide piece (152) move forward, thereby starting to move the needle (3), as shown in the second figure. At this time, the pusher piece (151) moves forward along the inclined guide groove (144) of the second guide plate (142), and thus the needle (3) moves toward the slot (2').

[0070] Subsequently, as shown in the third figure, the guide piece (152) stops and only the pusher piece (151) continues moving forward, when the needle (3) is inserted into the slot (2') to some extent while the pusher piece (151) and the guide piece (152) are moving forward together.

[0071] As the pusher piece (151) moves along the path defined by the guide groove (144), the needle (3) gradually moves into the slot (2') of the cylinder (1), and finally, is completely inserted in the slot (2'), as shown in the fourth figure.

[0072] Subsequently, the pusher piece (151) and guide piece (152) move backward to their original positions, and another one needle (3) is positioned again in the needle discharge part, and the process described above is performed to achieve the insertion of the another one needle.

[0073] If the insertion of the needles for any one section of the cylinder is completed by the process as described above, the guide rail is moved to and installed in the next section and then the process described above is repeat-

ed, whereby the insertion of the needles into the slots of the cylinder is automatically continued

[0074] Meanwhile, in the above description, the needle insertion apparatus for a circular knitting machine having a cylinder has been illustrated and described, but the needle insertion apparatus according to the present invention may be usefully used as a apparatus for automatically inserting the needles of a flat knitting machine having a flat needle bed or a textile machine as well as the described-above circular knitting machine.

[0075] As above, the present invention has been described by way of example. The terms used herein are only for the sake of description and should not be understood to have limited meanings. Various modifications and alterations of the present invention may be made according to the described-above matter. Therefore, the present invention may be freely carried out within the scope of claims, unless otherwise additionally mentioned.

Claims

1. A needle insertion apparatus for a knitting machine comprising:

   a guide rail detachably installed around a cylinder having a plurality of slots formed at constant pitch intervals, the needles being slidably mounted in the slots; and
   a needle insertion device mounted on the guide rail so as to be movable by the constant pitch interval to automatically insert the needles into the slots.

2. The needle insertion apparatus for a knitting machine according to claim 1, wherein the guide rail is formed in the shape of circular arc with an angle of 70 or 90° so that, by dividing the cylinder into four or five sections, a needle insertion operation is performed for each section.

3. The needle insertion apparatus for a knitting machine according to claim 1, wherein the needle insertion device comprises:

   a main body unit for accommodating a plurality of the needles; a needle guide unit for guiding the foremost needle of the needles accommodated in the main body unit from a discharge position to an insertion posture; and
   a needle pusher unit for pushing the needle guided by the needle guide unit toward one slot of the slots of the cylinder to insert the needle into the slot.

4. The needle insertion apparatus for a knitting machine according to claim 3, wherein the main body unit comprises:

   a main body which has a needle loading part where the plurality of needles are loaded while being arrayed in a row and a needle discharge part from which the needles are discharged;
   a sloped plate which is installed on the needle loading part of the main body to maintain the needles in an inclined posture of predetermined angle;
   a spring which positions the needles in the needle discharge part in order from the foremost needle to be on standby for discharge by resiliently supporting the plurality of needles loaded in the needle loading part toward the needle discharge part;
   feed rollers installed on a bottom of the main body; and
   a motor for rotationally driving the feed rollers.

5. The needle insertion apparatus for a knitting machine according to claim 4, wherein the needle guide unit comprises:

   a first guide plate which is installed inward of the needle discharge part of the main body and has a needle passage groove through which the foremost needle passes; and
   a second guide plate which is installed outward of the needle discharge part while facing the first guide plate and positions, in the needle discharge part, the needle which has passed through the needle passage groove and which has first and second guide grooves which provide a movement path for the needle pusher unit, the needle discharge part being interposed between the two guide plates.

6. The needle insertion apparatus for a knitting machine according to claim 5, wherein the needle pusher unit comprises:

   a pusher piece which has a first guide pin and a second guide pin inserted in the first guide groove and the second guide groove of the second guide plate and is installed to be movable forward and backward in the needle discharge part and which pushes out the needle positioned in the needle discharge part in the direction of the slot;
   a guide piece which guides movement of the needle under the needle when the needle is moved by the pusher piece;
   a first actuator for moving the pusher piece forward and backward; and
   a second actuator for moving the guide piece forward and backward.

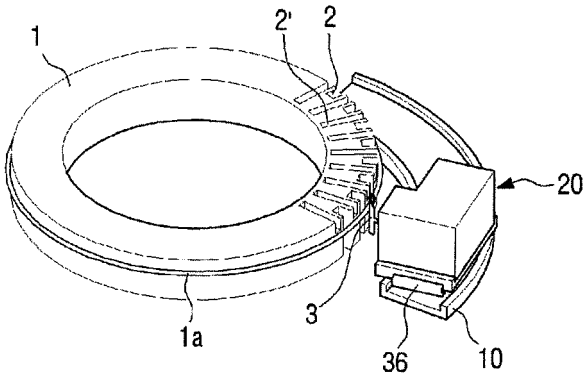
7. The needle insertion apparatus for a knitting machine according to claim 6, wherein the pusher piece and the guide piece move together forward and then move backward at the time when the hook portion of the needle enters the slot of the cylinder, thereby not hindering the insertion of the needle into the slot.

8. The needle insertion apparatus for a knitting machine according to claim 7, wherein the needles accommodated in the needle loading part of the main body unit are arrayed so as to be inclined upward in a needle discharge direction with their hook portions being oriented in the needle discharge direction, and thus the needle insertion apparatus is configured to insert the needles into the slots formed on an outer circumferential surface of the cylinder.

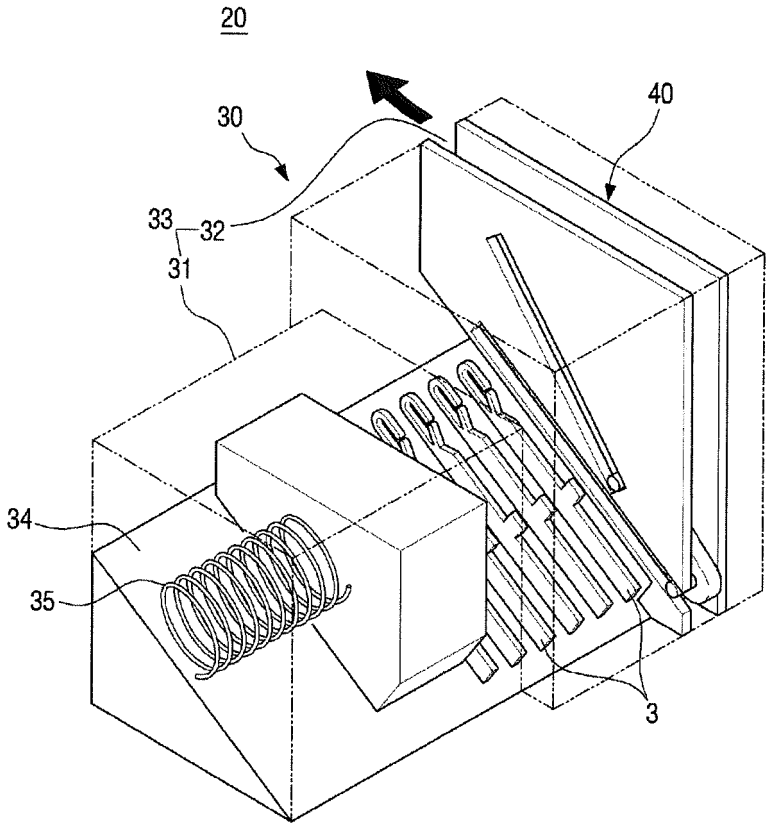
9. The needle insertion apparatus for a knitting machine according to claim 7, wherein the needles accommodated in the needle loading part of the main body unit are arrayed so as to be inclined downward in a needle discharge direction with their hook portions being oriented in a direction opposite the needle discharge direction, and thus the needle insertion apparatus is configured to insert the needles into the slots formed on an upper surface of the cylinder.

10. The needle insertion apparatus for a knitting machine according to claim 8 or 9, wherein the pusher piece moves the needle by contacting with a butt portion or rear end portion of the needle.

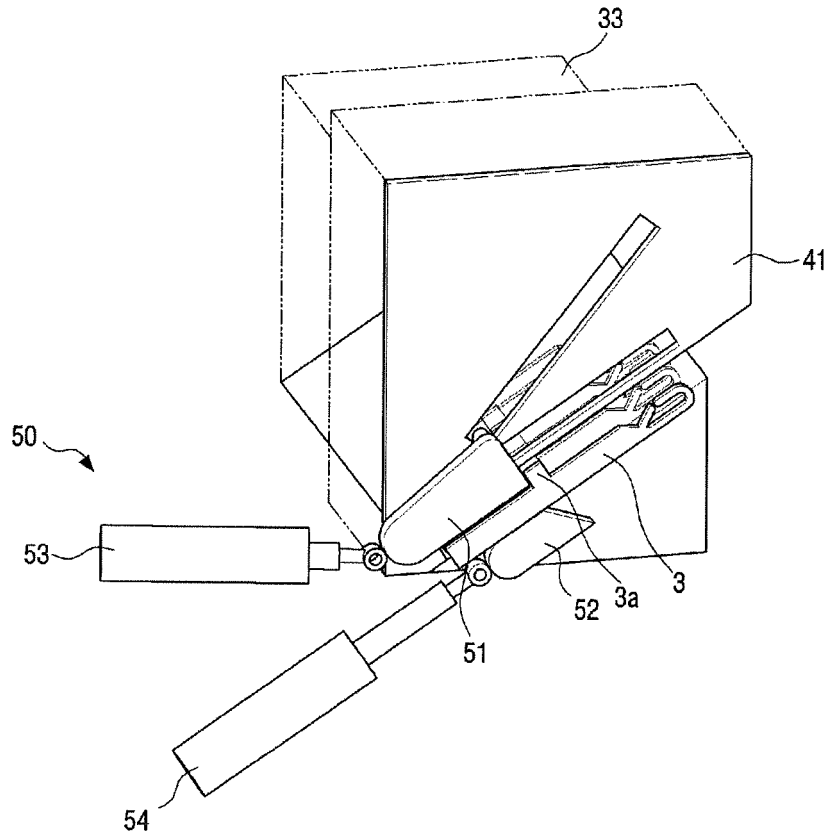
[Fig. 1]



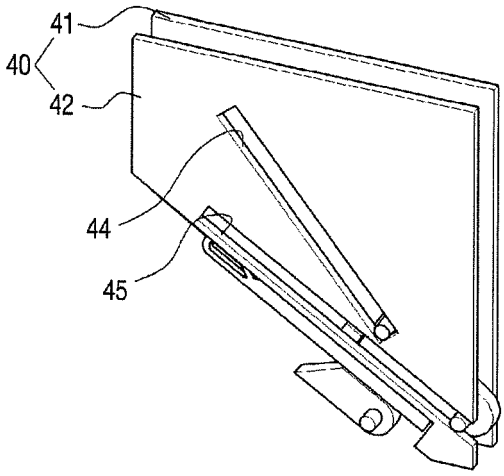
[Fig. 2]



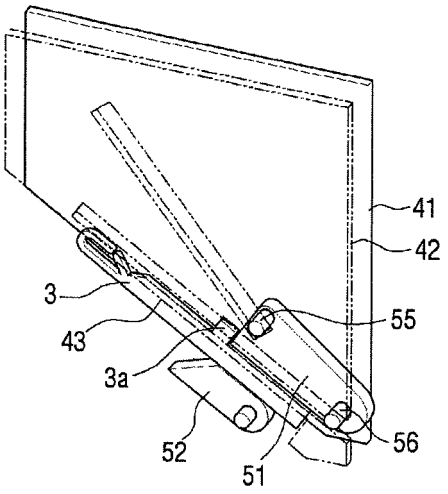
[Fig. 3]



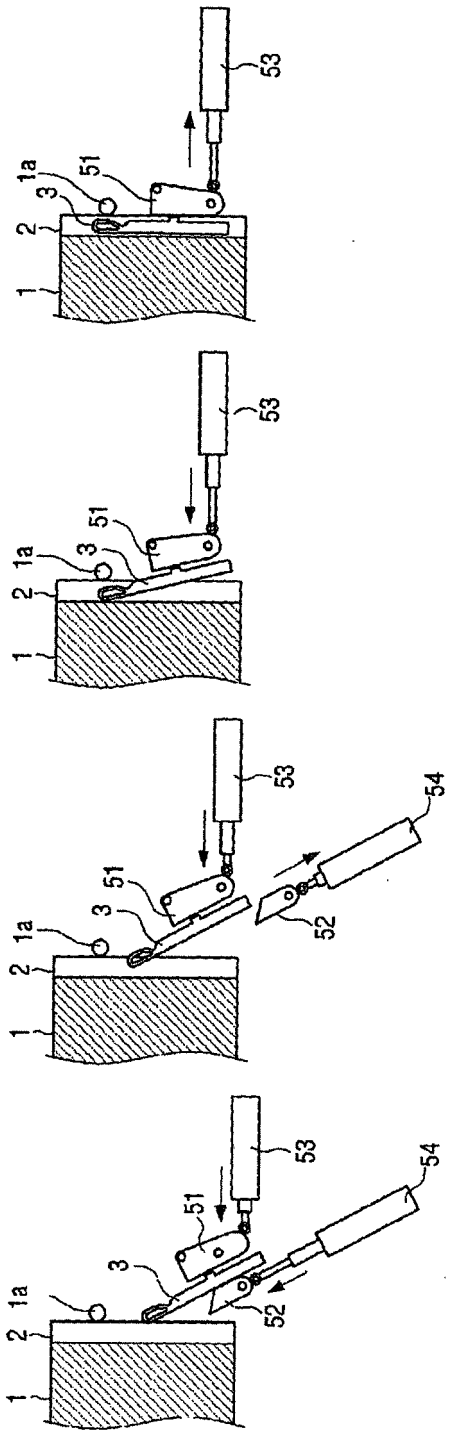
[Fig. 4]



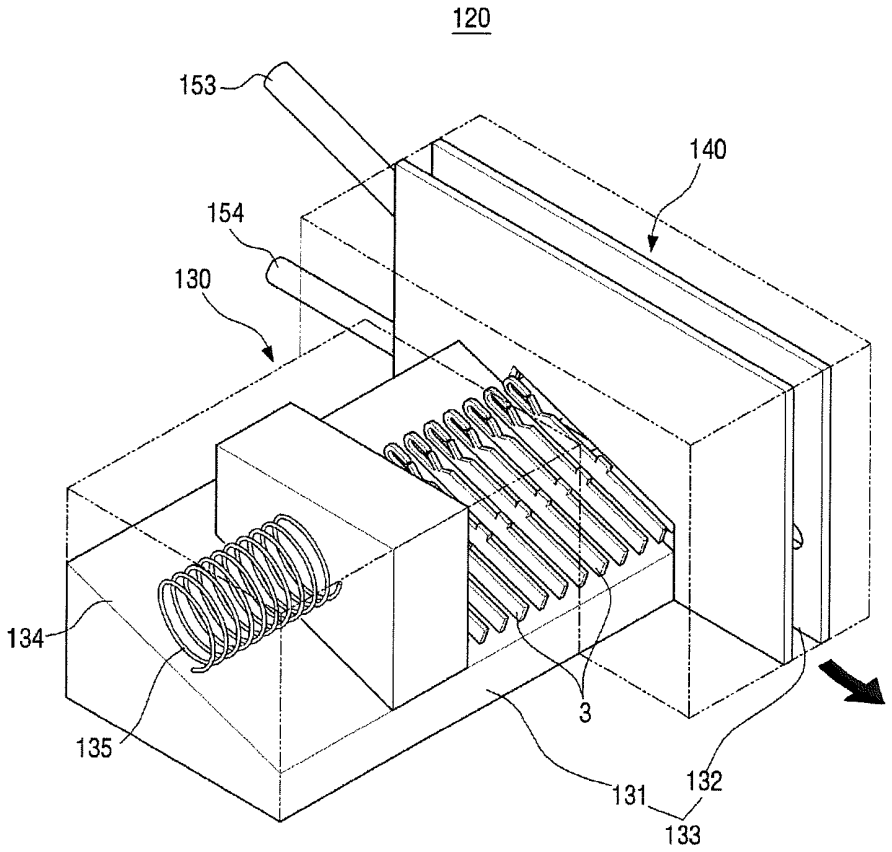
[Fig. 5]



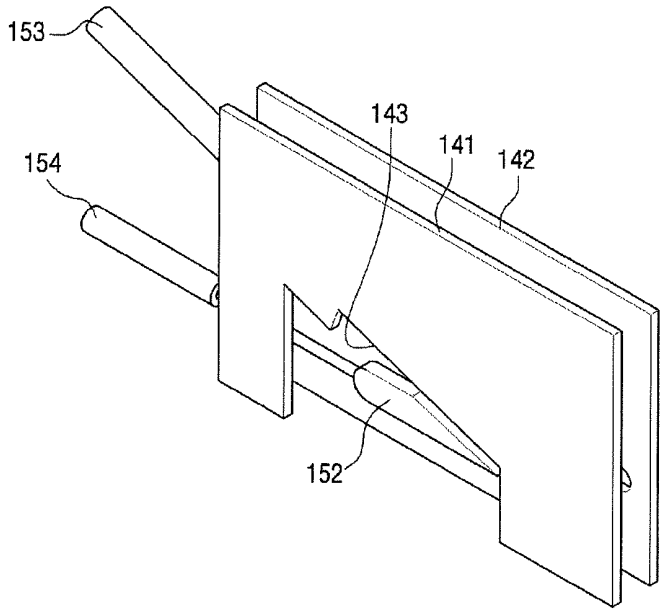
[Fig. 6]



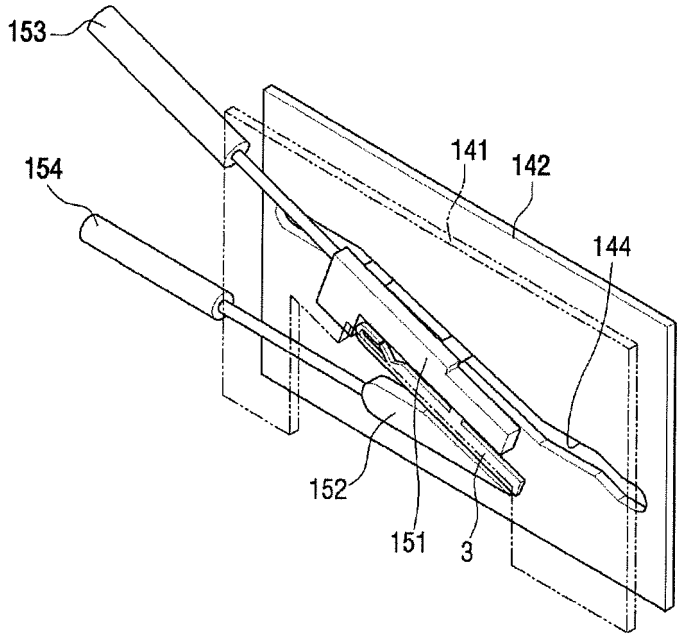
[Fig. 7]



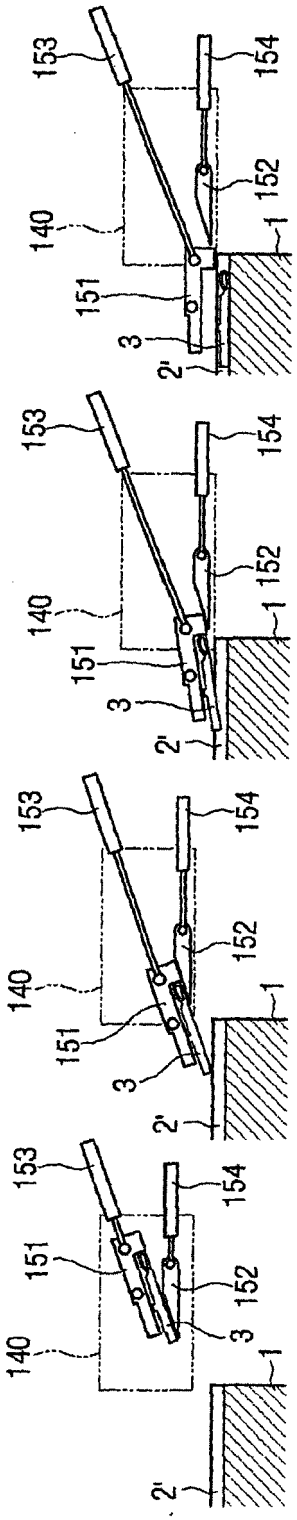
[Fig. 8]



[Fig. 9]



[Fig. 10]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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2013/001187

A. CLASSIFICATION OF SUBJECT MATTER

D04B 35/00(2006.01)i, D04B 15/00(2006.01)i, D04B 15/28(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D04B 35/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS (KIPO internal) & Keywords: needle, insertion

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2004-0055916 A1 (FALLER, Armin et al.) 25 March 2004 See abstract; claims 1 and 19; and figures 2 and 5.	1-10
A	JP 2008-291417 A (GROZ-BECKERT KG) 04 December 2008 See abstract; claims 1, 9 and 12; and figure 1.	1-10
A	KR 20-0304796 Y1 (PARK, Seung Heon) 19 February 2003 See claim 1; figures 1 and 4.	3

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 MAY 2013 (24.05.2013)	**27 MAY 2013 (27.05.2013)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2013/001187

Patent document cited in search report	Publication date	Patent family member	Publication date
US 2004-0055916 A1	25.03.2004	CN 1495112 C0	11.04.2007
		CN1495112 A	12.05.2004
		DE 10244315 A1	01.04.2004
		DE 10244315 B4	05.01.2006
		EP 1400619 A1	24.03.2004
		JP 03-936927 B2	27.06.2007
		JP 2004-115994 A	15.04.2004
		KR 10-0955407 B1	04.05.2010
		KR 2004-0026612A	31.03.2004
		US 7070050 B2	04.07.2006
JP 2008-291417 A	04.12.2008	CN 101298723 A	05.11.2008
		CN 101298723 B	20.04.2011
		DE 502007001851 D1	10.12.2009
		EP 1988200 A1	05.11.2008
		EP 1988200 B1	28.10.2009
		JP 05-009854 B2	08.06.2012
		KR 10-0969499 B1	14.07.2010
		KR 2008-0097925 A	06.11.2008
		US 2008-0271496 A1	06.11.2008
		US 7762106 B2	27.07.2010
KR 20-0304796 Y1	19.02.2003	NONE	

Form PCT/ISA/210 (patent family annex) (July 2009)