(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 803 595 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.10.1997 Bulletin 1997/44

(51) Int. Cl.[6]: **D01H 5/00**, D01D 5/16

(21) Application number: **97105398.8**

(22) Date of filing: **01.04.1997**

(84) Designated Contracting States:
DE FR IT

(30) Priority: **25.04.1996 JP 105669/96**

(71) Applicant: **Murata Kikai Kabushiki Kaisha**
Minami-ku, Kyoto-shi, Kyoto 601 (JP)

(72) Inventor: **Takada, Hiroshi**
Moriguchi-shi, Osaka (JP)

(74) Representative: **Liedl, Christine, Dipl.-Chem. et al**
Albert-Rosshaupter-Strasse 65
81369 München (DE)

(54) Fiber bundle threading device

(57) A device automating the threading of fiber bundle provided with a travelling car 3 that runs along the direction in which the feed rollers 2 are arranged, and an operating arm 4 that is arranged on the travelling car 3, operates in conjunction with that running and suitably threads tow on the feed rollers 2. The operating arm 4 is provided with a vertical swing system 5 for movement in the vertical direction and a lateral swing system 6 for movement in the horizontal direction.

EP 0 803 595 A2

Description

BACKGROUND OF THE INVENTION

TECHNICAL FIELD

The present invention relates to a fiber bundle threading device for sequentially threading fiber bundle on a plurality of processing rollers arranged with their axes approximately parallel.

BACKGROUND ART

Generally, the production of a staple fiber such as a polyester or the like is achieved by the drawing, oiling, crimping and cutting and other processes of a fiber bundle (tow) formed by the accumulation of a plurality of filaments continuously produced by a melt spinning yarn device. The production line consisting of these processes comprises processing rollers (for example, a feed roller of a draw off part) orderly arranged in a zigzag shape on an upper and lower level with their axes approximately parallel and a predetermined processing is performed on the tow by the rotation of these rollers before it is delivered to the next process.

However, on this kind of production line, it is necessary to sequentially thread new tow onto the feed rollers when cleaning or a brand exchange is to be carried out or a yarn breakage occurs. Conventionally, an operator would hold the end of the tow and perform this tow threading operation but due to such factors as a thick tow of several thousand denier for example having a high weight or the tow threading frequency being high due to many varieties of yarns being used in small quantities, automation of tow threading designed for a decrease in the operation load and an increase in the operation speed is desired.

SUMMARY OF THE INVENTION

In order to solve the above mentioned problems, it is an object of the present invention to propose a fiber bundle threading device which sequentially threads a fiber bundle around a plurality of processing rollers arranged with their axes approximately parallel provided with, a travelling car that runs along the direction in which the feed rollers are arranged and, an operation arm that is arranged on the travelling car, operates in conjunction with that running and suitably threads tow on the feed rollers. Accordingly, a fiber bundle may be automatically threaded on processing rollers by the combination of the running of the travelling car and the operations of the operating arm.

Further, it is preferable for the operating arm to have a vertical swing system for movement in the vertical direction and a lateral swing system for movement in the running direction of the travelling car.

Further still, it is preferable for the lateral swing system to have a cam that converts a rotational drive movement to a reciprocating movement.

Yet further, it is preferable for the operating arm to have a suction nozzle on the tip and for it to hold the fiber bundle by suction.

Yet further still, it is preferable for a bend to be possible in the suction nozzle at some mid-point.

Yet further, it is preferable for the travelling car to have a waste box that supports the basal part of the operating am and for a storage space be partitioned in that waste box in order to store fiber bundle sucked from the suction nozzle.

Further still, it is preferable for the operating arm to have an outer cylinder, an inner cylinder contained within the outer cylinder such that it may slide freely, and an extension-retraction system for suitably projecting the inner cylinder out of the outer cylinder.

Yet further, it is preferable for the operating arm to gradually and sequentially increase in diameter from the suction nozzle to the inner cylinder to the outer cylinder.

Yet further still, it is preferable for a cover to be provided that partially covers the processing rollers in order to prevent contact between the processing rollers and the operating arm.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front view of a first embodiment of the fiber bundle threading device of the present invention.

Figure 2 is a side view of Figure 1.

Figure 3 is a perspective view of Figure 1.

Figure 4 is a lateral sectional view of the main part of Figure 1.

Figure 5A is a side view of the lateral swing system of Figure 1 and Figure 5B is a front view of the lateral swing system of Figure 1.

Figure 6 is a vertical sectional view of the extension-retraction system of Figure 1.

Figures 7A and 7B are side views of the feed rollers describing the actions of Figure 1.

Figure 8 is a perspective view of the cover of Figure 7.

Figure 9 is a side view of another part of Figure 1.

Figure 10 is a top view of another embodiment of the lateral swing system of Figure 5.

Figure 11 is a trace drawing describing the actions of Figure 1.

Figure 12 is a front view of the arrangement of the feed rollers.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Hereafter, an embodiment of the present invention will be described in accordance with the attached drawings.

Figures 1 to 3 show the application of the fiber bundle threading device of the present invention on a staple fiber production line and show an example where tow threading is performed on a plurality of feed rollers 2

(refer to Figure 12) provided on that draw off part 1. With the axes approximately horizontal, the plurality of feed rollers 2 are formed into an upper level and lower level so that a pair of adjacent feed rollers 2 overlap in the vertical direction and are orderly arranged in a zig-zag shape. The fiber bundle threading device mainly comprises the travelling car 3 which runs in the direction in which the feed rollers 2 are arranged, and an operating arm 4 arranged on that travelling car 3. The operating arm 4 holds the tow T by suction air a, is provided with a vertical swing system 5 and lateral swing system 6 for movement in the vertical direction B and lateral direction C (running direction of the car) respectively and suitably winds the held tow T on the feed rollers 2 by the combination of these movements and the running of the travelling car 3.

The travelling car 3 is provided with a main frame 7 having a rectangular shape and a travelling means 8 arranged a the lower part of that main frame 7. The main frame 7 is partitioned with the front side of the travelling direction A being a waste box 9 and the rear side being an electrical box 10. Sequencers and the like for travelling and for swing control of the operating arm 4 are stored in the electrical box 10. The basal part of the operating arm 4 is supported on the front surface 11 of the waste box 9 and a storage space 12 is partitioned off in the waste box 9 in order to store surplus tow T that has been sucked up. A net (not shown in the drawings) is positioned in this storage space 12 and interrupts the flow of suction air downstream (outside of the box). Furthermore, a door 13 for removing stored tow T is arranged in the side of the waste box 9.

A fixed arm 16 coupled to a guide frame 15 hanging from the ceiling 14 is arranged on the upper part of the main frame 7. A "]" shaped guide part 17 is formed on the lower end of the guide frame 15 and a cable guide member 20 enclosing an air supply pipe 18 and cabtyre 19 extends along the base surface 17a of the guide part 17. Furthermore, a guide rail 21 having an L-shaped cross section is mounted on the tip of the base surface 17a. The fixed arm 16 is suitably angled and extended so that the tip is inserted into the guide part 17. At some point, a pair of guide wheels 22 arranged so that they enclose the guide rail 21, are arranged at the front and rear and the end of the cable guide member 20 is mounted on the tip 16a of the fixed arm 16. The standing part of the fixed arm 16 introduces air (compressed air) from the plant air source and a duct (not shown in the drawings) which is linked to the waste box 9 is mounted on the basal part of the arm. Furthermore, a pipe 23 for connecting the cabtyre 19 to the electrical box 10 is arranged along the standing part of the fixed arm 16. In short, suction air that flows approximately downwards into the storage space 12 is formed in the waste box 9 by negative pressure effects and electrical power for driving and control is supplied to the electrical box 10 utilizing the plant's power source.

The travelling means 8 is stored inside a lower frame 24 that is arranged on the lower part of the main frame 7, and comprises wheels 25, 26 positioned at each corner of the lower frame 24, a pinion of a rack and pinion system positioned in the vicinity of the front wheels 25,26, and a travelling motor 28 for driving that pinion 27. The lower frame 24 comprises a low flat rectangular shape being longer than the length in the front-rear direction of the main frame 7. The wheels 25, 26 are supported so as to rotate freely on the lower frame 24 via brackets 29, 30. The wheels 25, 26 on the left and right are formed to couple with a pair of rails 32,33 respectively which extend along the longitudinal direction of the production line on the floor 31 and in this embodiment, are formed so that they fit with a rail 32 having a circular cross-section and a rail 33 having a rectangular cross-section respectively. Naturally, the shape of these rails 32, 33 and the shape of the wheels 25, 26 is not limited to what is stated here and rails and wheels being the same on the left and right may be used. A rack 34 is arranged parallel with and between these rails 32, 33 and a toothed surface is formed on the side of that. The pinion 27 is mounted on an output shaft 35a of a reduction gear 35 provided on the travelling motor 28, and meshes with the rack 34 by rotating the shaft in the vertical direction. A spur wheel 36 is mounted on the shaft connected to and projecting above the output shaft 35a and the rotation count (distance travelled) of the seed reduction gear 35 is detected by a rotary encoder 38 having a spur wheel 37 that engages with that spur wheel 36. Aside from this, a sensor 39 that detects marks suitably positioned on the floor 31 is provided on the lower frame 24 and this sends a position signal of the travelling car 3 to the sequencer stored in the electrical box 10.

The operating arm 4 comprises an outer cylinder 40 having a length approximately corresponding to the distance from the travelling position of the travelling car 3 to the feed roller 2, an inner cylinder 41 stored inside the outer cylinder 40 and which may slide freely, and a suction nozzle 42 mounted on the tip of the inner cylinder 41. Apart from the vertical suing system 5 and lateral swing system 6, an extension-retraction system 43 for projecting the inner cylinder 41 with respect to the outer cylinder 40 is provided on the operating arm 4.

The outer cylinder 40 comprises an elbow 40a of which the basal part is bent at a right angle, ad a straight part 40b which extends straight outwards. The end of the elbow 40a is inserted in a base pipe 44 arranged on the waste box 9 with a suitable gap separating their peripheral surfaces. A base pipe 44 is positioned so that it projects forward of the travelling direction A from an upper position of the front surface 11 of the waste box 9 and is supported so that it may rotate freely via a bearing 46 on a support pipe 45 mounted on the front surface 11. Furthermore, as shown in Figure 4, a bracket plate 47 extending so that it encloses the elbow 40a is mounted on the base pipe 44 and supports, via a bearing 49, a projecting shaft 48 mounted on the upper end part of the straight part 40b in the radial direction. In short, the outer cylinder 40 is

restricted so that it rotates in unison about the axis of the base pipe 44 and is able to swing freely about the projecting shaft 48 in the radial direction with respect to the base pipe 44.

At some point along the base pipe 44, a concentric sprocket 50 is mounted and this is linked to a sprocket 53 mounted on the output shaft of a reduction gear 52 of a vertical swing motor 51 via a chain 54. In short, the vertical swing system 5 rotates the operating am 4 in the vertical direction via the base pipe 44 due to the forward and reverse rotation of the vertical swing motor 51 mounted on the main frame 7. Further, a spur wheel 55 is mounted on the output shaft of the vertical swing motor 51 and engages with spur wheel 56 arranged in the vicinity of the vertical swing motor 51. This spur wheel 56 is supported via a bracket 57 attached to the front surface 11 of the waste box 9 and the rotation of which is detected by a rotary encoder 59 supported on another bracket 58.

As shown in Figure 5, the lateral swing system 6 comprises a coupling member 60 having a semicircular shaped periphery and mounted on the elbow 40a of the outer cylinder 40, a cam 63 rotated by the lateral swing motor 61 via a speed reduction gear 62, and a lever member 64 joining the cam 63 and coupling member 60. The lateral swing motor 61 and speed reduction gear 62 are mounted on the front surface 11 of the waste box 9 by a bracket 65 and that output shaft projects in front of the travelling direction A. The cam 63 is a circular drum and a cam groove 66 that converts the rotation movement into a suitable reciprocating movement in the axial direction is formed on that outer periphery. The approximate center of the lever member 64 is supported on a shaft 67 in a cross-sectional direction to the travelling and a cam follower 68 attached to one end is fitted in the cam groove 66. In short, when the cam 63 rotates, the lever member 64 is made to swing with the shaft 64 as a fulcrum. The shaft 67 is arranged on a block (not shown in the drawings) mounted on the main frame 7. A cam follower 70 that fits with a guide groove 69 of the coupling member 60 is mounted on the other end of the lever member 64. The guide groove 69 is formed along the peripheral surface of that semi-circle so that the coupling of the lever member 64 and coupling member 60 is maintained regardless of whether the operating arm 4 swings upwards or downwards. As the operating arm 4 is supported so as to rotate freely about the projecting shaft 48 as mentioned previously, the rotational driving of the lateral swing motor 61 is converted and transmitted by a two step lever system, and thus lateral movement to the left and right within a predetermined width is carried out.

As shown in Figure 6, the extension-retraction system 43 comprises an extension-retraction motor 71 mounted on the basal part of the outer cylinder 40, a sprocket 72 mounted on the output shaft of the extension-retraction motor 71, a sprocket 74 supported on the tip side of the outer cylinder via a bracket 73 so that it may rotate freely, and a chain 75 suspended between those sprockets 72, 74. One end of a slide bar 76 extending parallel to the outer cylinder 40 is mounted on the chain 75 via an attachment member 77 and the other end of the slide bar 76 is mounted on the tip of the inner cylinder 41 via an attachment member 78. In short, the inner cylinder 41 is made to carry out a reciprocating movement in the longitudinal direction in accordance with the circulation of the chain 75. A rotary encoder 79 for detecting the angle of rotation (extension position) is arranged in the vicinity of the extension-retraction motor 71.

As shown in Figure 8, a circular cover 80 that covers the shaft end surface 2a is arranged on the feed roller 2. This cover 80 is mounted on the front surface of the frame 82 of the feed roller 2 by a flat attachment part 81 so that there is no interference with the wound tow T. In short, as shown in Figure 7A, it prevents the suction nozzle 42 of the swinging operating arm 4 from contacting the edge of the feed roller 2 or the like. Furthermore, as shown in Figure 9, some point along the suction nozzle 42 is split and joined by a coil spring 83 and is able to bend at his position so that there is no damage to the rotating operating arm 4 if it should strike the cover 80 as a result of a timing error or the like. It is preferable for this coil spring 83 to be so arranged that the pair of coil lines are lined up with no gap in between in order for it not to influence the actions of the suction air a. Furthermore, instead of the coil spring 83, linking may be carried out by a synthetic resin having a suitable degree of elasticity and flexibility.

When tow threading is sequentially carried out on a plurality of feed rollers 2 by a fiber bundle threading device constructed as described above, the tow T is taken up by being sucked into the suction nozzle 42 of the tip of the operating arm 4 at the supply position of the spinning device side. As this tow T is in a state where it is continuously spun et high speed by the spinning device, surplus tow T is stored in the storage space 12 of the waste box 9 after passing through the outer cylinder 40 and inner cylinder 41. In short, the tow T is pulled from the supply side while maintaining a suitable tension. As the diameter of this operating arm 4 increases sequentially from the suction nozzle 42 of the tip to the inner cylinder 41, outer cylinder 40 and base pipe 44, the tow T is smoothly sucked in without catching on anything at any point.

The travelling car 3 runs as far as the arrangement position of the feed rollers 2 by the driving of the travelling motor 28 and then exchanges the speed to a uniform speed when running along the roller arrangement direction once it has reached the position of the first feed roller 2 to be wound. This start position may be detected by calculation of the travelled distance or may cause the resetting of the home point by the detection of marks (Refer to number 89 in Figure 12) arranged on the floor 31 by the sensor 39. Simultaneous with this uniform running speed, the operating arm 4 is moved in the vertical and lateral directions by the operation of the vertical swing motor 51 and lateral swing motor 61 and

the held tow T is sequentially threaded on each feed roller 2.

In short, as shown in Figure 11, when the simultaneous actions of fixed speed running of the travelling car 3 (Figure 11B), vertical swing movements at a uniform speed (Figure 11D), and left-right swing movements by the cam 63 (Figure 11C) are performed, these actions are combined and produce a path 84 being a continuous S-shape (Figure 11A). Accordingly, the suction nozzle 42 moves following the path 84 while separated from the periphery of the feed rollers 2 arranged in a zig-zag two level arrangement and the tow T held in that tip is threaded in accordance with that path 84. It should be noted that a drive source (not shown in the drawings) is connected to each feed roller 2 and this kind of tow threading operation is carried out while each feed roller 2 is being rotated. Due to the suitable combination of the path 84, running speed of the travelling car 3, speed of swing movement in the vertical direction and that range, and speed of swing movement in the left-right direction and that range, the desired shape is formed. In short, the path 84 may be simply altered corresponding to the arrangement and size of the feed rollers 2 being the object.

It should be noted that tow T is threaded in a arc shape when seen from the arrangement direction of the feed roller 2 as shown in Figure 7A but as it is aligned along the sane plane in the production line direction while sliding along the roller peripheral surface as tension takes effect when operation resumes, there is no obstruction to the subsequent feed processing. Further, as shown in Figure 12 for example, when there is a place 85 apart from the ordered arrangement where threading is carried out between the feed rollers 2 of the same height, swing movements stop at that place 85. In short, if the operating arm 4 runs while maintained in the same fixed position, tow threading at that place 85 may be performed. Then, after passing this place 85, vertical and lateral swing movements are resumed. The movement exchange of the operating arm 4 is carried out based on the detection of marks 86 arranged on the floor 31 for example by the sensor 39. Once the tow T has finished being threaded on the last feed roller 2 and has arrived at the final point (for example, inside a can traverser) of that production line, the held tow T is cut and the surplus tow T in the waste box 9 ejected. A cutter may be provided on the tip of the suction nozzle 42 in order to automatically carry out this cutting.

Accordingly, as the operating arm 4 is arranged on the travelling car 3 and vertical/lateral swing movements of the operating arm 4 are carried out while this running is performed, correct and moreover fast tow threading on the feed rollers 2 which are orderly arranged may be carried out. In short, automation of tow threading may be achieved, the operation load on the operator may be largely reduced, operation restarting after the changing of brands becomes smoother and an increase in the operation efficiency is achieved. Furthermore, as the travelling car 3 smooths the movements of the swinging in the vertical and lateral directions by uniform speed running, there is no requirement for reverse running or stoppage during the tow threading operation even if a pair of adjacent feed rollers 2 overlap in the vertical plane, and the running means 8 and the control of that is extremely simple. Also, as lateral swinging following the running direction A is performed by driving of the cam 63, the driving and control of the operating arm 4 is simplified and the production costs and running costs can be kept low. Further, as the operating arm 4 is made pipe shaped and the tow T is held by suction air a, there is no requirement for a complicated chuck system and threading on a production line (draw off part 1) directly linked to a spinning device may be carried out without the dispersal of continuously produced tow T. Surplus tow T may be stored in the waste box 9. In short, correct tow threading may be carried out without stopping the production operations of the spinning machine.

Furthermore, in the present embodiment, as the extension-retraction system 43 is provided on the operating arm 4, transfer of the tow T may be easily performed and improvements in the general application of tow threading operations may be achieved. In short, as shown in Figure 7A, the suction nozzle 42 carries out threading of tow on the feed rollers 2 by following the a roughly arc shaped path but if a guide 87 that guides the tow T is arranged or if a short feed roller 88 is arranged (Figure 7B), this path 84 may be insufficient. At these times, the position and movement path of the suction nozzle 42 may be changed as shown by the double dotted line in the drawing by the suitable projection of the inner cylinder 41 by the operation of the extension-retraction motor 71, and thus tow threading may be performed on guides 87 and differently shaped rollers 88.

Figure 10 shows another embodiment of the lateral swing system 91 of the present invention with the operating arm 92 being freely able to slide in the running direction A with respect to the travelling car 3 and the synchronization of the running direction and vertical swing movement being performed by a cam 93 and lever 94. In this way, the suction nozzle 42 is able to move along a predetermined path and tow threading on orderly arranged feed rollers 2 may be performed.

It should be noted that in the above described embodiment, electrical power for driving and air are supplied by the cable guide member 20 but the driving of each motor 23, 51, 61, 71 and the operation of the suction air a may be carried out by the installation of a battery and blower on the main frame 7. Furthermore, the present invention is not limited to tow threading on feed rollers 2 of a draw off part 1 as shown but may also be applied to the threading of fiber bundle on other similat processing rollers such as oiling rollers or heat processing rollers.

According to the above described invention, the automation of fiber bundle threading on processing rollers is realised ad achievements such as a decrease in the operation load and increase in the operating efficiency are demonstrated. Furthermore, the travelling

car and operating arm may be driven by a simple system and thus contribute to a decrease in the costs.

Claims

1. A fiber bundle threading device which sequentially threads fiber bundle on a plurality of processing rollers arranged with their axes approximately parallel, comprising;

   a travelling car that runs along the direction in which the processing rollers are arranged, and an operating arm arranged on the travelling car, that operates in conjunction with that running and suitably winds fiber bundle on the processing rollers.

2. A fiber bundle threading device as in claim 1, wherein the operating arm has a vertical swing system for movement in an upwards and downwards direction, and a lateral swing system for movement in the running direction of the travelling car.

3. A fiber bundle threading device as in claim 2, wherein the lateral swing system has a cam for exchanging a rotational movement into a reciprocating movement.

4. A fiber bundle threading device as in any one of claims 1 - 3, wherein the operating arm has a suction nozzle on the tip and holds the fiber bundle by suction.

5. A fiber bundle threading device as in claim 4, wherein the suction nozzle is able to bend at some mid-point.

6. A fiber bundle threading device as in claims 4 or 5, wherein the travelling car has a waste box that supports the basal part of the operating arm and has a storage space partitioned in the waste box for storing fiber bundle sucked from the suction nozzle.

7. A fiber bundle threading device as in any one of claims 1 - 6, wherein the operating arm has an outer cylinder, an inner cylinder stored inside the outer cylinder such that it may slide freely, and an extension-retraction system for suitable projectng the inner cylinder from the outer cylinder.

8. A fiber bundle threading device as in claim 7, wherein the operating arm sequentially increases in diameter from the suction nozzle to inner cylinder to outer cylinder.

9. A fiber bundle threading device as in any one of claims 1 - 8, wherein a cover body that covers part of the processing rollers is provided to prevent contact between the processing rollers and operating arm.

FIG. 1

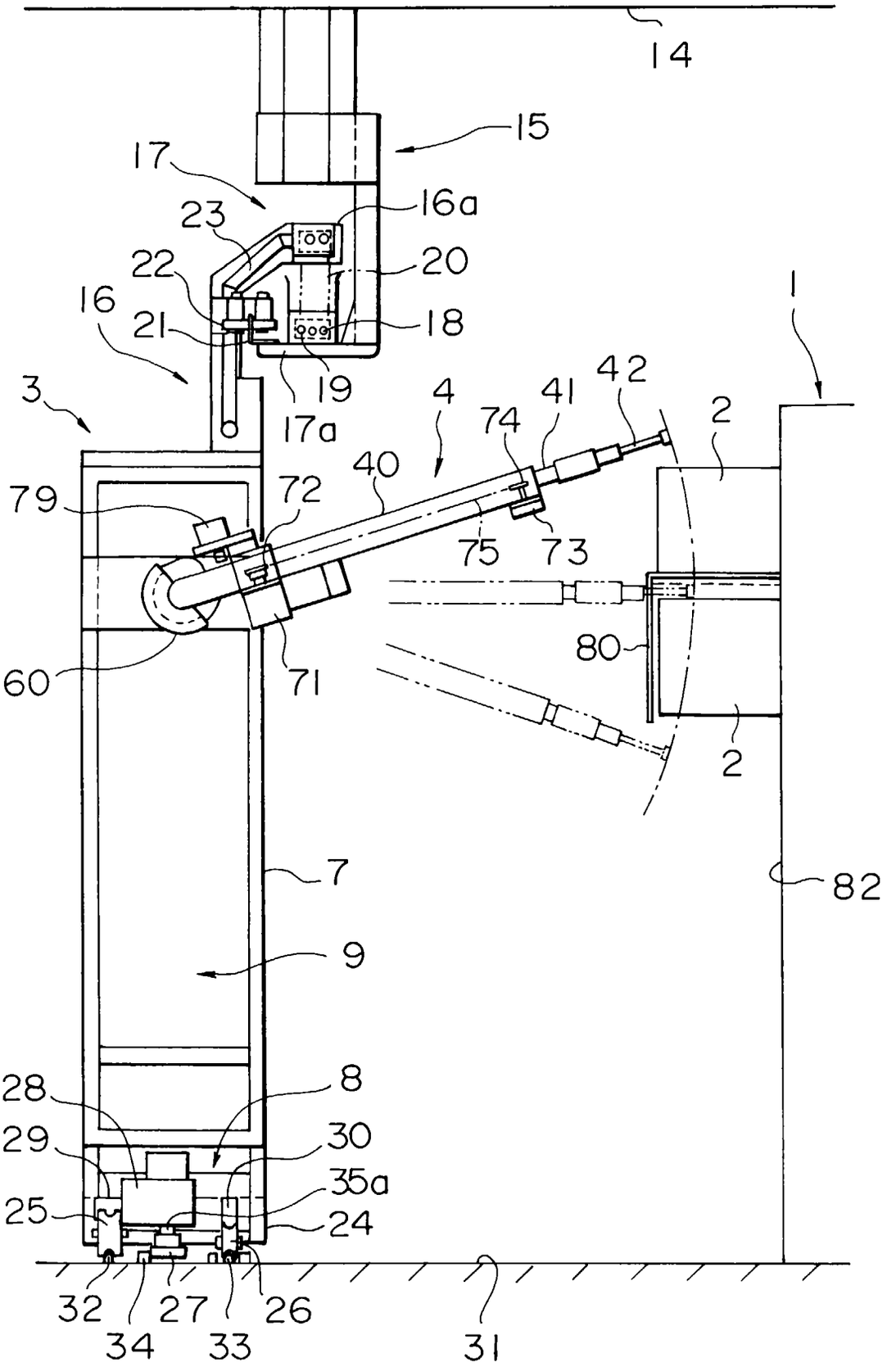
14
15
17
16a
23
20
22
16
21
18
1
19
3
4
41
42
17a
74
2
40
79
72
75
73
80
60
71
2
7
82
9
28
8
29
30
35a
25
24
32
27
26
34
33
31

FIG. 2

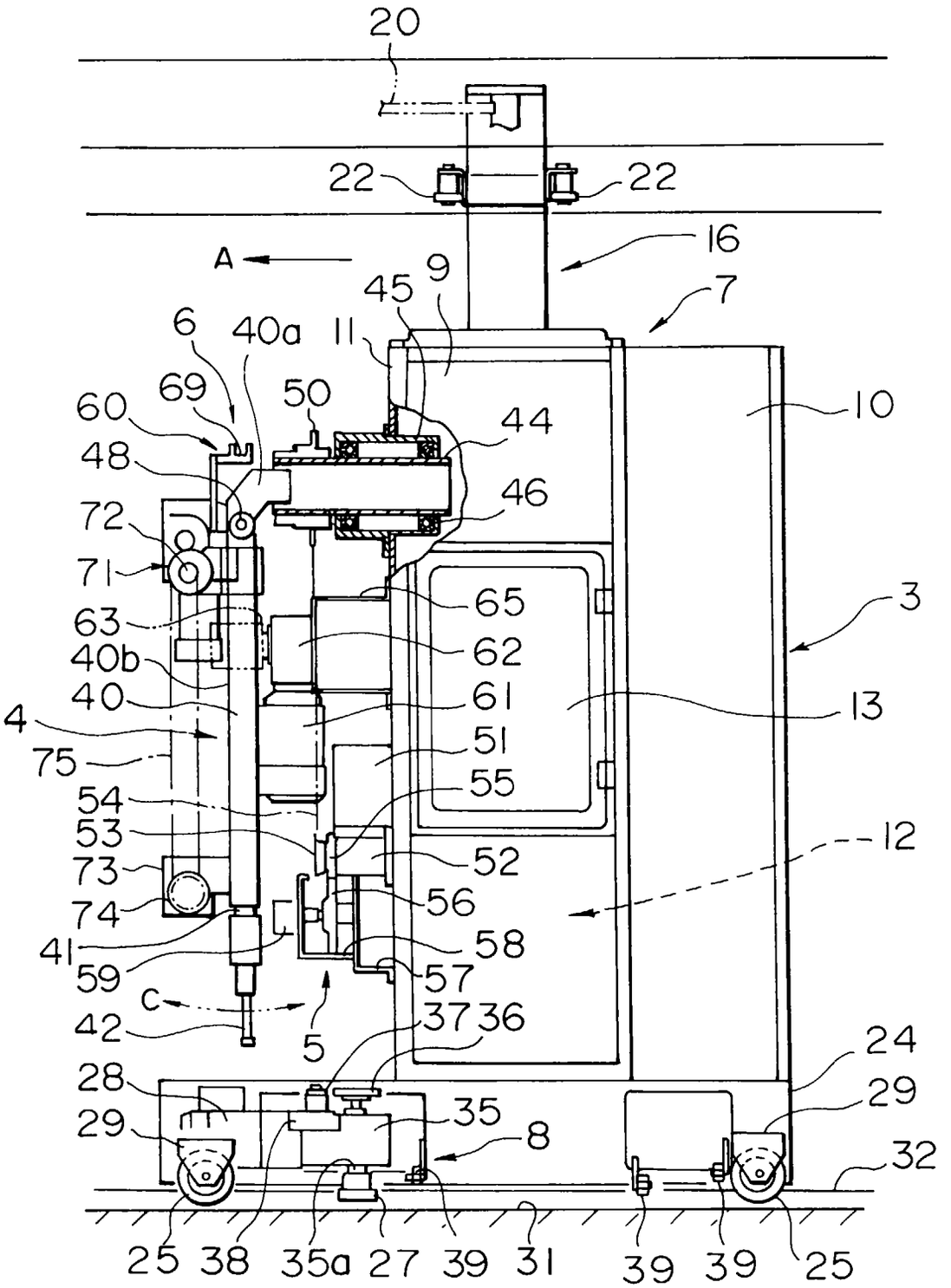
20
22
22
16
A
9
45
7
6
40a
11
69
50
10
60
44
48
46
72
71
65
3
63
62
40b
61
13
40
4
51
75
55
54
53
12
52
73
56
74
58
41
59
57
C
37
36
42
5
24
28
29
35
29
8
32
25
38
35a
27
39
31
39
39
25

FIG. 3

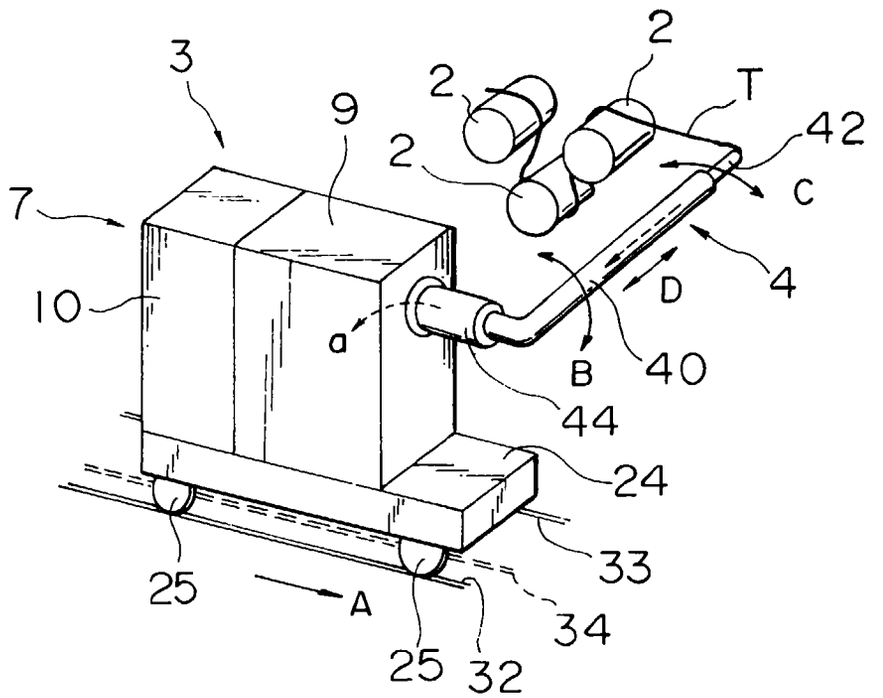
3
9
2
2
2
T
42
C
7
10
a
D
4
B
40
44
24
33
25
A
25
32
34

FIG. 4

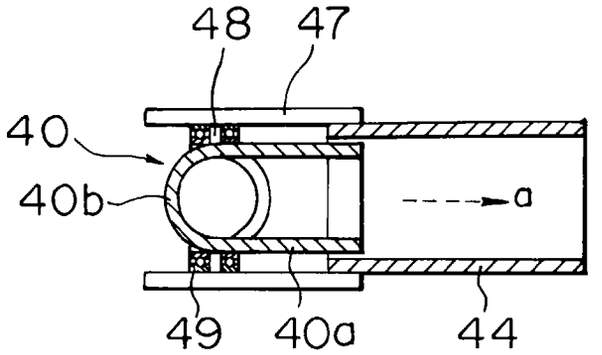
48
47
40
40b
a
49
40a
44

FIG. 5A

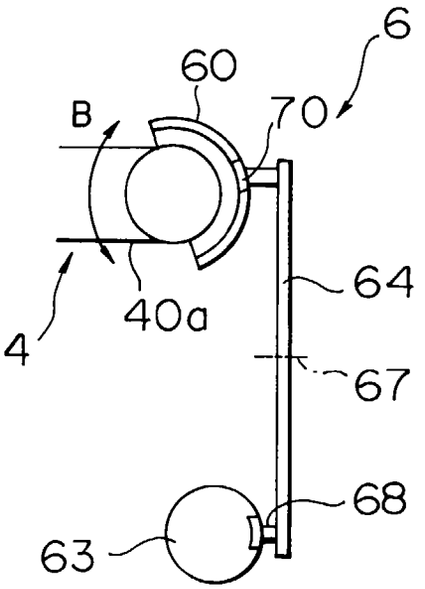

FIG. 5B

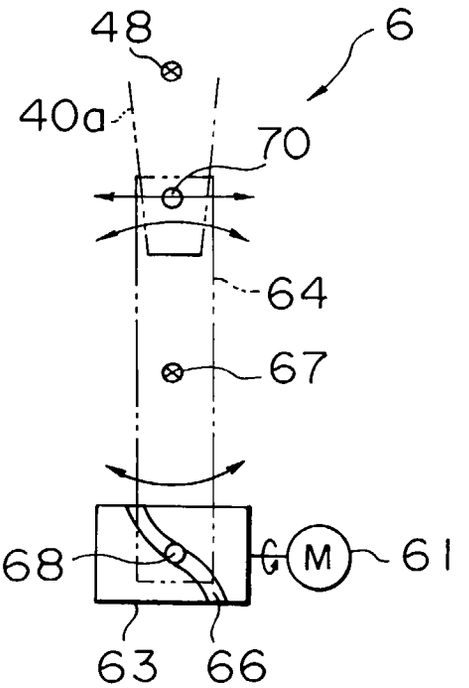

FIG. 6

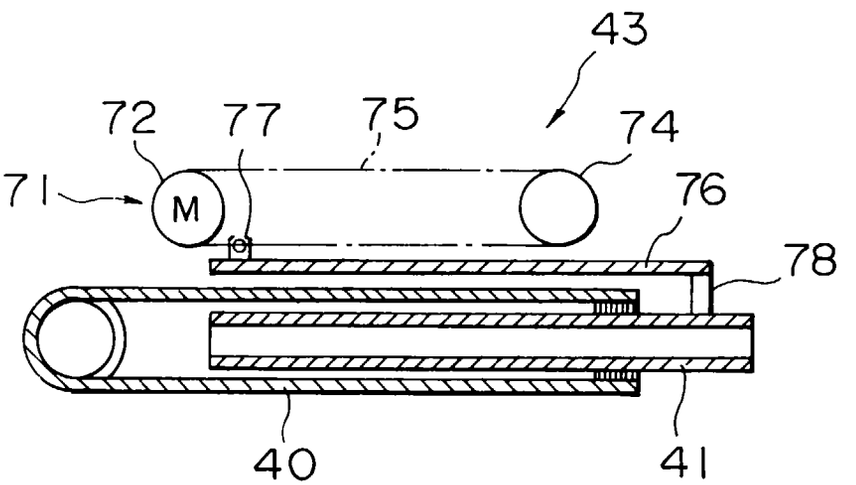

FIG. 7A

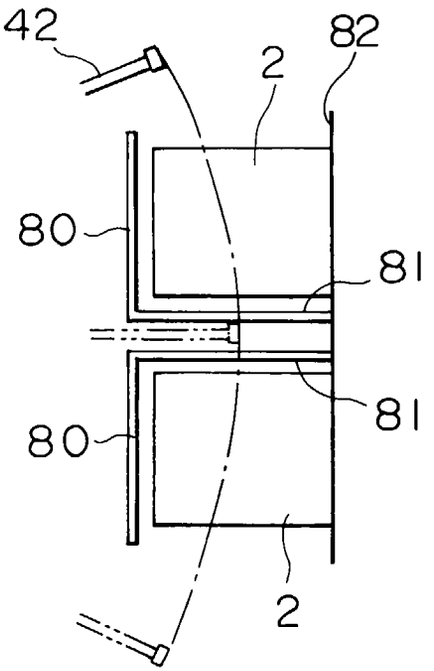

FIG. 7B

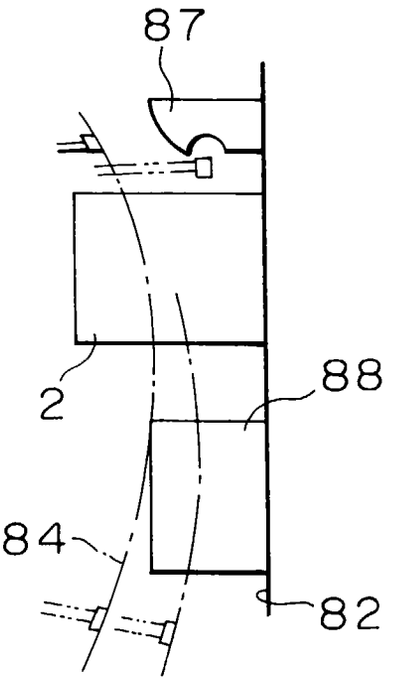

FIG. 8

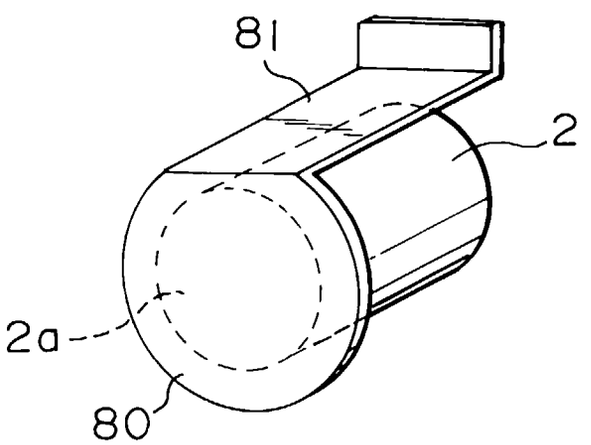

FIG. 9

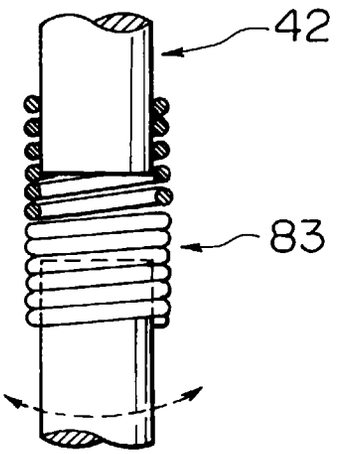

FIG. 10

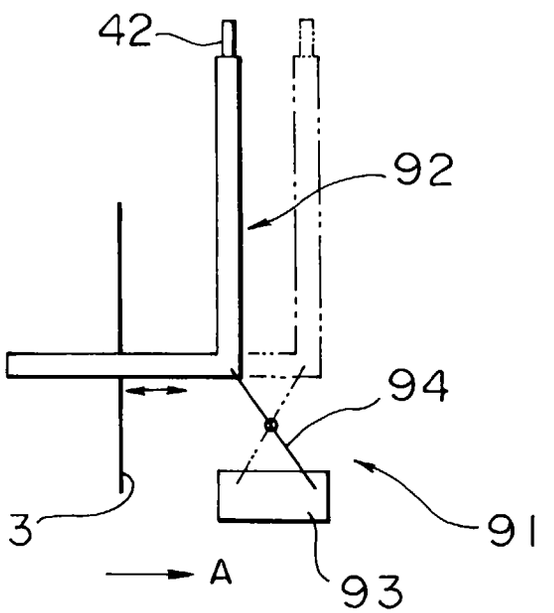

FIG.IIA

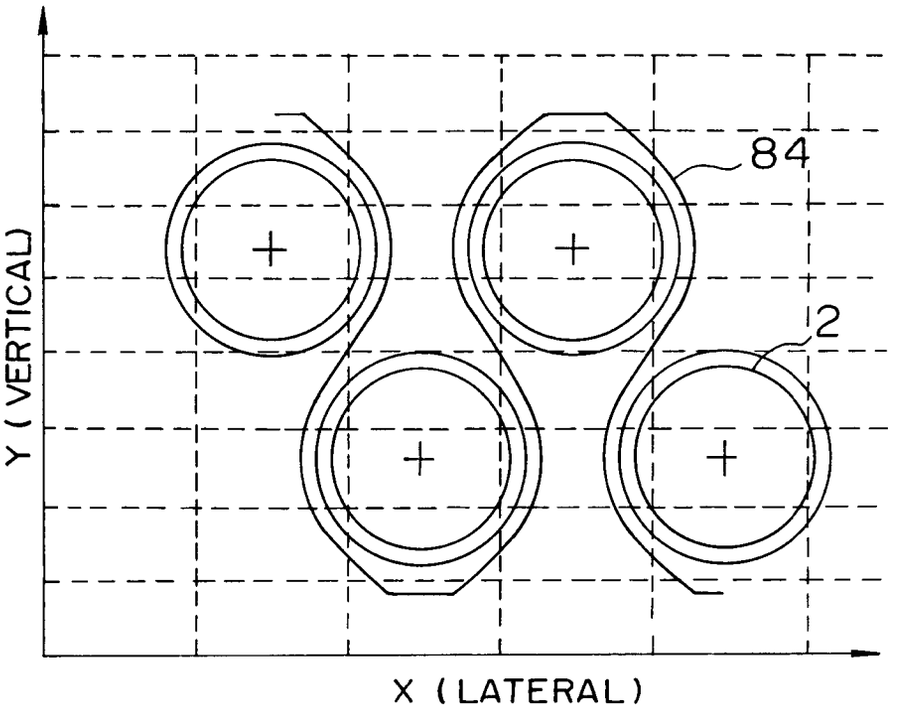

FIG.IIB

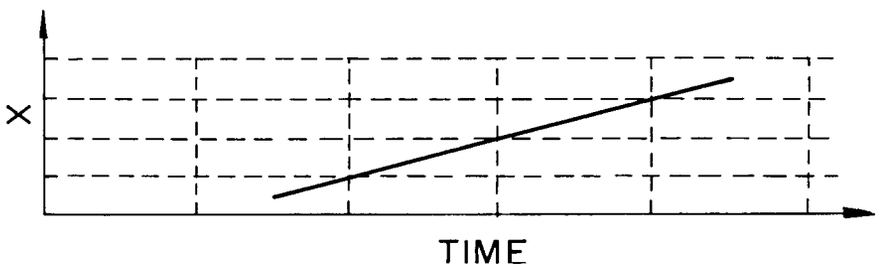

FIG.IIC

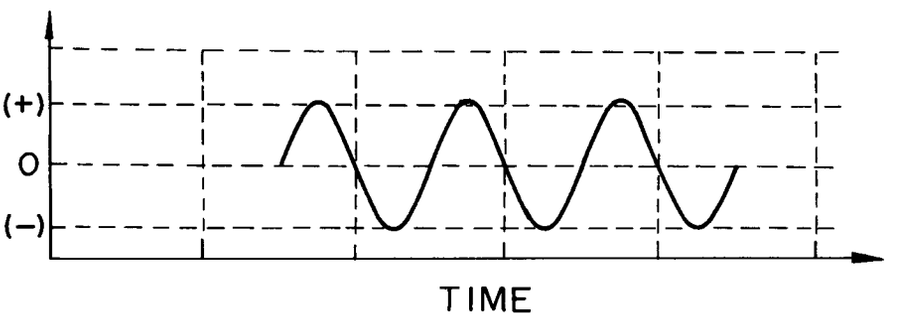

FIG.IID

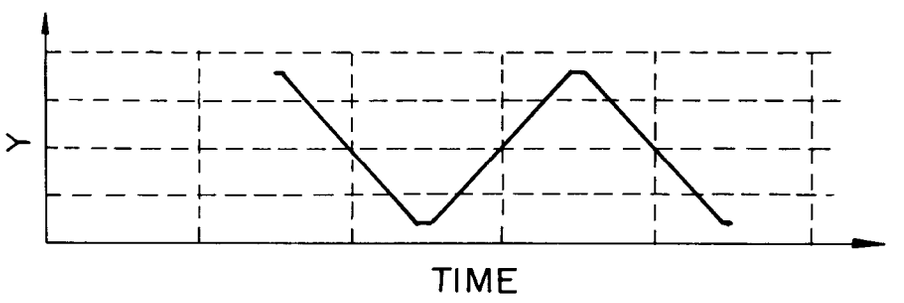

FIG. 12