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ORDER CHANGE SYSTEM FOR CORRUGATION MACHINE

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(56) Prior Art Documents
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EP 65014

(57) Claim

(1) An order change system for a corrugation machine which comprises a slitter scorer device which slit cuts a band-shaped corrugated board sheet produced continuously from web-shaped base paper into a plurality of sheets in parallel with the sheet running direction and a plurality of cutoff devices etc. which are located on the downstream side of said slitter scorer device to cut said slit cut sheet introduced after separating to each sheet in the direction perpendicular to the sheet running direction, wherein at order change including the case where the slit width and the number of slits are the same, a region without slit cut is formed between the front end of new order sheet and the rear end of old order sheet, and the sheets separated by a means for cutting the region between the substantially rear end of boundary slit line of old order and

.../2

the substantially front end of boundary slit line, which is separated on the downstream side of said slitter scorer, by a straight, curved, or free line are made independent.

(4) An order change method by means of a corrugation machine comprising the steps of slit cutting a band-shaped corrugated board sheet produced continuously from web-shaped base paper into a plurality of sheets in parallel with the sheet running direction by using a slitter scorer device and cutting said slit cut sheet in the direction perpendicular to the sheet running direction by using a plurality of cutoff devices located on the downstream side of said slitter scorer, wherein at order change including the case where the slit width and the number of slits are the same, a region without slit cuts is formed between the front end of new order sheet and the rear end of old order sheet, and the sheets separated by a means for cutting the region between the substantially rear end of boundary slit line of old order and the substantially front end of boundary slit line, which is separated on the downstream side of said slitter scorer, by a straight, curved, or free line are made independent.

AUSTRALIA

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COMPLETE SPECIFICATION
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APPLICATION NUMBER:
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RELATED ART:

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INVENTION TITLE: "ORDER CHANGE SYSTEM FOR CORRUGATION MACHINE"

ASSOCIATED PROVISIONAL APPLICATION NOS:

The following statement is a full description of this invention including the best method of performing it known to me/us:-

SPECIFICATION

1. TITLE OF THE INVENTION

ORDER CHANGE SYSTEM FOR CORRUGATION MACHINE

2. FIELD OF THE INVENTION AND RELATED ART STATEMENT

The present invention relates to an order change system for a corrugation machine which produces corrugated boards.

Figs. 8 through 11 are views illustrating an order change system installed on a conventional corrugation machine. In the figures, a rotary shear 2 cuts the corrugated board web 3 produced continuously in the preceding process in its width direction, or forms grooves at both ends of the width, that is, forms a slit in the width direction at both ends. It performs a function of changing over the setting mainly in changing the trim 23 or the width of product sheet 5.

The construction and functions of a conventional rotary shear will be described below with reference to Fig. 8. The rotary shear 2 comprises a knife cylinder 25 to which a knife 24 is fixed throughout substantially total length of the roll and an anvil cylinder 26 which is installed in parallel with the knife cylinder 25.

The surface of the anvil cylinder 26 has a height difference by gradually reducing the central portion of an elastic body 27 from the portion throughout the width to a

predetermined dimension on a partial peripheral surface. With this construction, the setting of relative phase of the knife cylinder 25 and the anvil cylinder 26 can be changed, and a cutting slit of a predetermined length is formed at both ends of the corrugated board web 3 by rotating two cylinders, or complete cutting throughout the width can be performed.

Next, the outline of a slitter scorer portion of the next process will be outlined with reference to Figs. 1 and 2. The slitter scorer 1a, 1b comprises a pair of upper and lower marking line rolls 28a and 28b and a pair of upper and lower slitter knives 29a and 29b, and puts a predetermined marking line and forms a slitting groove. The device relates to the required width W_0 of the product sheet, and can produce a plurality of sheets at the same time by appropriately selecting the width W of the corrugated board.

Ordinarily, two slitter scorers 1a and 1b are installed in the sheet running direction to shorten the time for resetting due to order change, and two slitter scorers are often used alternately for each order change. The width W of all corrugated board webs produced is set slightly wider than the width W_0 used as the product sheet, by which both the ends, where faults such as the deviation in sticking of body papers or the overflow of paste occur easily, are cut into a band shape, and disposed of into trim ducts 30a and 30b, respectively, as trims 23a and 23b.

The change of setting due to order change will be described. The trim position due to order change is sent as a signal from an order change system controller (not shown). On the standby slitter scorer 1b, the position setting of trim duct 30b and various settings for new order are performed. At the same time, on the trim cutting device (rotary shear) 2, the position of knife 24 and the relative angle of anvil cylinder 26 are set to set the cutting amount of both width ends of corrugated board web for new order.

Then, the knife cylinder 25 and the anvil cylinder 26 are synchronously rotated at a predetermined timing when the corrugated board web 3 runs through to form trim cutting notches at the intended position.

Next, the notch position is transferred to the standby slitter sorer 1b, where first a pair of upper and lower marking line rolls 28b are engaged, and then a pair of upper and lower slitter knives 29b are engaged, by which processing as new order is performed succeedingly.

On the other hand, the slitter scorer 1a which has operated at old order, the engagement of a pair of upper and lower marking line rolls 28a and the slitter knives 29a is released successively at a predetermined timing when the front edge of the corrugated board of new order reaches. The conventional rotary shear is constructed and functions as described above, so that only the trim width at the width end

is changed according to order change in two-sheet production setting.

With the conventional order change system, the specification can be changed stably under limited conditions such as a condition in which a slit groove M for separating sheet is of a continuous shape, in which the cutting lengths of two sheets running in parallel are the same even if the slit groove M for sheet separation becomes discontinuous due to the change of sheet width, or in which only one kind of sheet is produced from one web (not shown).

In the change of specification according to order change, however, not only the dimension of width direction of product sheet 5 changes, but also the cutting lengths LT and LD of two sheets running in parallel are often changed arbitrarily as shown in Fig. 8. When the cutting lengths of the sheets running in parallel are different, the running path of one sheet is changed at a cutoff 22 in the downstream process, so that the sheets are transferred to a separate cutoff (rotary drum shear) 22a, 22b to cut to respective length.

Therefore, when the specification is changed, for example, as shown in Fig.8, a discontinuous portion * remains in the central slitting groove. In the change of path (vertical separation) at the cutoff 22 in the downstream process, which is performed when the sheet lengths running in parallel are different, the discontinuous portion is broken and

defective boards are produced, and further, the broken sheet is caught by a downstream transfer means (feed roll), thereby jamming occurring.

To solve these problems, a system including a cutting apparatus 31 as shown in Fig. 9 has recently been proposed. This cutting apparatus forms a groove No perpendicular to the web running direction at a predetermined central position in the width direction of the corrugated board web 3.

This system is provided with a publicly known knife cylinder 33 on which a knife 32 is fixed throughout substantially total width of the roll outer peripheral surface and a pressurizing means (pressure plate, etc.) 34 which divides the corrugated board web 3 into a plurality of pieces in the width direction and each of which can be raised or lowered independently. Between the knife cylinder 33 and the pressurizing means 34, a running corrugated board web 3 and an endless elastic belt 35 which is driven at a predetermined timing are interposed. With the cutting apparatus 31, a groove No is formed in the corrugated board web 3 by rotating the knife 32 and the elastic belt 35 while grasping the corrugated board web 3. Control is carried out so that the pressurizing means is operated (raised) only at the portion requiring the formation of groove.

This system produces a plurality of kinds of sheets 5 with different cutting length from the corrugated board web 3

according to order change. Even when the sheet width changes as shown in Fig. 10, a groove can be formed only at the portion requiring the formation of groove in the sheet width direction. Therefore, broken sheet at the specification change point and other faults are eliminated without complete separation of new and old order sheets.

However, with the system of this type, when one sheet of corrugated board web 3 is divided into many sheets 5 as shown in Fig. 11, and the sheets 5c and 5b are completely cut by the groove No in the width direction which provides continuous separation slit groove M for separating the sheet to the upper and lower stage cutoffs 22a and 22b, the control of the rear end of old order sheet 5c and the front end of new order sheet 5b is eliminated, so that a sheet with no continuity is formed in the TOP sheet group or the DOWN sheet group. Therefore, the zigzag running of sheet or the variations in transfer speed occur as with the case where the corrugated board web 3 is cut and separated throughout the width. As a result, the accuracy of cutting length, angle, etc. becomes unreliable, and various troubles are caused until the sheet running conditions are stabilized.

The conventional rotary shear shown in Figs. 8 through 11 forms a groove in the sheet width direction at both ends of width of the corrugated board web, or completely cuts the sheet throughout the width, so that there are disadvantages at order

change.

Therefore, with the system which produces two kinds or a plurality of kinds of sheets from one corrugated board web, when the sheet width is changed by order change and the sheet cutting lengths are different, the position of slitting groove for separation deviates at the order change point, so that the sheet is connected while a discontinuous slit portion is formed. Therefore, the sheet is torn by the vertical separation of sheet running path to the cutoff in the next process, thereby defective boards being produced.

To solve these problems, a method has been proposed in which a cutting device for forming a groove perpendicular to the web running direction at a predetermined position in the width direction of corrugated board web is installed together with the conventional rotary shear for cutting the trim, so that the slit groove for separation for new and old order separating the sheet to upper and lower stage cutoffs is made continuous.

This method eliminates the disadvantage of breakage of sheet at the slit groove portion for vertical separation. However, when the groove in the middle of the corrugated board web extends through a plurality of corrugated board web which have been divided, there is a completely cut portion in the middle, so that the rear end of old order sheet and the front end of new order sheet becomes free as with the case where the

corrugated board web is completely cut throughout the width, by which the transfer condition becomes unstable. As a result, the end of sheet runs in a zigzag manner or the running speed (quantity) of each sheet fluctuates. For these reasons, the cutting dimension accuracy at the cutoff in the next process is lowered, or jamming occurs.

3. OBJECT AND SUMMARY OF THE INVENTION

The present invention was proposed to solve the problems with the above-described conventional system. Accordingly, an object of the present invention is to provide an order change system such that when the sheet width changes in multi-sheet production according to order change, new and old order corrugated board sheets are not separated completely and are transferred to the downstream process in a continuous state, by which poor accuracy of cutting length and angle at the downstream cutoff is avoided.

To achieve the above object, the present invention provides an order change system for a corrugation machine which comprises a slitter scorer device which slit cuts a band-shaped corrugated board sheet produced continuously from web-shaped base paper into a plurality of sheets in parallel with the sheet running direction and a plurality of cutoff devices etc. which are located on the downstream side of the slitter scorer device to cut the slit cut sheet introduced after separating to

each sheet in the direction perpendicular to the sheet running direction, wherein at order change including the case where the slit width and the number of slits are the same, a region without slit cut is formed between the front end of new order sheet and the rear end of old order sheet, and the sheets separated by a means for cutting the region between the substantially rear end of boundary slit line of old order and the substantially front end of boundary slit line, which is separated on the downstream side of said slitter scorer, by a straight, curved, or free line are made independent.

According to the present invention, when the trim width dimension at both end of width of corrugated board web is changed according to order change or when the sheet width is changed in multi-sheet production in which a plurality of kinds of sheets with different cutting length are produced, a slit groove can be formed only at the required portion in the middle of the sheet. Therefore, the breakage of sheet at the specification change point and other faults are eliminated even if new and old order sheets are not separated completely. In addition, all corrugated board webs cut along the running direction can be transferred downstream in a continuous state.

As a result, the sheet can be transferred stably, the cutting dimension accuracy can be maintained precisely, and troubles such as jamming can be eliminated.

As described above, according to the present invention,

even if the position of slit groove for separating the sheet to the upper and lower cutoffs is deviated at order change, the slit groove for separating new and old order sheets can be made continuous. Moreover, the cutting groove for connection is formed slantwise at a predetermined angle with respect to the running direction of corrugated board web, and a predetermined gap is formed between the slitting grooves of new and old order sheets cut along the running direction of the web. Therefore, there is no completely cut portion even when the slant cutting line extends through a plurality of separated corrugated board webs, thereby all new and old order sheets being transferred downstream in a continuous state.

Therefore, jamming, which occurs in the downstream process at high-speed change order, or at change order of fragile sheet, is prevented. Also, the zigzag of the rear end of old order sheet and the front end of new order sheet caused by the complete cutting at order change is eliminated, so that poor accuracy of cutting length and angle at the downstream cutoff is avoided, thereby improvement in quality being assured.

4. BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings,

Fig. 1 is a plan view illustrating the processing of corrugated board web on a corrugation machine in accordance

with the embodiment of the present invention,

Fig. 2 is a side view of a corrugation machine in accordance with the embodiment of the present invention,

Fig. 3(a) is a plan view of a cutting apparatus for forming a groove of arbitrary angle and length with respect to the web running direction at a predetermined central position in the width direction of corrugated board web on a corrugation machine in accordance with the embodiment of the present invention, and Fig. 3(b) is a view showing the relationship between the knife transfer amount, the web running amount, and the cutting length,

Fig. 4 is a front view of the cutting apparatus of Fig. 3,

Fig. 5 is a side view of the cutting apparatus of Fig. 3,

Fig. 6 is a front view of a central cutting apparatus in the width direction of corrugated board web, which shows an embodiment different from that of Fig. 4,

Fig. 7 is a front view of a cutting apparatus in accordance with an embodiment different from that of Fig. 6,

Fig. 8 is a view illustrating faults in the conventional rotary shear,

Fig. 9(a) and 9(b) are a front view and a side view, respectively, of a conventional cutting apparatus for forming a groove perpendicular to the web running direction at a predetermined central position in the width direction of the

corrugated board web,

Fig. 10 is a view illustrating the cutting condition and faults for the cutting apparatus shown in Fig. 9, and

Fig. 11 is a view illustrating the cutting condition and faults different from those of Fig. 10 for the cutting apparatus shown in Fig. 9.

5. DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention will be described with reference to the embodiment shown in the drawings. Figs. 1 through 7 show one embodiment of the present invention. Figs. 1 and 2 show the basic configuration of an order change system and processing of corrugated board web corresponding to vertical position. Figs. 3 through 7 show typical constructions of cutting apparatuses for forming a slit groove of a predetermined length in a slant direction at an arbitrary central position of the corrugated board web.

As shown in Figs. 1 and 2, the system of the present invention comprises a conventional rotary shear 2 which is located on the upstream side of slitter scorers 1a and 1b on a corrugation machine and forms a groove at both ends of the width, and a cutting apparatus 4 which can form a groove N having an arbitrary angle and length with respect to the running direction of corrugated board web 3 at an arbitrary position on the corrugated board web 3. Thus, the rotary shear

2 and the cutting apparatus 4 are operated at a predetermined timing corresponding to the order change point, by which the slit groove M for separation to the upper and lower stage cutoffs is made continuous while the trims of new and old orders are separated to be disposed of, thereby preventing the breakage of sheet and permitting stable change of order.

According to the present invention, when a plurality of kinds of product sheet 5 with different width and length in parallel with each other are produced from one corrugated board web 3, the corrugated board web 3 is not cut and separated completely unlike the conventional method, but the corrugated board web 3 having slits along the running direction is transferred to the downstream process in a continuous state.

The general configuration and functions of the system will be described below. The central cutting apparatus 4 for the corrugated board web 3 shown in Fig. 3 is provided with two sets of sprockets 9 and 10 fixedly mounted on an oscillating plate 8 and movable brackets 11a and 11b constructed to move in the axial direction of the oscillating plate 8 on the surface of the oscillating plate 8 pivotally mounted to a rotating frame 6 and a moving frame 7 at both ends.

On the movable bracket 11a, 11b, two sets of sprockets 12a, 13a, 12b, 13b are pivotally mounted. An endless chain 15 to which a knife 14 is fixed is wound between the sprockets 9 and 10. In Fig. 3, reference numeral 16 denotes a motor for

swinging the oscillating plate 8 with the supporting axis as a center, and 17 denotes a motor for reciprocating the endless chain 15 having the knife 14 mounted thereon by rotating the sprocket 9.

In Fig. 4, reference numeral 36 also denotes a motor. The motor 36 performs functions of rotating running wheels 18 mounted at the lower end of moving frame 7 to run the moving frame 7 on a trajectory surface 20 in an arc form with the supporting axis 19 of the rotating frame as a center, and to incline the oscillating plate 8 at a predetermined angle θ with respect to the width direction of the corrugated board web 3. Reference numeral 21 denotes an angle detecting means for detecting the swing angle θ of the oscillating plate 8.

A pair of movable brackets 11a and 11b are constructed so as to move independently relative to the oscillating plate 8. Therefore, the cutting range (length) in the figure can be set by adjusting the relative distance (clearance). Also, a groove N is formed at an arbitrary position in the width direction on the corrugated board web by moving in the same direction, right or left.

With this apparatus, the oscillating plate 8 is inclined at an arbitrary angle θ with respect to the width direction of the corrugated board web 3, and also is swung in synchronization with the running speed of the corrugated board web 3, by which consideration is given to reduce the cutting

resistance of the knife 14 with respect to the corrugated board web.

A central cutting apparatus 37 shown in Figs. 6 and 7 uses water jet or laser beam in place of the knife 14 on the cutting apparatus shown in Figs. 3 through 5. Thus, the region between the boundaries of new and old order sheets can be separated by cutting arbitrarily.

In the figures, reference numeral 38 denotes a frame for supporting an endless chain 15, 39 denotes a water jet (laser beam) nozzle mounted to the chain 15, and 40 denotes a receiving member for water jet (laser beam) which is mounted under the water jet (laser beam) nozzle.

The cutting apparatus 4 for the central portion of the sheet is operated in a real-time mode in association with the conventional rotary shear at the rear end of old order sheet and the front end of new order sheet, by which slit groove of new and old order for separating to the upper and lower stage cutoffs 22a and 22b can be made continuous as shown in Fig. 1, and all sheets including the sheets 5c and 5b can be transferred to the downstream cutoff 22 in a continuous state, which was impossible with the conventional cutting apparatus.

Therefore, even in the case shown in Fig. 11, the problem can be overcome in that the rear end of old order sheet and the front end of new order sheet becomes free, so that the transfer state becomes unstable, by which zigzag running or the

fluctuation in running speed (quantity) occur, thereby the cutting dimension accuracy at the downstream cutoff being lowered.

As a cutting apparatus for forming a groove of arbitrary angle and length with respect to the web running direction at a predetermined central position in the width direction of the corrugated board web, various types of apparatuses can be thought out besides those shown in Figs. 3 through 7.

The claims defining the invention are as follows:

(1) An order change system for a corrugation machine which comprises a slitter scorer device which slit cuts a band-shaped corrugated board sheet produced continuously from web-shaped base paper into a plurality of sheets in parallel with the sheet running direction and a plurality of cutoff devices etc. which are located on the downstream side of said slitter scorer device to cut said slit cut sheet introduced after separating to each sheet in the direction perpendicular to the sheet running direction, wherein at order change including the case where the slit width and the number of slits are the same, a region without slit cut is formed between the front end of new order sheet and the rear end of old order sheet, and the sheets separated by a means for cutting the region between the substantially rear end of boundary slit line of old order and the substantially front end of boundary slit line, which is separated on the downstream side of said slitter scorer, by a straight, curved, or free line are made independent.

(2) An order change system for a corrugation machine according to claim (1) wherein said system comprises a rotary shear which is located on the upstream side of said slitter scorer device to form a groove at both end of width of sheet and a cutting apparatus which forms a groove having an arbitrary angle and length with respect to the running direction of corrugated board web at an arbitrary position on the corrugated board web,

said rotary shear and said cutting apparatus are operated at a predetermined timing corresponding to the order change point, by which the trims of new and old orders are separated and disposed of and the slit groove for separating to upper and lower stage cutoffs is made continuous.

(3) An order change system for a corrugation machine according to claim (2) wherein said cutting apparatus includes a rotating frame and an oscillating plate pivotally mounted to a moving frame, two sets of sprockets are fixedly mounted to said oscillating plate, movable brackets are mounted to said oscillating plate in such a manner that they can move in the axial direction, two sets of sprockets are mounted on each of said movable bracket, and an endless chain to which a knife is fixed is wound between said sprockets.

(4) An order change method by means of a corrugation machine comprising the steps of slit cutting a band-shaped corrugated board sheet produced continuously from web-shaped base paper into a plurality of sheets in parallel with the sheet running direction by using a slitter scorer device and cutting said slit cut sheet in the direction perpendicular to the sheet running direction by using a plurality of cutoff devices located on the downstream side of said slitter scorer, wherein at order change including the case where the slit width and the number of slits are the same, a region without slit cuts is formed between the front end of new order sheet and the rear

end of old order sheet, and the sheets separated by a means for cutting the region between the substantially rear end of boundary slit line of old order and the substantially front end of boundary slit line, which is separated on the downstream side of said slitter scorer, by a straight, curved, or free line are made independent.

5. An order change system for a corrugation machine substantially as hereinbefore described with reference to Figures 1 to 5, Figure 6 or Figure 7 of the accompanying drawings.

6. An order change method for a corrugation machine substantially as hereinbefore described with reference to Figures 1 to 5, Figure 6 or Figure 7 of the accompanying drawings.

DATED SEPTEMBER 27 1993

MITSUBISHI JUKOGYO KABUSHIKI KAISHA

By their Patent Attorneys

KELVIN LORD AND COMPANY

PERTH, WESTERN AUSTRALIA

7. ABSTRACT

The present invention provides an order change system for a corrugation machine which comprises a slitter scorer device which slit cuts a corrugated board sheet web and a plurality of cutoff devices which are located on the downstream side of the slitter scorer device to cut the slit cut sheet in the direction perpendicular to the sheet running direction, wherein at order change including the case where the slit width and the number of slits are the same, a region without slit cut is formed between the front end of new order sheet and the rear end of old order sheet, and the sheets separated by a means for cutting the region between the substantially rear end of boundary slit line of old order and the substantially front end of boundary slit line, which is separated on the downstream side of the slitter scorer, by a straight, curved, or free line are made independent.

FIG. 1

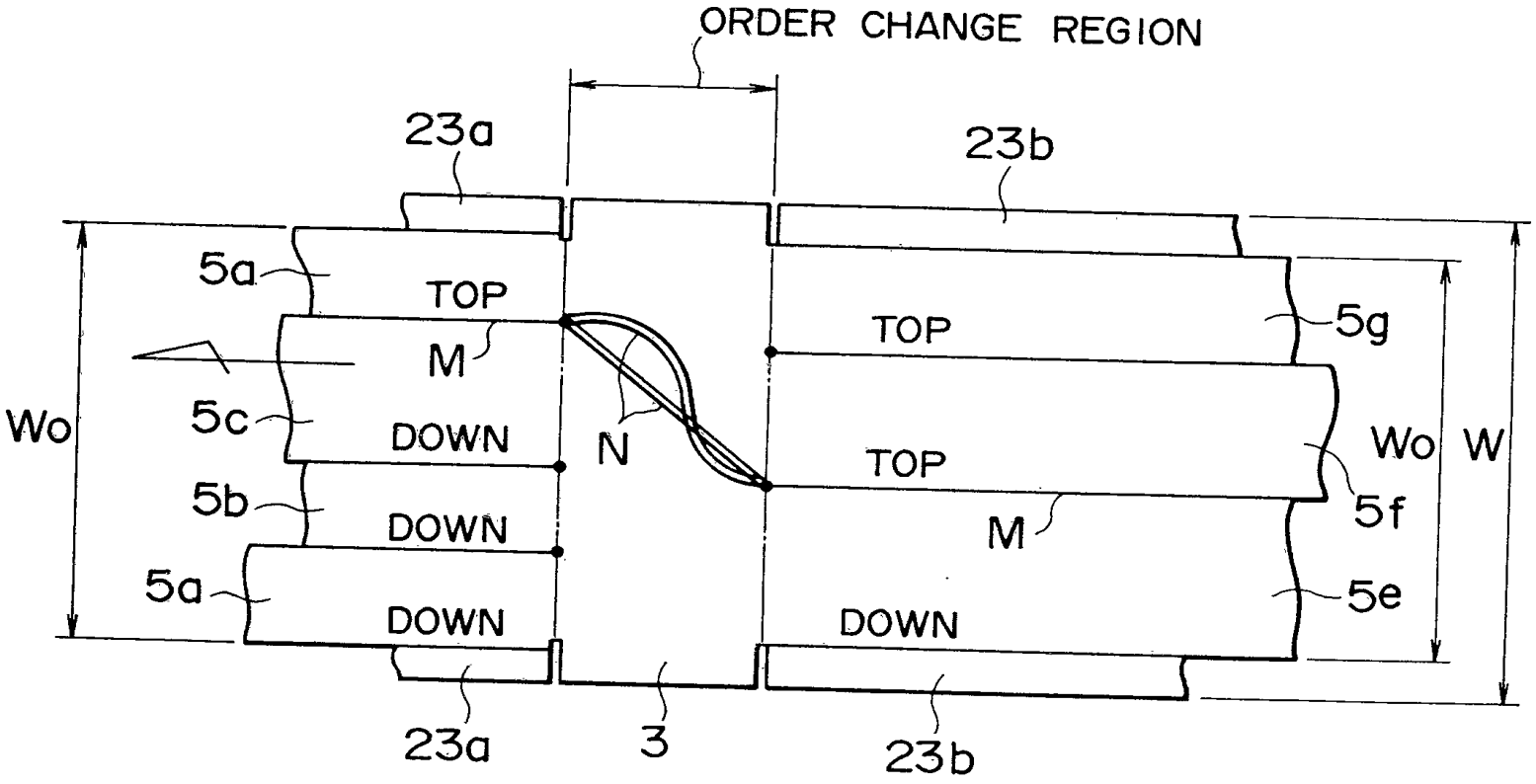
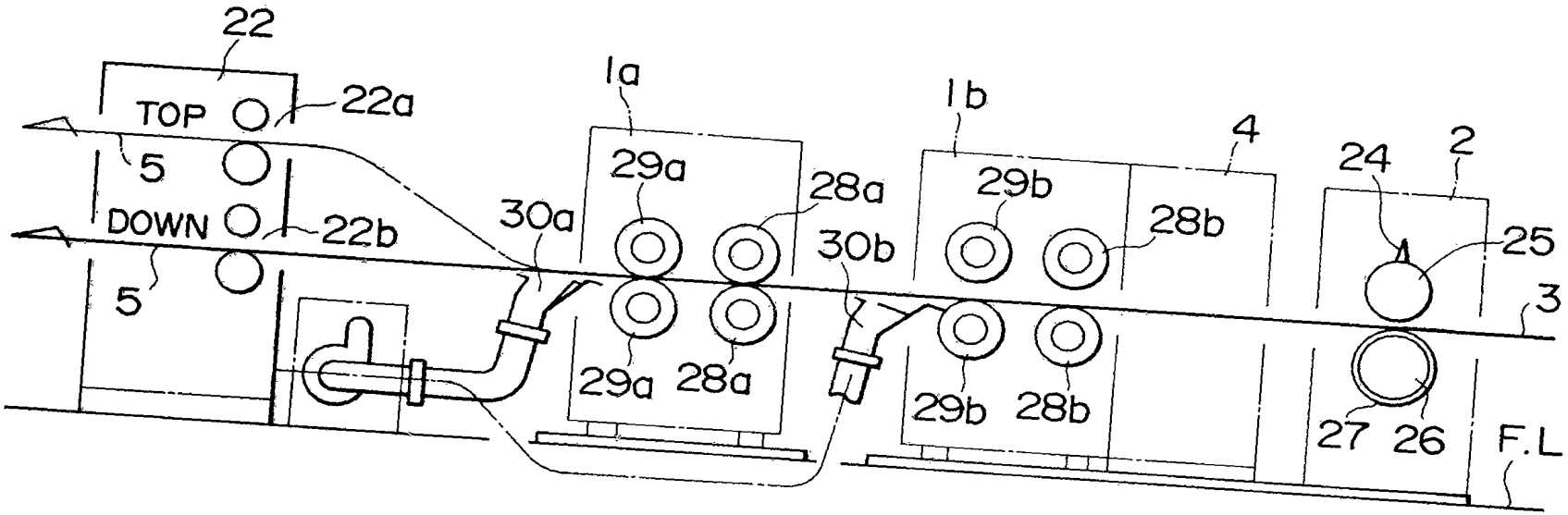


FIG. 2


22
TOP
22a
5
DOWN
22b
5
1a
29a
28a
30a
1b
4
29b
28b
30b
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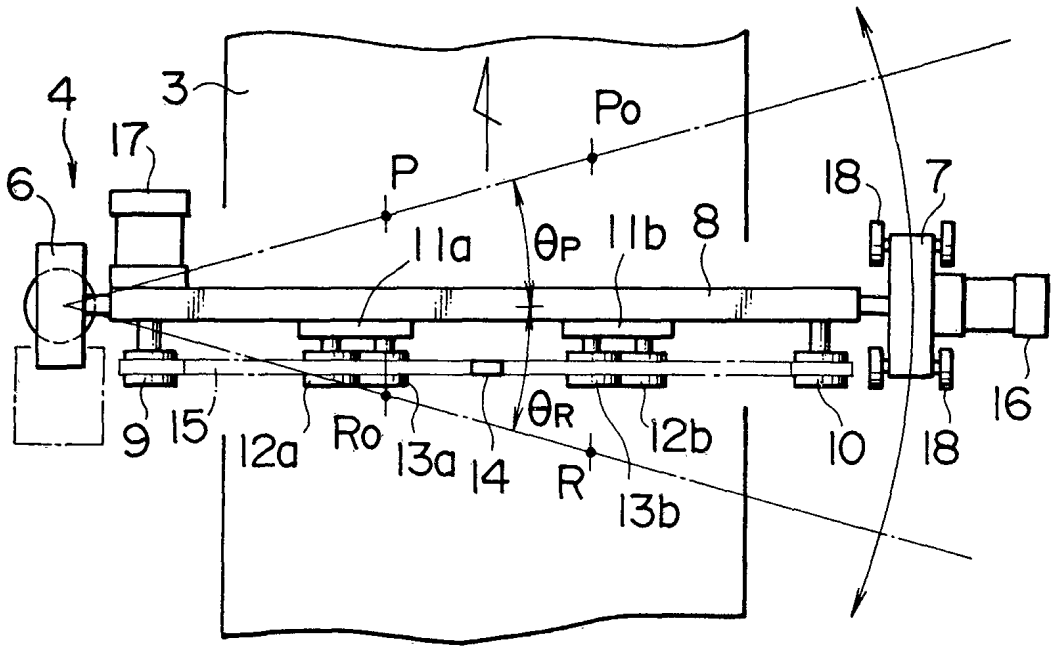
2
25
3
29a
28a
29b
28b
27
26
F.L

FIG. 3(a)


4
3
17
6
Po
P
18
7
11a
θP
11b
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9
15
12a
Ro
13a
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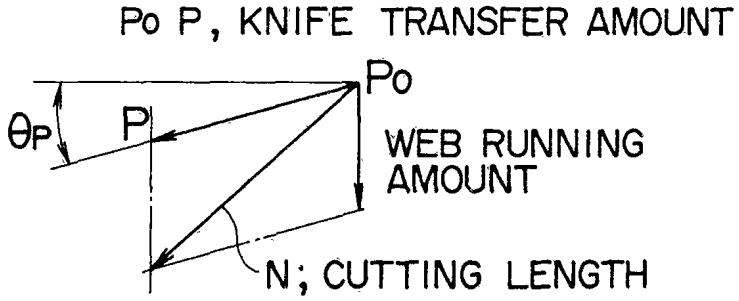
12b
10
18
16
R
13b

FIG. 3(b)


Po P, KNIFE TRANSFER AMOUNT
Po
θP
P
WEB RUNNING AMOUNT
N; CUTTING LENGTH

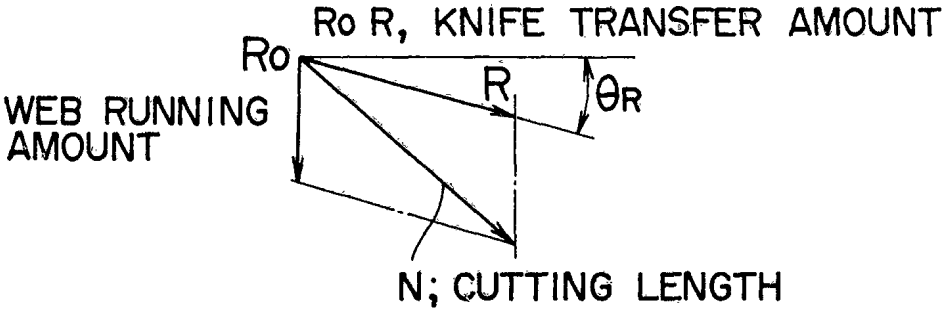

Ro R, KNIFE TRANSFER AMOUNT
Ro
R
θR
WEB RUNNING AMOUNT
N; CUTTING LENGTH

FIG. 4

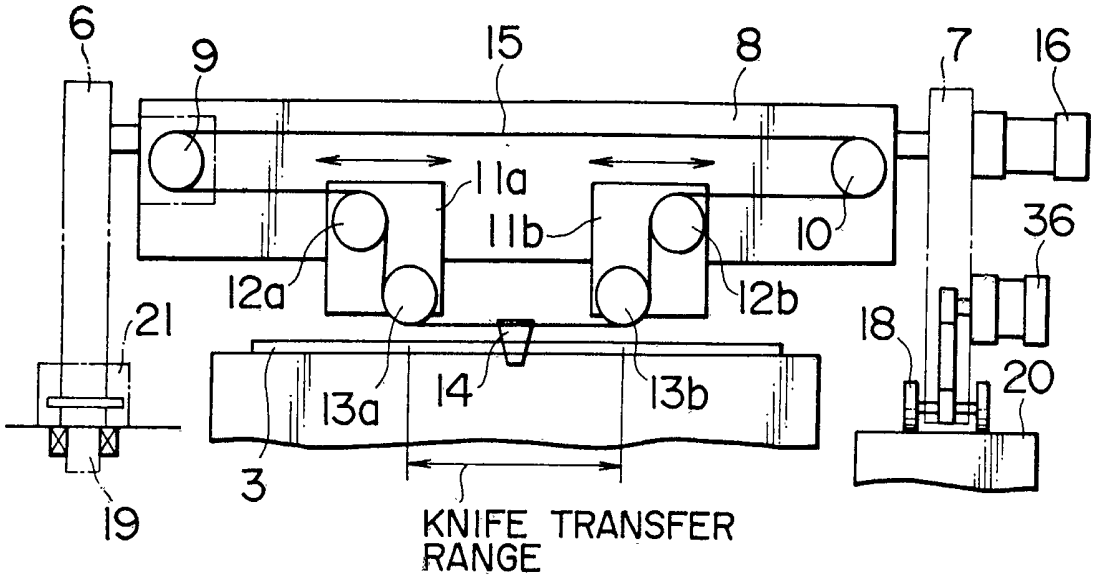
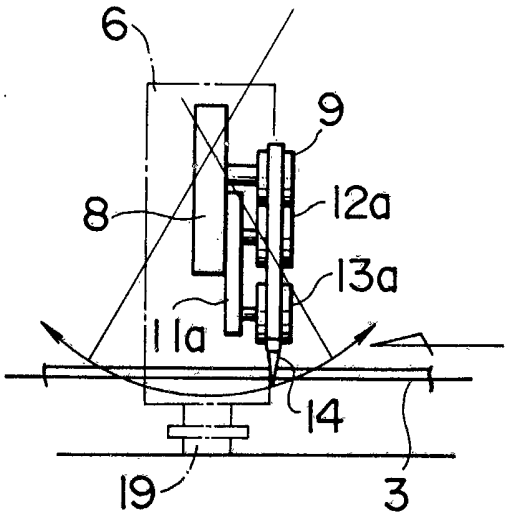

6
9
15
8
7
16
11a
11b
10
36
12a
12b
21
18
13a
14
13b
20
3
19
KNIFE TRANSFER RANGE

FIG. 5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9
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12a
13a
11a
14
19
3

FIG. 6

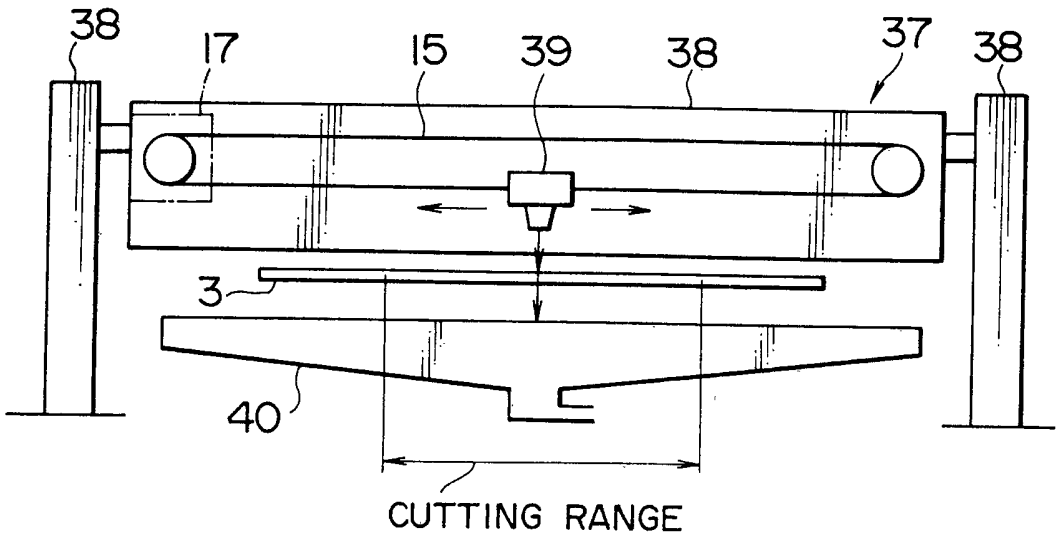

38
17
15
39
38
37
38
3
40
CUTTING RANGE

FIG. 7

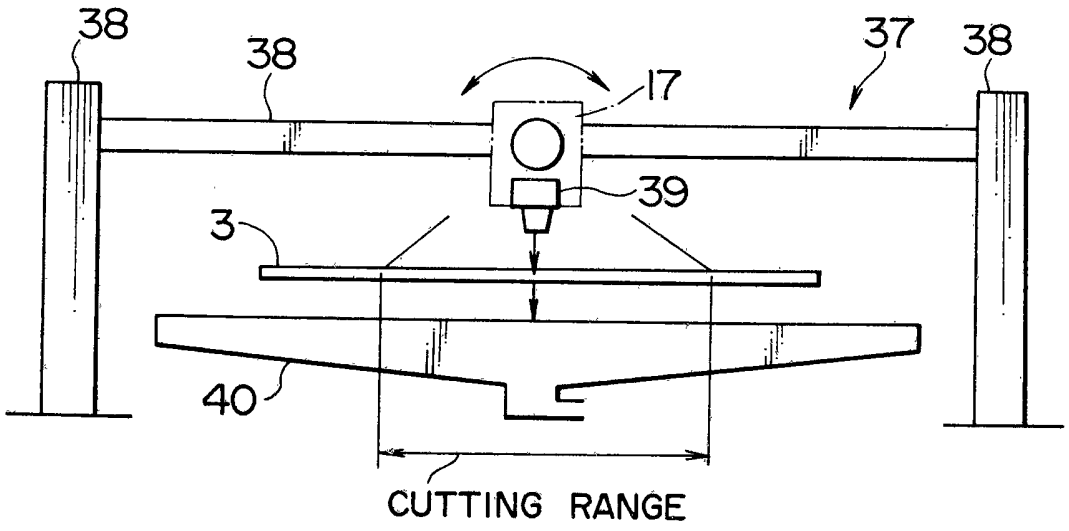

38
38
37
38
17
39
3
40
CUTTING RANGE

FIG. 8

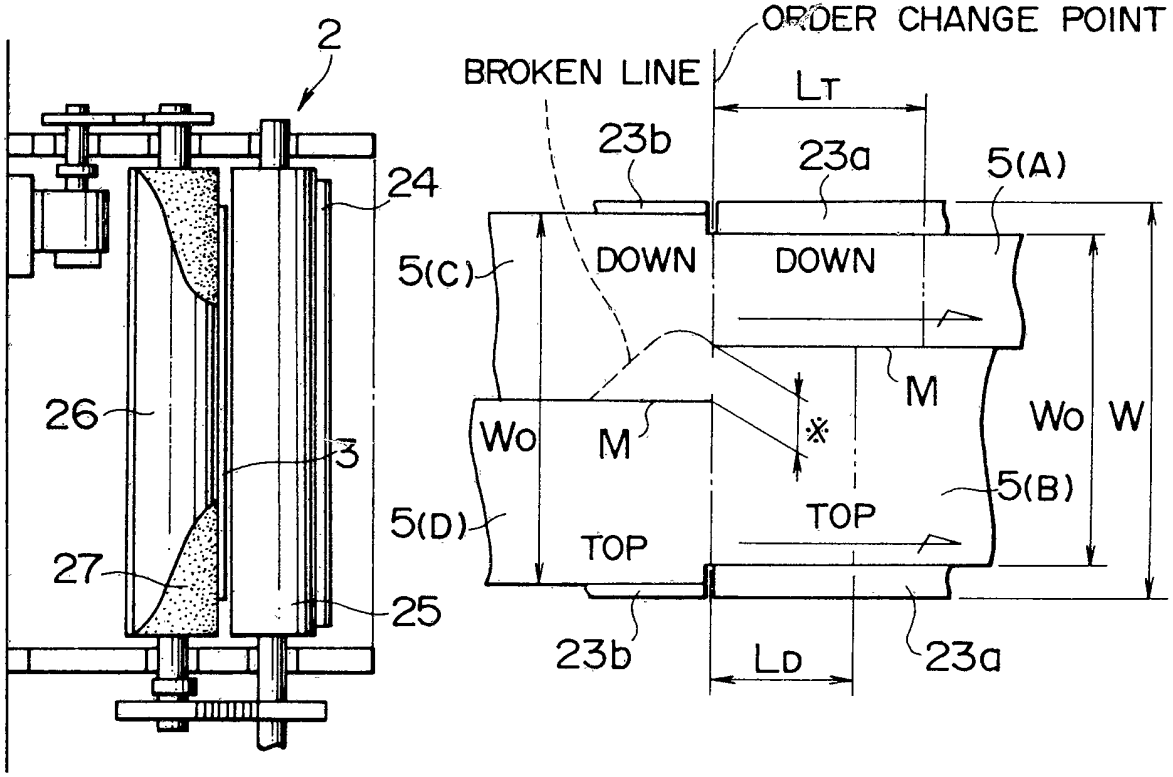

2
24
26
3
27
25
ORDER CHANGE POINT
BROKEN LINE
LT
23b
23a
5(A)
5(C)
DOWN
DOWN
M
Wo
W
Wo
M
※
5(B)
5(D)
TOP
TOP
23b
LD
23a

FIG. 9(a)

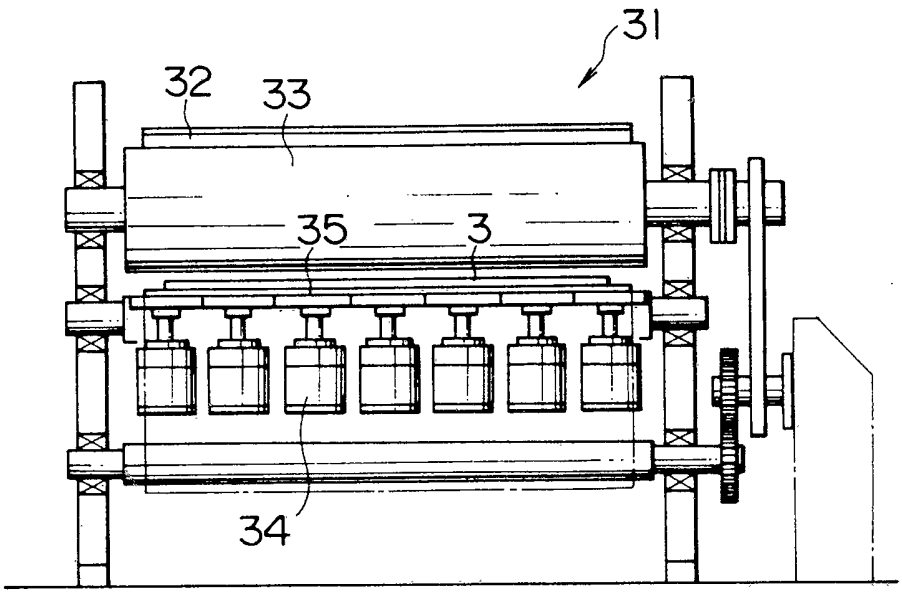


FIG. 9(b)

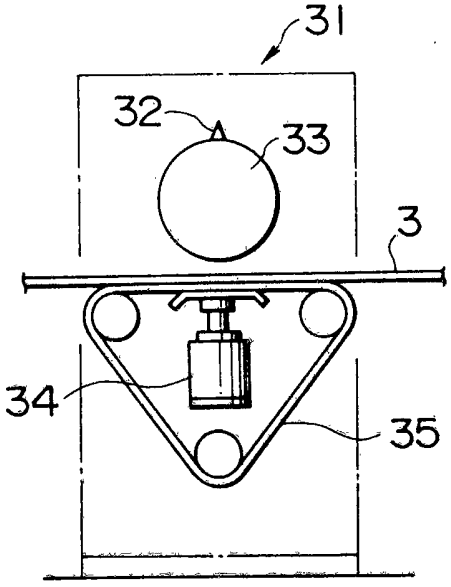


FIG. 10

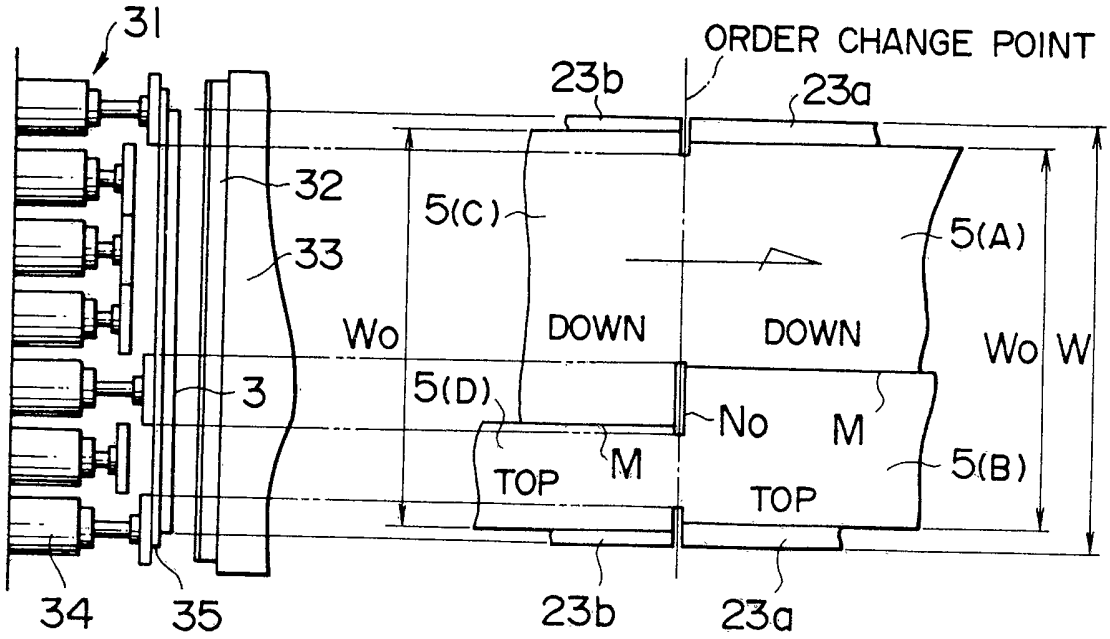
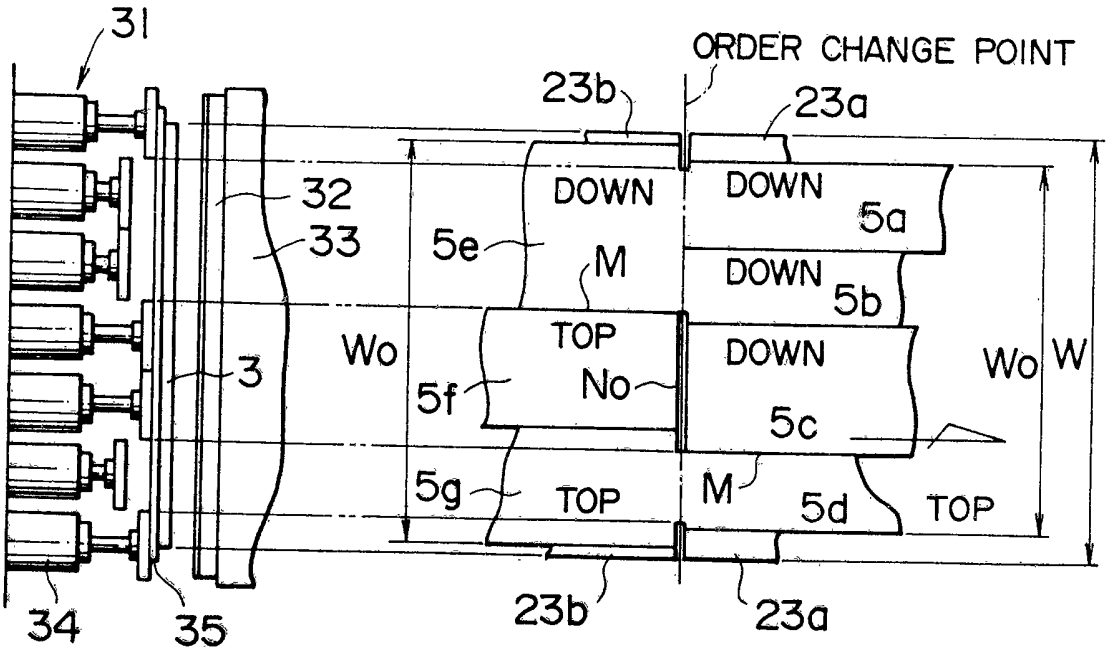

31
ORDER CHANGE POINT
23b
23a
32
33
5(C)
5(A)
Wo
DOWN
DOWN
Wo
W
3
5(D)
No
M
M
5(B)
TOP
TOP
34
35
23b
23a

FIG. 11


31
ORDER CHANGE POINT
23b
23a
32
33
DOWN
DOWN
5a
5e
M
DOWN
5b
Wo
TOP
DOWN
Wo
W
3
5f
No
5c
5g
TOP
M
5d
TOP
34
35
23b
23a