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(71) Applicant: **HIROSE ELECTRIC CO., LTD.**
5-23 Osaki 5-chome
Shinagawa-ku
Tokyo (JP)
Applicant: **Sumitomo Wiring System, Ltd.**
1-14, Nishisuehiro-cho
Yokkaichi-shi
Mie-ken (JP)

(72) Inventor: **Ichitou, Toshikatsu, c/o Hirose Electric Co., Ltd.**
No. 5-23, Ohsaki 5-chome
Shinagawa-ku,
Tokyo (JP)
Inventor: **Ishioka, Hideyuki, c/o Hirose Electric Co., Ltd.**
No. 5-23, Ohsaki 5-chome
Shinagawa-ku,
Tokyo (JP)
Inventor: **Okamura, Takahiro, c/o Sumimoto Wiring System, Ltd**
No. 1-14, Nishisuehiro-cho
Yokkaichi-shi,
Mie (JP)
Inventor: **Nakamura, Atsuro, c/o Sumimoto Wiring System, Ltd**
No. 1-14, Nishisuehiro-cho
Yokkaichi-shi,
Mie (JP)
Inventor: **Takehana, Shinichi**
No. 3046-3, Fujiyama-oaza
Ueda-shi,
Nagano (JP)
Inventor: **Yokozawa, Hirokazu**
No. 1396, Tougou,
Aoki-mura
Chiisagata-gun,
Nagano (JP)
Inventor: **Hizawa, Toshiharu**
No. 579-2, Oki,
Takeishi-mura
Chiisagata-gun,
Nagano (JP)

(74) Representative: **Jilderda, Anne Ayolt**
LIOC B.V.
P.O. Box 85096
NL-3508 AB Utrecht (NL)

(54) Cable feeding device for automatic connecting apparatus.

(57) A cable feeding device for an automatic connecting apparatus includes: guiding sections (2A - 2E) disposed between a cable supplying device (30, 35) and a cutting section (15), each of the guiding sections being adapted to guide one cable (C), which is pulled out from the cable supplying device (30), linearly toward the cutting section (15); and a length-measuring section (14) for feeding out a predetermined length of the cable while measuring the length of the cable at an intermediate position or a forward position of the guiding section, wherein the guiding sections are arranged such that the cables (C) become parallel in an identical imaginary plane, the guiding sections being attached to a shifting/driving section (8) and being movable by a distance corresponding to an integral multiple of a pitch between the guiding sections in a direction in which the guiding sections are arranged, one of the guiding sections being selected to be located on a line connecting the length-measuring section (14) and the cutting section (15).

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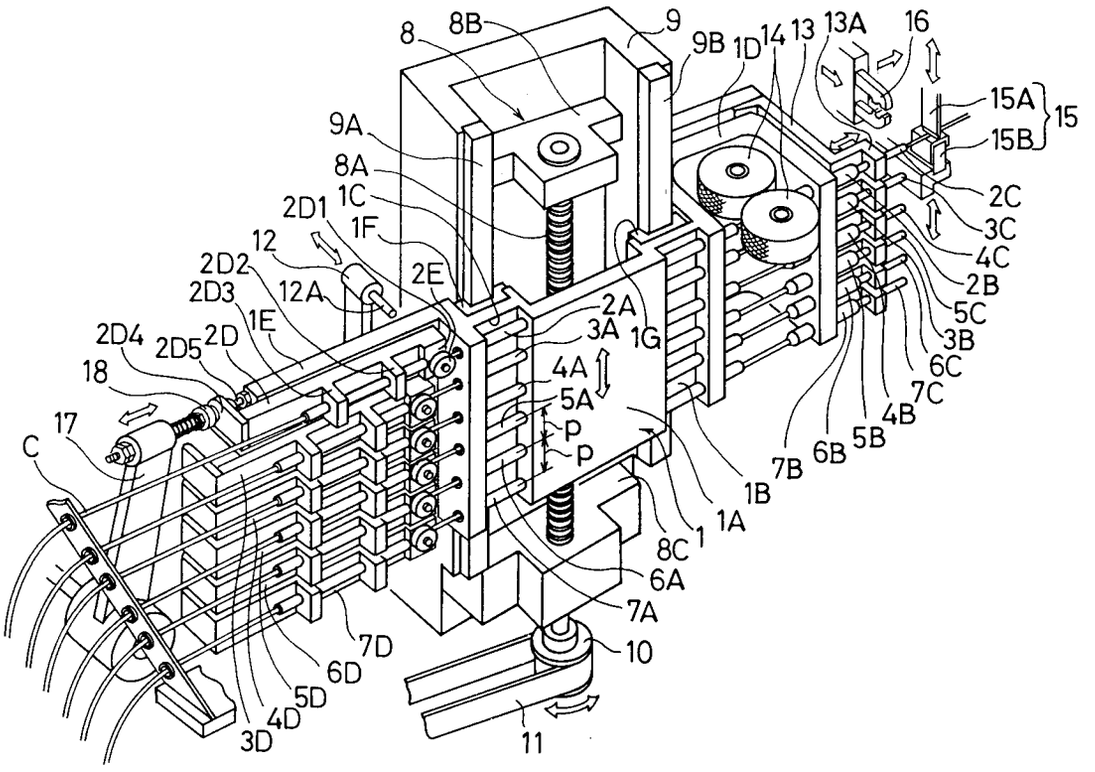
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2D3
12A
2E
2A
3A
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2D4
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2D
1E
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4A
5A
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6C
7C
4B
5B
6B
7B
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1A
1
8C
6A
7A
10
7D
6D
5D
4D
3D
11

Fig 1

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a cable feeding device for an automatic connecting apparatus, for feeding out a cable to be connected to a connector or the like.

Description of the Related Art:

When cables are connected to a connector or the like by an automatic connecting apparatus, each cable, which has been cut after being measured to a predetermined length by a cable feeding device, is brought to a contactor located at a predetermined connecting position by means of a transporting member so as to effect connection such as insulation displacement connection at that position. Subsequently, the transporting member transports an ensuing cable to the position of another contactor to effect connection in a similar manner. In many cases, it is sufficient to consecutively connect cables of the same kind to a plurality of contactors in the above-described manner. Depending on usages, however, there is a demand for changing the cables of some contactors to a type different from that of the cables of the other contactors, such as the color. Conventionally, in such a case, each time the color is changed, the cables that are supplied to the cable feeding device are replaced, and the connecting operation is carried out after conducting measurement and cutting.

In the case where the color of cables is to be changed for the contactors, the operation of replacing the cables in the cable feeding device is conventionally required, and much time and trouble are required for the operation. In particular, when the colors of a large number of cables are to be made respectively different, the operating efficiency declines appreciably.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a cable feeding device for an automatic connecting apparatus which has a small floor area required, and is capable of selectively supplying desired cables automatically in a case where different cables are to be connected depending on contactors.

To this end, in accordance with the present invention, there is provided a cable feeding device for an automatic connecting apparatus, comprising: guiding sections disposed between a cable supplying device and a cutting section, each of the guiding sections being adapted to guide one cable, which is pulled out from the cable supplying device, linearly toward the cutting section; and a length-measuring section for feeding out a predetermined length of the cable while measuring the length of the cable at an intermediate position or a forward position of the guiding section, wherein the guiding sections are arranged such that the cables become parallel in an identical imaginary plane, the guiding sections being attached to a shifting/driving section and being movable by a distance corresponding to an integral multiple of a pitch between the guiding sections in a direction in which the guiding sections are arranged, one of the guiding sections being selected to be located on a line connecting the length-measuring section and the cutting section).

In accordance with the device of the present invention arranged as described above, one cable which is guided by the guiding section is fed out a predetermined length by the length-measuring section, and is cut by the cutting section. The cut cable of the predetermined length is brought to a connecting position and is connected.

When a cable is to be changed to a cable of a different type, e.g., to a cable of a different color, on each occasion of connection, the shifting/driving section is driven by manual selection or program selection, the plurality of guiding sections are moved so as to bring the guiding section for guiding the cable of the desired color to a line connecting the length-measuring section and the cutting section. Subsequently, the cable is fed out a predetermined length through the guiding section by the length-measuring section, and is cut by the cutting section. Thus, cables of desired colors can be connected.

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description of the invention when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view illustrating a cable feeding device in accordance with an embodiment of the present invention;

Fig. 2 is a perspective view of a cable supplying device used in the device shown in Fig. 1;

Fig. 3 is a diagram illustrating a process using the device shown in Fig. 1; and

Fig. 4 is a diagram illustrating the process using the device shown in Fig. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the accompanying drawings, a description will be given of an embodiment of the

present invention. Fig. 1 is a perspective view illustrating an arrangement of a cable feeding device in accordance with this embodiment, and Fig. 2 is a perspective view illustrating a cable supplying device for supplying cables to the device shown in Fig. 1.

The cable feeding device shown in Fig. 1 has a support 1 which has a vertical flat surface in a central portion 1A and extends in the longitudinal direction of the device. Guide pipes 2A, 3A, 4A, 5A, 6A, and 7A, which form parts of guiding sections, are supported horizontally at equal intervals with a pitch p by the support 1. (Incidentally, one guiding section is constituted by, for instance, the guide pipe 2A and members 2B, 2C, 2D, and 2E which will be described later.) The support 1 has a block portion (not shown) on the back-surface side of the central portion 1A, and a feed screw 8A of a shifting/driving section 8 is threadedly engaged in the block section. Although an ordinary screw may be used as the feed screw 8A, a ball screw is preferable for accurate and smooth rotation. The feed screw 8A is supported rotatably about an axis by members 8B and 8C at upper and lower ends thereof, and the members 8B and 8C are fixed to an immobile frame 9. Accordingly, the feed screw 8A is rotatable, but is at a fixed position in the vertical direction. The feed screw 8A has a pulley 10 attached to a lower end thereof, and is rotatively driven by a predetermined amount in both forward and reverse directions by means of a belt 11 wound around the pulley 10. The belt 11 is driven by an unillustrated driving source, and is driven intermittently by an amount for moving the support 1 by a distance which is an integral multiple of the pitch p.

The support 1 has shallow groove portions 1B and 1C extending vertically at the front and the rear of the central portion 1A. A U-shaped portion 1D extending vertically for forming a deep groove portion is provided in front of the front shallow groove portion 1B, while an L-shaped portion 1E extends rearwardly at the back of the rear shallow groove portion 1C. The support 1 has U-shaped sliding members 1F and 1G respectively attached to rear sides of the shallow groove portions 1C and 1B, and the U-shaped sliding members 1F and 1G are guided vertically slidably by guide rails 9A and 9B provided at front and rear portions of the frame 9.

In the support 1, the six guide pipes 2A, 3A, 4A, 5A, 6A, and 7A, which extend in the range of the central portion 1A of the support 1 as well as the two shallow groove portions 1B and 1C formed at the front and the rear thereof, are held in parallel at equal intervals with the pitch p. The inside diameters of these guide pipes are sufficient if they are slightly larger than the diameter of a cable C. A material which has low friction with respect to the traveling of the cable C and has outstanding wear resistance, such as a ceramic, is preferably used as the material of the guide pipes.

Additional guide pipes 2B, 3B, 4B, 5B, 6B, and 7B whose inside diameters are slightly larger than the inside diameters of the guide pipes 2A, 3A, 4A, 5A, 6A, and 7A are held in a front wall portion of the U-shaped portion 1D of the support 1 on the extensions of axes of the latter guide pipes. These guide pipes 2B 3B, 4B, 5B, 6B, and 7B at forward ends thereof respectively support nozzles 2C, 3C, 4C, 5C, 6C, and 7C whose amounts of projection are made variable by sliding. The inside diameters of the rear portions of the guide pipes 2B, 3B, 4B, 5B, 6B, and 7B and the nozzles 2C, 3C, 4C, 5C, 6C, and 7C are set to be substantially identical to the inside diameters of the guide pipes 2A, 3A, 4A, 5A, 6A, and 7A.

Cable gripping/moving members 2D, 3D, 4D, 5D, 6D, and 7D having the same configuration are provided along a wall surface of the L-shaped portion 1E of the support 1 in such a manner as to be mutually independent from each other.

Hereafter, a description will be given of the cable gripping/moving member 2D located at an uppermost position by way of example. The cable gripping/moving member 2D is a slender plate-like member extending in the longitudinal direction, and has on one surface thereof (on its surface opposite to the surface facing the L-shaped portion 1E) a gripping surface 2D1 formed at a front portion thereof, as well as supporting projections 2D2 and 2D3 provided in an intermediate portion thereof. In addition, the cable gripping/moving member 2D at a rear end thereof is provided with a projecting end 2D4 projecting toward the side facing the L-shaped portion 1E, and the projecting end 2D4 is opposed to a rear-end surface of the L-shaped portion 1E.

The disk-shaped clamp member 2E attached to a shaft passed through the gripping surface 2D1 is disposed in face-to-face relation to the gripping surface 2D1. This shaft is guided by the cable gripping/moving member 2D in such a manner as to be axially slidable, and is constantly urged toward the gripping surface 2D1 by means of a spring (not shown) or the like provided between the clamp member 2E and the cable gripping/moving member 2D. An elongated hole (not shown) is formed in the longitudinal direction in the L-shaped portion 1E by a length corresponding to an amount of longitudinal movement of the cable gripping/moving member 2D, and the shaft of the clamp member 2E is plunged into the elongated hole, and reaches the position of the rear surface of the L-shaped portion 1E. A rod 12A, which is driven out by a driving member 12 such as a cylinder, is provided on the rear-surface side of the L-shaped portion 1E. At a predetermined timing,

the rod 12A presses an end face of the shaft in the elongated hole so as to cause the clamp member 2E to be spaced apart from the gripping surface 2D1 in order to cancel clamping, thereby releasing the cable C which was being clamped and held.

The projecting end 2D4 provided at the rear end of the cable gripping/moving member 2D is connected to the rear end of the L-shaped portion 1E by means of a rod 2D5, such that the cable gripping/moving member 2D is supported in such a manner as to be capable of advancing and retracting with respect to the L-shaped portion 1E. In addition, a spring (not shown) is attached to the rod 2D5 so as to urge the cable gripping/moving member 2D in a direction in which the cable gripping/moving member 2D is retracted up to a position for abutment against an unillustrated stopper.

The other cable gripping/moving members 3D, 4D, 5D, 6D, and 7D located below the cable gripping/moving member 2D are also arranged in entirely the same way as the cable gripping/moving member 2D.

Arms 13 which are capable of advancing and retracting are provided at vertical positions parallel to the front surface of the U-shaped portion 1D of the support 1. The arms 13 respectively correspond to the six nozzles 2C, 3C, 4C, 5C, 6C, and 7C, and are respectively independently movable. The nozzle 2C which is slidably accommodated in the guide pipe 2B is connected to a crank-shaped distal end portion 13A of an uppermost one of the arms 13. As the arm 13 advances forward, the nozzle 2C is pulled out forward.

A length-measuring section which is comprised of a pair of feed rollers 14 is disposed in the U-shaped portion 1D of the support 1. The pair of feed rollers 14 are capable of moving toward or away from each other at predetermined timings. The feed rollers 14, when approaching each other, are adapted to nip the cable C exposed between the guide pipe 2A and the guide pipe 2B, measure a predetermined length by rotating through a predetermined angle, and feed out the cable C.

A cutting section 15 for cutting the cable C is provided at a position located forwardly of the nozzle 2C. The cutting section 15 is comprised of a blade 15A located at an upper position and a blade-receiving base 15B for receiving the same, and these two members are driven in such a manner as to vertically move toward or away from each other, and cut the cable C when they are brought into contact with each other.

A gripper 16, which moves to the position of the cable C and grips and advances the cable C, is disposed at a lateral position between the nozzle 2C and the cutting section 15.

A pressing member 18, which is driven by the rotation of a lever 17 and advances the cable gripping/moving member 2D by a predetermined amount, is disposed at a position located rearwardly of the cable gripping/moving member 2D of the guiding section.

Meanwhile, the cable supplying device for supplying cables to the above-described cable feeding device is arranged as shown in Fig. 2. In contrast to the fact that the cable feeding device shown in Fig. 1 is so adapted as to feed out six cables that are arranged vertically, the cable supplying device is so adapted as to supply six cables that are arranged horizontally. The six cables C are respectively wound around mutually independent reels (not shown), and after the cables are pulled out from the reels, their curled state is corrected by a series of curl-removing rollers 21 and 22 which rotate about horizontal and vertical axes. Then, the cables C are respectively nipped and transported by pairs of feed rollers 23. Lower rollers of the six pairs of rollers 23 for the six cables C are connected by one shaft 24, and the shaft 24 is driven by a motor 26 via a pulley 25. The cables C fed out by the feed rollers 23 are guided by curved pipes 27 having small friction resistance and high wear resistance, and are introduced into an arrangement-direction converting device 30.

The arrangement-direction converting device 30 has a plurality of guide plates 31 for forming slits for causing the cables C to approach each other in a mutually separated state, as well as a vertically arranging member 35. Within the range of each guide plate 31, each cable C is guided in a slack state so that its tension becomes very small. An upper-limit sensor 32 and a lower-limit sensor 33 are attached to the guide plate 31 in correspondence with each cable C, and the aforementioned motor 26 is controlled so that each cable C is located between the upper-limit sensor 32 and the lower-limit sensor 33.

The plurality of guide plates 31, when viewed from the top, are arranged in a fan shape, and the interval between the adjacent guide plates 31 becomes narrower toward their forward portions. The vertically arranging member 35 is disposed in front of the guide plate 31. The vertically arranging member 35 is provided with a member 37 having six guide rings 36 arranged in the vertical direction, so that the arrangement of the six cables C arranged and guided in close proximity to each other in the horizontal direction by the guide plates 31 is converted to the vertical direction.

The plurality of reels are ordinarily arranged in the horizontal direction, but the cables are rearranged in the vertical direction by the arrangement-direction converting device 30 without becoming entangled with each other.

Next, referring also to Figs. 3 and 4, a description will be given of the operation of the device of

this embodiment arranged as described above.

(1) First, in Fig. 1, the support 1 is moved to a predetermined height so that one cable C selected in accordance with a program is brought to the position of the feed rollers constituting the length-measuring section.

(2) The selected cable C has its curled state corrected by the series of rollers 21 and 22 shown in Fig. 2, passes through the guide plates 31 and the vertically arranging member 35, and is then brought to the guide pipes 2A and 2B and the nozzle 2C. Incidentally, the remaining five cables at lower positions are prevented from retracting since they are clamped by the clamp members 2E, respectively, such that the distal ends of the cables are located at the positions of the distal ends of the nozzles 3C, 4C, 5C, 6C, and 7C.

(3) The clamp member 2E of the guiding section for guiding the selected cable C clamps the cable C, and the pair of feed rollers 14 are in a mutually-spaced-apart state, so that the cable is not nipped (see the state shown in the part (A) of Fig. 3).

(4) Next, as the pressing member 18 advances forward, the cable gripping/moving member 2D is pushed forward, as shown in the part (B) of Fig. 3. The cable C being clamped by the clamp member 2E advances forward together with the cable gripping/moving member 2D, and the distal end of the cable C projects from the nozzle 2C, and reaches the position of the cutting section 15.

(5) The cable C projecting from the nozzle 2C is gripped by the gripper 16 which approaches the cable C from a lateral direction (see the state shown in the part (C) of Fig. 3), and the cable C is pulled out forward by the gripper 16 which advances forward after the cable C is released from the clamp member 2E (see the state shown in the part (D) of Fig. 3). At this time, the nozzle 2C is also pulled out forward by the arm 13.

(6) Next, as in the state shown in the part (E) of Fig. 3, a gripper 51 of a cable transporting device (not shown) of the connecting apparatus, which is used in a process following the cable-feeding process by the device of this embodiment, advances and grips the cable C. At this time, the pair of feed rollers 14 approach each other and nip the cable C. It should be noted that if the process of the aforementioned connection or the like is not carried out as a subsequent process, the cable C may be left gripped by the gripper 16 of the device of this embodiment, instead of carrying out the shift in holding the cable C to the holding by the gripper 51.

(7) Subsequently, the pair of feed rollers 14 are rotated, and the cable C being nipped by the feed rollers 14 is fed forward by a predetermined length (see the state shown in the part (F) of Fig. 4). At this time, the gripper 51 is at a fixed position, and the cable C is suspended downward in a state of being slackened by the fed portion.

(8) Then, another gripper 52 of the cable transporting device of the connecting apparatus advances and grips the cable C at a position located forwardly of the nozzle. Subsequently, the nozzle 2C is retracted by the gripper 16 (see the state shown in the part (G) of Fig. 4).

(9) As the nozzle 2C is retracted, a space is formed between the gripper 52 and the nozzle 2C, and the cutting section 15 advances into this space, as in the state shown in the part (H) of Fig. 4. After the cable C is cut by the cutting section 15, the cable C is gripped by the gripper 51 and 52 and is brought to a predetermined connecting position. At this time, the cable C is clamped by the clamp member 2E, and the pair of feed rollers are in a spaced-apart state. Subsequently, the pressing member 18 retracts, and the cable gripping/moving member 2D is also retracted by the restoring force of the spring provided on the rod 2D5 between the L-shaped portion 1E of the support 1 and the cable gripping/moving member 2D, and returns to the state shown in the part (A) of Fig. 4.

(10) Next, when the cable is to be changed to a different type, e.g., to a different color, the support 1 is vertically moved by a distance corresponding to an integral multiple of the pitch between the cables so that a predetermined cable is brought to the position of the cable feed rollers 14. Subsequently, the operation of steps (1) to (9) is performed in the same manner.

In the present invention, as described above, since the guide sections for respectively guiding the cables are arranged to be capable of moving by the pitches between the cables, it is possible to appropriately select cables which are each fed out after being measured and cut to a predetermined length. By connecting the device of the present invention to the connecting apparatus for consecutively connecting cables of different types, the connecting operation can be improved remarkably. At that time, if the plurality of guiding sections are arranged in such a manner as to be parallel to each other in a vertical plane so as to arrange the cables, the cable feeding device can be made a device having a small floor area.

In addition, in the device of the present invention, if each guiding section is provided with the cable gripping/moving member, only one cable which is to be measured and cut can be advanced,

and distal ends of the remaining cables can be brought to retracted positions, thereby preventing the distal ends of the remaining cables from becoming impediments during cutting and transport. At that time, if each cable gripping/moving member is provided with a clamp member, and the cable is clamped at times other than when the cable is fed out in the cable-length measuring section, the cable is prevented from moving in the longitudinal direction thereof while on standby. In particular, the cable is prevented from being pulled back by the device located in the rear, and the cable can remain at a fixed position.

Furthermore, if the nozzle which is capable of advancing to the vicinity of a cutting position and retracting therefrom is provided at the distal end portion of each guiding section, the distal end of the cable is maintained at a predetermined position by the nozzle, so that it is possible to prevent the cutting position from becoming offset and prevent an error in the cutting length from occurring due to the offset of the cutting position.

Claims

1. A cable feeding device for an automatic connecting apparatus, comprising:

guiding sections (2A - 2E) disposed between a cable supplying device (30, 35) and a cutting section (15), each of said guiding sections being adapted to guide one cable (C), which is pulled out from said cable supplying device (30), linearly toward said cutting section (15); and

a length-measuring section (14) for feeding out a predetermined length of the cable while measuring the length of the cable at an intermediate position or a forward position of said guiding section,

wherein said guiding sections are arranged such that the cables (C) become parallel in an identical imaginary plane, said guiding sections being attached to a shifting/driving section (8) and being movable by a distance corresponding to an integral multiple of a pitch between said guiding sections in a direction in which said guiding sections are arranged, one of said guiding sections being selected to be located on a line connecting said length-measuring section (14) and said cutting section (15).

2. A cable feeding device for an automatic connecting apparatus according to Claim 1, wherein each of said guiding sections (2A - 2E) is provided with a cable gripping/moving member (2D, 3D, 4D, 5D, 6D, 7D) for causing a distal end of the cable to advance a predetermined distance up to a cutting position of said cutting section and to retract from the position.

3. A cable feeding device for an automatic connecting apparatus according to Claim 2, wherein said cable gripping/moving member (2D, 3D, 4D, 5D, 6D, 7D) has a moving member which advances and retracts a predetermined distance and a clamp member (2E) provided on said moving member and adapted to clamp the cable.

4. A cable feeding device for an automatic connecting apparatus according to Claim 3, wherein said clamp member (2E) is so set as to clamp the cable at times other than when the cable is fed out in said length-measuring section.

5. A cable feeding device for an automatic connecting apparatus according to Claim 1, wherein a nozzle (2C, 3C, 4C, 5C, 6C, 7C) for guiding the cable is provided at a distal end portion of each of said guiding sections (2A - 2E), and said nozzle is capable of advancing to a vicinity of a cutting position and retracting therefrom.

Fig 1

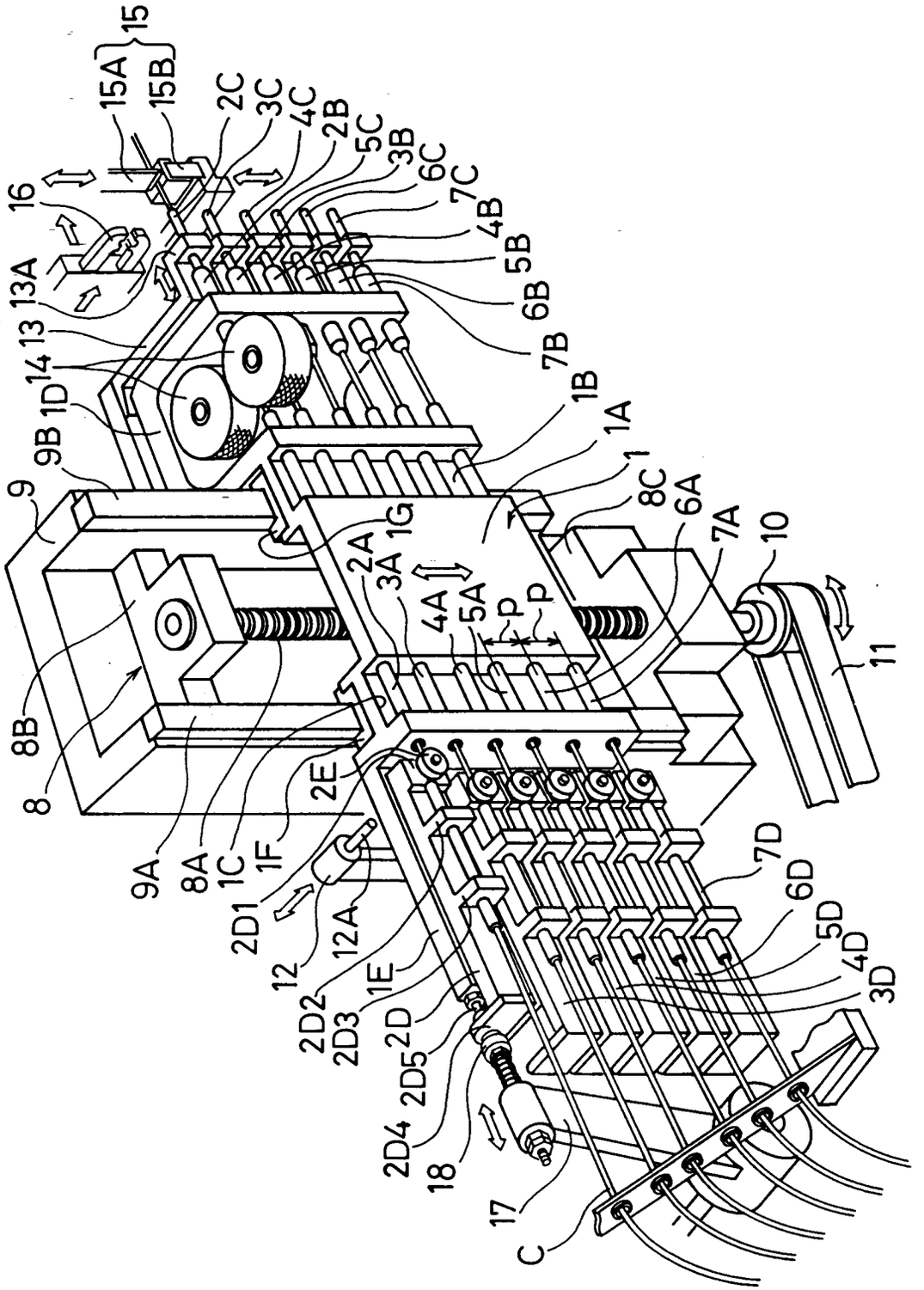
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Fig 2

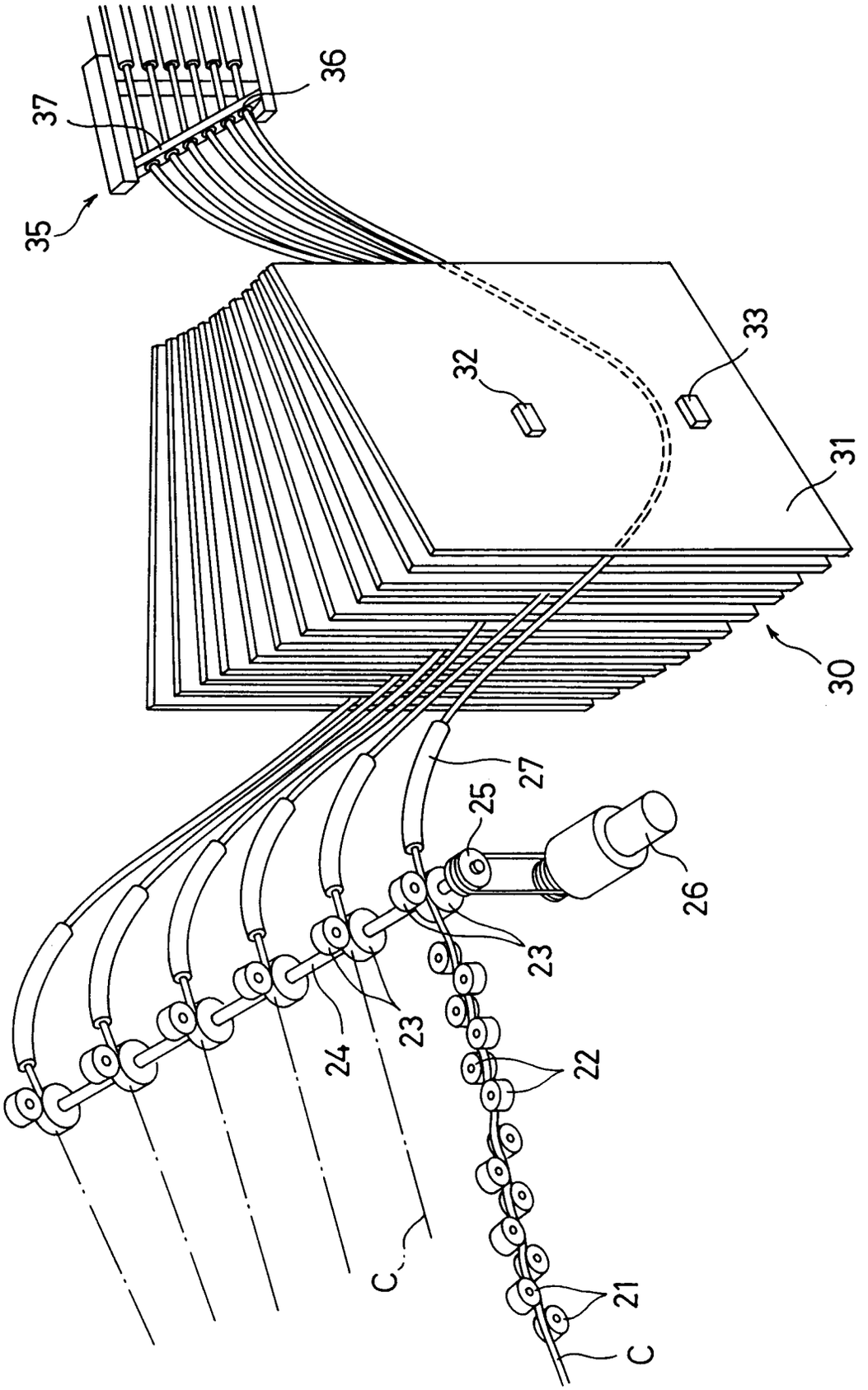

Fig 3

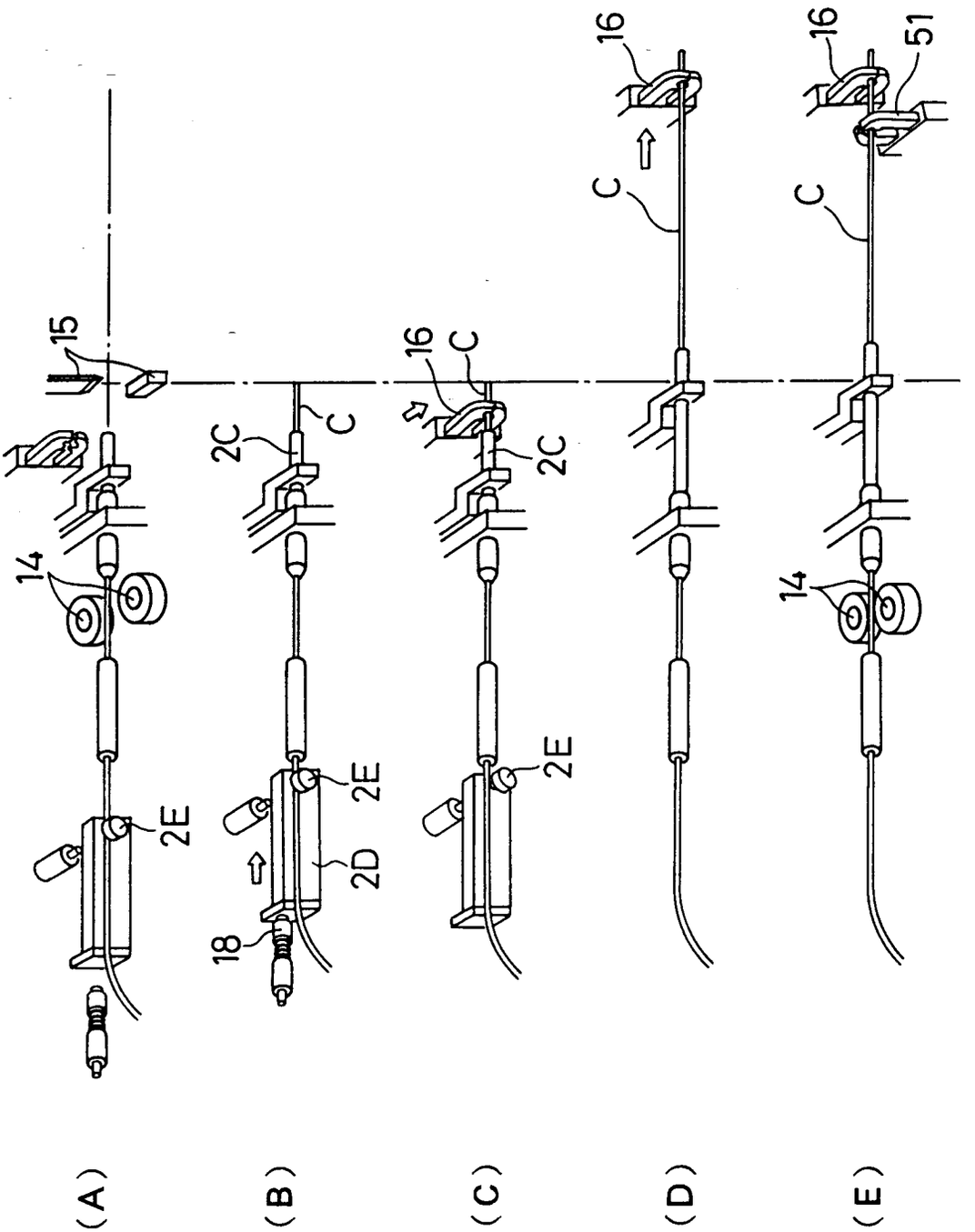

Fig 4