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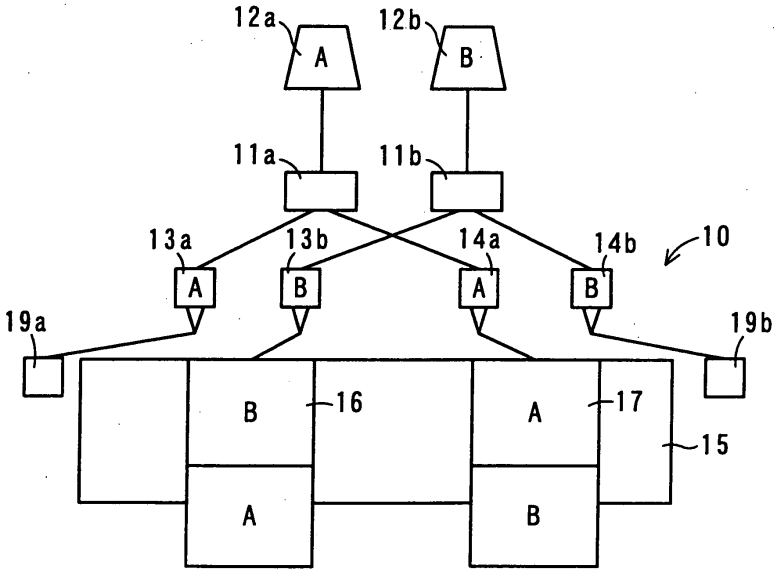
# (54) KNITTING YARN SWITCHING METHOD AND KNITTING YARN SWITCHING DEVICE

(57) The invention relates to a knitting yarn switching method and a knitting yarn switching device. When knitting yarns from yarn cones (12b, 12a) are fed to yarn feeders (13b, 14a), end portions of the knitting yarn fed to the yarn feeders (14b, 13a) are held, and when knitting yarns from the yarn cones (12b, 12a) are fed to the yarn feeders (14b, 13a), end portions of the knitting yarns fed to the yarn feeders (13b, 14a) are held. The knitting yarns to be connected thus held and the yarn cones (12b, 12a) are pieced into each other, and thereafter, holding of the end portions of the knitting yarns to be connected is released, and the knitting yarns fed from the yarn cones (12b, 12a) are cut between the pieced portions of the knitting yarns to be connected and portions reaching the yarn feeders, and the end portions of the knitting yarns cut off from the yarn cones (12b, 12a) are held.

FIG. 1

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## Description

Technical Field

**[0001]** The present invention relates to a knitting yarn switching method and a knitting yarn switching device.

Background Art

**[0002]** Fig. 14 is a view schematically showing the manner that knitting yarns are fed in a weft knitting machine 1. In the case where the weft knitting machine 1 is used to knit a muffler or the like while changing colored yarns from a predetermined region, a plurality of knit fabrics 3 and 4 are knitted with a predetermined gap interposed therebetween on one needle bed 2. When the plurality of knit fabrics 3 and 4 are knitted in this manner, yarn feeders 5a and 5b that respectively feed knitting yarns A and B necessary for knitting the knit fabric 3 and having mutually different colors and yarn feeders 6a and 6b that respectively feed the knitting yarns A and B necessary for knitting the knit fabric 4 are arranged, and the knitting yarns are fed to knitting needles of the needle bed 2. The knitting yarns A are fed respectively from yarn cones 7a and 8a, which are knitting yarn-feeding sources, to the yarn feeders 5a and 6a, and the knitting yarns B are fed respectively from yarn cones 7b and 8b to the yarn feeders 5b and 6b.

**[0003]** In a conventional technique, in order to knit the plurality of knit fabrics 3 and 4, one yarn cone has to be prepared for one yarn feeder. Thus, in order to knit the plurality of knit fabrics 3 and 4 while switching knitting yarns of a large number of colors, the number of yarn cones increases according to the number of necessary knitting yarns. Accordingly, this configuration is problematic in that a large installation space for installing the yarn cones is necessary and that management of the knitting yarns becomes difficult.

Disclosure of Invention

**[0004]** It is an object of the invention to provide a knitting yarn switching method and a knitting yarn switching device that can reduce the number of knitting yarn-feeding sources such as yarn cones necessary for knitting and can easily manage knitting yarns.

**[0005]** The invention is directed to a knitting yarn switching method for switching a plurality of yarn feeders to which a knitting yarn from a knitting yarn-feeding source is to be fed, using a holding device that can hold an end portion of a knitting yarn, a cutting device that can cut a knitting yarn, and a piecing device that pieces knitting yarns, comprising the steps of:

causing the holding device to hold an end portion of a knitting yarn individually fed to one of the plurality of yarn feeders in a state where a knitting yarn from the knitting yarn-feeding source is fed to another yarn feeder;

causing the piecing device to piece the knitting yarn as a piecing target held at the end portion by the holding device and the knitting yarn from the knitting yarn-feeding source into each other;

releasing the end portion of the knitting yarn as a piecing target that has been held by the holding device, after the piecing step;

causing the cutting device to cut the knitting yarn fed from the knitting yarn-feeding source at a point between the portion of the knitting yarn as a piecing target pieced by the piecing device and the portion reaching the yarn feeder; and

causing the holding device to hold a cut end portion of the knitting yarn cut off from the knitting yarn-feeding source.

**[0006]** Moreover, the invention is directed to a knitting yarn switching device, comprising:

a selection portion that has two insertion holes through which knitting yarns are respectively and individually inserted, and that arranges one of the knitting yarns at a selection position and the other knitting yarn at a retraction position by moving the insertion holes;

a cutting and holding portion that can hold an end portion of a knitting yarn inserted through the insertion hole and that can cut a knitting yarn arranged at the selection position by the selection portion;

a piecing portion that has an accommodation space into which knitting yarns are inserted, and pieces a plurality of knitting yarns inserted into the accommodation space by a jet of a compressed fluid onto the plurality of knitting yarns;

a guide portion that catches the knitting yarn held at the end portion by the cutting and holding portion and arranged at the selection position by the selection portion, and inserts part of the caught knitting yarn into the accommodation space; and

a control portion that controls the selection portion, the cutting and holding portion, the piecing portion, and the guide portion so that, in a state where an end portion of a knitting yarn inserted through one insertion hole is held by the cutting and holding portion and a knitting yarn inserted through another insertion hole is inserted through the accommodation space of the piecing portion, the selection portion arranges the knitting yarn inserted through the one insertion hole at the selection position, the guide portion then inserts part of the knitting yarn arranged at the selection position into the accommodation space of the piecing portion, the piecing portion performs a piecing operation, the end portion of the knitting yarn inserted through the one insertion hole that has been held by the cutting and holding portion is then released, the selection portion arranges the knitting yarn inserted through the other insertion hole at the

selection position, and the cutting and holding portion then cuts the knitting yarn inserted through the other insertion hole and holds the end portion of the knitting yarn inserted through the other insertion hole.

**[0007]** Furthermore, in the invention, it is preferable that the cutting and holding portion comprises:

a first member that has a cutting blade, and a first holding face disposed on one side of the cutting blade in a predetermined direction;
a second member that has a second holding face; and
a driving portion that moves the first member between a holding position at which a knitting yarn can be held between the first and the second holding faces, and a release position at which a knitting yarn held between the first and the second holding faces can be released, the release position being disposed away in the predetermined direction from the holding position.

**[0008]** Furthermore, in the invention, it is preferable that the selection portion comprises:

plates in which the insertion holes are individually formed; and
a driving portion that drives the plates.

Brief Description of Drawings

**[0009]** Other and further objects, features, and advantages of the invention will be more explicit from the following detailed description taken with reference to the drawings wherein:

Fig. 1 is a view schematically showing the manner in which knitting yarns are fed in a weft knitting machine 10 using a knitting yarn feeding method according to an embodiment of the invention;
Figs. 2A and 2B are a plan view and a front view showing a knitting yarn switching device 11 acording to an embodiment of the invention;
Figs. 3A and 3B are a plan view and a front view showing a main portion of the knitting yarn switching device 11;
Figs. 4A and 4B are a plan view and a front view showing an enlarged one end portion of a first member 37;
Fig. 5 is a block diagram showing the electrical configuration necessary for controlling a knitting yarn-switching operation of the knitting yarn switching device 11;
Fig. 6 is a flowchart showing the procedure of a piecing operation;
Figs. 7A and 7B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where a currently used knitting yarn A is disposed at the retraction position and a standby knitting yarn B is disposed at the selected position;
Figs. 8A and 8B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A and the standby knitting yarn B are accommodated in the accommodation space 51;
Figs. 9A and 9B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A and the standby knitting yarn B are accommodated in the accommodation space 51 and one end portion of the knitting yarn B that has been held is released;
Figs. 10A and 10B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A and the standby knitting yarn B are accommodated in a accommodation space 51, one end portion of the standby knitting yarn B that has been held is released, and then the knitting yarn A is disposed at the selected position and the knitting yarn B is disposed at the retraction position;
Figs. 11A and 11B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A is cut, and one end portion thereof (a cut end portion) is held;
Figs. 12A and 12B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the knitting yarn A held at the one end portion is moved to the retraction position and the knitting yarn B is moved to the selected position;
Figs. 13A and 13B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the knitting yarn A is moved to the retraction position, the knitting yarn B is moved to the selected position, and then the guide lever 55 is disposed at the standby position; and
Fig. 14 is a view schematically showing the manner that knitting yarns are fed in a weft knitting machine.

Best Mode for Carrying out the Invention

**[0010]** Now referring to the drawings, preferred embodiments of the invention are described below.

**[0011]** Fig. 1 is a view schematically showing the manner in which knitting yarns are fed in a weft knitting machine 10 using a knitting yarn feeding method according to an embodiment of the invention. In the knitting yarn feeding method of this embodiment, knitting yarn switching devices 11a and 11b are used to selectively feed a knitting yarn from a yarn cone 12a to a plurality of yarn feeders 13a and 14a and selectively feed a knitting yarn from a yarn cone 12b to a plurality of yarn feeders 13b

and 14b. The yarn cones 12a and 12b are knitting yarn-feeding sources.

**[0012]** In the case where the weft knitting machine 10 is used to knit a muffler or the like while changing colored yarns from a predetermined region, a plurality of knit fabrics 16 and 17 are knitted with a predetermined gap interposed therebetween on one needle bed 15. When the plurality of knit fabrics 16 and 17 are knitted in this manner, the yarn feeders 13a and 13b that respectively feed knitting yarns A and B necessary for knitting the knit fabric 16 and the yarn feeders 14a and 14b that respectively feed the knitting yarns A and B necessary for knitting knit fabric 17 are arranged, and the knitting yarns are fed to knitting needles of the needle bed 15. The knitting yarn A is selectively fed from the yarn cone 12a via the knitting yarn switching device 11a to the yarn feeders 13a and 14a, and the knitting yarn B is selectively fed from the yarn cone 12b via the knitting yarn switching device 11b to the yarn feeders 13b and 14b.

**[0013]** The knitting yarn switching devices 11a and 11b hold end portions of the knitting yarns A and B on an upstream side in a feeding direction thereof, the knitting yarns A and B being fed not to a currently used yarn feeder to which the knitting yarns A and B are directly fed from the yarn cones 12a and 12b, but to a standby yarn feeder, among the yarn feeders 13a, 13b, 14a, and 14b. In the standby knitting yarns A and B in which the end portions on the upstream side in the feeding direction thereof are held by the knitting yarn switching devices 11a and 11b, end portions on a downstream side in the feeding direction thereof are held by clips 19a and 19b arranged near the needle bed 15.

**[0014]** In the case where the weft knitting machine 10 is used to respectively knit the knit fabrics 16 and 17, by using the knitting yarn switching device 11a to selectively feed the knitting yarn A to the yarn feeder 13a and simultaneously using the knitting yarn switching device 11b to selectively feed the knitting yarn B to the yarn feeder 14b, or by using the knitting yarn switching device 11a to selectively feed the knitting yarn A to the yarn feeder 14a and simultaneously using the knitting yarn switching device 11b to selectively feed the knitting yarn B to the yarn feeder 13b, the knit fabrics 16 and 17 can be simultaneously knitted using only the knitting yarns A and B fed from the two yarn cones 12a and 12b, and the number of yarn cones can be reduced. Accordingly, an increase in the size of the installation space can be suppressed, and the knitting yarns can be easily managed. The knitting yarn switching devices 11a and 11b have similar configurations. Hereinafter, the knitting yarn switching devices 11a and 11b are collectively referred to as a knitting yarn switching device 11.

**[0015]** Figs. 2A and 2B are a plan view and a front view showing the knitting yarn switching device 11 of an embodiment of the invention. Figs. 3A and 3B are a plan view and a front view showing a main portion of the knitting yarn switching device 11. Figs. 4A and 4B are a plan view and a front view showing an enlarged one end portion of a first member 37. The knitting yarn switching device 11 includes a selection portion 21, a cutting and holding portion 22, a piecing portion 23, a guide portion 24, and a base portion 25 on which these portions are arranged.

**[0016]** The selection portion 21 includes plates 27a and 27b in which insertion holes 26a and 26b through which knitting yarns are respectively and individually inserted are individually formed at one end portion in a longitudinal direction thereof and cutouts 29a and 29b are respectively formed at the other end portion, and a first driving portion 29 that drives both plates 27a and 27b. The plates 27a and 27b have the substantially same length in the longitudinal direction thereof, are arranged so as to partially overlap each other in a thickness direction thereof, and respectively have elongated holes 32a and 32b through which a guide member 33 is inserted. Hereinafter, a knitting yarn inserted through the insertion hole 26a is referred to as a "knitting yarn A", and a knitting yarn inserted through the insertion hole 26b is referred to as a "knitting yarn B". A knitting yarn that is not specified as either the knitting yarn A or the knitting yarn B is simply referred to as a "knitting yarn".

**[0017]** The first driving portion 29 is implemented by an electric motor. A first connecting member 30 having rollers 31a and 31b that can rotate about a rotational axis L1 is fixed to the rotational axis of the first driving portion 29. The rollers 31a and 31b respectively fit to the cutouts 29a and 29b. When the first connecting member 30 is angularly displaced to one side F1 about the rotational axis L1, the plate 27a is projected forward with respect to the plate 27b in the section of the diagram of Fig. 2B. Thus, the knitting yarn A is disposed at the retraction position, and the knitting yarn B is disposed at the selection position. Furthermore, when the first connecting member 30 is angularly displaced to the other side F2 about the rotational axis L1, the plate 27b and the plate 27a are arranged the other way around. Thus, the knitting yarn B is disposed at the retraction position, and the knitting yarn A is disposed at the selection position. The base portion 25 includes a first base portion 25a and a second base portion 25b, and is substantially formed in a T-shape. The first driving portion 29 is fixed to the first base portion 25a.

**[0018]** The cutting and holding portion 22 can hold one end portion of the knitting yarns A and B inserted through the insertion holes 26a and 26b, and can cut a knitting yarn arranged at the selection position by the selection portion 21. The cutting and holding portion 22 includes a first member 37 in which a projecting portion 42 having a cutting blade 35 and a first holding face 36 is formed at one end portion in the longitudinal direction thereof and an elongated hole 43 and a roller 44 are formed at the other end portion, a second member 39 having a second holding face 38, and a second driving portion 41. The cutting blade 35 is formed adjacent to the first holding face 36, at an end portion of the projecting portion 42 closer to the elongated hole 43, and this end portion is

inclined rightward in Figs. 2A to 4B toward the first holding face 36 and the second base portion 25b. Furthermore, the projecting portion 42 has an inclined face 50 that guides a knitting yarn at the selection position toward the second base portion 25b when moving the first member 37 to a release position.

**[0019]** The second member 39 is fixed via an attachment member 46 to the second base portion 25b, and extends from the attachment member 46 toward the second base portion 25b. The second holding face 38 parallel to the first holding face 36 is formed on an end portion of the second member 39 on the side of the first member 37. The second driving portion 41 moves the first member 37 between a holding position at which a knitting yarn can be held between the first and the second holding faces 36 and 38 and a release position at which a knitting yarn held between the first and the second holding faces 36 and 38 can be released. In Figs. 4A and 4B, the positions of the second member 39 at the holding position and the release position relative to the first member 37 are respectively indicated by the dashed double dotted line and the dashed dotted line.

**[0020]** The second driving portion 41 is implemented by an electric motor. At the rotational axis of the second driving portion 41, a connecting shaft 45 that is inserted through the elongated hole 43 is disposed, and a second connecting member 40 in which a guide groove 47 that guides the roller 44 is formed is fixed. The guide groove 47 is formed so as to be away from a rotational axis L2 toward one side F3 about the rotational axis L2. Accordingly, when the second connecting member 40 is angularly displaced to the other side F4 about the rotational axis L2, the roller 44 moves along the guide groove 47, the connecting shaft 45 moves in the elongated hole 43, and the first member 37 can be moved to the release position. When the second connecting member 40 is angularly displaced to one side F3 about the rotational axis L2, the first member 37 can be moved to the holding position the other way around. The second driving portion 41 is fixed to the second base portion 25b.

**[0021]** The piecing portion 23 has a splicing head 52 in which an accommodation space 51 that passes through the knitting yarn-feeding direction and into which knitting yarns are inserted is formed, and pieces a plurality of knitting yarns inserted into the accommodation space 51 by a jet of compressed air, which is a compressed fluid, onto the plurality of knitting yarns. The splicing head 52 has a communication path 53 that connects the accommodation space 51 and the outside space in communication with each other, expands away from the accommodation space 51 as shown in Fig. 2A, and guides a knitting yarn caught by the guide portion 24 to the accommodation space 51. The splicing head 52 is disposed at the second base portion 25b, on an opposite side to the first holding face 36 of the first member 37.

**[0022]** The guide portion 24 includes a guide lever 55 that catches a knitting yarn held at one end portion thereof by the cutting and holding portion 22 and arranged at the selection position by the selection portion 21, and inserts part of the caught knitting yarn into the accommodation space 51, and a third driving portion 56. The third driving portion 56 is implemented by an electric motor. The guide lever 55 includes a third connecting member 58 that is fixed at the base end portion thereof to the rotational axis of the third driving portion 56, and pin members 57a and 57b that are arranged at a free end portion of the third connecting member 58. The pin members 57a and 57b are arranged about a rotational axis L3 with a predetermined gap interposed therebetween. The third driving portion 56 is fixed to the first base portion 25a. The pin members 57a and 57b each have a columnar shape, and yarn-catching grooves 61a and 61b are formed at the front end portion thereof.

**[0023]** The third driving portion 56 angularly displaces the guide lever 55 between a standby position and an insertion position. The pin members 57a and 57b are arranged so that the movement path thereof intersects only a knitting yarn disposed at the selection position, without being brought into contact with a knitting yarn when the guide lever 55 is at the standby position. The guide lever 55 is angularly displaced to one side F5 about the rotational axis L3 to move from the standby position to the insertion position, and angularly displaced to the other side F6 to move from the insertion position to the standby position. When the guide lever 55 moves from the standby position to the insertion position, the yarn-catching grooves 61a and 61b catch a knitting yarn arranged at the selection position, and the accommodation space 51 accommodates the portion of the caught knitting yarn between the portion caught by the yarn-catching groove 61a and the end portion held by the cutting and holding portion 22.

**[0024]** Fig. 5 is a block diagram showing the electrical configuration necessary for controlling a knitting yarn-switching operation of the knitting yarn switching device 11. The knitting yarn switching device 11 includes a control portion 71, a retraction position sensor 72 that detects whether or not either the plate 27a or 27b is at the retraction position, a lever home position sensor 73 that detects the standby position of the guide lever 55, and a cam home position sensor 74 that selects the holding position of the second connecting member 40. For example, a stepping motor is used as the first to the third driving portions 29, 41, and 56, and the control portion 71 drives the rotational axes of the driving portions back and forth so as to correspond to a certain angular range by controlling the angular position and the rotational direction by regulating the number of drive pulses generated and the like based on the detection results obtained by the sensors 72 to 74.

**[0025]** Upon receiving an instruction to perform a piecing operation, the control portion 71 controls the selection portion 21, the cutting and holding portion 22, the piecing portion 23, and the guide portion 24. Furthermore, the control portion 71 controls the piecing portion 23 so that an air-supplying valve 75 implemented by a solenoid

valve is electrically opened and closed. The air-supplying valve 75 is connected to a gas cylinder or a compressor, and compressed air is supplied to the splicing head 52 or the supply is stopped according to the opening and closing of the air-supplying valve 75.

**[0026]** Fig. 6 is a flowchart showing the procedure of a piecing operation. Figs. 7A and 7B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A is disposed at the retraction position and the standby knitting yarn B is disposed at the selection position. Figs. 8A and 8B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A and the standby knitting yarn B are accommodated in the accommodation space 51. Figs. 9A and 9B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A and the standby knitting yarn B are accommodated in the accommodation space 51 and one end portion of the knitting yarn B that has been held is released. Figs. 10A and 10B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A and the standby knitting yarn B are accommodated in the accommodation space 51, one end portion of the standby knitting yarn B that has been held is released, and then the knitting yarn A is disposed at the selection position and the knitting yarn B is disposed at the retraction position. Figs. 11A and 11B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the currently used knitting yarn A is cut, and one end portion thereof (a cut end portion) is held. Figs. 12A and 12B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the knitting yarn A held at the one end portion is moved to the retraction position and the knitting yarn B is moved to the selection position. Figs. 13A and 13B are a plan view and a front view schematically showing the knitting yarn switching device 11 in a state where the knitting yarn A is moved to the retraction position, the knitting yarn B is moved to the selection position, and then the guide lever 55 is disposed at the standby position.

**[0027]** The knitting yarn-switching operation is performed while being controlled by the control portion 71, and started when knitting yarns have to be changed. Here, for the sake of description, in the initial state, the knitting yarn A inserted through the insertion hole 26a is taken as a currently used knitting yarn, and the knitting yarn B inserted through the insertion hole 26b is taken as a standby knitting yarn, as shown in Figs. 3A and 3B. Furthermore, the first member 37 is disposed at the holding position, and one end portion of the standby knitting yarn B is held by the cutting and holding portion 22. Furthermore, the knitting yarn A is disposed at the selection position, and the knitting yarn B is disposed at the retraction position. Furthermore, the knitting yarn A is inserted through the accommodation space 51 of the splicing head 52. Furthermore, the guide lever 55 is disposed at the standby position, the air-supplying valve 75 is closed, and there is no flow of compressed air for piecing yarns.

**[0028]** In Step s1, as shown in Figs. 7A and 7B, the control portion 71 causes the selection portion 21 to move the knitting yarn B to the selection position at which the knitting yarn B can be caught by the yarn-catching grooves 61a and 61b and to move the knitting yarn A to the retraction position at which the knitting yarn A cannot be caught by the guide lever 55.

**[0029]** Next, in Step s2, the control portion 71 controls the second driving portion 41 so that the guide lever 55 is angularly displaced from the standby position, and that the angular displacement of the guide lever 55 is stopped when the guide lever 55 reaches the insertion position as shown in Figs. 8A and 8B. The currently used knitting yarn A passes in front of the front end portion of the guide lever 55 in the section of the diagram of Fig. 8B. When the guide lever 55 is angularly displaced, only the knitting yarn B at the selection position can be caught by the yarn-catching grooves 61a and 61b. The knitting yarn B can be accommodated in the accommodation space 51 of the splicing head 52 as the guide lever 55 moves. Since the pin members 57a and 57b are arranged with a predetermined gap interposed therebetween as described above, when the guide lever 55 is disposed at the insertion position, only the portion of the knitting yarn B between the pin member 57a and the portion held by the cutting and holding portion 22 can be accommodated in the accommodation space 51.

**[0030]** Next, in Step s3, the control portion 71 controls the air-supplying valve 75 so that compressed air is supplied to the splicing head 52 for a predetermined period of time, and the knitting yarns A and B are pieced into each other. A nozzle for compressed air is formed in the splicing head 52. In the air flow at the accommodation space 51, the knitting yarns A and B that have been each twisted are untwined and then intertwined for piecing yarns.

**[0031]** Next, in Step s4, as shown in Figs. 9A and 9B, the control portion 71 controls the second driving portion 41 so that the second connecting member 40 is angularly displaced from the holding position, and the first member 37 is moved from the holding position to the release position. Accordingly, one end portion of the knitting yarn B that has been held by the cutting and holding portion 22 is released.

**[0032]** During movement from the holding position to the release position, the front end portion of the first member 37 is brought into contact with the portion of the knitting yarn B that is extended between the insertion hole 26b and the pin member 57b, but the knitting yarn B is guided along the inclined face 50 described above in the first member 37 toward the second base portion 25b, and thus, the knitting yarn B is prevented from being caught by the projecting portion 42.

**[0033]** Next, in Step s5, as shown in Figs. 10A and

10B, the control portion 71 controls the first driving portion 29 so that the knitting yarn A inserted through the insertion hole 26a is disposed at the selection position.

**[0034]** Next, in Step s6, as shown in Figs. 11A and 11B, the control portion 71 controls the second driving portion 41 so that the second connecting member 40 is angularly displaced, and the first member 37 is moved from the release position to the holding position. Accordingly, the knitting yarn A disposed at the selection position is caught by the projecting portion 42 of the first member 37, and pulled in the movement direction of the first member 37. When the first member 37 moves to the position at which the first holding face 36 faces the second holding face 38, the knitting yarn A is held between the first and the second holding faces 36 and 38. Furthermore, the knitting yarn A caught by the projecting portion 42 is also in contact with the cutting blade 35. When the first member 37 moves in a state where one end portion of the knitting yarn A is held between the first and the second holding faces 36 and 38, the knitting yarn A is pressed against the cutting blade 35 and cut.

**[0035]** Next, in Step s7, as shown in Figs. 12A and 12B, the control portion 71 controls the first driving portion 29 so that the knitting yarn A is moved to the retraction position, and that the knitting yarn B is moved to the selection position.

**[0036]** Next, in Step s9, as shown in Figs. 13A and 13B, the control portion 71 controls the third driving portion 56 so that the guide lever 55 is moved from the insertion position to the standby position. Since the knitting yarn A is at the retraction position, the guide lever 55 moves to the standby position without catching the knitting yarn A.

**[0037]** Through the above-described operation, it is possible to put the knitting yarn A inserted through the insertion hole 26a on standby in a state where one end portion of the knitting yarn A is held by the cutting and holding portion 22, and to use the knitting yarn B inserted through the insertion hole 26b. In the foregoing description, the case was described in which a state where a knitting yarn from a yarn cone is fed to the insertion hole 26a is switched to a state where the knitting yarn is fed to the insertion hole 26b, but the case in which a state where a knitting yarn from a yarn cone is fed to the insertion hole 26b is switched to a state where the knitting yarn is fed to the insertion hole 26a can be implemented through the same operation except that the insertion holes 26a and 26b at the selection position or the retraction position are arranged the other way around in Steps s1, s5, and s7 of the above-described flowchart.

**[0038]** With this knitting yarn switching device 11, the knitting yarn A can be selectively fed from the yarn cone 12a to the plurality of yarn feeders 13a and 14a, and the knitting yarn B can be selectively fed from the yarn cone 12b to the plurality of yarn feeders 13b and 14b. Accordingly, the number of yarn cones can be reduced, an increase in the size of the installation space can be suppressed, and the knitting yarns can be easily managed.

**[0039]** Furthermore, in the knitting yarn switching device 11, when the second driving portion 41 moves the first member 37 from the release position to the holding position, a knitting yarn arranged at the selection position can be pulled and held between the first holding face 36 and the second holding face 38, and the cutting blade 35 can be brought into contact with the knitting yarn and cut the knitting yarn. Since one end portion of a knitting yarn can be held and cut by driving the first member 37 with one driving portion, the device can be made smaller.

**[0040]** Furthermore, in the knitting yarn switching device 11, one knitting yarn can be disposed at the selection position and the other knitting yarn can be disposed at the retraction position, by driving the plates 27a and 27b not with respective driving portions but with one driving portion. Thus, the device can be made smaller. The above-described cutting and holding portion 22 is a holding device and a cutting device, and the piecing portion 23 is a piecing device.

**[0041]** In the foregoing embodiment, the knitting yarn switching device 11 is used to switch a portion to which a yarn from one yarn cone is to be fed, but a configuration is also possible in which a conventional splicer device is disposed on the upstream side in the yarn-feeding direction of the knitting yarn switching device 11, and this splicer device is used to feed a knitting yarn from any of a plurality of yarn cones to the knitting yarn switching device 11.

**[0042]** The above-described knitting yarn switching device 11 may be used as a splicer device that selectively switches knitting yarns fed from two yarn cones to one yarn feeder in a state where a knitting yarn from one of the two yarn cones is inserted through the insertion hole 26a and fed to the yarn feeder and a knitting yarn from the other yarn cone is inserted through the insertion hole 26b and held at one end portion thereof by the cutting and holding portion 22.

**[0043]** The foregoing embodiments are merely one example of the invention, and the configuration can be modified within the scope of the invention. For example, in the foregoing embodiments, compressed air was used as a compressed fluid, but the type of fluid is not limited to air, and a gas inert to a yarn that is to be pieced, such as nitrogen gas, may be used instead of air. Also, compressed water may be used as a compressed fluid.

**[0044]** The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and the range of equivalency of the claims are therefore intended to be embraced therein.

## Industrial Applicability

**[0045]** According to the invention, a knitting yarn fed

from a knitting yarn-feeding source to any one of a plurality of yarn feeders can be pieced into a knitting yarn individually fed to another yarn feeder and fed to the yarn feeder. That is to say, a knitting yarn from a common knitting yarn-feeding source can be selectively fed to different yarn feeders, and thus, the number of knitting yarn-feeding sources can be reduced. Accordingly, an increase in the size of the installation space can be suppressed, and the knitting yarns can be easily managed.

**[0046]** According to the invention, a knitting yarn inserted through one insertion hole in a state where an end portion thereof is held by a cutting and holding portion and a knitting yarn inserted through another insertion hole are pieced into each other, and the knitting yarn inserted through the other insertion hole is cut, and an end portion thereof is held. Thus, when the insertion holes are on the downstream side in the knitting yarn-feeding direction, the knitting yarn can be selectively fed to one of the two insertion holes. When the insertion holes are on the upstream side in the knitting yarn-feeding direction, the knitting yarn can be fed selectively via one of the insertion holes.

**[0047]** For example, in the case where knitting yarns inserted through the insertion holes are respectively fed to yarn feeders, a knitting yarn fed from a knitting yarn-feeding source to one yarn feeder can be pieced into a knitting yarn fed to the other yarn feeder and can be fed to the other yarn feeder. That is to say, a knitting yarn from a common knitting yarn-feeding source can be selectively fed to different yarn feeders, and thus, the number of knitting yarn-feeding sources can be reduced. Accordingly, an increase in the size of the installation space can be suppressed, and the knitting yarns can be easily managed.

**[0048]** According to the invention, when a driving portion moves a first member from a release position to a holding position, a knitting yarn arranged at a selection position can be pulled and held between a first holding face and a second holding face, and a cutting blade can be brought into contact with the knitting yarn and cut the knitting yarn. Since an end portion of a knitting yarn can be held and cut by driving the first member with one driving portion, the device can be made smaller.

**[0049]** According to the invention, one knitting yarn can be disposed at a selection position and the other knitting yarn can be disposed at a retraction position, by driving plates with one driving portion. Thus, the device can be made smaller.

## Claims

**1.** A knitting yarn switching method for switching a plurality of yarn feeders to which a knitting yarn from a knitting yarn-feeding source is to be fed, using a holding device that can hold an end portion of a knitting yarn, a cutting device that can cut a knitting yarn, and a piecing device that pieces knitting yarns, comprising the steps of:

causing the holding device to hold an end portion of a knitting yarn individually fed to one of the plurality of yarn feeders in a state where a knitting yarn from the knitting yarn-feeding source is fed to another yarn feeder;
causing the piecing device to piece the knitting yarn as a piecing target held at the end portion by the holding device and the knitting yarn from the knitting yarn-feeding source into each other;
releasing the end portion of the knitting yarn as a piecing target that has been held by the holding device, after the piecing step;
causing the cutting device to cut the knitting yarn fed from the knitting yarn-feeding source at a point between the portion of the knitting yarn as a piecing target pieced by the piecing device and the portion reaching the yarn feeder; and
causing the holding device to hold a cut end portion of the knitting yarn cut off from the knitting yarn-feeding source.

**2.** A knitting yarn switching device, comprising:

a selection portion that has two insertion holes through which knitting yarns are respectively and individually inserted, and that arranges one of the knitting yarns at a selection position and the other knitting yarn at a retraction position by moving the insertion holes;
a cutting and holding portion that can hold an end portion of a knitting yarn inserted through the insertion hole and that can cut a knitting yarn arranged at the selection position by the selection portion;
a piecing portion that has an accommodation space into which knitting yarns are inserted, and pieces a plurality of knitting yarns inserted into the accommodation space by a jet of a compressed fluid onto the plurality of knitting yarns;
a guide portion that catches the knitting yarn held at the end portion by the cutting and holding portion and arranged at the selection position by the selection portion, and inserts part of the caught knitting yarn into the accommodation space; and
a control portion that controls the selection portion, the cutting and holding portion, the piecing portion, and the guide portion so that, in a state where an end portion of a knitting yarn inserted through one insertion hole is held by the cutting and holding portion and a knitting yarn inserted through another insertion hole is inserted through the accommodation space of the piecing portion, the selection portion arranges the knitting yarn inserted through the one insertion hole at the selection position, the guide portion

then inserts part of the knitting yarn arranged at the selection position into the accommodation space of the piecing portion, the piecing portion performs a piecing operation, the end portion of the knitting yarn inserted through the one insertion hole that has been held by the cutting and holding portion is then released, the selection portion arranges the knitting yarn inserted through the other insertion hole at the selection position, and the cutting and holding portion then cuts the knitting yarn inserted through the other insertion hole and holds the end portion of the knitting yarn inserted through the other insertion hole.

**3.** The knitting yarn switching device of claim 2, wherein the cutting and holding portion comprises:

a first member that has a cutting blade, and a first holding face disposed on one side of the cutting blade in a predetermined direction;
a second member that has a second holding face; and
a driving portion that moves the first member between a holding position at which a knitting yarn can be held between the first and the second holding faces, and a release position at which a knitting yarn held between the first and the second holding faces can be released, the release position being disposed away in the predetermined direction from the holding position.

**4.** The knitting yarn switching device of claim 2 or 3, wherein the selection portion comprises:

plates in which the insertion holes are individually formed; and
a driving portion that drives the plates.

FIG. 1

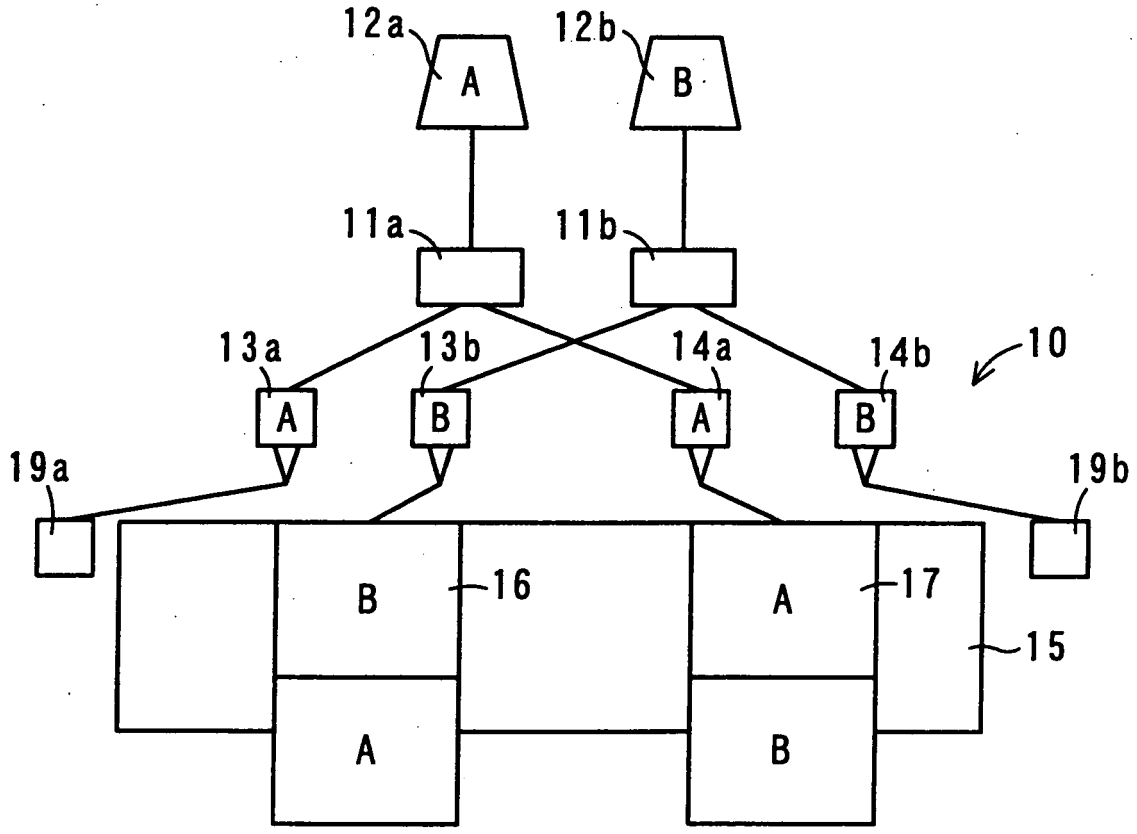


FIG. 2A

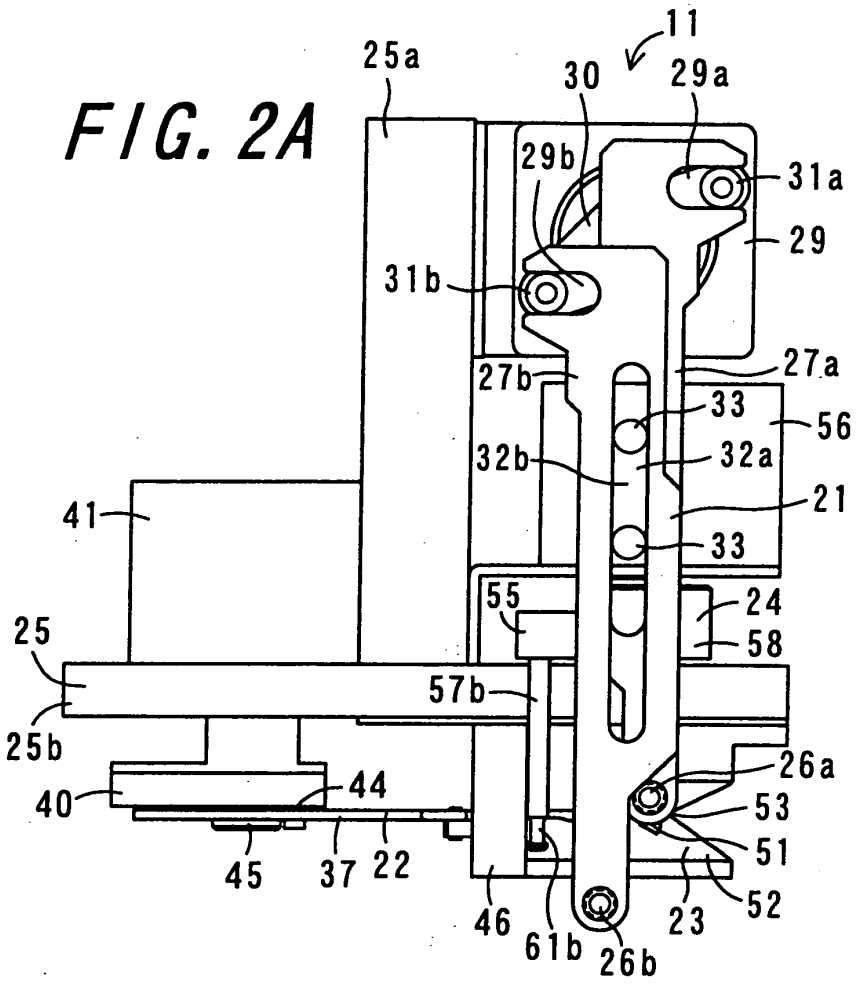

11
25a
30
29a
29b
31a
29
31b
27b
27a
33
56
32b
32a
21
41
33
55
24
58
25
57b
25b
26a
40
44
53
51
45
37
22
46
61b
26b
23
52

FIG. 2B

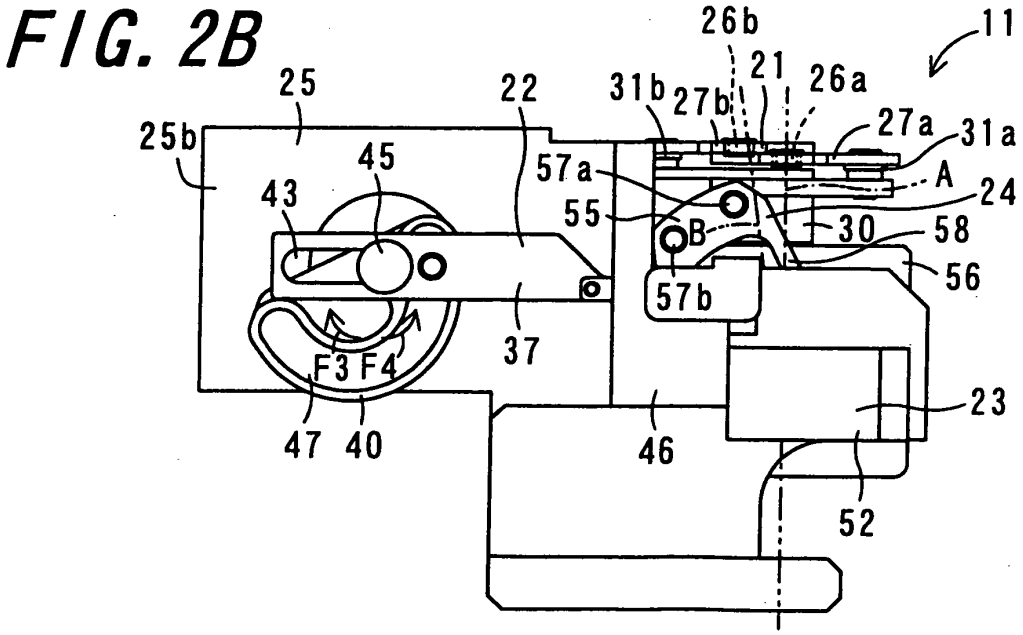
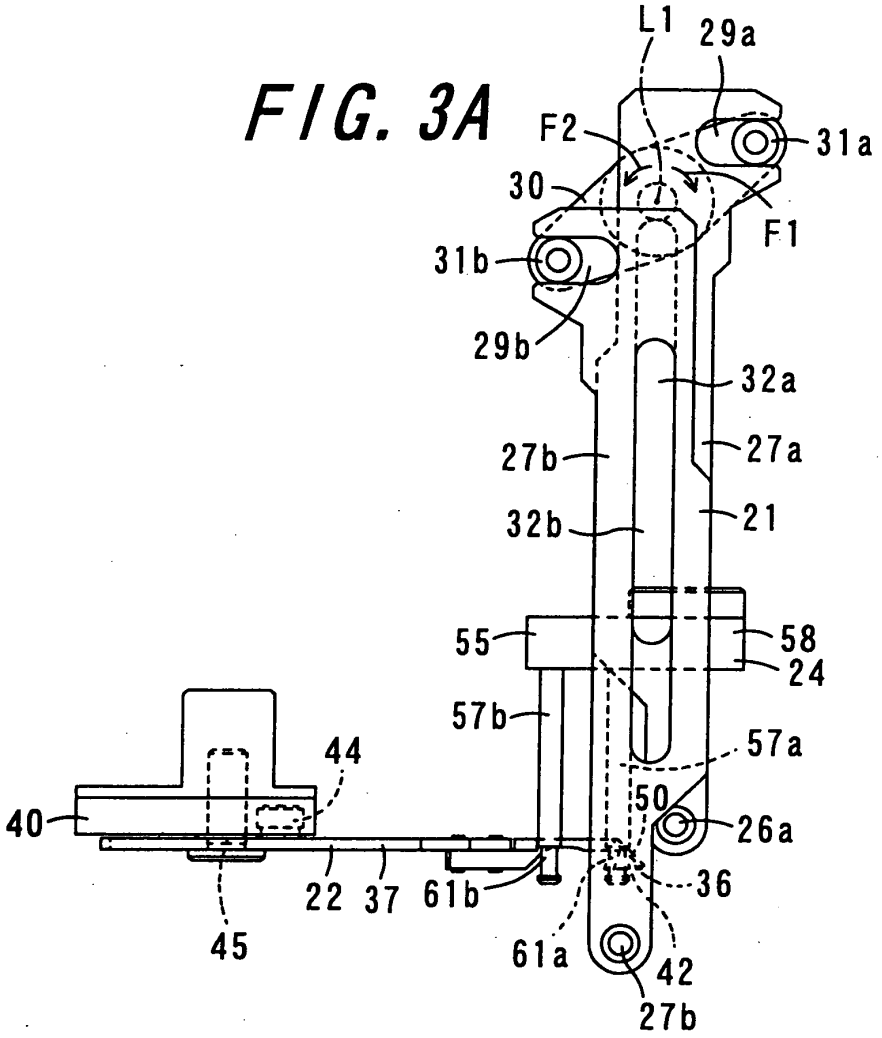

26b
11
21
25
22
31b
27b
26a
25b
27a
31a
45
57a
A
43
55
24
B
30
58
56
57b
37
F3 F4
23
47
40
46
52

FIG. 3A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29a
F2
31a
30
F1
31b
29b
32a
27b
27a
32b
21
55
58
24
57b
57a
44
50
40
26a
36
22
37
61b
45
61a
42
27b

FIG. 3B

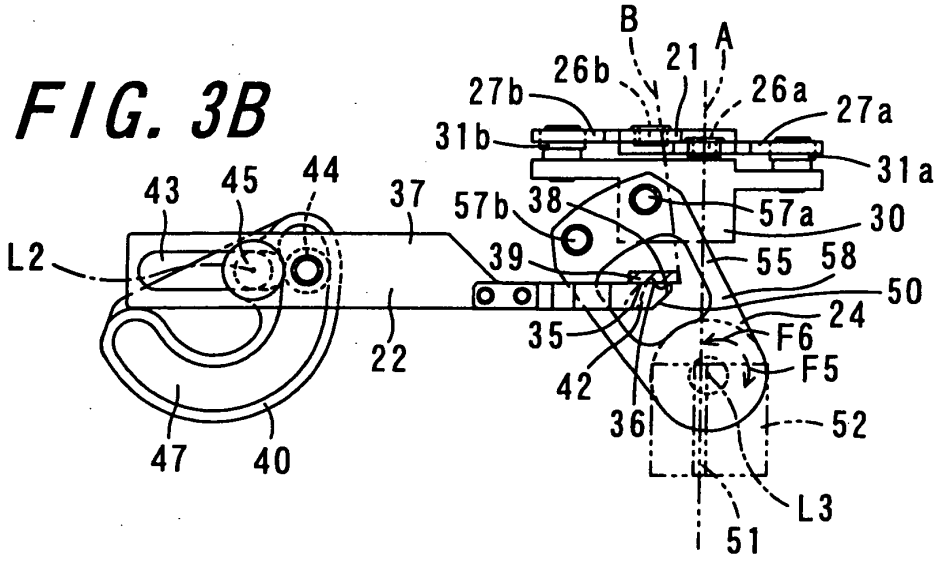

B
A
21
26b
27b
26a
27a
31b
31a
43
45
44
37
57b
38
57a
30
L2
39
55
58
50
24
35
F6
22
F5
42
36
52
47
40
L3
51

FIG. 4A

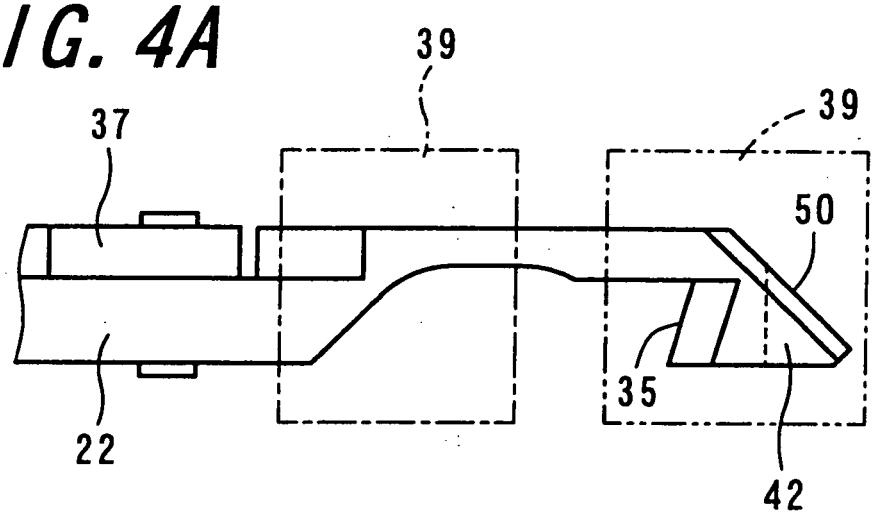



FIG. 4B

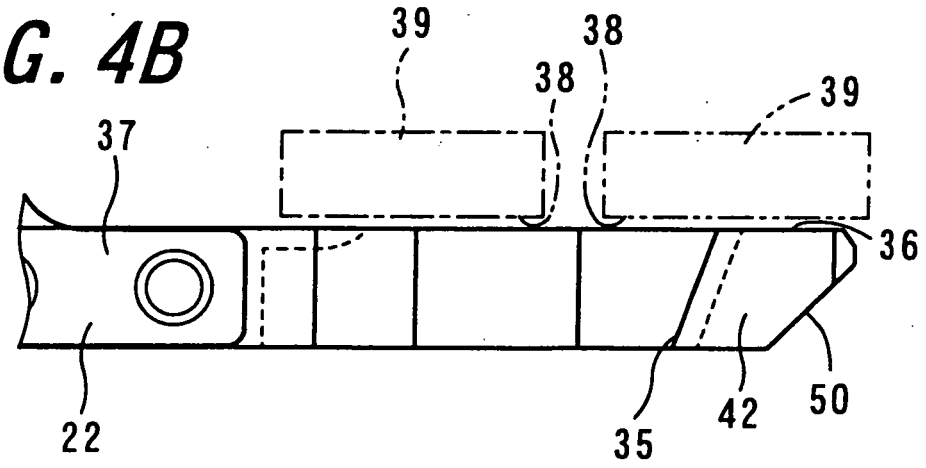


FIG. 5

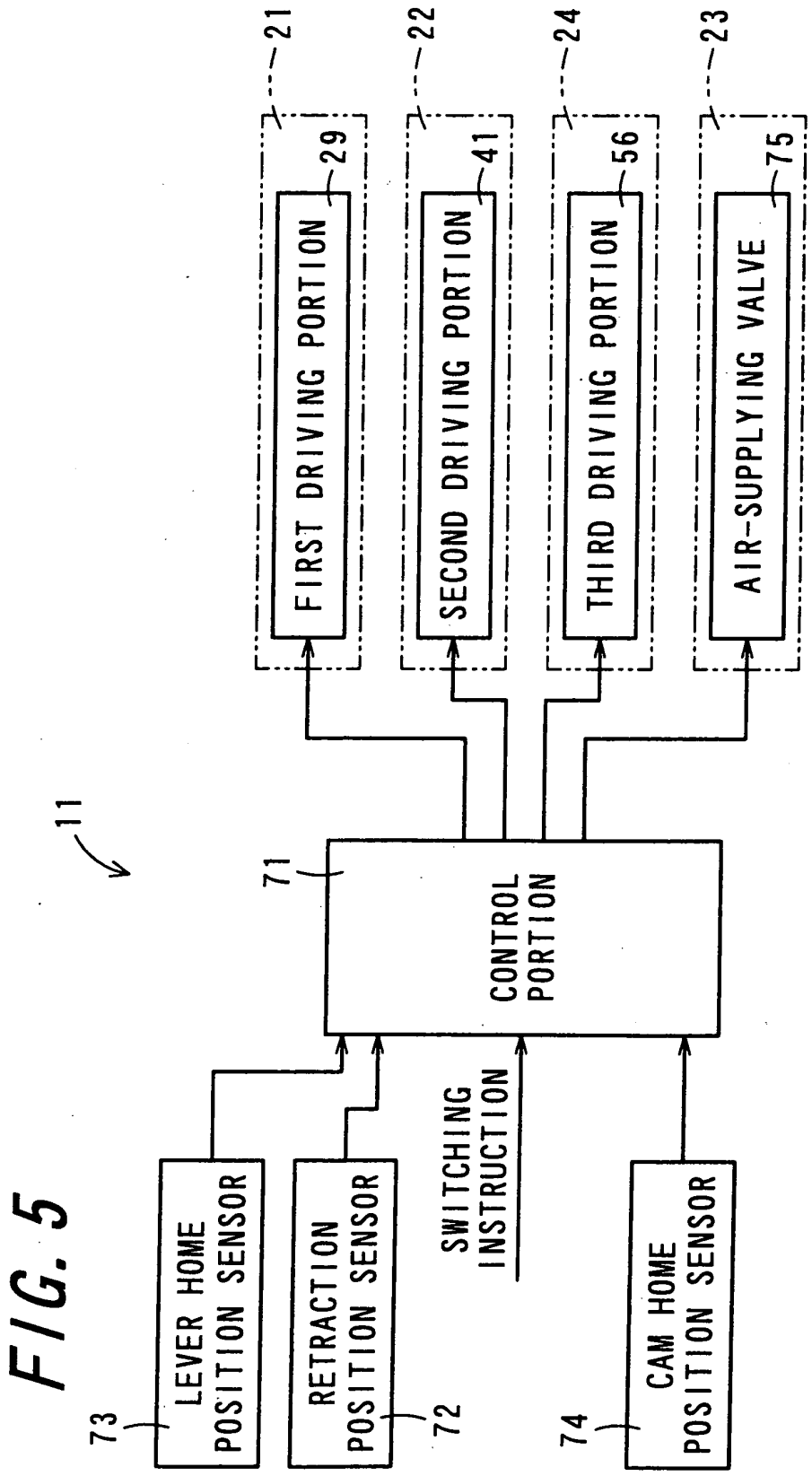

11
21
22
24
23
29
41
56
75
FIRST DRIVING PORTION
SECOND DRIVING PORTION
THIRD DRIVING PORTION
AIR-SUPPLYING VALVE
71
CONTROL PORTION
SWITCHING INSTRUCTION
73
LEVER HOME POSITION SENSOR
72
RETRACTION POSITION SENSOR
74
CAM HOME POSITION SENSOR

FIG. 6

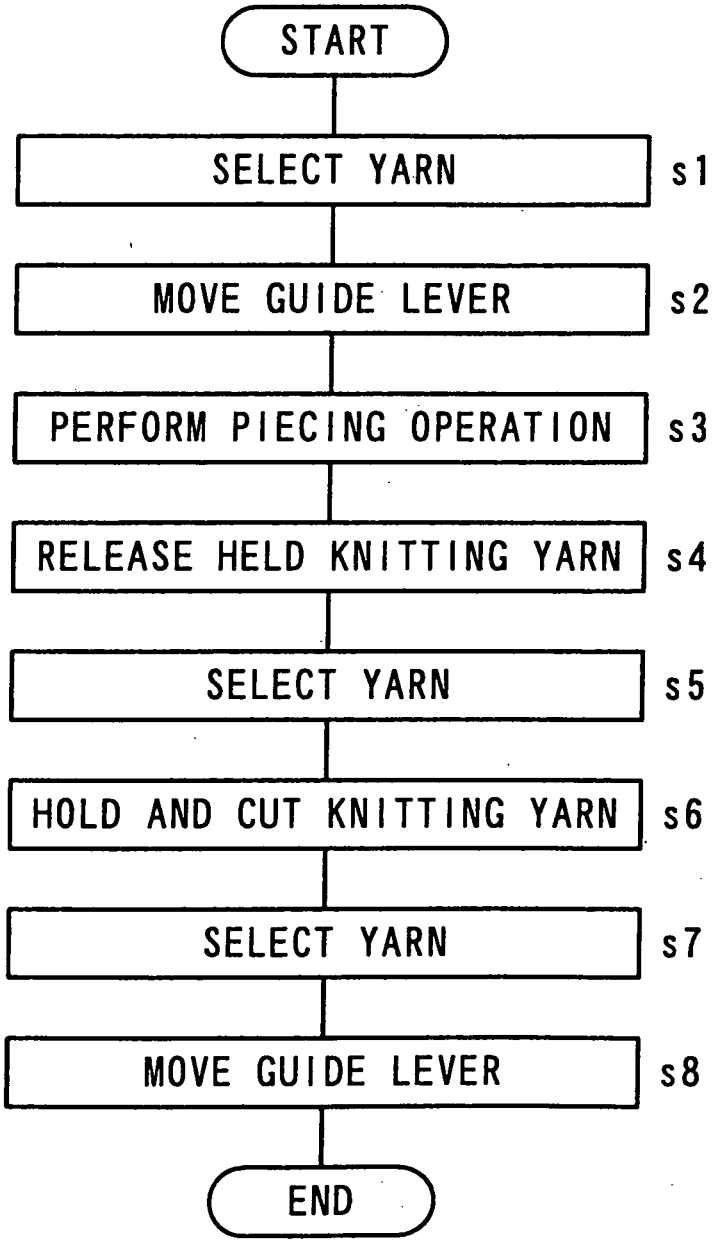

START
SELECT YARN
s1
MOVE GUIDE LEVER
s2
PERFORM PIECING OPERATION
s3
RELEASE HELD KNITTING YARN
s4
SELECT YARN
s5
HOLD AND CUT KNITTING YARN
s6
SELECT YARN
s7
MOVE GUIDE LEVER
s8
END

FIG. 7A

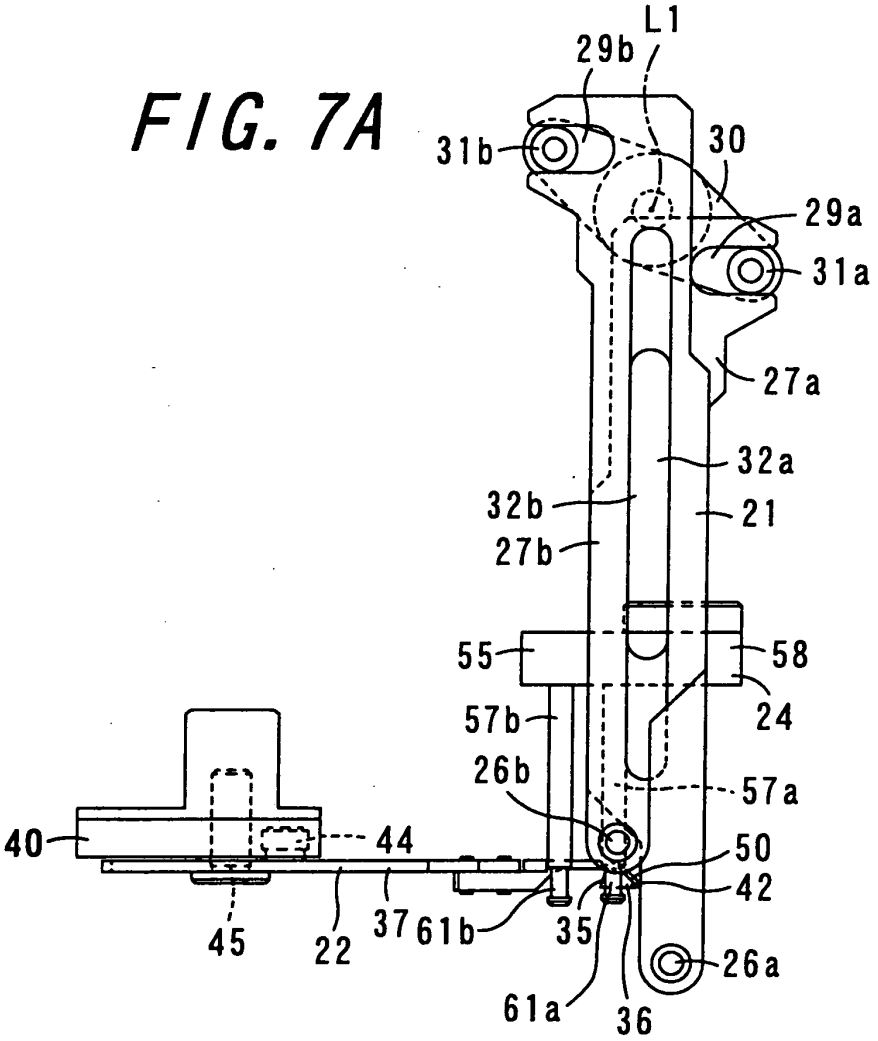

L1
29b
31b
30
29a
31a
27a
32a
32b
21
27b
55
58
24
57b
26b
57a
40
44
50
42
45
22
37
61b
35
26a
61a
36

FIG. 7B

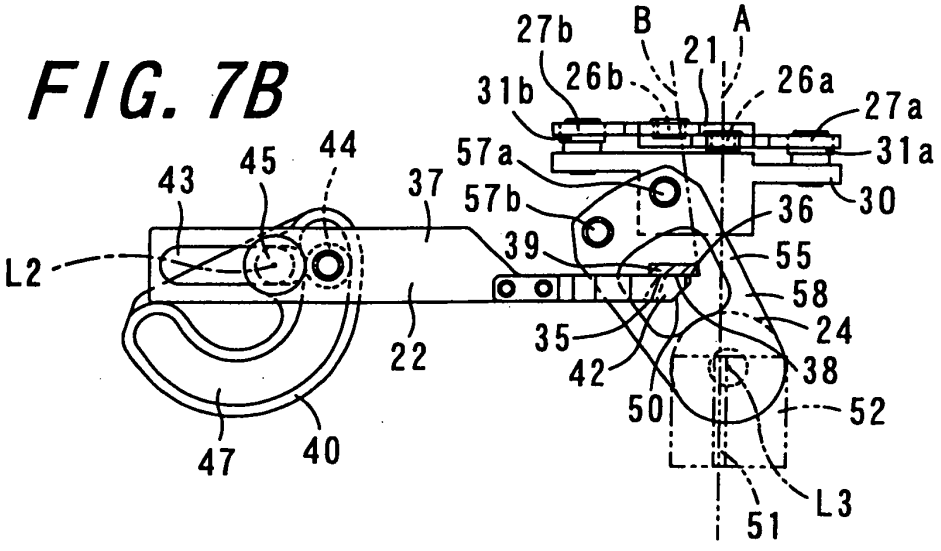
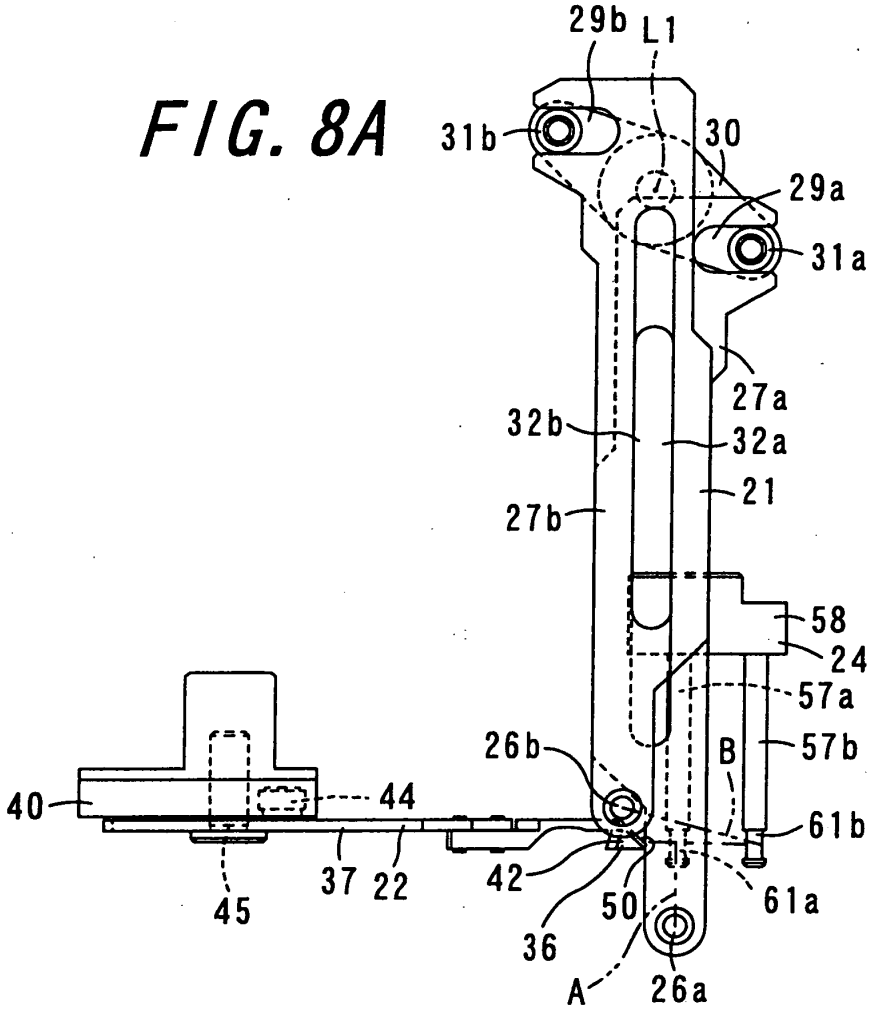

27b
B
A
21
26b
26a
31b
27a
31a
57a
57b
30
36
43
45
44
37
39
55
L2
58
24
35
42
38
22
50
52
47
40
L3
51

FIG. 8A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L1
31b
30
29a
31a
27a
32b
32a
21
27b
58
24
57a
26b
B
57b
40
44
61b
37
22
42
50
61a
45
36
A
26a

FIG. 8B

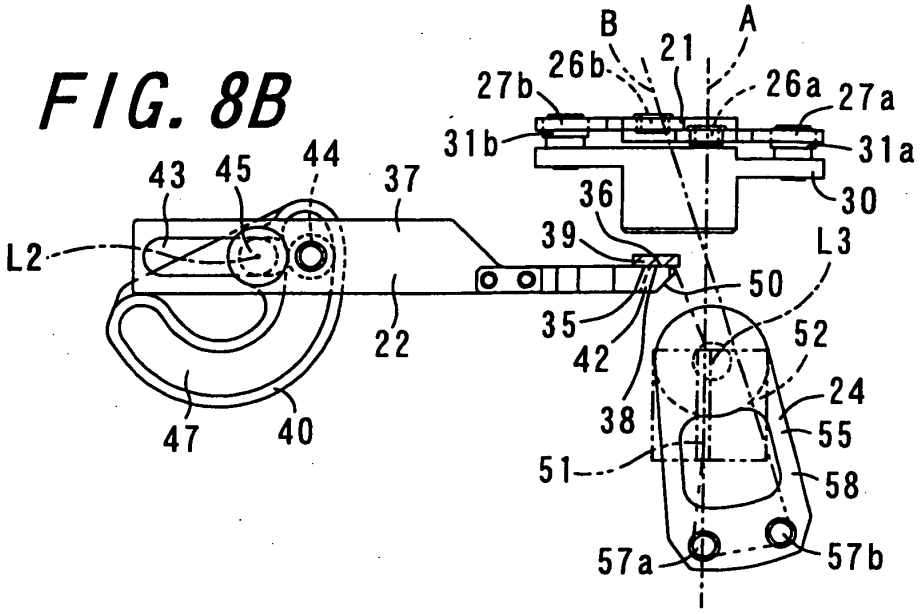

B
A
21
26b
27b
26a
27a
31b
31a
43
45
44
37
36
30
L2
39
L3
50
35
52
42
22
24
38
55
47
40
51
58
57a
57b

FIG. 9A

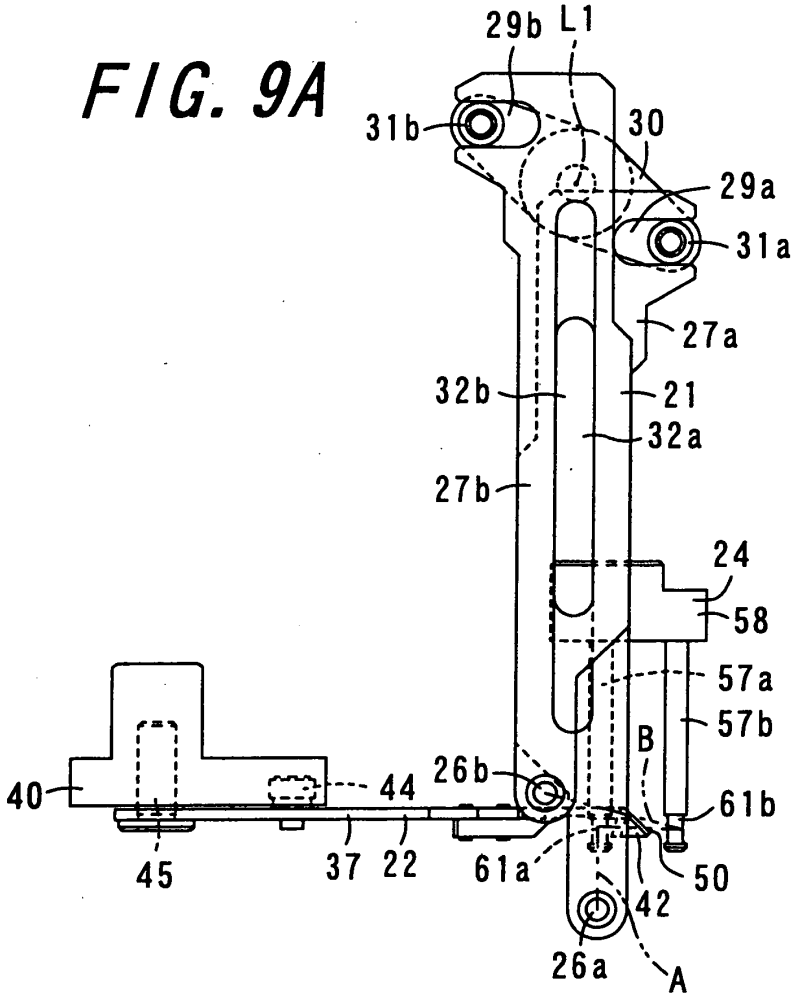

29b
L1
31b
30
29a
31a
27a
32b
21
32a
27b
24
58
57a
57b
B
26b
40
44
61b
45
37
22
61a
50
42
26a
A

FIG. 9B

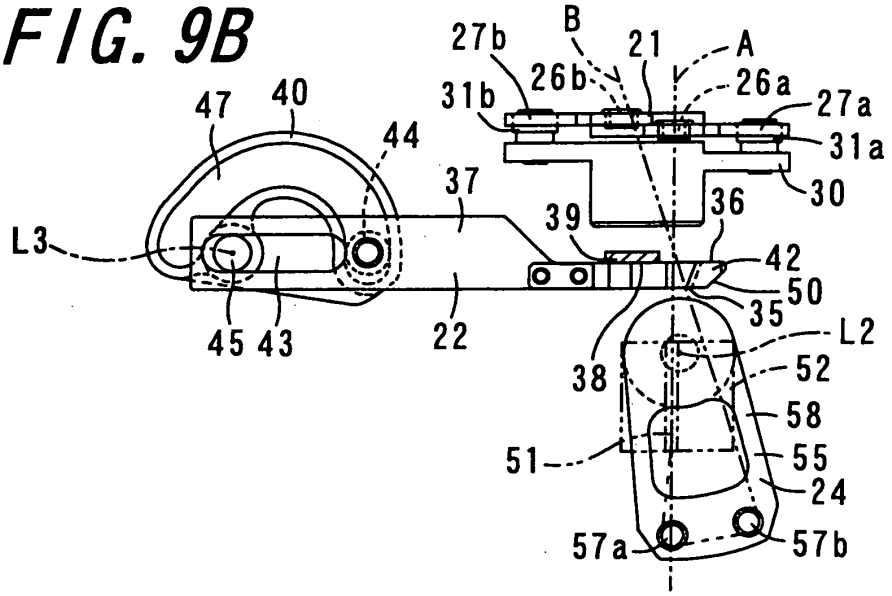

27b
B
21
A
26b
26a
27a
31b
31a
47
40
44
30
37
36
39
L3
42
50
35
L2
45
43
22
38
52
58
51
55
24
57a
57b

FIG. 10A

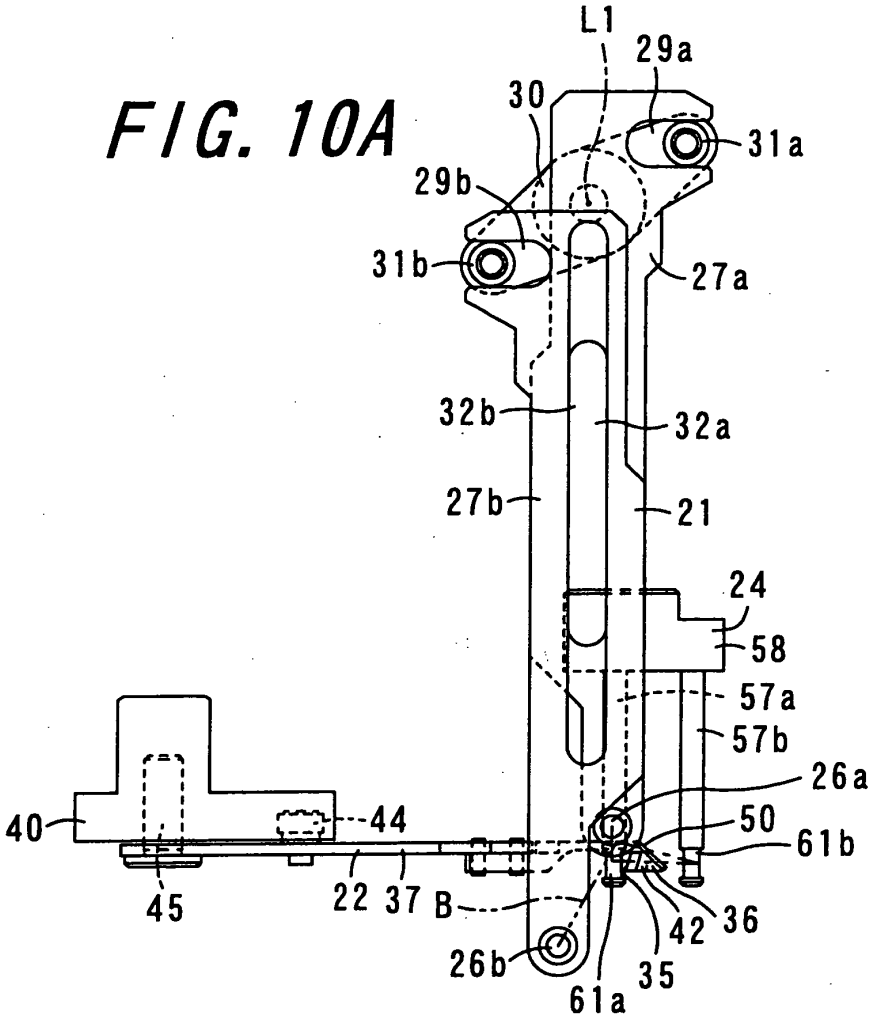



FIG. 10B

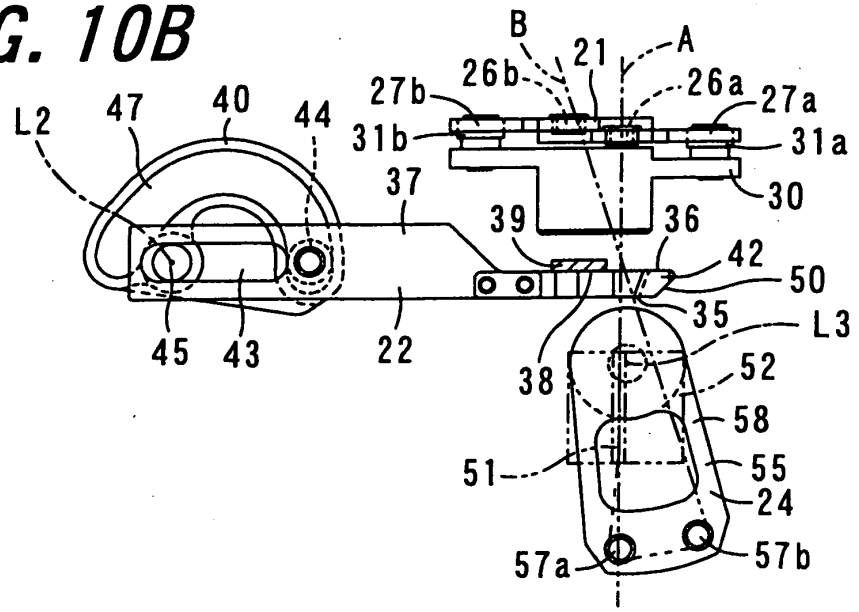


FIG. 11A

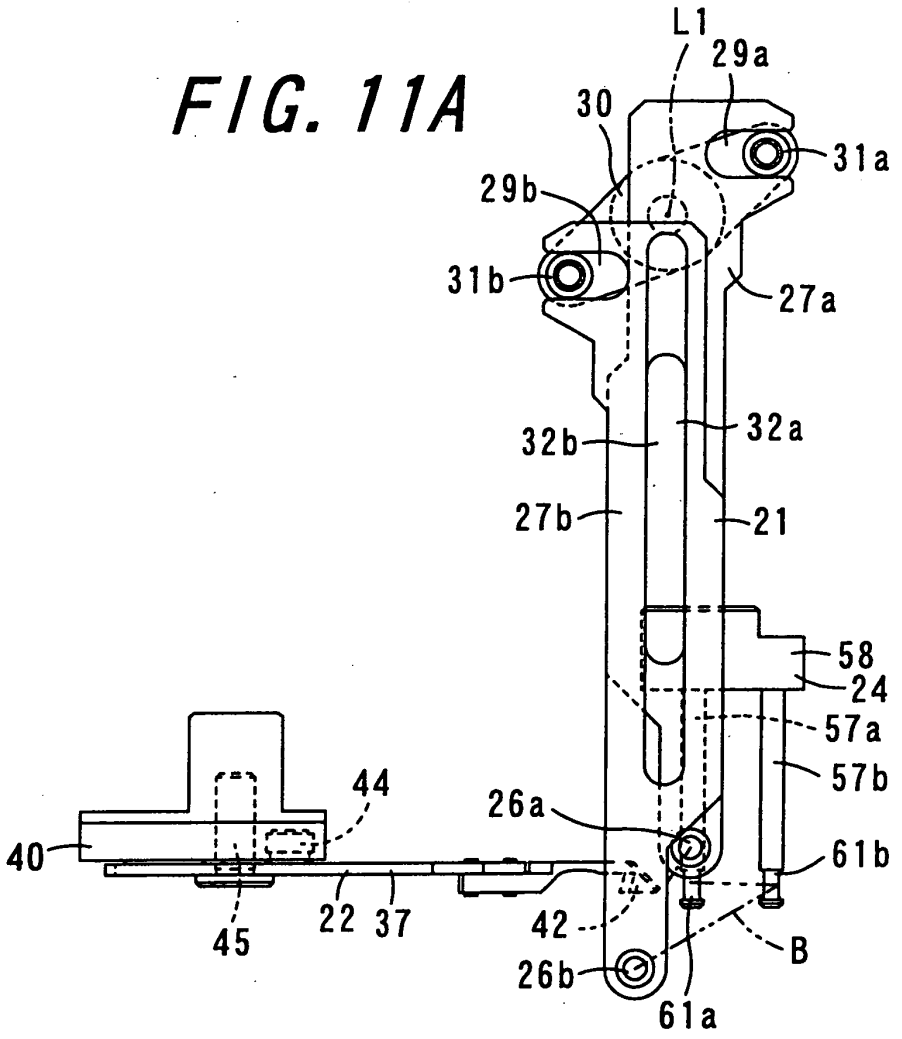



FIG. 11B

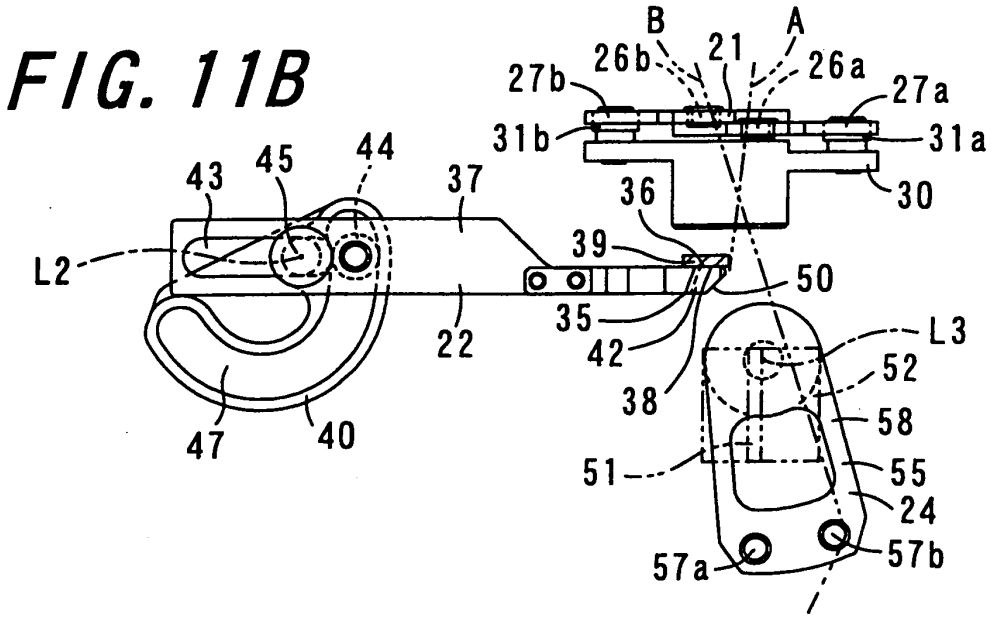


FIG. 12A

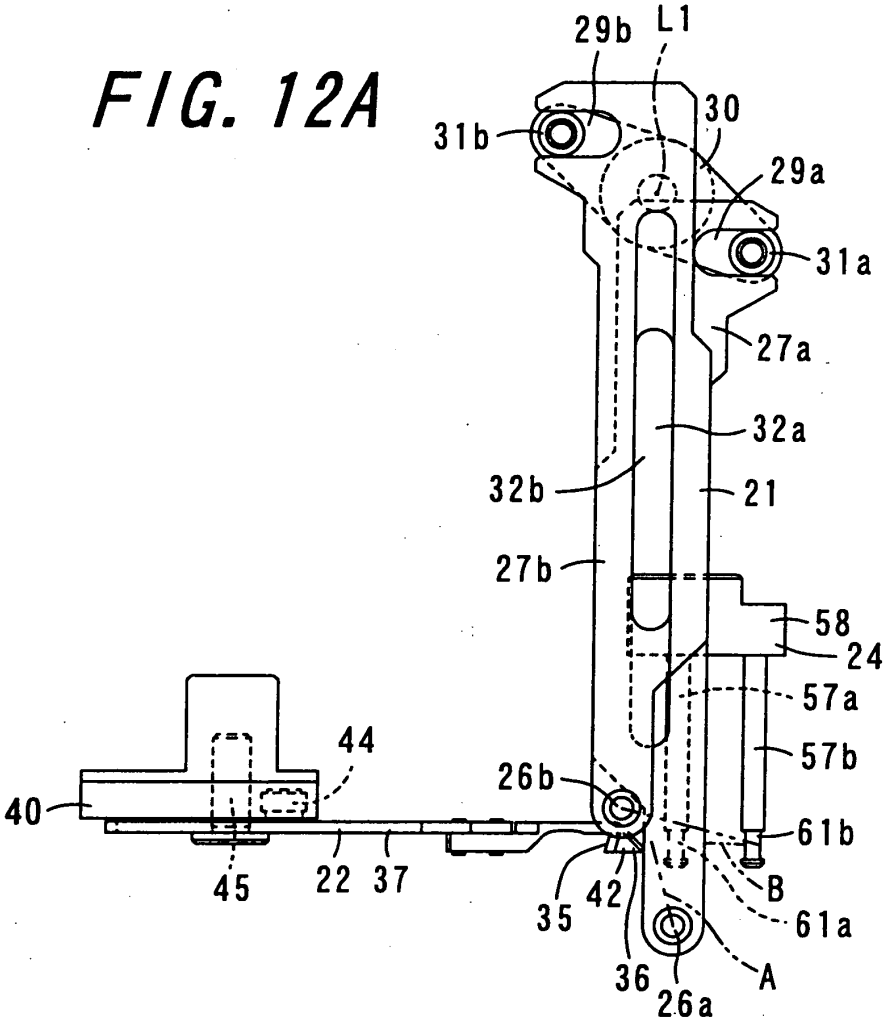



FIG. 12B

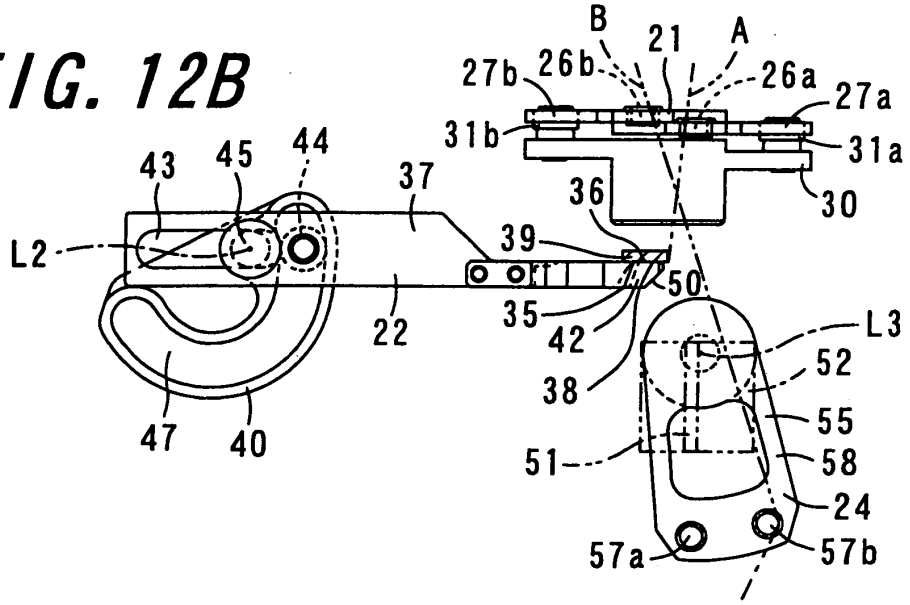


FIG. 13A

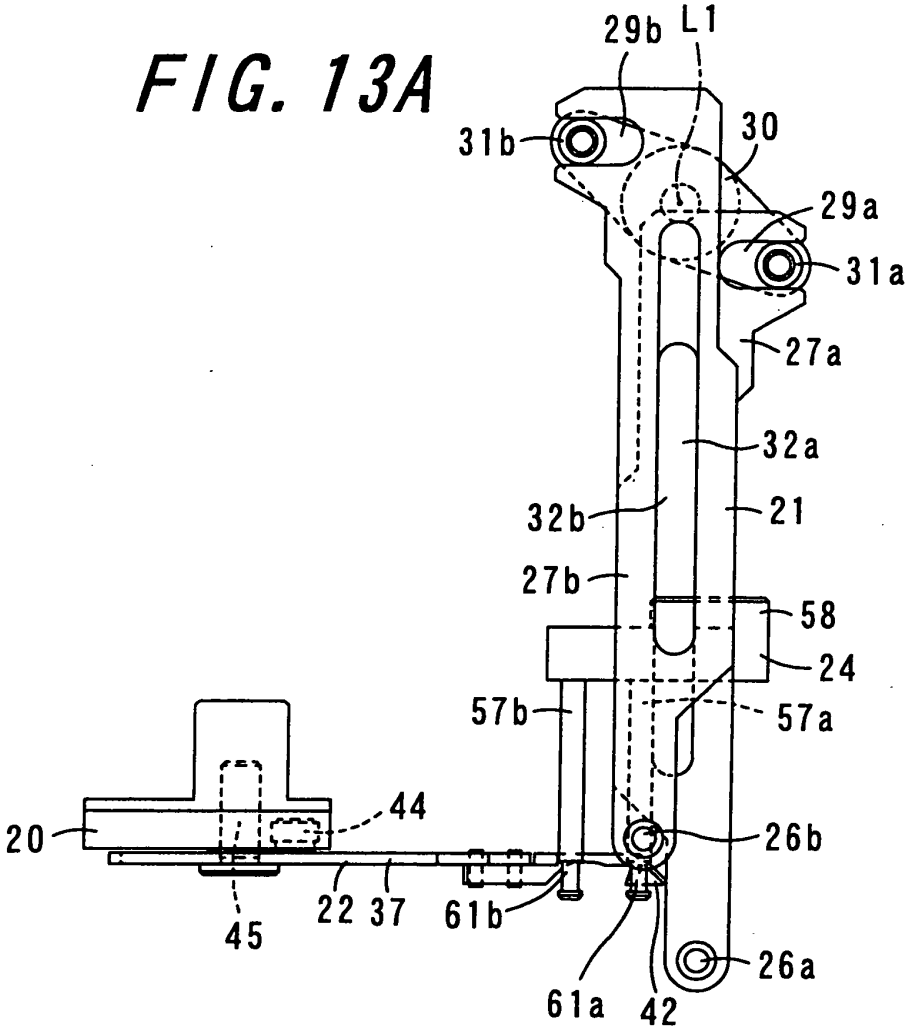



FIG. 13B

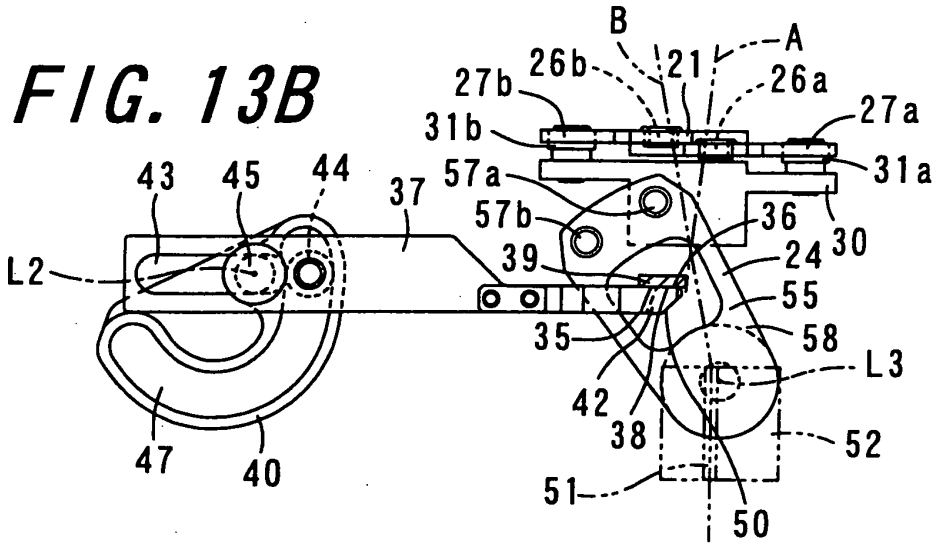
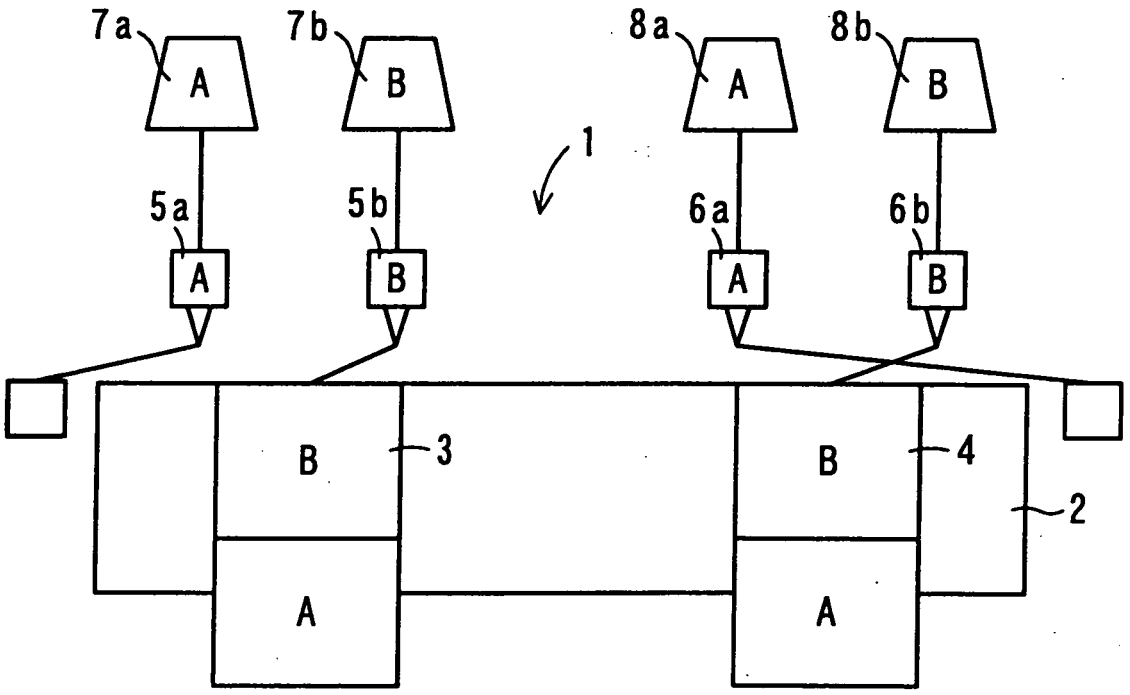


FIG. 14



**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2008/055336

A. CLASSIFICATION OF SUBJECT MATTER
*D04B15/56*(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)
D04B15/54-15/64, B65H69/00-69/08, D05C11/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2008
Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | JP 63-54820 B2 (Sipra Patententwicklungs-und Beteiligungsgesellschaft mbH), 31 October, 1988 (31.10.88), & US 4691535 A & GB 2112423 A & DE 3244887 A & CH 643015 A | 1-4 |
| A | JP 2004-156184 A (Murata Machinery Ltd., Katayama Co., Ltd.), 03 June, 2004 (03.06.04), & EP 1411015 A2 & CN 1590616 A | 1-4 |
| P,A | WO 2007/43336 A1 (Murata Machinery Ltd., Shima Seiki Mfg., Ltd.), 19 April, 2007 (19.04.07), (Family: none) | 1-4 |

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

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 21 April, 2008 (21.04.08) | 13 May, 2008 (13.05.08) |
| Name and mailing address of the ISA/ Japanese Patent Office<br>Facsimile No. | Authorized officer<br>Telephone No. |

Form PCT/ISA/210 (second sheet) (April 2007)