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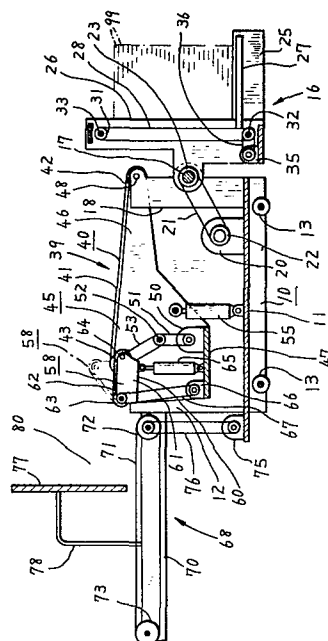
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⑤④ **Conveying apparatus for sheet-like articles.**

⑤⑦ Apparatus for conveying sheet-like articles (99) e.g. cardboard from a stack to a processing station comprises a pivoting holder (16) for the stacked articles, a pivotable transfer conveyor assembly (39), and a downstream feed conveyor (68) above which a gap forming restricting member (77) forms a stacking space (80). Assembly (39) comprises a transfer conveyor (40) having a movable conveyor (58) at its downstream end pivotable between positions in which its feed end lies above or below the supporting surface of conveyor (40) for selective non-reversal or reversal of the articles (99). Control means including a detector (81) ensures that the height of the discharge end of assembly (39) corresponds to that of the stack of articles (99) in space (80).



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"Conveying apparatus for sheet-like articles"

The present invention relates generally to conveying apparatus for sheet-like articles, and particularly but not exclusively to apparatus for
5 conveying sheets of cardboard to machines which are used in various steps of making up cartons from cardboard sheets.

For making cartons from cardboard sheets, three methods for supplying the cardboard sheets are needed.

10 In many cases, the sheets are fed after reversal thereof from a stacked condition. In some cases, the sheets have to be fed without reversal thereof. Cardboard sheets generally have warps when they have been produced. For removing these warps, sometimes the
15 sheets are stacked in a condition, wherein the stack consists of many groups of sheets, each of the groups having several sheets facing in the same direction, upward or downward, the facing directions of the group alternating. In supplying such sheets, it is necessary
20 to obtain the same facing direction of the sheets. Therefore, every group of several sheets has to be fed so as to alternate reversal and non-reversal thereof.

Kumagai Japanese non-examined Patent Publication No. 54-55970 discloses a machine which is able to be
25 used for the supplying of cardboard sheets in the above-mentioned three cases. But, in the case of automatic supply of sheets without reversal thereof, it is very difficult to supply at a systematic condition; an operator therefore has to transfer or pile the sheets
30 by lifting them at the connecting portion of two conveyors involving substantial labor. In the case of supplying sheets so as to alternate partial reversal and partial non-reversal thereof by use of the machine, an operator handles facing directions of the cardboard

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at the connecting portion of two conveyors, wherein it is very easy to reverse a group of the sheets by pivoting around lower edges thereof, but supplying a group of the sheets without reversal thereof is very
5 difficult, because the operator has to transfer by lifting, involving substantial labor.

Accordingly, it is an object of this invention to provide an apparatus for conveying sheet-like articles, such as for example, cardboard, sheets of timber, metal
10 plates or the like, easily from a stacked condition thereof without a great amount of manual labor, wherein the articles are able to be fed in three conditions, i.e. wholly reversed condition, wholly non-reversed condition, and alternate conditions of reversal and non-
15 reversal thereof. Another object of this invention is to provide the apparatus with a short length and compact structure.

According to one aspect of the invention, there is provided conveying apparatus for sheet-like articles
20 comprising a pivotable member for receiving said articles, a transfer conveyor assembly for receiving and passing said articles from said member to a feed conveyor, a restricting means disposed above the feed conveyor so as to form a small gap above the supporting surface
25 thereof and define thereby an article stacking space above the infeed end of the feed conveyor, said assembly comprising a transfer conveyor having a movable conveyor disposed adjacent the discharge end thereof, and means for changing the disposition of said movable conveyor
30 such that the infeed end thereof is movable between a position beneath the supporting surface of the transfer conveyor to a position above said supporting surface whereby to receive articles from the transfer conveyor and pass said articles to the stacking space.

35 To ensure the smooth transfer of the articles from

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the transfer conveyor assembly to the stack, there may be provided means for detecting the position of the uppermost article in the stacking space, and means controlled by the detecting means for changing the disposition of the transfer conveyor assembly such that the discharge end thereof is movable upwardly and downwardly to maintain said discharge end at a predetermined height relative to the uppermost article in the stacking space, said movable conveyor being mounted on a frame of said transfer conveyor assembly for movement therewith.

Viewed from another aspect, the invention provides conveying apparatus for sheet-like articles comprising a pivotable member for receiving said articles, a transfer conveyor assembly for receiving and passing said articles from said member to a feed conveyor, a restricting means disposed above the feed conveyor so as to form a small gap above the supporting surface thereof and define thereby an article stacking space above the infeed end of the feed conveyor, means for detecting the position of the uppermost article in the stacking space, and means controlled by the detecting means for changing the disposition of the transfer conveyor assembly such that the discharge end thereof is movable upwardly and downwardly to maintain said discharge end at a predetermined height relative to the uppermost article in the stacking space.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, wherein:

FIG. 1 is a side elevational view of the apparatus incorporating the present invention;

FIG. 2 is a plan view of the apparatus shown in FIG. 1;

FIG. 3 is a front view of the apparatus shown in

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FIGS. 1 and 2;

FIG. 4 is a sectional view taken along the line 4-4 of FIG. 2;

5 FIG. 5 is a sectional view taken along the line 5-5 of FIG. 1;

FIGS. 6A and 6B are side views of cardboard sheets being fed with reversal thereof by the operation of the apparatus;

10 FIGS. 7A and 7B are side views of the cardboard sheets being fed without reversal thereof by the operation of the apparatus; and

FIG. 8 is a side view of the cardboard sheets being fed with partial reversal thereof by the operation of the apparatus.

15 In the embodiment shown in Figs. 1 to 5 10 designates a base composed of a bottom member 11 and a pair of vertical side walls 12. The base has four wheels 13 for moving along rails 14 and a pair of supporting plates 15 which extend horizontally outwardly from respective side walls 12 for operators to stand on.

20 A pivoting device designated generally by 16 has an axle 17 pivotally supported by a pair of supporting members 18 extending upwardly from the base 10 on both ends thereof. A motor 20 installed on the base 10 is 25 able to drive the axle 17 in both rotative directions by means of a chain 21 and sprockets 22 and 23 so as to pivot the pivoting device 16 between a position shown in full lines in FIG. 1 and positions 16a or 16b shown in chain-dot lines. The pivoting device 16 has a pair 30 of supporting members 25 for supporting the bottom surface of cardboard sheets 99 stacked flat thereon and a pair of edge supporting members 26 extending perpendicularly from the supporting members 25 for supporting the edges of the sheets 99 at one side. A 35 thrusting member 27 is attached to a pair of chains 28,

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each of which is entrained about sprockets 30, 31 fixed to a pair of shafts 32, 33, respectively, the shafts being rotatably journaled on the edge supporting members 26 at both ends thereof. The thrusting member 5 27 is initially disposed at a position between the supporting members 25. The pivoting device 16 has a motor 35 which is adapted to drive the shaft 32 in both directions of rotation by means of a chain 36 entrained about appropriate sprockets so that the thrusting member 10 27 is moved along the edge supporting members 26.

A transfer conveyor assembly 39 includes a transfer conveyor 40 having a pair of belts 41, each of which is entrained about an idler roller 42 positioned near the pivoting device 16 and a drive roller 43 positioned at 15 the opposite end. The transfer conveyor assembly 39 also includes a pivotal frame 45 having two pairs of side plates 46 fixed to each other by a connecting plate 47, each pair of the side plates embracing a respective belt 41. Each idler roller 42 has a shaft 48 which extends 20 at each end through the respective side plates 46 and is rotatably journaled in the vertical plate 12 and the supporting member 18 at both ends thereof. A drive motor 50 is mounted on the pivotal frame 45 to drive the drive rollers 43 so that the belts 41 are driven as 25 shown by the arrows in FIG. 2 by means of a chain 51, shaft 52, a pair of chains 53 and appropriate sprockets. A pneumatic actuator 55 is connected to the base 10 and the pivotal frame 45 so as to move the discharge end of the transfer conveyor assembly 39 upwardly and downwardly.

30 A shaft 56 is rotatably journaled in the foremost portion of the pivotal frame 45 spaced ahead of the drive rollers 43. A pair of rollers 57 are fitted about the shaft 56 and fixed thereto at positions between the each pair of side plates 46. The conveyor assembly 39 also 35 includes a movable conveyor 58 positioned near the

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discharge end of the transfer conveyor 40, which has a frame 60 having a pair of side plates 61 through which the shaft 56 is rotatably extended, the frame extending from the shaft 56 in a direction opposite to the progressing direction of the supporting surface of belt 41. The movable conveyor 58 also has a belt 62 entrained about a drive roller 63 fitted about the shaft 56 and fixed thereto and an idler roller 64 rotatably supported by the frame 60 the other end thereof. The movable conveyor 58 can be pivoted about the shaft 56 by means of a pneumatic actuator 65 so as to change the disposition thereof. The infeed end of the movable conveyor 58 therefore is able to be raised to a position above the supporting surface of the belts 41 as shown in FIG. 4 in chain-dot lines and lowered to the original position lower than the supporting surface of the belts 41 as shown in full. A motor 66 is mounted on the frame 60, which drives the belt 62 in a direction of arrow shown in FIG. 8 at a speed far greater than that of the belt 41, the rollers 57 also being driven by the shaft 56.

A feeding conveyor 68 adapted to receive sheets from the conveyor assembly 39 includes a pair of side plates 70 fixed to the vertical plates 12 of the base 10 and three belts 71 entrained about rollers 72, 73 and driven by means of a motor 75 and a chain 76. A restricting member 77 is fixed to the side plates 70 by means of connecting members 78, the lower end thereof being spaced a suitable small distance from the supporting surface of the feeding conveyor 68. A stacking space 80 for the cardboard sheets 99 is formed by the restricting member 77 at a position above the infeed end of the feeding conveyor 68.

A detecting means or sensor 81 is mounted on the frame 45 so as to face to the stacking space 80 for detecting the uppermost position of the cardboard sheets

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stacked there, which emits light and receives light reflected by the cardboard sheets. The pneumatic actuator 55 changes the disposition of the transfer conveyor assembly 39 by receiving a signal from the
5 senser 81 so as to maintain the discharge end of the transfer conveyor assembly 39 a little higher than the uppermost position of the cardboard sheets 99 stacked at the stacking space 80.

Another detecting means or senser 82 is also
10 mounted on the frame 45 so as to face upwardly for detecting the progress of the leading cardboard sheet supported on the transfer conveyor 40 to a position near the discharge end of the transfer conveyor. The senser emits light and receives the light reflected by
15 the cardboard. The senser 82 is able to be switched into active and non-active conditions. In its active condition the pneumatic actuator 65 changes the disposition of the movable conveyor 58 by receiving a signal from the senser 82 so as to raise the infeed end
20 thereof as seen in chain-dot lines in FIG. 4 for a short time and return the movable conveyor to its original disposition. The motors 35, 50 are stopped while the infeed end of the movable conveyor 58 is raised so that the pushing member 27 and the belts 41
25 are also stopped for the same time.

A foot switch 83 is provided for use by an operator in the non-active condition of the senser 82. When the foot switch is pressed by the operator, the disposition of the movable conveyor 58 is changed so as
30 to raise the infeed end thereof and the motors 35, 50 are stopped so that the thrusting member 27 and the belts 41 are stopped in the same way as described above relating the senser 82.

Referring now particularly to FIGS. 6A-8, the
35 operation of the apparatus will be described. Firstly,

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a stack of cardboard sheets 99 is supported on the bottom surface supporting parts 25 of the pivoting device 16 as seen in FIG. 1. The stack of cardboard sheets 99 may be brought to the pivoting device 16 by means of a pallet, not shown, or the like. In a case wherein all of the stacked cardboard sheets 99 are to be fed after reversal thereof, the sensor 82 is maintained in a non-active condition thereof. The pivoting device 16 is pivoted to the position 16a as shown in FIG. 1 by the motor 20. The cardboard sheets 99 are rotated about their lower edges and reversed by receiving pushing pressure from the bottom surface supporting parts 25 as seen in FIG. 6A. The reversed sheets 99 are supported on the belts 41 of the transfer conveyor 40 and the edge supporting parts 26 of the pivoting device 16. Then, the motors 35, 50, 66, 75 are driven, and the sheets 99 are advanced by the transfer conveyor 40 and movable conveyor 58 and fed onto the infeed end of the feeding conveyor 68 or the stacking space 80 as seen in FIG. 6B. The thrusting member 27 serves to feed those sheets 99 supported by edge supporting parts 26 to the transfer conveyor 40. The sheets 99 fed onto the feeding conveyor are fed singly to a receiver or processing machine, not shown, by passing through the gap between the restricting member 77 and the feeding conveyor 68. The sheets 99 collect at the stacking space 80, because the feeding speed of the transfer conveyor assembly 39 is greater than the feeding speed of the feeding conveyor 68. The sensor 81 detects the uppermost position of the sheets 99 stacked at the stacking space 80, and the position of the discharge end of the transfer conveyor assembly 39 is controlled so as to lie a little above the uppermost sheet 99 stacked at the stacking space 80. Thus the sheets 99 fed from the discharge end of the transfer

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conveyor assembly 39 are supported a little lower and piled in perfect order at the stacking space 80. Therefore, it is possible to feed the sheets 99 without large upwardly or downwardly inclined angles from the transfer conveyor assembly 39 to the stacking space 80. Owing to the high speed of the movable conveyor 58, sheets 99 fed from the transfer conveyor assembly 39 to the stacking space 80 can be stopped by contact of their leading edges with the restricting member 77 and not by contact their edges to the surfaces of the already piled sheets 99. Thus, feeding of the sheets in perfect order is readily obtained. The movable conveyor 58 can be pivoted so as to raise its infeed end a little higher than the supporting surface of the transfer conveyor 40 by means of the pneumatic actuator 65.

After the sheets 99 have been moved from the position above the pivoting device 16, the pivoting device and the pushing member 27 are returned to their initial position by means of the motors 20 and 35. The above described operation of the pivoting device is to be repeated for continuously supplying the sheets 99. While the next stack of the sheets 99 is to be fed from the transfer conveyor assembly 39 to the stacking space 80, the sheets 99 stacked at the stacking space 80 are fed continuously, the uppermost position of the stack of the sheets being lowered with the discharge end of the transfer conveyor assembly 39, thus a continuous feeding of the sheets 99 is obtained by the apparatus which has a short length and a compact structure. The rollers 57 cooperate with the movable conveyor 58 for feeding the sheets 99 from the conveyor assembly 39 to the stacking space 80.

In a case wherein all of the stacked sheets 99 are to be fed in a non-reversed condition, the operation of the apparatus will now be described. The sensor 82 is arranged in its active condition. A stack of cardboard

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5 sheets 99 supported by the pivoting device 16 is
pivoted to the disposition 16b as seen in FIG. 1,
whereby the sheets are supported in an inclined
condition on the transfer conveyor 40 and the edge
10 supporting parts 26 of the pivoting device 16 as seen
in FIG. 7A. Then, the thrusting member 27, the transfer
conveyor 40, the movable conveyor 58, the feeding
conveyor 68 are driven by means of the motors 35, 50, 66,
75, respectively, to advance the sheets. The thrusting
15 member 27 serves to feed the sheets 99 on the edge
supporting parts 26 to the transfer conveyor 40 and to
avoid the rear sheets falling into the horizontal
position.

15 When the leading sheet reaches a position above the
senser 82, the senser detects the sheet and the
conveyor 58 is automatically pivoted as seen in FIG. 7B
by means of the pneumatic actuator 65, whereby several
sheets 99 disposed above the movable conveyor 58 are fed
very quickly to the stacking space 80, and the motors
20 35, 50 are stopped so that the other sheets 99 supported
on the transfer conveyor 40 are stopped and engaged to
the upwardly projected infeed end of the movable
conveyor 58. After the sheets 99 on the movable
conveyor 58 have been fed to the stacking space 80, the
25 movable conveyor 58 is returned to its original
disposition by means of the pneumatic actuator 65, and
the motors 35, 50 are driven. Thus, the sheets 99 are
fed by repeating such actions. After the sheets 99
supported by the transfer conveyor 40 have been moved
30 from the position above the pivoting device 16, the
pivoting device and the thrusting member 27 are
returned to the initial dispositions thereof by means of
the motors 20, 35. The discharge end of the transfer
conveyor assembly 39 is controlled by means of the
35 senser 81 in the same manner as described above. In the

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case wherein all of the sheets 99 are to be fed in a non-reversed condition, it is possible to use the foot switch 83, with the senser 82 maintained in its non-active condition. When the sheets 99 supported on the transfer conveyor 40 have been advanced to a position where the leading one is above the senser 82, the operator depresses the foot switch 83 with his foot, and the infeed end of the movable conveyor 58 is raised as shown in FIG. 7B and the motors 35, 50 are stopped. The sheets 99 on the movable conveyor 58 are fed and the other sheets 99 on the transfer conveyor 40 are stopped in the same manner as described above. After the sheets 99 on the movable conveyor 58 have been fed to the stacking space 80, the operator releases the foot switch 83, and the movable conveyor 58 returns to its original disposition and the motors 35, 50 are driven. Thus, the sheets 99 on the transfer conveyor 40 are fed by repeating such actions.

When the sheets 99 on the pivoting device 16 are stacked in alternate condition, the operation of the apparatus to deal with this will now be described. In this case, the sheets 99 are piled on the pivoting device 16 wherein the upper few sheets face in the same direction, either upwards or downwards, the next few sheets face in the opposite direction, and the rest alternate in the same way. The pivoting device 16 is pivoted as shown in FIG. 7A. Then the thrusting member 27, the transfer conveyor 40, the movable conveyor 58, and the feeding conveyor 68 are driven by means of the motors 35, 50, 66, 75, respectively to advance the sheets. When the leading few sheets which are to be reversed have reached near the discharge end of the transfer conveyor 40, an operator reverses the several sheets by pushing upper portion thereof as shown in FIG. 8, so that the sheets fall down on the movable conveyor 58

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and are fed to the stacking space 80 by the movable conveyor. When the leading few sheets which are to be fed without reversal thereof have reached a position above the movable conveyor 58, the operator depresses
5 the foot switch 83 and the group of sheets are fed to the stacking space 80 in the same manner as described with reference to FIG. 7B. Thus, all of the sheets supported on the transfer conveyor 40 are fed to the stacking space 80 so as to face in the same direction
10 by repeating such actions alternately. The other actions are the same with the above described other cases.

The apparatus described above has a number of advantages, particularly that the apparatus enables the
15 supply of thin, flat articles in three cases, i.e. with reversal, non-reversal, partial reversal and partial non-reversal of the articles, from a stacked condition thereof, with a minimum of manual labour.

The foregoing is of course considered as
20 illustrative only of the principle of the invention. Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. For example, the transfer conveyor assembly 39 may be installed to the pivoting device 16
25 so as to act as edge supporting parts 26. In such case, the thrusting member 27 may not be installed.

CLAIMS

1. Conveying apparatus for sheet-like articles (99) comprising a pivotable member (16) for receiving said articles, a transfer conveyor assembly (39) for receiving and passing said articles from said member (16) to a feed conveyor (68), a restricting means (77) disposed above the feed conveyor (68) so as to form a small gap above the supporting surface thereof and define thereby an article stacking space (80) above the infeed end of the feed conveyor (68), said assembly (39) comprising a transfer conveyor (40) having a movable conveyor (58) disposed adjacent the discharge end thereof, and means (65) for changing the disposition of said movable conveyor (58) such that the infeed end thereof is movable between a position beneath the supporting surface of the transfer conveyor (40) to a position above said supporting surface whereby to receive articles (99) from the transfer conveyor (40) and pass said articles to the stacking space (80).
2. Apparatus according to claim 1 including means (81) for detecting the position of the uppermost article (99) in the stacking space (80), and means (55) controlled by the detecting means (81) for changing the disposition of the transfer conveyor assembly (39) such that the discharge end thereof is movable upwardly and downwardly to maintain said discharge end at a predetermined height relative to the uppermost article in the stacking space (80), said movable conveyor (58) being mounted on a frame (45) of said transfer conveyor assembly (39) for movement therewith.
3. Apparatus according to claim 2 including a base (10), said pivotable member (16) and said transfer conveyor assembly frame (45) being pivotably connected to said base (10), said movable conveyor (58) having a frame

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(60) pivotably connected to the transfer conveyor assembly frame (45).

4. Apparatus according to claim 1,2 or 3 including means (82) for detecting the advancement of the leading article to a predetermined position near the discharge end of the transfer conveyor (40), said movable conveyor disposition changing means (65) being adapted to move the infeed end of the movable conveyor (58) to its upper position in response to said detecting means and to return said conveyor (58) to its lower position after discharge of articles from the movable conveyor (58), and means for stopping said transfer conveyor (40) while the infeed end of the movable conveyor (58) is raised to its upper position.

5. Apparatus according to any of the preceding claims including an operator-actuable switch (83) adapted to actuate said movable conveyor disposition changing means (65), and stop the transfer conveyor while the infeed end of the movable conveyor (58) is raised to its upper position.

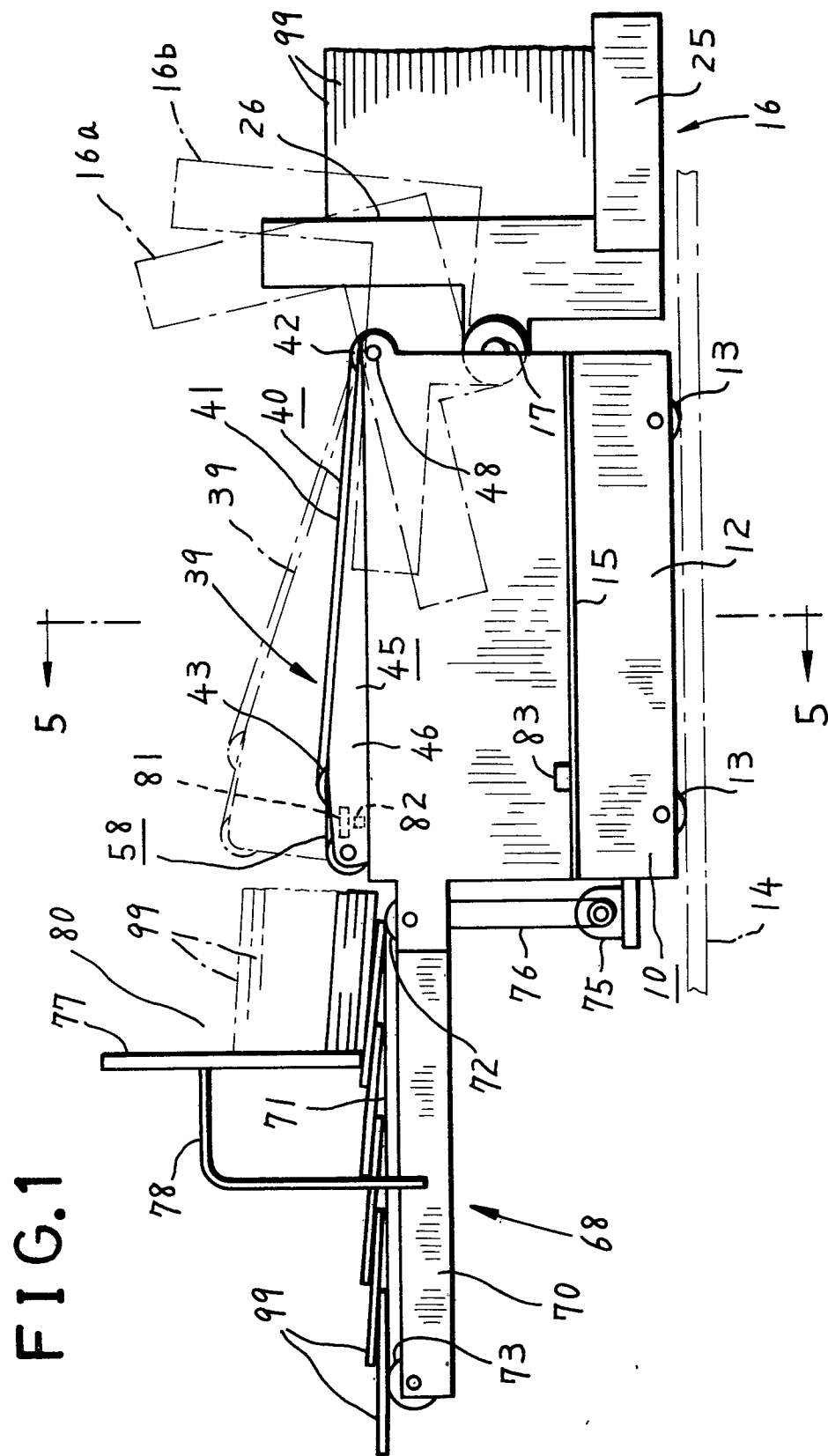
6. Apparatus according to claim 5 wherein said switch (83) is a foot-operated switch.

7. Conveying apparatus for sheet-like articles (99) comprising a pivotable member (16) for receiving said articles, a transfer conveyor assembly (39) for receiving and passing said articles from said member (16) to a feed conveyor (68), a restricting means (77) disposed above the feed conveyor (68) so as to form a small gap above the supporting surface thereof and define thereby an article stacking space (80) above the infeed end of the feed conveyor (68), means (81) for detecting the position of the uppermost article (99) in the stacking space (80), and means (55) controlled by the detecting means (81) for changing the disposition of the transfer conveyor assembly (39) such that the

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discharge end thereof is movable upwardly and downwardly to maintain said discharge end at a predetermined height relative to the uppermost article in the stacking space (80).

8. Apparatus according to claim 7 including a base (10), said transfer conveyor assembly (39) including a frame (45) said pivotable member (16) and said frame (45) being pivotably connected to said base (10).



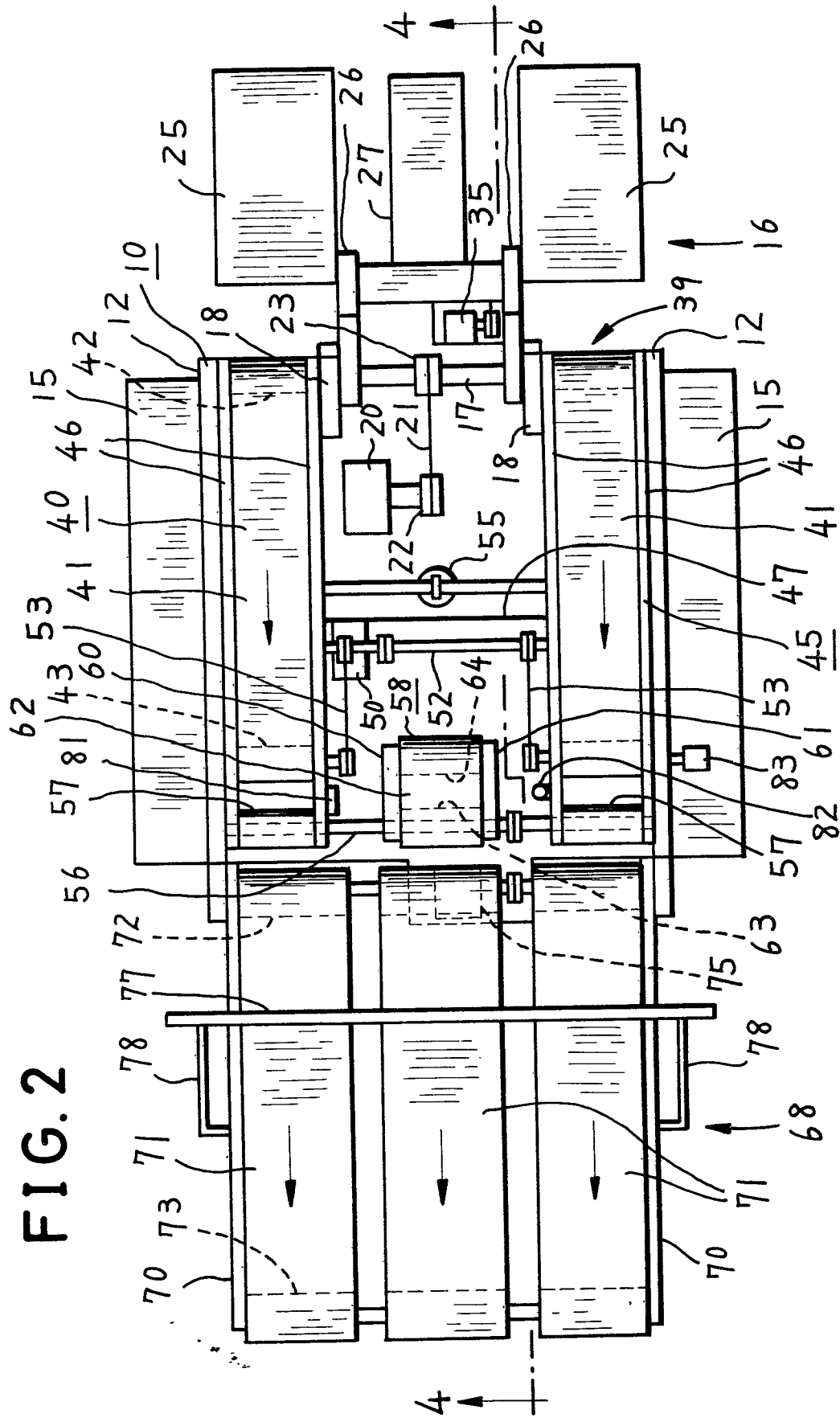


FIG. 3

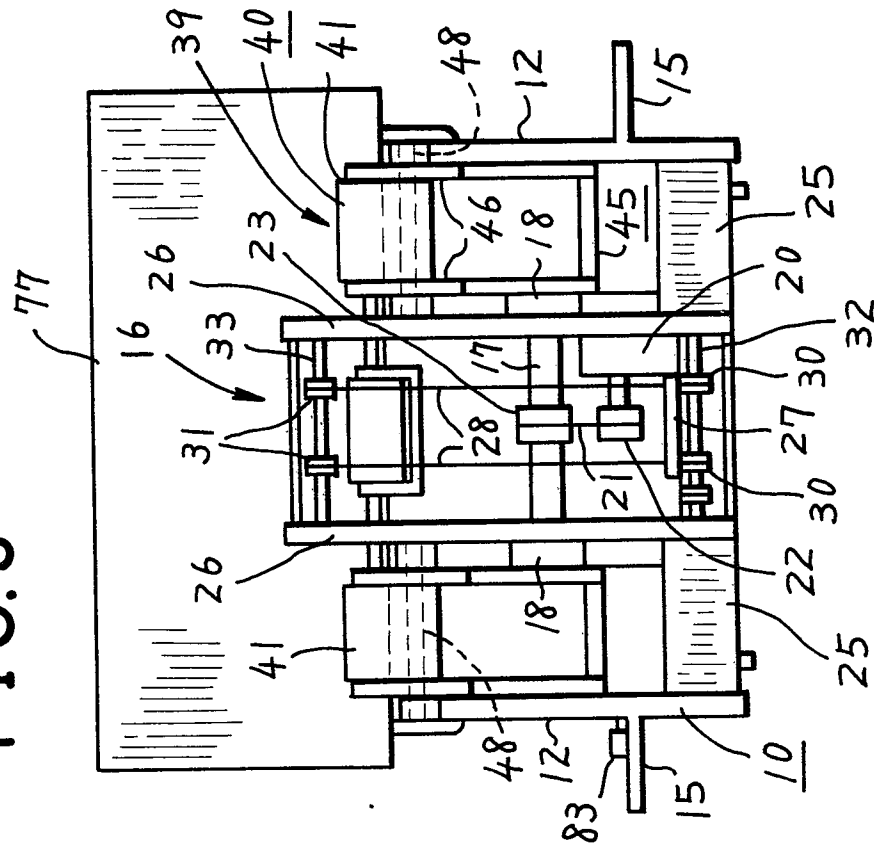


FIG. 5

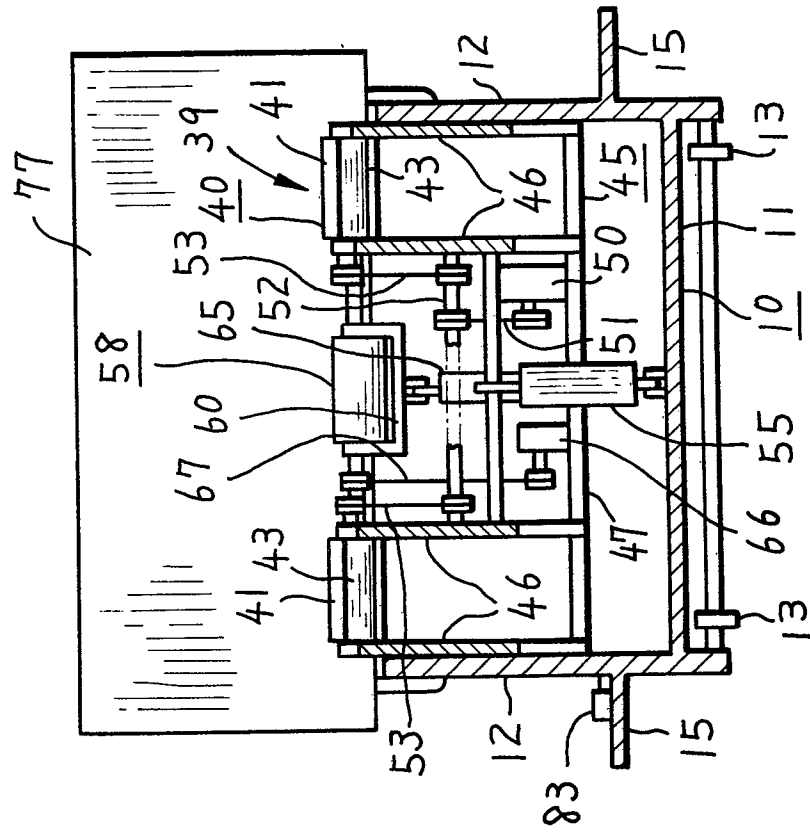


FIG. 4

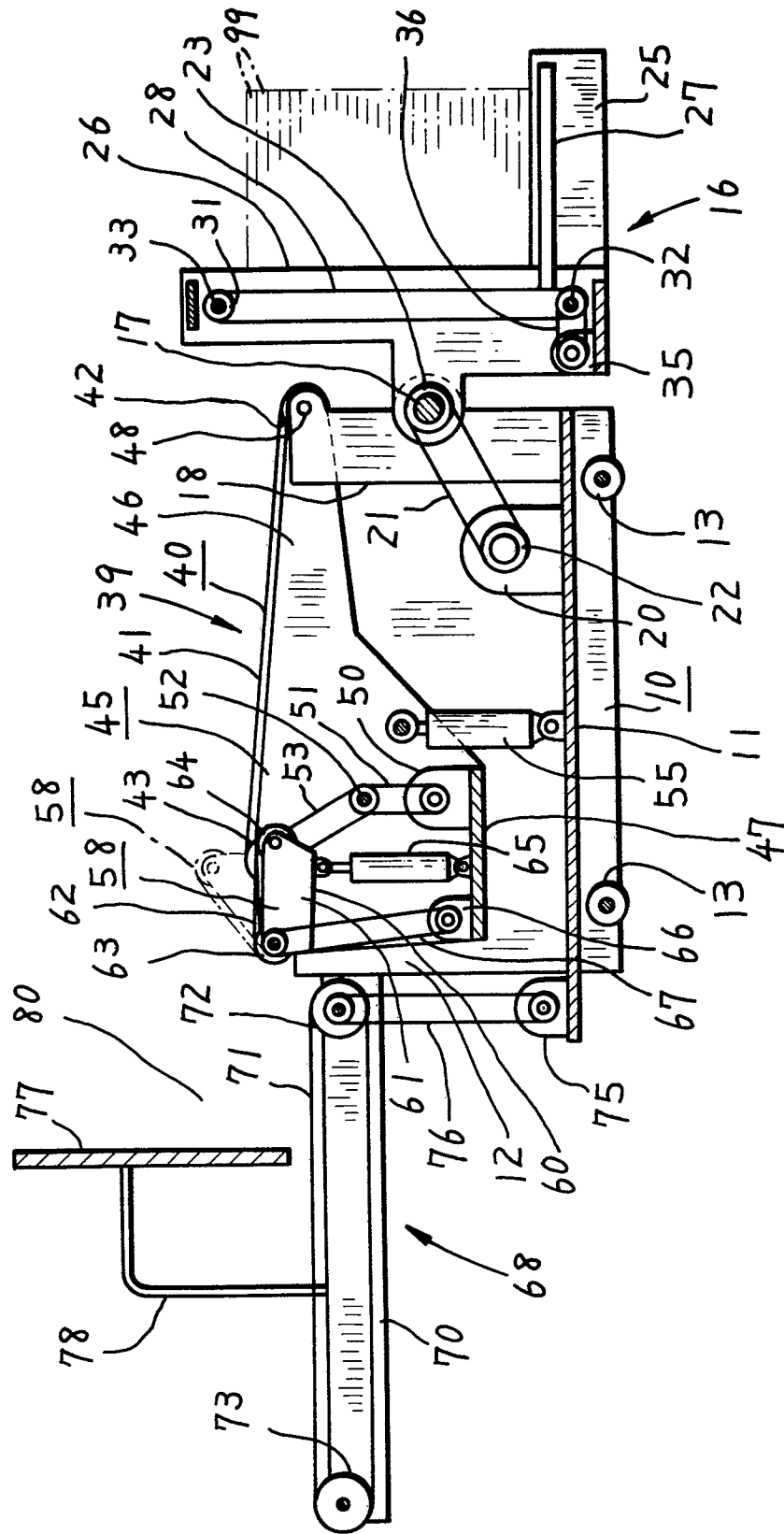


FIG. 6A

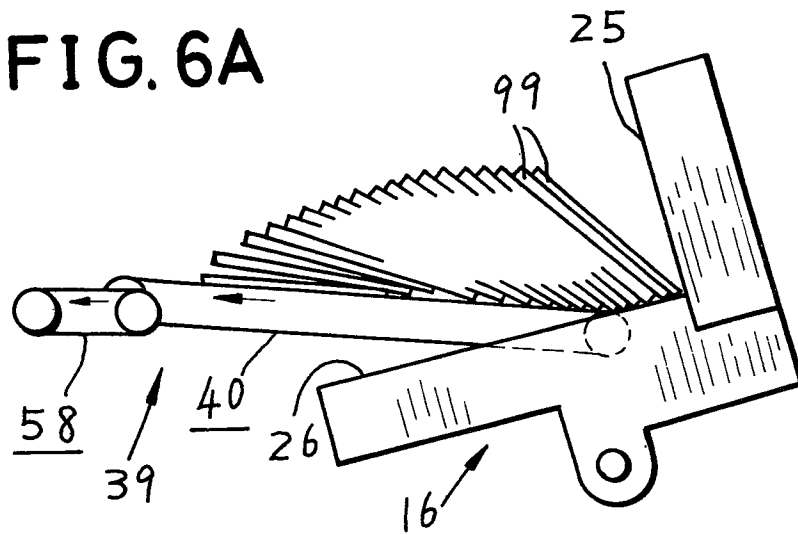


FIG. 6B

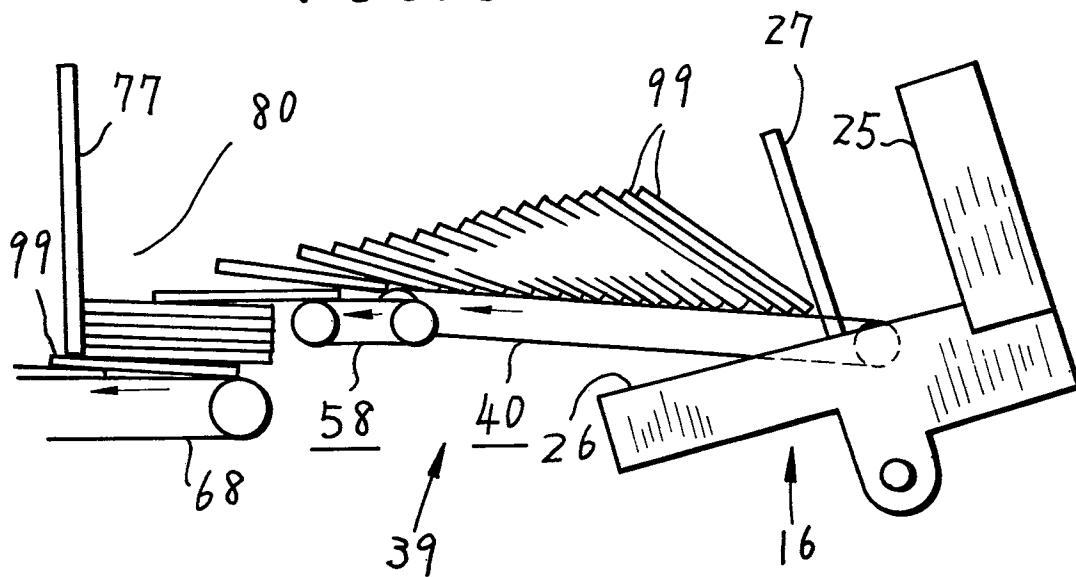
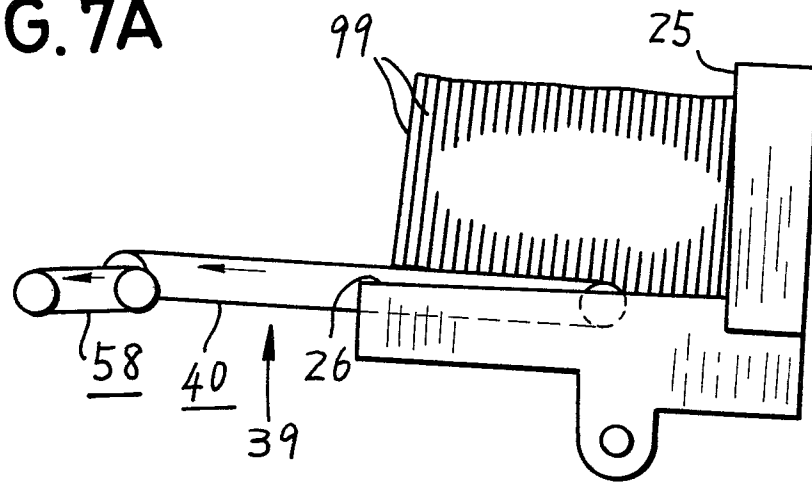
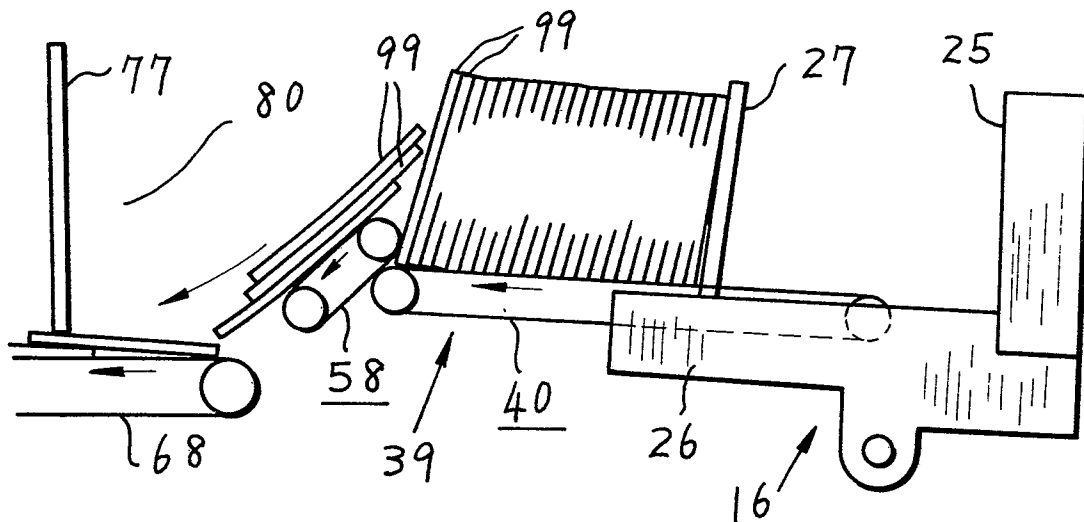
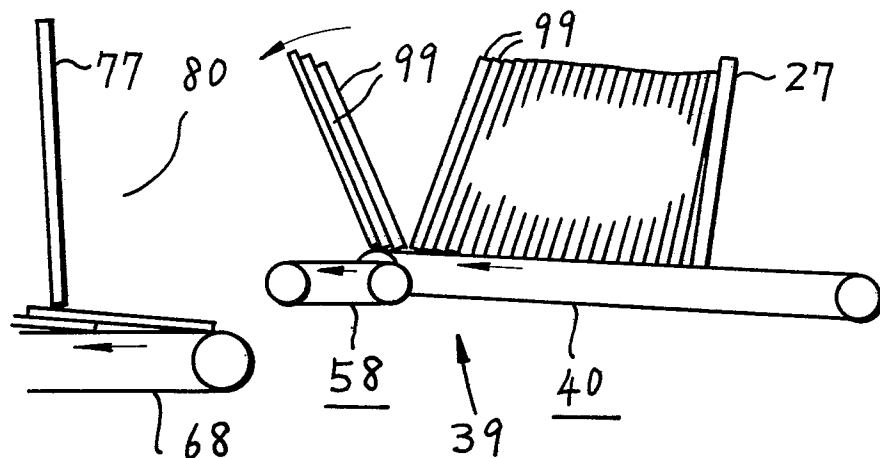


FIG. 7A**FIG. 7B****FIG. 8**



European Patent
Office

EUROPEAN SEARCH REPORT

0033799

Application number

EP 80303786.0

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	<u>FR - A - 2 389 562</u> (S.A. MARTIN) + Page 5; fig. 1 + --	1,3,7	B 65 H 5/02 B 65 H 5/24
	<u>DE - A - 2 511 618</u> (MATSUO, MASAHARU) + Claim 1; fig. 3 + --	1	
	<u>CH - A - 565 697</u> (J.BOBST & FILS S.A.) + Column 1, line 58 - column 2, line 14; fig. 1,4 + ----	1	
			CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
X	The present search report has been drawn up for all claims		&: member of the same patent family, corresponding document
Place of search VIENNA		Date of completion of the search 07-04-1981	Examiner HOFMANN