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(71) Applicant: **AGFA-GEVAERT**
2640 Mortsel (BE)

(72) Inventor: **Plessers, Hendrik c/o Agfa-Gevaert**
2640 Mortsel (BE)

(54) Method and apparatus for stacking sheets

(57) A device (30) for stacking sheets (25) and a method therefore, the device (30) including a support (31, 40-42) for a sheet (25), wherein the support (31, 40-42) can protrude from the device (30) over a protruding length (L), that can be increased while the sheet (25) is supported.

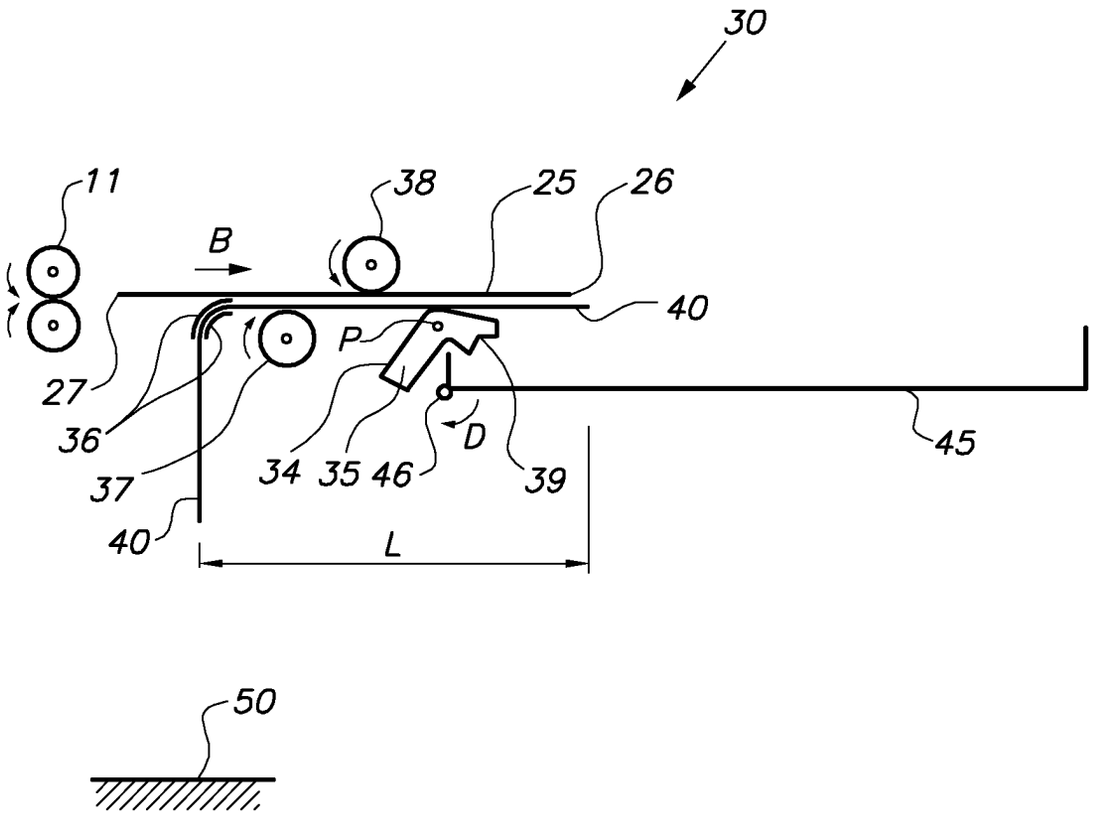

FIG. 3A

EP 1 400 473 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates to the field of stacking processed sheets, in particular stacking processed printing plates.

BACKGROUND OF THE INVENTION

[0002] Before a printing plate can be used on an offset press, it is first imaged and then processed. When large numbers of printing plates are processed, it is customary to stack the processed printing plates automatically in a so-called plate stacker, at the output side of the processor. An operator can then carry away the stack of plates on a transport trolley.

[0003] Figs. 1 and 2 show the operation of a Lithostar™ plate stacker LS82 Ultra (Lithostar is a trade mark of Agfa-Gevaert N.V.). A plate 25 is processed by a processor 10 (only partially shown in Figs. 1-2) and transferred by the output roller pair 11 of processor 10 to a plate stacker 30, in the direction of arrow A. In the plate stacker 30, plate 25 is supported and transported by a number of strings 31 in the direction of arrow B. Fig. 1 only shows one string 31, guided by pulleys 32, 33. In reality, plate 25 is supported by several strings 31 at regular distances in the direction perpendicular to the plane of Fig. 1. Plate 25 is transported up to hinge 22 of transport trolley 20. Then, as shown in Fig. 2, plate 25 is put onto transport trolley 20 by rotating the tilting bars 21 in the direction of arrow C. Only one tilting bar 21 is shown in Fig. 2; in reality, transport trolley 20 has several tilting bars 21, at regular distances in the direction perpendicular to the plane of Fig. 2 and alternating with the strings 31. One plate 25 after the other is put onto trolley 20, so that a stack of plates 25 is formed on bottom 23 of transport trolley 20. When there are enough plates 25 on the transport trolley 20, it is wheeled away by an operator.

[0004] Patent application **EP-A-1 155 835** discloses a plate stacker that is adapted for large format plates; the stacker contains a device that avoids buckling of the plates.

[0005] Existing plate stackers require much floor space and are rather complex.

[0006] There is thus a need for an improved plate stacker.

SUMMARY OF THE INVENTION

[0007] The present invention is a device for stacking sheets as claimed in independent claim 1, and a method for stacking sheets as claimed in independent claim 9. Preferred embodiments of the invention are set out in the dependent claims. The device in accordance with the invention can be incorporated in a processor, as claimed in claim 7, or in a transport trolley, as claimed in claim 8.

[0008] In this document, a "sheet" is preferably a printing plate, more preferably an aluminum printing plate. A "sheet" may however also be a, generally rectangular, piece of poly(ethylene terephtalate), of paper, cardboard, plastic, sticker material, etc.

[0009] A device in accordance with the invention comprises supporting means to support a sheet, so that the supporting means can protrude from the device over a protruding length. The device further comprises means to increase the protruding length; advantageously the protruding length is increased while the sheet is supported by the supporting means.

[0010] Before a sheet is supported, the protruding length may be zero.

[0011] In a preferred embodiment of the invention, the supporting means is rollable or collapsible.

[0012] An important advantage of a device according to the invention is that it is space-saving. Another advantage is that it is simple and inexpensive.

[0013] Since a device in accordance with the invention is compact and cheap, it may be incorporated into a transport trolley or into a processor.

[0014] Preferred embodiments of a device in accordance with the invention may include features of a method - as claimed or as described below - in accordance with the invention, and vice versa.

[0015] Further advantages and embodiments of the present invention will become apparent from the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The invention is described with reference to the following drawings without the intention to limit the invention thereto, and in which:

Figs. 1 and 2 show a prior art device, in diagram form;
Fig. 3A shows, in diagram form, a device in accordance with the invention;
Fig. 3B shows a first embodiment of a supporting means in accordance with the invention;
Figs. 4A and 4B show a second embodiment of a supporting means in accordance with the invention;
Fig. 5 shows a third embodiment of a supporting means in accordance with the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Fig. 3A shows a first embodiment of a stacking device 30 in accordance with the invention. A sheet 25 is output by a processor; for simplicity, only the output roller pair 11 of the processor is shown in Fig. 3A. The output roller pair 11 moves sheet 25 to stacking device 30, where sheet 25 is supported by a supporting means 40.

[0018] In the embodiment shown in Fig. 3A, the supporting means 40 includes a flexible strip 40, that is

shown in more detail in Fig. 3B. The flexible strip 40 may be a steel tape of a type that is customarily used for measuring purposes. The stiffness of such steel measuring tapes is low enough so that they are rollable, and that a measuring tape can be stored coiled up in its housing; yet a steel measuring tape has a sufficiently high stiffness so that an unrolled, straightened tape can support a load. Advantageously, instead of a steel measuring tape, a flexible strip 40 as shown in Fig. 3B is used. Moreover, it is preferred to use a plurality of steel tapes or flexible strips 40. E.g. an aluminum printing plate having a width of 67 cm (in the direction perpendicular to the plane of Fig. 3A) and a length of 70 cm may be supported by four such flexible strips 40, spaced at regular distances in the direction perpendicular to the plane of Fig. 3A.

[0019] The supporting means 40 of this embodiment of the invention is thus rollable; however this does not imply that the supporting means is coiled up when it is not in use. In Fig. 3A, the supporting means 40, when not in use, is oriented vertically with respect to the floor 50, so that it only requires minimal floor space. When a sheet 25 arrives from the processor, the supporting means 40 is moved in the direction of arrow B and bent to a horizontal orientation by guiding means 36. The portion of the supporting means 40 that is guided by guiding means 36 is in a curved state; when it leaves guiding means 36, this portion is straightened by its own elasticity and may then support a sheet 25.

[0020] In the embodiment shown in Fig. 3A, a sheet 25 is put onto a stack as follows. Sheet 25 exits from the processor 10 (not shown in Fig. 3A) and is still transported by the output roller pair 11 of the processor. Then, sheet 25 as well as supporting means 40 are moved in the direction of arrow B by rollers 37 and 38, i.e. the protruding length L of supporting means 40 is increased while the supporting means 40 supports sheet 25. As shown in Fig. 3A, the axes of rollers 37 and 38 are not located in the same vertical plane: the leading edge 26 of sheet 25 first reaches roller 37 and afterwards roller 38. The supporting means 40 passes over roller 37 and under roller 38. Sheet 25 is supported by supporting means 40, and also, initially, by roller 37; roller 38 presses slightly on sheet 25. Supporting means 40 and the leading edge 26 of sheet 25 bend somewhat downwards as they are moved further in the direction of arrow B, but this does not affect the operation of the stacking device 30. When the trailing edge 27 of sheet 25 is moved past roller 38, rollers 37 and 38 are stopped and their direction of rotation is reversed. Supporting means 40 and sheet 25 are now moved in the direction opposite to that of arrow B. Sheet 25, which is supported only by supporting means 40, is stopped by stop means 35, as explained further below, so that supporting means 40 is withdrawn but sheet 25 is not. When supporting means 40 is completely withdrawn, sheet 25 drops by gravity into receiving means such as tray 45 shown in Fig. 3A. Now, the next sheet 25 exiting from the processor may be handled, so that a stack of sheets 25 is formed in tray 25. Advantageously, the withdrawal speed of supporting means 40 is larger than the transport speed in the direction of arrow B (e.g. twice as large); this allows short delays between successive sheets.

[0021] In a preferred embodiment, the stop means includes two identical cams 35 and the supporting means comprises four flexible strips 40; the two cams 35 are positioned respectively between the first and the second and between the third and the fourth flexible strips 40, when viewed in the direction perpendicular to the plane of Fig. 3A. The position and the shape of cams 35 are such that the leading edge 26 of sheet 25 pushes against the cams 35 so that they rotate around point P in the sense of arrow D; sheet 25 can now freely pass the cams. After the trailing edge 27 of sheet 25 passed cams 35, the cams rotate back to their rest position by gravity, so that their sides 34 are approximately vertical. When withdrawing supporting means 40, in the direction opposite to that of arrow B, the trailing edge 27 of sheet 25 is caught by edges 39 of cams 35. Cams 35 are blocked so that they cannot rotate beyond their rest position in the sense opposite to arrow D.

[0022] As is clear from the explanation above, a single drive means suffices for rollers 37 and 38, and cams 35 do not need a drive means. The single drive means is used for increasing the protruding length L of supporting means 40 and for withdrawing the supporting means 40. Using only one drive means is an advantage with respect to prior art devices as shown in Figs. 1 and 2, which use two motors: a first motor to move the strings 31 to transport a sheet 25 in the direction of arrow B (see Fig. 1) and a second motor to rotate the tilting bars 21 and sheet 25 in the direction of arrow C (see Fig. 2) .

[0023] Another advantage of a stacking device 30 in accordance with the invention is that it is much smaller than a prior art device. When the stacking device is not in use, tray 45 in Fig. 3A may manually be rotated around hinge 46 over an angle of 90° in the direction of arrow D, so that stacking device 30 requires much less floor space than the prior art device 30 shown in Figs. 1 and 2. Such a rotation may also be used to transfer a stack of sheets 25 from stacking device 30 to a transport trolley 20. Alternatively, stacking device 30 may be incorporated in a transport trolley 20; this transport trolley is then wheeled away by an operator and replaced by an empty transport trolley 20 (also including a stacking device 30) when a certain number of sheets 25 have accumulated in tray 45. In yet another embodiment, a portion of the stacking device 30 is incorporated in the transport trolley 20, while another portion is either a separate apparatus or is incorporated in the processor 10. For example, of the embodiment of stacking device 30 as shown in Fig. 3A, the receiving means 45 may be incorporated in the transport trolley 20, while the supporting means 40, the means 36, 37, 38 for increasing the protruding length L of the stacking device 30 and the stop means 35, are either part of a separate apparatus

or are incorporated in the processor 10.

[0024] Fig. 3B shows a preferred embodiment of a flexible strip 40. It has the shape of a very flattened U. It may be made of a metal, preferably steel. Its thickness, e.g. 0.25 mm, is chosen to obtain an appropriate stiffness: large enough to support a sheet 25, and small enough to be easily deformed by guiding means 36. In Fig. 3B, only a short portion of a flexible strip 40 is shown; in practice, a flexible strip 40 has a larger length.

[0025] Instead of a flexible strip 40, other embodiments of supporting means can be used. Figs. 4A and 4B show in diagram form a supporting means 41 comprising successive segments, interlinked by hinges, and further comprising means to allow the supporting means to span a long self-supporting length. Such a type of supporting means 41 is called a "multi-segment supporting means" in this document; it is customarily used in cable carrier systems, wherein it guides one or more cables from a stationary connection to a movable device. More information on cable carrier systems and on multi-segment supporting means can be found e.g. in patent **US-A-4 625 507**. Figs. 4A and 4B illustrate two variants of an embodiment with multi-segment supporting means 41; for simplicity, only a sheet 25, a multi-segment supporting means 41 and their orientation with respect to the floor 50 are shown; the rest of the stacking device 30 can easily be designed by a person skilled in the art, starting from the stacking device illustrated in Fig. 3A. The multi-segment supporting means 41 is moved at a speed v_2, which is preferably twice the speed v_1 of the sheet 25 since both the portion 43 of the supporting means 41 that supports the sheet 25 and the portion 44 that does not support the sheet 25 have to be advanced, so that sheet 25 may be supported adequately, over its entire length.

[0026] Fig. 5 shows in diagram form yet another embodiment of a supporting means; here also, only a sheet 25, the supporting means 42 and their orientation with respect to the floor 50 are shown. The supporting means 42 is telescopic (as a telescopic car antenna). It includes several segments that may be moved e.g. by a rope transfer mechanism: the telescopic supporting means 42 is retracted by pulling the rope 48; it is extended by pushing the rope 48. Rope 48 may be made of a synthetic resin having moderate hardness and elasticity. The portion of rope 48 outside the supporting means 42 may be coiled on a spool.

[0027] As in the case of flexible strips 40, it is preferred to use more than one, e.g. four, multi-segment supporting means 41 or telescopic supporting means 42.

[0028] The supporting means shown in Figs. 3A to 5 are rollable or collapsible, so that they may assume a compact shape when not in use. This allows a space-saving construction of the stacking device 30. In this document, a "rollable" supporting means does not mean that the supporting means has to be coiled upon a spool; it suffices that the supporting means can be deformed to a curved state (as e.g. by the guiding means 36 in Fig. 3A).

[0029] The invention is not limited to the types of supporting means discussed above; any other means as known in the art and falling within the scope of the claims may be used.

[0030] The invention may be applied to any kind of sheets, but is especially useful for printing plates, because of their larger stiffness. Film sheets and other flexible sheets can easily be bent when output from the processor, and stacked vertically in a tray, thus requiring only little floor space. Printing plates, on the other hand, have a larger stiffness and often have large dimensions, so that prior art stacking devices are bulky, as illustrated by Figs. 1 and 2.

EXAMPLE

[0031] In the embodiment shown in Figs. 3A and 3B:

- number of flexible strips 40 : 4
- spacing between two strips : 20 cm
- dimensions of a flexible strip :
  - thickness : 0.25 mm
  - width : 15 mm
  - length : 120 cm
- sheet 25 :
  - aluminum printing plate
  - thickness : 0.15 mm
  - length : 70 cm
  - width : 67 cm

[0032] Those skilled in the art will appreciate that numerous modifications and variations may be made to the embodiments disclosed above without departing from the scope of the present invention.

List of reference signs

[0033]

10 : processor
11 : roller pair
20 : transport trolley
21 : tilting bar
22 : hinge
23 : trolley bottom
25 : sheet
26 : leading edge
27 : trailing edge
30 : stacker
31 : string
32 : pulley
33 : pulley
34 : side

35 : cam
36 : guide
37 : roller
38 : roller
39 : edge
40 : flexible strip
41 : multi-segment support
42 : telescopic support
43 : portion
44 : portion
45 : tray
46 : hinge
48 : rope
50 : floor
A : arrow
B : arrow
C : arrow
D : arrow
L : length
P : point

Claims

1. A device (30) for making a stack of sheets (25), the device (30) comprising supporting means (31, 40-42) for supporting a given sheet (25) and for protruding from said device (30) over a protruding length (L);
characterized in that said device (30) further comprises means (36, 37, 38) for increasing said protruding length (L) while supporting said given sheet (25) by said supporting means (31, 40-42) .

2. The device (30) according to claim 1 wherein said supporting means (31, 40-42) is selected from the group of a rollable supporting means (40, 41) and a collapsible supporting means (42) .

3. The device (30) according to claim 2 wherein said supporting means (31, 40-42) comprises a flexible strip (40) for supporting said given sheet (25).

4. The device (30) according to any one of the preceding claims wherein said given sheet (25) is a printing plate (25).

5. The device (30) according to any one of the preceding claims further comprising means (37, 38, 48) for withdrawing said supporting means (40-42) and stop means (35) for stopping said given sheet (25) during said withdrawal.

6. The device (30) according to claim 5 further comprising receiving means (45) for receiving said given sheet (25) onto said stack of sheets (25) after said withdrawal of said supporting means (40-42) .

7. A processor (10) for processing said given sheet (25), the processor (10) comprising a device (30) according to any one of claims 1 to 6.

8. A transport trolley (20) for transporting said stack of sheets (25), the transport trolley (20) comprising a device (30) according to any one of claims 1 to 6.

9. A method for making a stack of sheets (25), the method comprising the step of:

- supporting a given sheet (25) by supporting means (31, 40-42) protruding from a stacking device (30) over a protruding length (L) ;

characterized in that the method further comprises the step of:

- increasing said protruding length (L) while supporting said given sheet (25) .

10. The method according to claim 9 wherein said given sheet (25) is a printing plate (25) .

11. The method according to claim 9 or claim 10 further comprising the step of:

- straightening a portion of said supporting means (40-42) from a state of said portion selected from the group of a collapsed state and a curved state;
- supporting said given sheet (25) by said straightened portion.

12. The method according to any one of claims 9 to 11 further comprising the step of:

- withdrawing said supporting means (40-42) without withdrawing said given sheet (25).

13. The method according to any one of claims 9 to 12 further comprising the step of:

- dropping (25) said given sheet onto said stack of sheets (25).

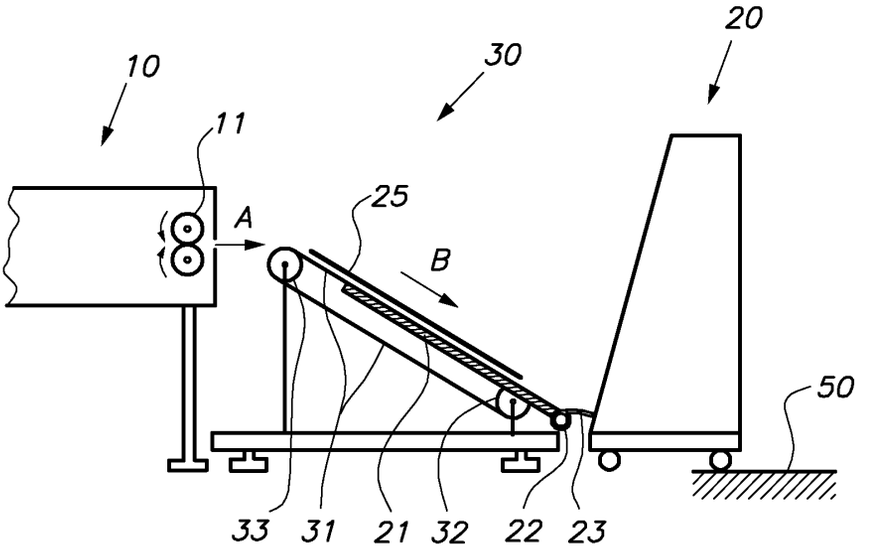

FIG. 1 PRIOR ART

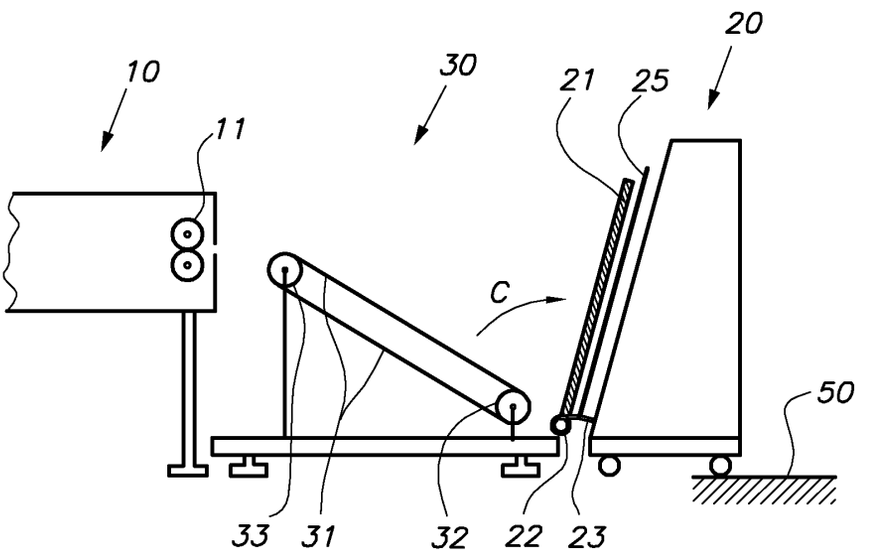

FIG. 2 PRIOR ART

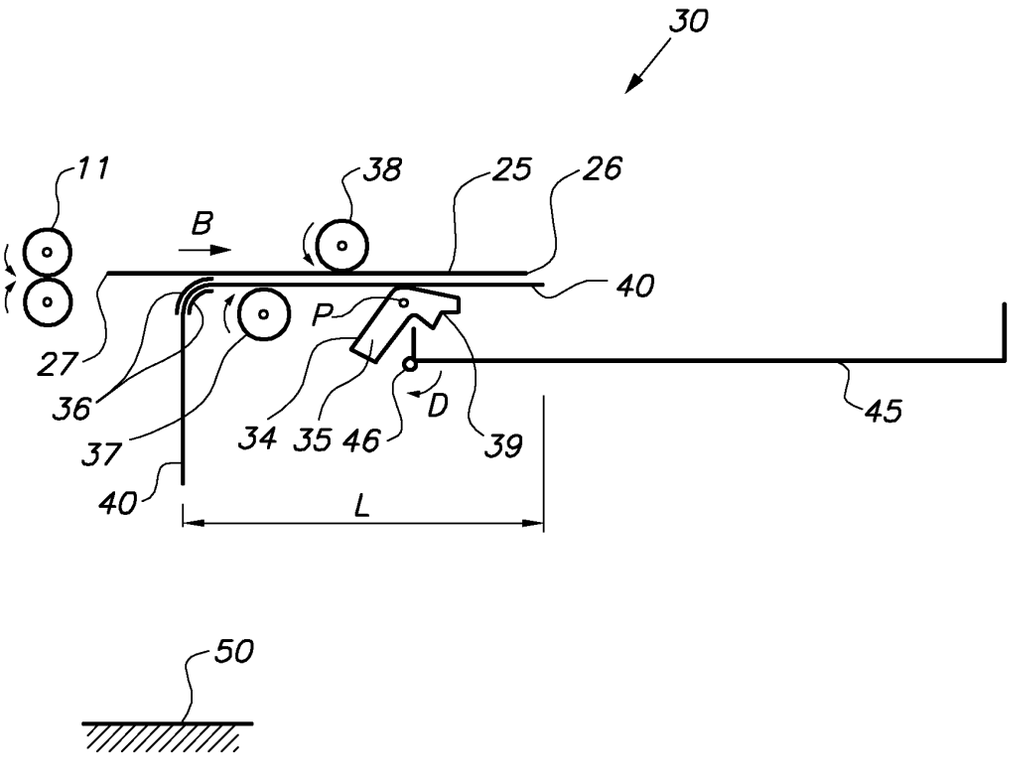

FIG. 3A

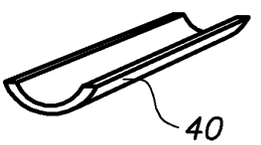

FIG. 3B

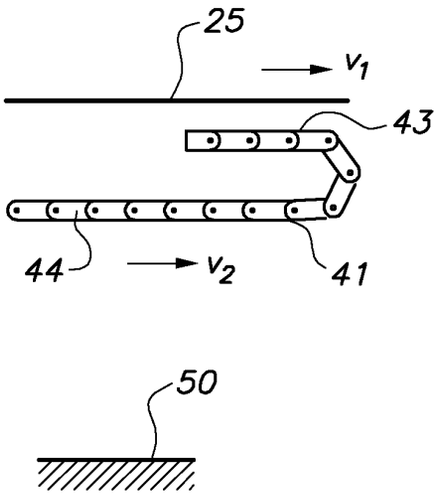

FIG. 4A

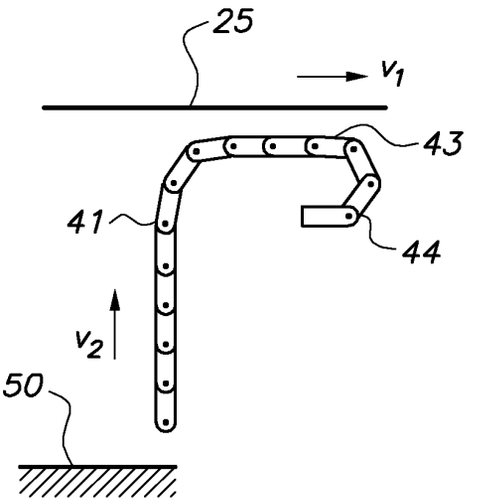

FIG. 4B

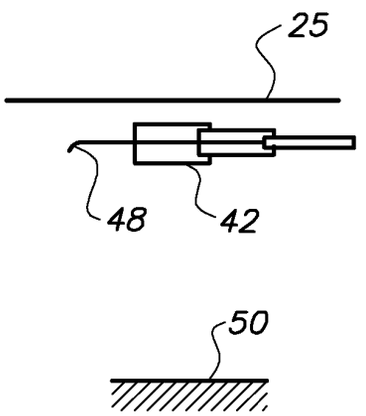

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 02 10 2373

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 327 (M-0998), 13 July 1990 (1990-07-13) & JP 02 110069 A (FUJI PHOTO FILM CO LTD), 23 April 1990 (1990-04-23) * abstract *	1,9	TECHNICAL FIELDS SEARCHED (Int.Cl.7) B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 February 2003	Thibaut, E

CATEGORY OF CITED DOCUMENTS

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