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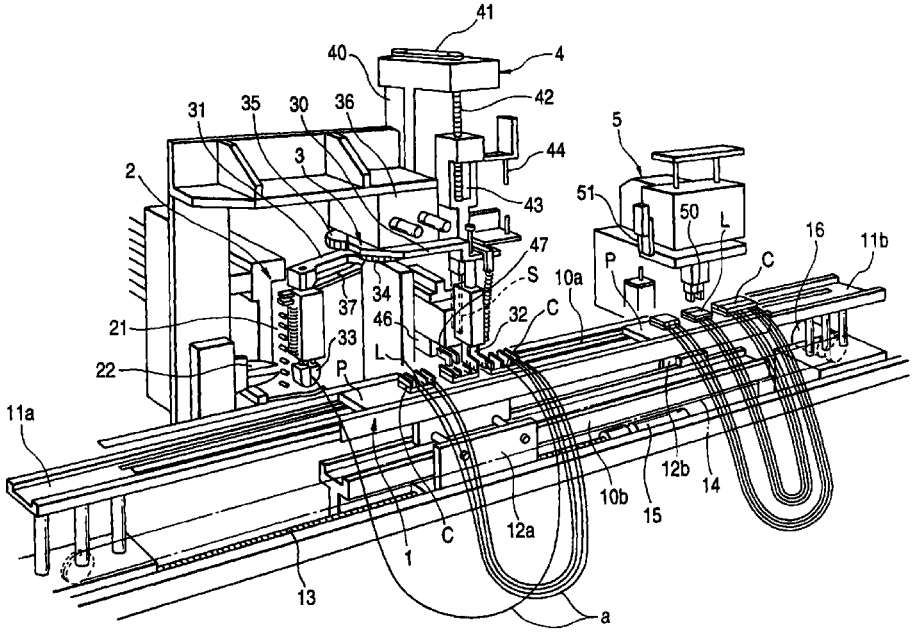
(54) Device for conveying a wire independently at each end

(57) If it is assumed that one of both ends of a wire harness is set as an A end, and another one of the both ends as a B end, when the wire is pressed into a terminal of a connector at each of the A and B ends, the conveyance of the wire from a wire supplying section 2 to a wire pressure-connecting section 4 is effected by two chucks 32 and 33 respectively corresponding to the A and B ends. A pair of arms 30 and 31 for supporting the chucks 32 and 33 are concurrently swung in opposite directions by an identical driving source, so as to shorten the interval in the pressure-connecting operation.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a wire conveying device for conveying both ends of a wire respectively independently to a wire pressure-connecting section in the manufacture of a wire harness.

[0002] As an example of a wire harness for an automobile in which connectors are attached to both ends of wires arranged in parallel, one shown in Fig. 7 is known. In this wire harness, eight wires "a" are connected to one connector C at one end thereof (hereafter referred to as the A end), and four wires "a" are connected to two connectors C, respectively, at the other end thereof (hereafter referred to as the B end).

[0003] Pressure connection (insulation displacement connection) such as the one shown in Fig. 8 is adopted as the means of connecting the wires "a" to the connector C by taking into account operational features and the like. In this pressure connection, the wires "a" are pressed into grooves 60 in pressure connection terminals T, which are provided in each connector C, by being depressed by a press-in blade S. In conjunction with the pressing in, a sheathing 62 surrounding a bundle of conductors 61 of each wire "a" is cut off at side edges of the groove 60, and the bared bundle of conductors 61 is brought into contact with the pressure connection terminal T, and each wire "a" is held in the groove 60 by the springing back of the pressure connection terminal T. Then, after the pressing in of the wires "a" into the pressure connection terminal T, the connector C is covered with a terminal cover L so as to prevent the wires "a" from coming off, as shown in Fig. 9.

[0004] As the apparatus for automatically manufacturing the wire harness such as the one described above, an apparatus is conceivable which grips the end portion of the wire by means of a chuck so as to convey the end portion of the wire to the wire pressure-connection section having the press-in blade.

[0005] With such an apparatus, however, if each end portion of the wire is conveyed by one chuck, there is a problem in that much time is required in the reciprocation of the chuck, so that the interval in the pressure-connecting operation becomes long, thereby making it impossible to perform efficient production.

SUMMARY OF THE INVENTION

[0006] Accordingly, an object of the present invention is to convey the wire speedily to the pressure connecting section so as to improve production efficiency.

[0007] To attain the above-described object, in accordance with the present invention, both end portions of a wire corresponding to both ends of a wire harness are conveyed from a wire supplying section to a wire pressure-connecting section by two independent chucks, respectively. By allowing the reciprocating motions of these two chucks to overlap, the interval in the pressure-connecting operation can be shortened.

[0008] In this case, if a pair of arms for supporting the respective chucks are concurrently swung in opposite directions by an identical driving source, the time required for the chucks to reciprocate can be minimized, and the structure can be simplified.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is an overall perspective view illustrating an embodiment of the present invention;
Fig. 2 is a schematic perspective view of a wire supplying section of the embodiment;
Fig. 3A is a plan view illustrating a state of a wire setting section of the embodiment;
Fig. 3B is a plan view illustrating another state of the embodiment;
Fig. 4 is a right-hand side view of a pressure-connecting head section of the embodiment;
Fig. 5 is a schematic perspective view illustrating the operation of a wire curvature correcting chuck of the embodiment;
Fig. 6 is a schematic perspective view illustrating the operation of a cover fitting section of the embodiment;
Fig. 7 is a schematic plan view illustrating an example of a wire harness;
Fig. 8 is a perspective view illustrating the pressure connection of a wire to a connector terminal; and
Fig. 9 is a perspective view of a connector with a terminal cover fitted thereon.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Referring now to the accompanying drawings, a description will be given of an example in which an embodiment of a device for conveying a wire independently at each end in accordance with the present invention is applied to a wire harness manufacturing apparatus.

[0011] As shown in Fig. 1, this wire harness manufacturing apparatus is comprised of a pallet feeding section 1, a wire supplying section 2, a wire setting section 3, a pressure-connecting head section (wire pressure-connecting section) 4, and a cover fitting section 5.

[0012] The pallet feeding section 1 includes two guide rails 10a and 10b arranged in upper and lower stages for guiding a pallet P on which a plurality of connectors C are juxtaposed; two lifts 11a and 11b respectively located on both sides thereof to deliver the pallet P between the guide rails 10a and 10b; and two carriages 12a and 12b for moving the pallet P along the guide rail 10a or 10b. The carriage 12a is threadedly engaged on a screw shaft 13 by means of a ball screw

structure, while the carriage 12b is secured to an endless belt 14 trained between a pair of pulleys, the respective carriages being adapted to travel as servo motors 15 and 16 are driven.

[0013] As shown in Figs. 1 and 2, the wire supplying section 2 includes two pairs of rollers 20, which are adapted to move toward and away from each other, and a lifting member 21 for lifting or lowering in a vertically parallel state a multiplicity of wires "a" to be formed into the harness. Through the operation of the lifting member 21, the wire supplying section 2 positions the wire "a" to be pressure-connected next at the level of the rollers 20, clamps that wire "a" by the pairs of rollers 20, and feeds it a predetermined length. Provided in front of the wire supplying section 2 are clippers 22 adapted to advance or retract with respect to a feeding hole for the wire "a" as well as a supporting bar 23 which can be raised or lowered.

[0014] As shown in Figs. 1 and 3, the wire setting section 3 has two swing arms 30 and 31, and an A-end chuck 32 and a B-end chuck 33 for respectively gripping the A end and the B end are provided on distal end portions of the swing arms 30 and 31. The swing arms 30 and 31 are threadedly engaged with each other by gears 34 and 35 at their proximal ends, and are simultaneously swung in opposite directions by the same driving motor 36. At the time of this swinging motion, since the distal end portions of the swing arms 30 and 31 pass along different paths, the A-end chuck 32 and the B-end chuck 33 do not interfere with each other. Here, a link 37, which forms a parallel crank mechanism together with the swing arm 31, is connected to one side of the B-end chuck 33, whereby the B-end chuck 33 is adapted to face the same direction at all times.

[0015] As shown in Figs. 1, 4 and 5, the pressure-connecting head section 4 causes a screw shaft 42 to rotate via a belt 41 by driving a servo motor 40, and raises or lowers a press-in blade S provided at a lower end of a raising/lowering rod 43 which is threadedly engaged with the screw shaft 42 in a ball screw structure, so as to depress the A-end chuck 32 or the B-end chuck 33 in conjunction with the lowering of the raising/lowering rod 43. This pressure-connecting head section 4 is provided with a linear scale 44 for detecting the height of the raising/lowering rod 43 from a reference position as well as a load cell 45 for detecting a reaction force from the press-in blade S.

[0016] In addition, a wire curvature correcting device 46 is provided below the pressure-connecting head section 4. This wire curvature correcting device 46 is comprised of a wire curvature correcting chuck 47 which moves back and forth after gripping the end portion of the wire "a" projecting from the A-end chuck 32 or the B-end chuck 33, as well as an opening/closing sensor (not shown) therefor.

[0017] As shown in Figs. 1 and 6, the cover fitting section 5 has a cover gripping chuck 50 which is raised or lowered and moves back and forth by the driving of a cylinder or the like, and this cover fitting section 5 is provided with a linear scale 51 for detecting the height of the cover gripping chuck 50 from a reference position.

[0018] To manufacture the wire harness such as the one shown in Fig. 7 by using the above-described wire harness manufacturing apparatus, the three connectors C corresponding to the A end and the B end of the wire harness as well as terminal covers L are juxtaposed on the pallet P on the lift 11b which is at its raised position. Then, the lift 11b is lowered, and this pallet P is sent to the lift 11a, which is at its lowered position, by means of the guide rail 10b in conjunction with the traveling of the carriage 12b.

[0019] Subsequently, the engagement between the carriage 12b and the pallet P is canceled, the lift 11a is raised, and the carriage 12b is engaged with the pallet P. In conjunction with the traveling of the carriage 12a, the pallet P is moved onto the guide rail 10a, and the terminal T of the connector C to which the wires "a" are first pressure-connected is positioned below the press-in blade S. This positioning is effected by a program set in advance.

[0020] Next, the first wire "a" set in advance by the program is slightly fed from the wire supplying section 2, its leading end portion is clamped by the A-end chuck 32 [see Fig. 3(a)], and the A-end chuck 32 is positioned in front of the pressure-connecting head section 4 by swinging the swing arm 30 while further feeding the wire "a" [see Fig. 3(b)].

[0021] Then, the feeding of the wire "a" is stopped, the leading end portion of the wire "a" projecting from the A-end chuck 32 is clamped by the wire curvature correcting chuck 47 as shown in Figs. 4 and 5, and this chuck 47 is slid in the pulling direction along the surface of the sheathing of the wire "a", thereby correcting the curvature in the wire "a" to a straight state.

[0022] At this time, by detecting whether or not the wire curvature correcting chuck 47 has clamped the wire "a" by means of the opening/closing sensor, whether the projecting allowance of the wire "a" is sufficient or insufficient with respect to the pressure connection is determined by the program.

[0023] Subsequently, the press-in blade S of the pressure-connecting head section 4 is lowered together with the A-end chuck 32, and the leading end portion of the wire "a" is pressed into the groove in the terminal T of the predetermined connector C. This pressed-in height is set in advance to an optimum value by a control program of the servo motor 40. Then, whether the pressed-in state is good or bad is determined by the program by measuring this pressed-in height by the linear scale 44 and by measuring the pressing-in resistance by the load cell 45.

[0024] Meanwhile, concurrently with this pressure connection, the wire "a" which is at a standstill in front of the wire supplying section 2 is gripped by the B-end chuck 33 while being supported by the supporting bar 23, and the clippers 22 is advanced to cut the wire "a" to

a predetermined length in the rear of the B-end chuck 33 [see Fig. 3(b)].

[0025] Then, after completion of the pressure connection of the A end, the swing arm 31 is swung to position the B-end chuck 33 in front of the pressure-connecting head section 4. Concurrently, the clamping of the wire "a" by the A-end chuck 32 is canceled, the swing arm 30 it swung in the opposite direction at the same time as the swing arm 31, and the A-end chuck 32 is positioned in front of the wire supplying section 2 [see Fig. 3(a)]. In addition, the pallet P is moved in accordance with the setting of the program so as to allow the terminal T of the connector C at the B end, to which this wire "a" is pressure-connected, to be positioned below the press-in blade S of the pressure-contact head section 4.

[0026] Next, the press-in blade S of the pressure-connecting head section 4 is lowered together with the B-end chuck 33, and the rear end portion of the wire "a" is pressed into the groove in the terminal T of the predetermined connector C at the B end. In the same way as the A end side, this pressed-in height is also set in advance to an optimum value by the control program of the servo motor 40. In addition, at the time of pressing in, whether the pressed-in state is good or bad is determined by the program by measuring this pressed-in height by the linear scale 44 and by measuring the pressing-in resistance by the load cell 45.

[0027] During the pressure connection of the B end, the wire supplying section 2 effects the operation of feeding the wire "a" to be pressure-connected next, and by repeating the above-described pressure-connecting operation with respect to all the wires "a", the formation of the harness such as the one shown in Fig. 7 is completed.

[0028] Subsequently, the engagement of the pallet P and the carriage 12a is canceled, the carriage 12b is instead engaged with the pallet P, and this pallet P is moved to below the cover fitting section 5.

[0029] Then, as shown in Fig. 6, the terminal cover L is gripped and lifted by the cover gripping chuck 50, is moved forward, and is placed on the corresponding connector C. If this operation is consecutively performed for each connector C, the wire harness is completed.

[0030] Here, at the time of fitting the terminal cover L, whether the fitted state is good or bad is determined by measuring the height of the terminal cover L from the connector C by the linear scale 51 and by comparing that value and an allowable value by means of the program. Then, only nondefective products are shipped as products.

[0031] It should be noted that, after the pressing in of the wire "a" and prior to the fitting of the terminal cover L, if the pressed-in height of the wire "a" is measured by a laser sensor, and the terminal cover L is fitted on only the connector C in which the pressed-in height of all the wires "a" is within an allowance, it is possible to dispense with the trouble of removing the terminal cover L at the time of repairing a product with faulty pressure connection.

[0032] As described above, in the present invention, since both end portions of the wire corresponding to both ends of the wire harness are conveyed from the wire supplying section to the wire pressure-connecting section by two independent chucks, respectively, by allowing the reciprocating motions of these two chucks to overlap, the interval in the pressure-connecting operation can be shortened, and the wire harness can be manufactured efficiently.

[0033] In this case, if the pair of arms for supporting the respective chucks are concurrently swung in opposite directions by an identical driving source, the time required for the chucks to reciprocate can be minimized, and the structure can be simplified.

Claims

1. A deVice for conveying a wire independently at each end in the manufacture of a wire harness, comprising:

   a first chuck for conveying one end of a wire which is corresponding one end of the wire harness from a wire supplying section to a wire pressure connecting section; and
   a second chuck for conveying another end of the wire which is corresponding to said another end of the wire harness from the wire supplying section to the wire pressure connecting section.

2. A device for conveying a wire independently at each end in the manufacture of a wire harness according to claim 1, wherein said first chuck and second chuck are respectively held on a pair of arms of which ends are concurrently swung between said wire supplying section and said wire pressure-connecting section in opposite directions by an identical driving source.

3. A device for conveying a wire independently at each end in the manufacture of a wire harness according to claim 1, wherein distal ends of said pair of the arms pass along different paths.

FIG. 1

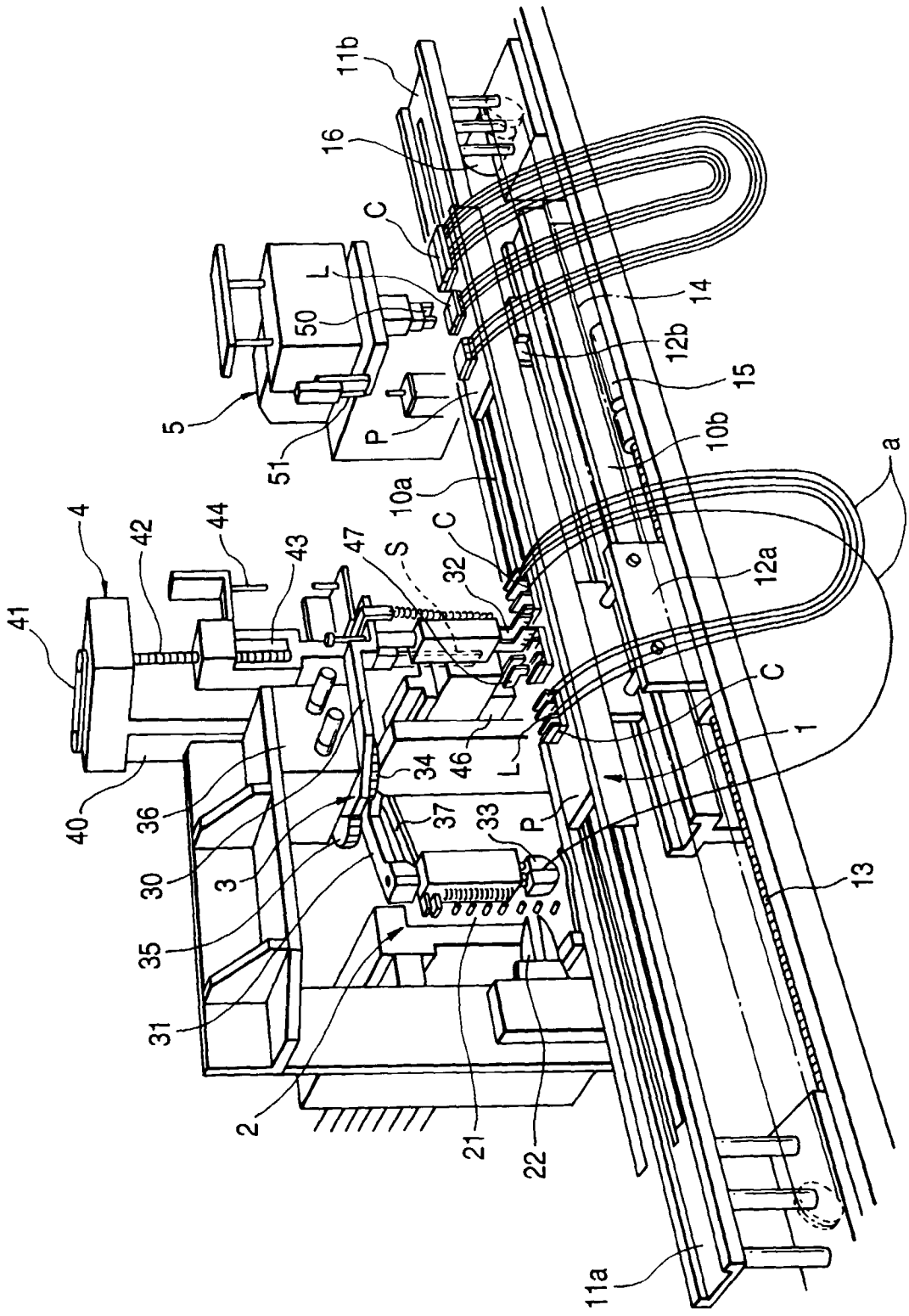
11b
16
C
L
50
5
51
P
14
12b
15
10b
10a
a
4
42
44
43
47
S
C
32
12a
41
C
1
34
46
L
40
36
37
33
P
30
3
13
35
31
2
21
22
11a

FIG. 2

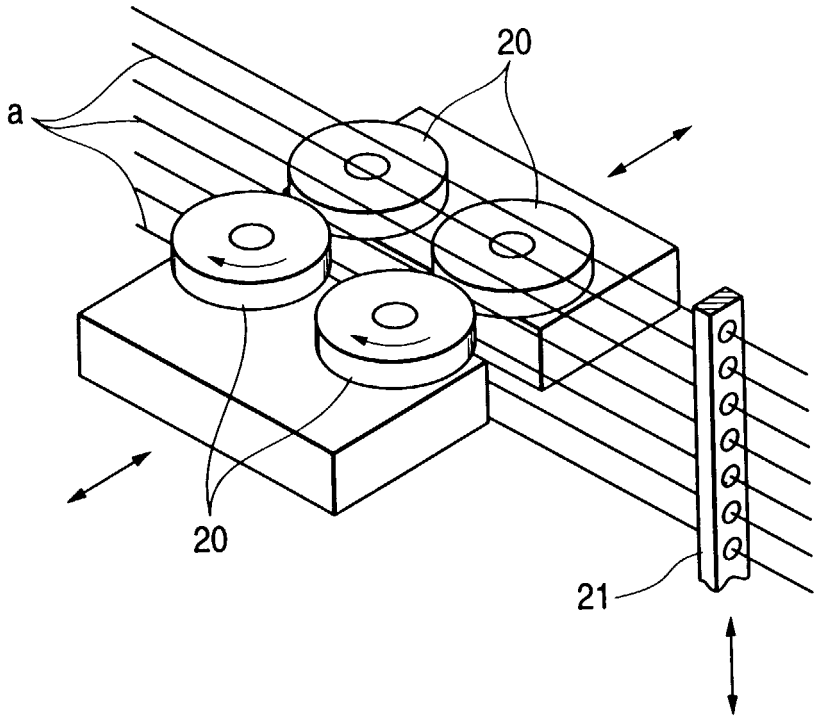

FIG. 3A

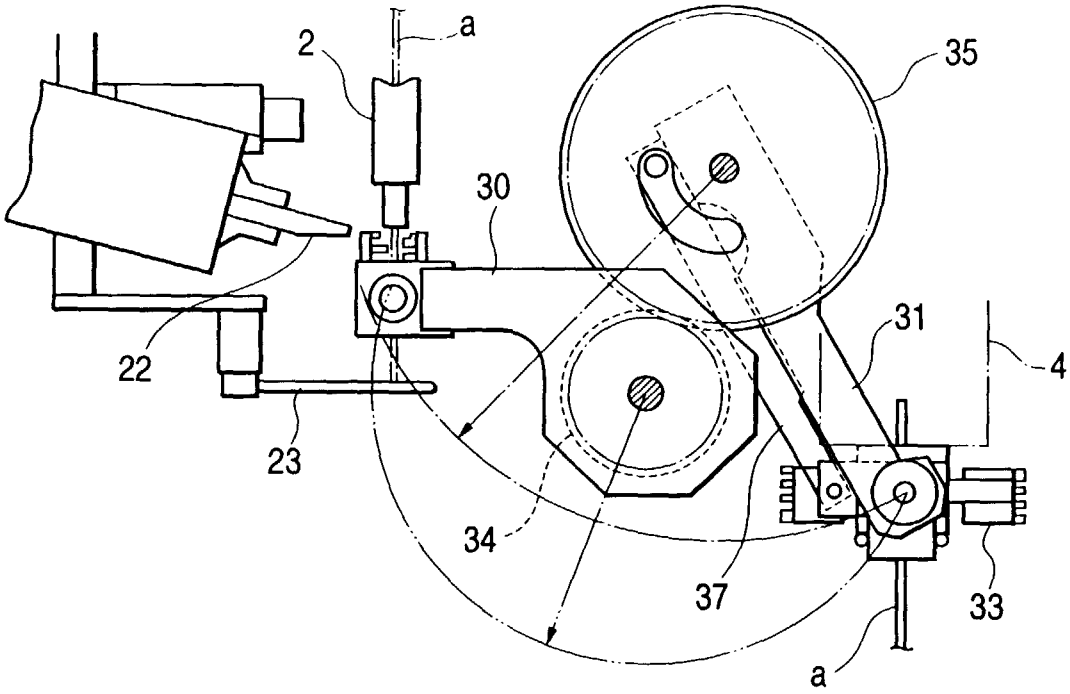

FIG. 3B

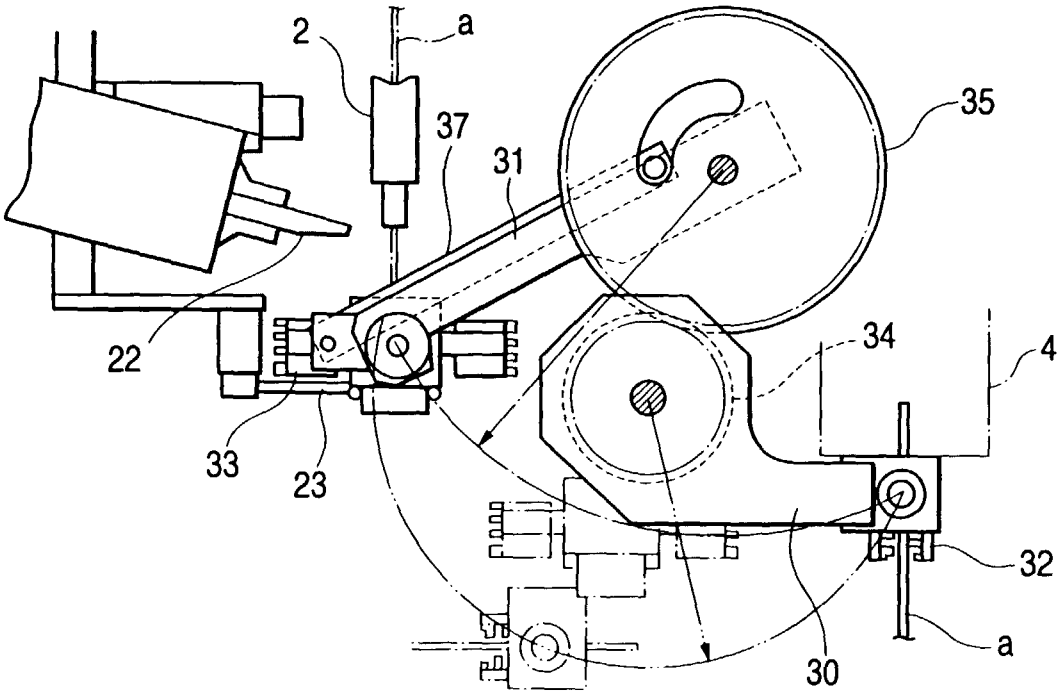

FIG. 4

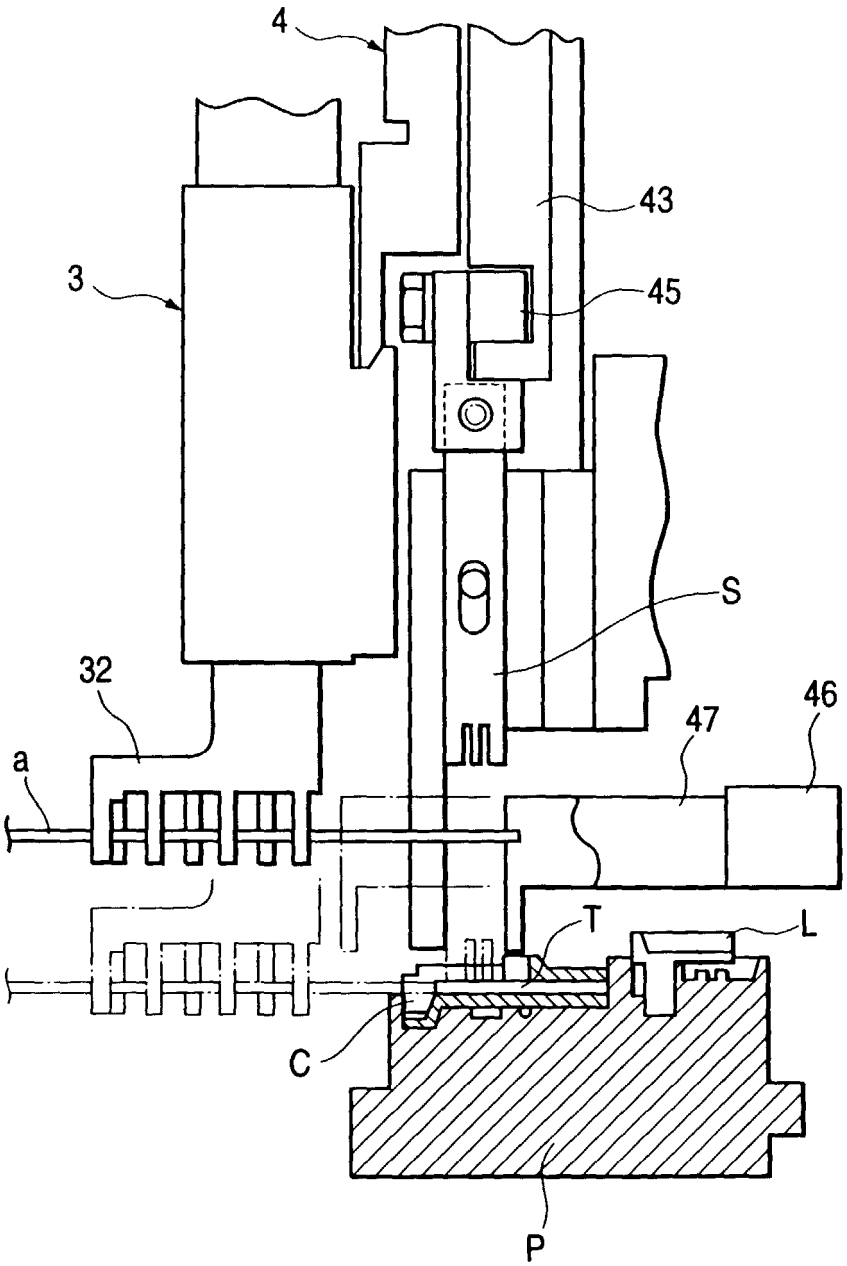

FIG. 5

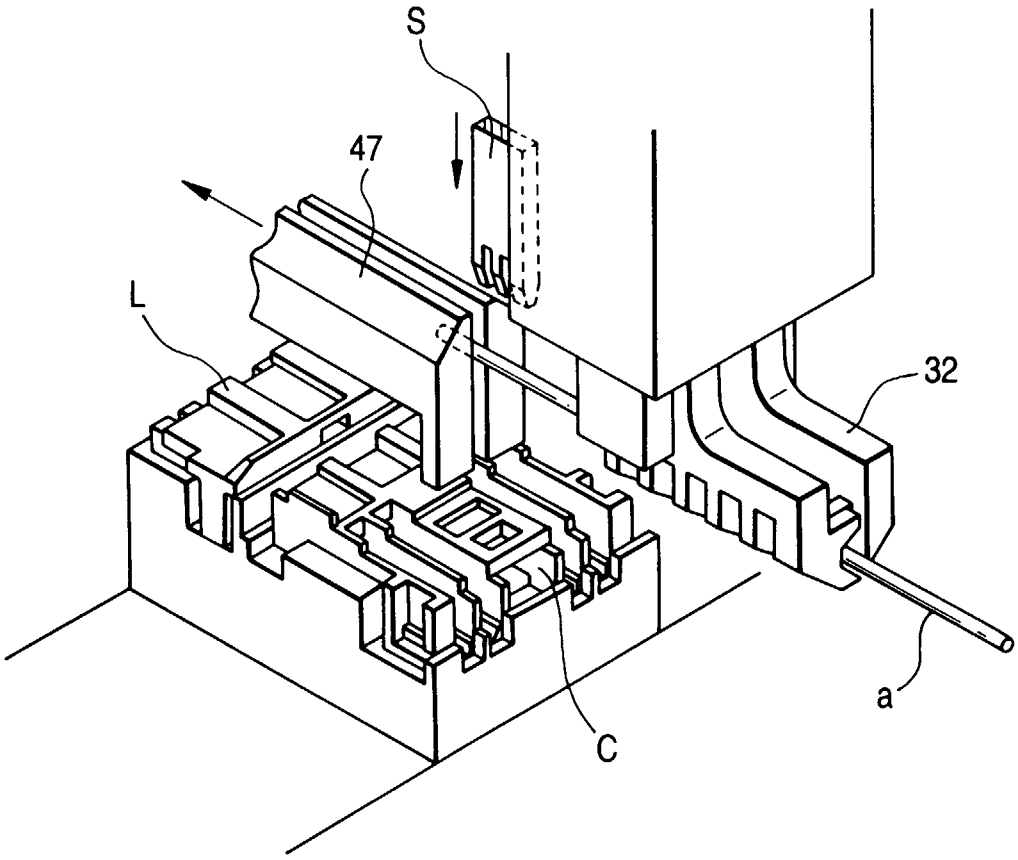

FIG. 6

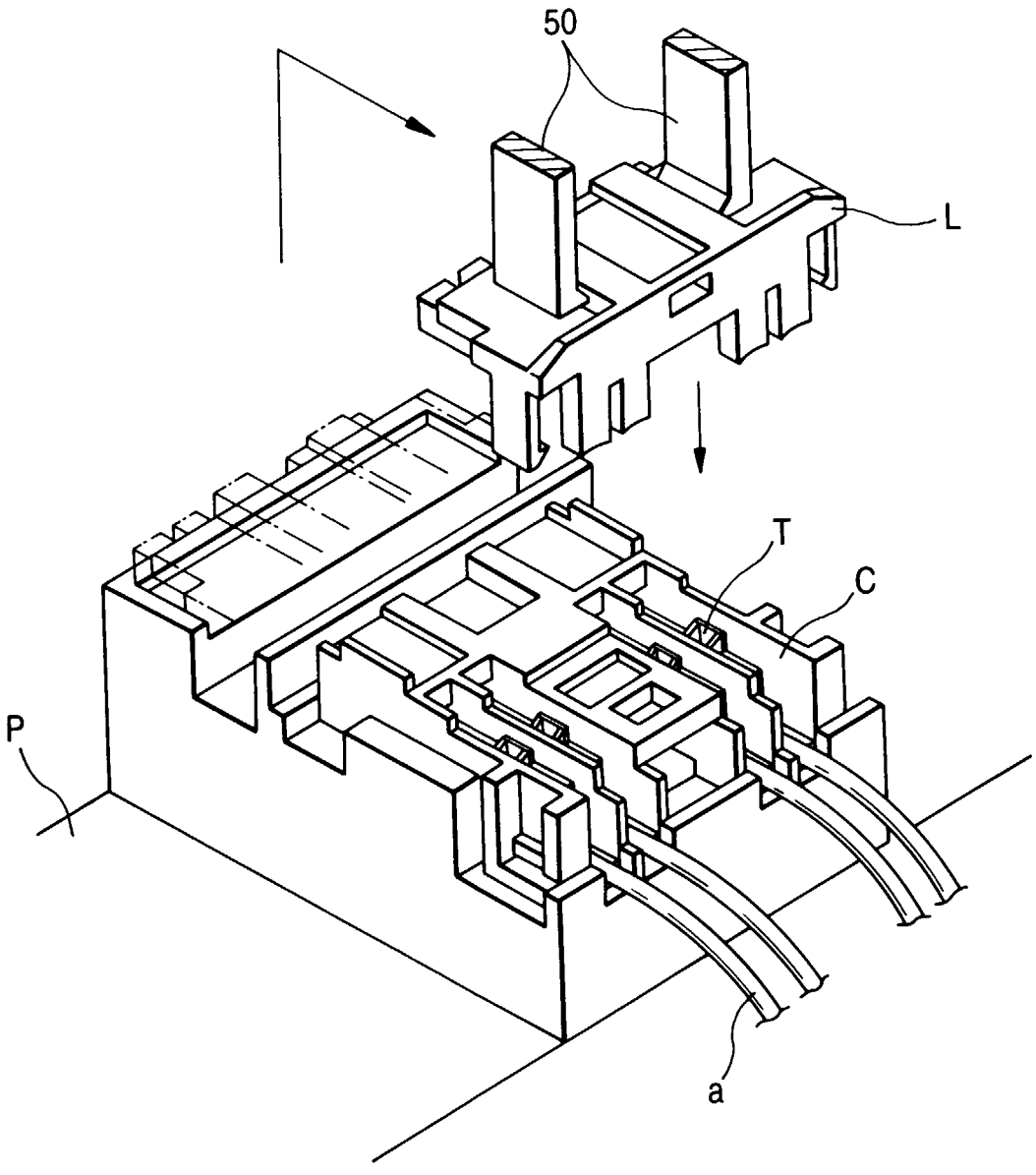

FIG. 7

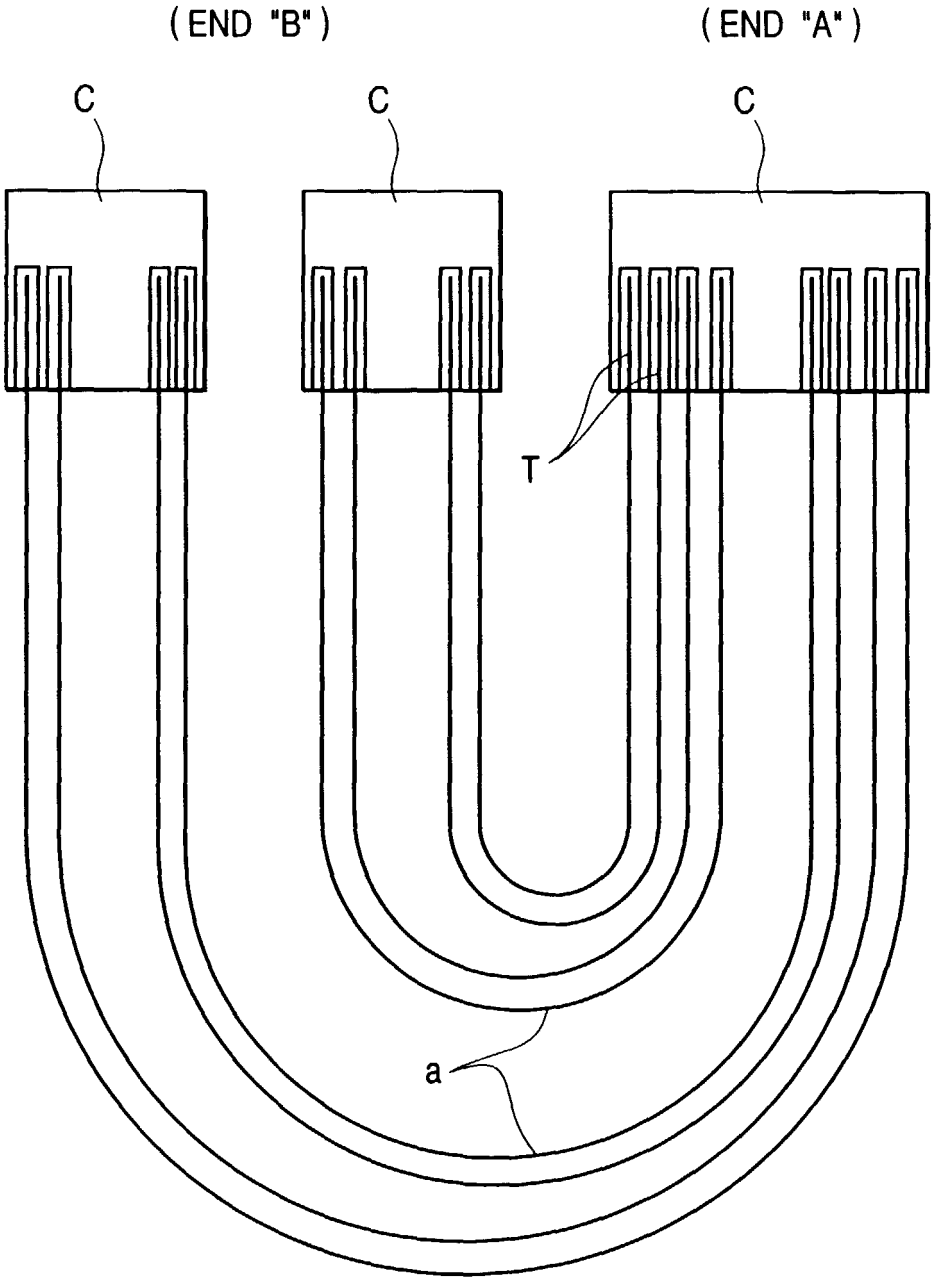

FIG. 8

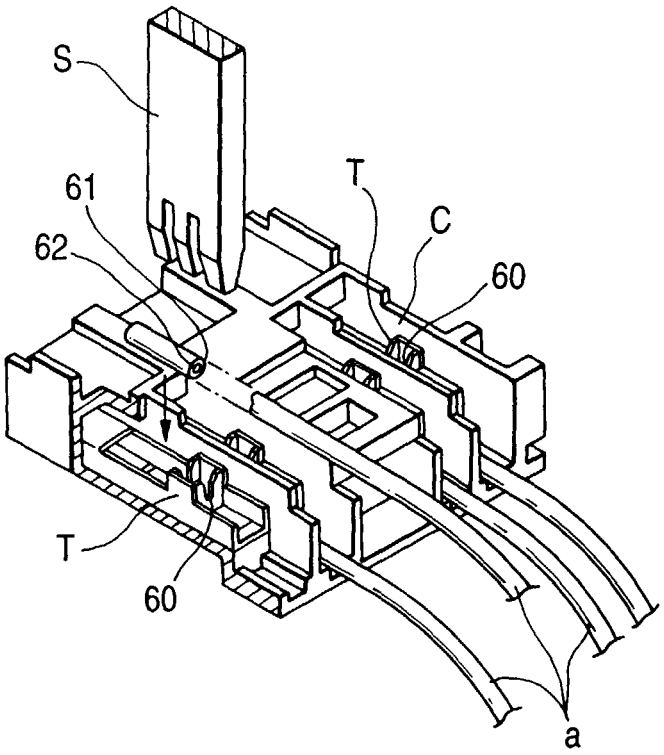

FIG. 9