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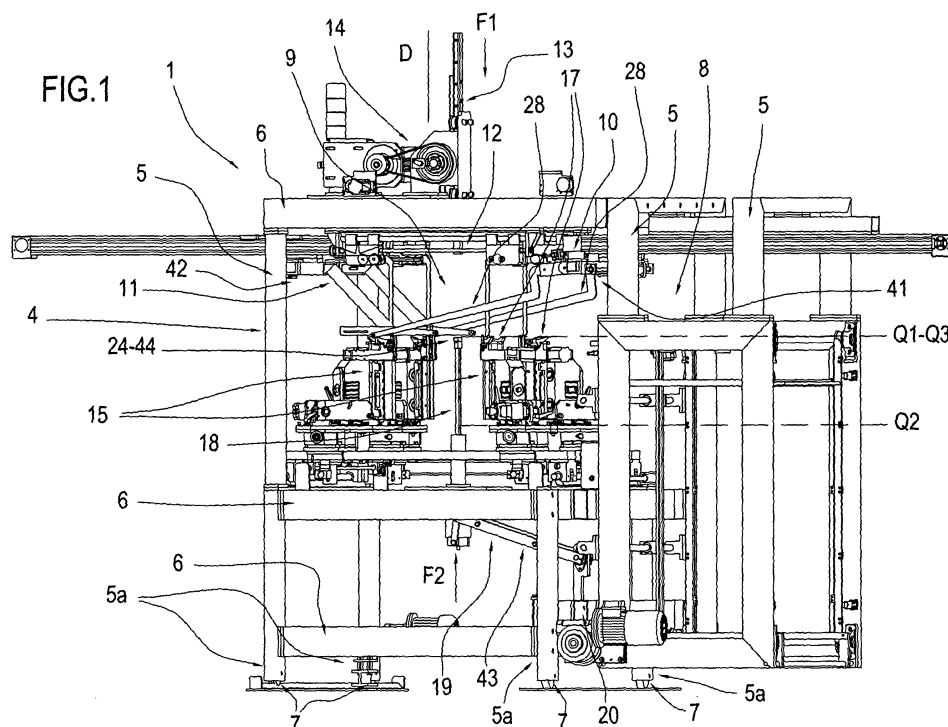
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(54) **Box erecting apparatus and method**

(57) The apparatus for erecting boxes (2) using flat blanks (3) made of card, comprises: a station (8) for storing the blanks (3), a unit (9) for erecting the blanks (3), said unit (9) being designed to fold portions (3a) of the blanks (3) themselves in such a way as to form the boxes (2); means (41) for feeding the blanks (3) picked up from the storage station (8) to the erecting unit (9), the blanks (3) being fed to the erecting unit (9) at a first defined height (Q1); means (42) for transferring the erect-

ed boxes (2) to further processing units. The erecting unit (9) comprises a vertically mobile mandrel (12) and folding elements (17) that press the blank (3) against the mandrel (12), the mandrel (12) being designed to engage and hold the blank (3), while the latter is in a substantially flat configuration, and to move it from a first position, located at the aforementioned first defined height (Q1), to a second position, located at a second defined height (Q2) where the blank (3) defines the erected box (2).



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Description

[0001] The present invention relates to an apparatus for erecting boxes.

[0002] In particular, the present invention relates to an apparatus for erecting boxes from flat blanks made of card.

[0003] The invention also relates to a method for erecting boxes using flat blanks made of card.

[0004] Prior art apparatus and machines for erecting boxes normally comprise a magazine for the flat blanks, a station for picking up the blanks and feeding them to an erecting unit where the blanks, moved by a vertical mandrel, are folded by contact with suitable folders along defined fold lines or creases in such a way as to form the side walls of the boxes.

[0005] The side walls are then connected to each other by joining elements consisting usually of lengths of adhesive tape.

[0006] The lengths of adhesive tape are normally applied by application heads located at the side corners of the boxes being erected.

[0007] The partly erected box, is then fed out and conveyed either directly or after further processing to a covering machine.

[0008] The covering machine is a machine of known type that covers the boxes, for example with sheets of paper to give them an appropriate surface finish which may reproduce a company logo or the name of the end user of the boxes.

[0009] The process cycle of the covering machine is such that the boxes to be covered must be fed to the machine at a precise and well-defined height from the floor. This height is determined mainly by the maximum dimensions of the boxes that may be covered.

[0010] Since the erecting apparatus folds the boxes by causing the mandrel to lower the blanks and then feeds the erected boxes out from the bottom, it is evident that to be able to feed the boxes to the covering machine at the defined height, the erecting station and all the other stations upstream must be positioned at a height above the covering machine.

[0011] This positioning constraint means that most of the units or stations making up the erecting apparatus must be positioned at a height where they are not directly accessible to the operator.

[0012] As a result, the erecting apparatus has to be equipped with gangways running substantially all the way round the apparatus.

[0013] This necessity has several drawbacks, including, for example, the fact that it appreciably increases the overall dimensions of the erecting apparatus and also that the apparatus has to be provided with a complex supporting framework.

[0014] Another drawback typical of prior art erecting apparatus is connected with the blank pickup and feed stations. These stations normally comprise devices for fast feeding the blanks. These fast infeed devices have

a pair of parallel counterrotating rollers. The rollers revolve at high speed and have a rough surface finish designed to grip the blanks one by one. When a blank comes between the two rollers, it is accelerated and fed at high speed to the erecting unit.

[0015] This high-speed feed operation, besides being very difficult to adjust, is also quite dangerous not only because the blanks move very fast but also because the rollers revolve at extremely high speeds and therefore are themselves a source of accident risk for operators working on the apparatus.

[0016] In order to reduce the risk of accidents, bulky screens have been introduced. These screens, besides being cumbersome, also make it difficult for operators to access the apparatus for normal operations and maintenance.

[0017] The aim of this invention is to overcome the above mentioned disadvantages through a box erecting apparatus that is economical to make, efficient and practical to use.

[0018] Another aim of the invention is to provide a box erecting method that is easy to implement and effective.

[0019] The technical characteristics of the invention, with reference to the above aims, can be easily inferred from the appended claims.

[0020] The advantages of the invention are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate a preferred embodiment of the invention provided merely by way of example, without restricting the scope of the inventive concept, and in which:

- Figure 1 is a front perspective view of a preferred embodiment of the box erecting apparatus according to the present invention;
- Figure 2 is a schematic top plan view of the apparatus of Figure 1;
- Figures 3 to 5 are perspective views from above of three details of the apparatus illustrated in Figures 1 and 2;
- Figure 6 is a top plan view of a flat blank from which a box is erected according to the present invention;
- Figure 7 is a perspective view from above of box erected from the blank of Figure 6.

[0021] With reference to Figure 1, the reference numeral 1 denotes in its entirety an apparatus for erecting boxes 2 made according to the present invention.

[0022] The boxes 2, an example of which is illustrated in Figure 7, are made by erecting flat card blanks 3 of the type shown in Figure 6.

[0023] The apparatus 1 comprises a supporting frame 4 consisting of a plurality of interconnected uprights 5 and crosspieces 6.

[0024] At the bottom ends 5a of four uprights 5, there are respective supporting elements 7, such as wheels and/or feet, by which the apparatus rests on the floor.

[0025] The apparatus 1 comprises a station 8 for stor-

ing the flat blanks 3 and a blank 3 erecting unit 9 which folds portions 3a of the blanks 3 about respective fold lines L thereby shaping the boxes 2.

[0026] The apparatus 1 also comprises first means 10 for transporting the flat blanks 3 and second means 11 for transporting the erected boxes 2.

[0027] The erecting unit 9 comprises a customary mandrel 12 (not illustrated in detail in the accompanying drawings) positioned at the bottom end of a reciprocating rod 13 that is driven vertically in a defined direction D by respective drive means 14.

[0028] The erecting unit 9 also comprises a plurality of heads 15 which are not illustrated in detail in the accompanying drawings, said heads 15 being designed to join the vertical corners 16 of the box 2 being erected by applying respective lengths 16a of heat adhesive tape.

[0029] At the tops of the heads 15 there are folding elements 17 (not illustrated in detail), said elements 17 being designed to engage the blank 3 in order to fold the blank 3 portions 3a which form the respective walls 2a of the erected box.

[0030] As illustrated in Figures 1 and 3, the erecting unit 9 further comprises a lifting arm 18 which extends lengthways in the direction D and is connected by a linkage 19 to a block 20 attached to the frame 4.

[0031] As explained in more detail below, the arm 18 is driven in the direction D by a pneumatic spring 21, a mobile stem of which 22 acts directly on the linkage 19 and, thus, indirectly, on the arm 18 itself.

[0032] Instead of the pneumatic spring 21, the lifting arm 18 may be driven by an electric or pneumatic actuator, neither of which is illustrated.

[0033] The pneumatic spring 21 or the electric actuator or the pneumatic actuator constitutes means 23 for driving the lifting arm 18.

[0034] With reference to Figure 3, the top of the lifting arm 18 has detachably fixed to it a plate 24 that is designed, as described in more detail in the rest of this specification, to support the blank 3 and the box 2 during the different operating steps performed by the erecting unit 9.

[0035] The aforementioned first transporting means 10 are mobile between a first retracted configuration, not illustrated in Figure 1, for picking up the flat blanks 3 from the storage station 8 and a second, advanced configuration, illustrated in Figure 1, for releasing the blanks 3 at the erecting unit 9.

[0036] With reference to Figure 4, the first transporting means 10 are supported by and slidably engaged with a respective straight guide rail 25 which is in turn supported at the top, as shown in Figure 1, by two crosspieces 6 forming part of the frame 4.

[0037] As illustrated, again in Figure 4, the first transporting means 10 comprise a central body 26, a crosspiece 27 attached to the central body 26 and two arms 28 which, at their respective first ends 28a, are pivoted on respective blocks 29.

[0038] The blocks 29 are slidably supported by the aforementioned crosspiece 27 and are screwed to a threaded rod 32a connected to a motor 32 so that the distance of the blocks 29 from each other can be adjusted according to the size of the blank 3 to be picked up.

[0039] Each block 29 has mounted on it an actuator 30, advantageously pneumatic, designed to allow the respective arm 28 to swing about its pivot axis A.

[0040] At its second end 28b, opposite the aforementioned first end 28a, each arm 28 has a suction element 31 for picking up and holding the blanks 3.

[0041] A motor (not illustrated) drives the first transporting means 10, advantageously through a toothed belt or chain, in such a way as to move the transporting means 10 along the guide rail 25 along a first, substantially straight path P1.

[0042] The aforementioned second means 11 for transporting the boxes 2 are mobile between a first configuration, illustrated in Figure 1, for picking up the erected boxes 2 from the erecting station 9, and a second configuration, not illustrated in Figure 1, for feeding the boxes 2 out towards further processing units of known type and also not illustrated.

[0043] With reference to Figure 5, the second transporting means 11 are supported by and slidably engaged with a respective straight guide rail 33 which is in turn supported at the top, as shown in Figure 1, by crosspieces 6 forming part of the frame 4.

[0044] As illustrated, again in Figure 5, the second transporting means 11 comprise a central body 34, a crosspiece 35 attached to the central body 34 and two arms 36 connected to respective blocks 37.

[0045] The blocks 37 are slidably supported by the aforementioned crosspiece 35 and are screwed to a threaded rod 40a connected to a motor 40 so that the distance of the blocks 37 from each other can be adjusted according to the size of the box 2 to be fed out.

[0046] Each arm 36 has a suction element 38 and a contact plate 39 for picking up and feeding the boxes 2.

[0047] A motor (not illustrated) drives the second transporting means 11, advantageously through a toothed belt or chain, in such a way as to move the transporting means 11 along the guide rail 33 in the direction of a second, substantially straight path P2.

[0048] The first transporting means 10, together with their motor 32 and the guide rail 25 constitute for the erecting apparatus 1 respective means 41 for feeding the blanks 3 to the erecting unit 9.

[0049] The second transporting means 11, together with their motor 40 and the guide rail 33 constitute for the erecting apparatus 1 respective means 42 for transferring the erected boxes 2 to further processing units (not illustrated).

[0050] The lifting arm 18 and the respective drive means 23 constitute means 43 for lifting the erected box 2.

[0051] During use, the suction pickup elements 31 on the arms 28 of the first transporting means pick up a first

blank 3 from a stack of blanks 3 (not illustrated) located in the storage station 8.

[0052] To pick up the blank 3, the arms 28 are lowered a few centimetres by the respective pneumatic actuators 30. Once they are in contact with the blank 3, the suction elements 31 are activated so as to pick up and hold the blank 3 by suction.

[0053] The blank 3 is lifted a few centimetres by the arms 28, driven by the actuators 30, and then moved forward by the transporting means 10 in a direction parallel with the first, straight path P1.

[0054] Once they have reached the aforementioned second, releasing configuration, the transporting means 10 lower the blank 3 to a first defined height Q1 and, at this height Q1, allow the flat blank 3 to drop onto the plate 24 mounted on the lifting arm 18 and constituting a respective supporting element 44 for the blank 3 and for the box 2 being erected.

[0055] The first transporting means 10 are then retracted and return to their first configuration to pick up another blank 3.

[0056] Once the blank 3 has been positioned on the supporting element 44, the mandrel 12 is lowered in the direction D as indicated by the arrow F1 in Figure 1. When the mandrel 12 comes into contact with the blank 3, it continues moving down and forces the lifting arm 18 to move down with it.

[0057] During the downward motion, the flat blank 3 portions 3a that will form the vertical walls 2a of the box 2 being erected, are folded by contact with respective folding elements 17 of substantially known type and therefore not illustrated or described in further detail in this specification.

[0058] As mentioned above, these folding elements 17 are located at the top of each of the heads 15 that join the vertical corners 16 of the box 2.

[0059] The downward movement stops when the box 2 has been fully erected and its corners 16 have been joined by respective lengths 16a of heat adhesive tape, at a second defined height Q2, which is lower than the first defined height Q1, as illustrated in Figure 1.

[0060] Obviously, the second height Q2 depends on the size of the box 2 to be erected.

[0061] During the downstroke of the mandrel 12, blank 3 and supporting element 44, the pneumatic spring 21 connected to the lifting arm 18 is compressed and thus accumulates elastic energy which, when the mandrel 12 is lifted back to its raised position shown in Figure 1, causes the lifting arm 18 and the supporting element 44 mounted on it to also move upwardly in the direction indicated by the arrow F2.

[0062] Thus, the erected box 2 located on the supporting element 44 is also lifted until it reaches a third defined height Q3 which, in the preferred embodiment illustrated in the accompanying drawings, substantially coincides with the first height Q1.

[0063] During the aforementioned downward movement of the mandrel 12, the heads 15 are close to the

mandrel 12 and face the blank 3 in such a way as to be able to perform all the required box erecting operations. Once the box 2 has been erected, the heads 15 are moved away from it so that it can be lifted from the height Q2 to the height Q1 without interference.

[0064] When the aforementioned second transporting means 11 are in the first pick-up configuration illustrated in Figure 1, their suction elements 38 engage and hold the erected box 2, whose base 2b is at the third defined height Q3.

[0065] The box 2 is then moved forward in a direction parallel to the straight path P2 of the second transporting means 11 and, when the latter reach the second, out-feed configuration (not illustrated) the box 2 is transferred to the aforementioned means which feed it to the further processing units, whose description is outside the scope of this invention.

[0066] It should be noticed that, for greater clarity, the arms 28 and 36 forming part of the first and second transporting means 10, 11, respectively, are illustrated in the accompanying drawings in their furthest apart configurations suitable for handling boxes 2 of the largest size. On the other hand, again for clarity, the element 44 for supporting the blank 3 on the lifting arm 18 is illustrated in a version of it suitable for handling boxes 2 of the smallest size (see Figure 3).

[0067] In this specification, the term erected box 2 is used to include a partially finished box requiring further processing by other operating units.

[0068] In this specification, too, the term "pneumatic actuator" includes any type of fluid-operated actuator, whether pneumatic, hydraulic or oil-hydraulic since they are all substantially equivalent for the purposes of the operation of the apparatus according to this invention.

[0069] Advantageously, the apparatus 1 according to this invention comprises a computerised control unit which governs all the functions and operations performed by the apparatus 1, in particular the movements of the motors and actuators.

[0070] As may be clearly inferred from the above description, the present invention advantageously makes it possible to reduce the overall dimensions of the box 2 erecting apparatus 1, providing it with a compact structure and making it easy to access by personnel responsible for its operation and maintenance.

[0071] Another advantage of the invention is that the transporting means 10 allow the blanks 3 to be conveyed from the storage station 8 to the erecting unit 9 without using prior art high-speed feed devices.

[0072] It will be understood that the invention described, useful in many industrial applications, may be modified and adapted in several ways without thereby departing from the scope of the inventive concept and that all the details of the invention may be substituted by technically equivalent elements.

Claims

1. An apparatus for erecting boxes (2), in particular from flat blanks (3) made of card, comprising:

- a station (8) for storing the blanks (3);
- a unit (9) for erecting the blanks (3), said unit (9) being designed to fold portions (3a) of the blanks (3) themselves in such a way as to form the boxes (2);
- means (41) for feeding the blanks (3) picked up from the storage station (8) to the erecting unit (9), the blanks (3) being fed to the erecting unit (9) at a first defined height (Q1);
- means (42) for transferring the erected boxes (2) to further processing units;

the erecting unit (9) comprising a vertically mobile mandrel (12) and folding elements (17) that press the blank (3) against the mandrel (12), the mandrel (12) being designed to engage and hold the blank (3), while the latter is in a substantially flat configuration, and to move it from a first position, located at the aforementioned first defined height (Q1), to a second position, located at a second defined height (Q2) where the blank (3) defines the erected box (2); the apparatus being **characterised in that** the erecting unit (9) comprises lifting means (43) for lifting the erected box (2) from the second defined height (Q2) to a third defined height (Q3) close to the first defined height (Q1).

2. The apparatus according to claim 1, **characterised in that** the third defined height (Q3) substantially coincides with the first defined height (Q1).

3. The apparatus according to claim 1 or 2, **characterised in that** the lifting means (43) comprise a lifting arm (18) and actuating means (23) for driving the lifting arm (18).

4. The apparatus according to claim 3, **characterised in that** the actuating means (23) comprise a pneumatic spring (21) operatively connected to the arm (18), said spring (21) being loaded during the downstroke of the mandrel (12) from the first height (Q1) to the second height (Q2).

5. The apparatus according to claim 3, **characterised in that** the actuating means (23) comprise an electric actuator.

6. The apparatus according to claim 3, **characterised in that** the actuating means (23) comprise a pneumatic actuator.

7. The apparatus according to any of the foregoing claims from 3 to 6, **characterised in that** the lifting

means (43) comprise a supporting element (44) mounted on the arm (18) and designed to support the erected box (2) as it moves at least between the second defined height (Q2) and the third defined height (Q3).

8. An apparatus for erecting boxes (2) from flat blanks (3) made of card, in particular according to any of the foregoing claims from 1 to 7, comprising:

- a station (8) for storing the blanks (3);
- a unit (9) for erecting the blanks (3), said unit (9) being designed to fold portions (3a) of the blanks (3) themselves in such a way as to form the boxes (2);
- means (41) for feeding the blanks (3) picked up from the storage station (8) to the erecting unit (9), the apparatus being **characterised in that** the feed means (41) comprise first transporting means (10) mobile at least from a first configuration for picking up the flat blanks (3) from the storage station (8) to a second configuration for releasing the blanks (3) at the erecting unit (9).

9. The apparatus according to claim 8, **characterised in that** the feed means (41) comprise a motor for driving the first transporting means (10) in such a way as to move the transporting means (10), which are mounted on a respective guide rail (25), along a first, substantially straight path (P1).

10. The apparatus according to claim 9, **characterised in that** the first transporting means (10) comprise at least one suction element (31) for picking up the blanks (3).

11. An apparatus for erecting boxes (2) from flat blanks (3) made of card, in particular according to any of the foregoing claims from 1 to 10, comprising:

- a unit (9) for erecting the blanks (3), said unit (9) being designed to fold portions (3a) of the blanks (3) themselves in such a way as to form the boxes (2);
- means (42) for transferring the erected boxes (2) to further processing units, the apparatus being **characterised in that** the transfer means (42) comprise second transporting means (11) mobile at least from a first configuration for picking up the erected boxes (2) at the erecting unit (9) to a second configuration for feeding the erected boxes (2) to further processing units.

12. The apparatus according to claim 11, **characterised in that** the transfer means (42) comprise a motor for driving the second transporting means (11) in such a way as to move the transporting means

(11), which are mounted on a respective guide rail (33), along a second, substantially straight path (P2).

13. The apparatus according to claim 12, **characterised in that** the second transporting means (11) comprise at least one suction element (38) for picking up the blanks (3). 5

14. A method for erecting boxes (2), in particular from flat blanks (3) made of card, comprising: 10

- a step of feeding the flat blanks (3) from a blank (3) storage station (8) to an erecting unit (9) at a first defined height (Q1); 15
- a step of folding portions (3a) of the blanks (3) in such a way as to form the boxes (2);
- a step of transferring the erected boxes (2) to further processing units; 20

the folding step comprising a step of engaging the blanks (3) with a vertically mobile mandrel (12) and a step of moving the mandrel (12) so as to move the blanks (3) from a first position, located at the aforementioned first defined height (Q1), to a second position, located at a second defined height (Q2) where the blank (3) defines the erected box (2); the method being **characterised in that** it comprises a further step of lifting the erected box (2) from the second defined height (Q2) to a third defined height (Q3) close to the first defined height (Q1). 25 30

15. A method for erecting boxes (2) from flat blanks (3) made of card, in particular according to claim 14, comprising: 35

- a step of feeding the flat blanks (3) from a blank (3) storage station (8) to an erecting unit (9);
- a step of folding portions (3a) of the blanks (3) in order to form the boxes (2), the method being **characterised in that** the step of feeding the blanks (3) to the erecting unit (9) comprises the step of picking up the flat blanks (3) from the storage station (8) using first transporting means (10) that move along a respective path. 40 45

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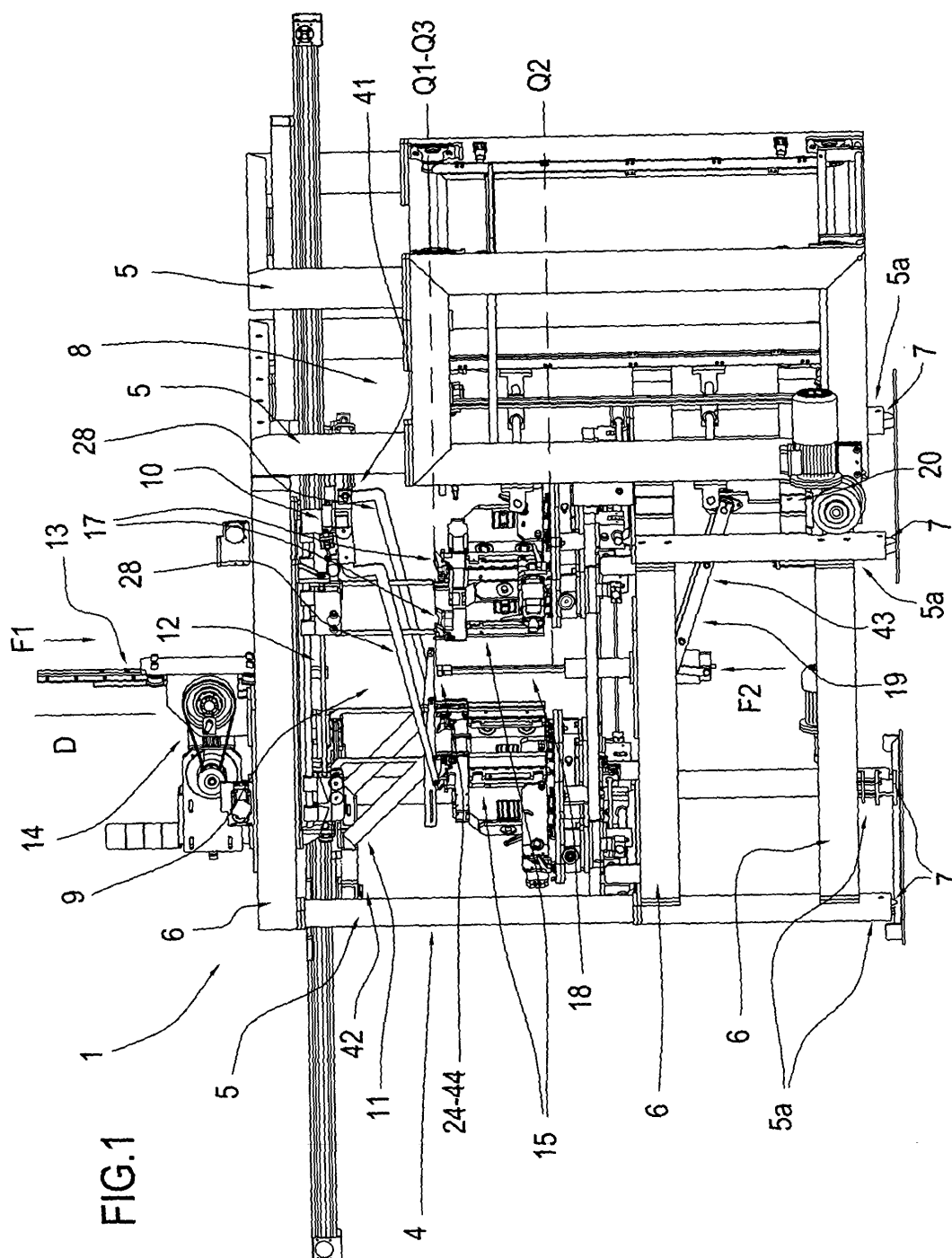
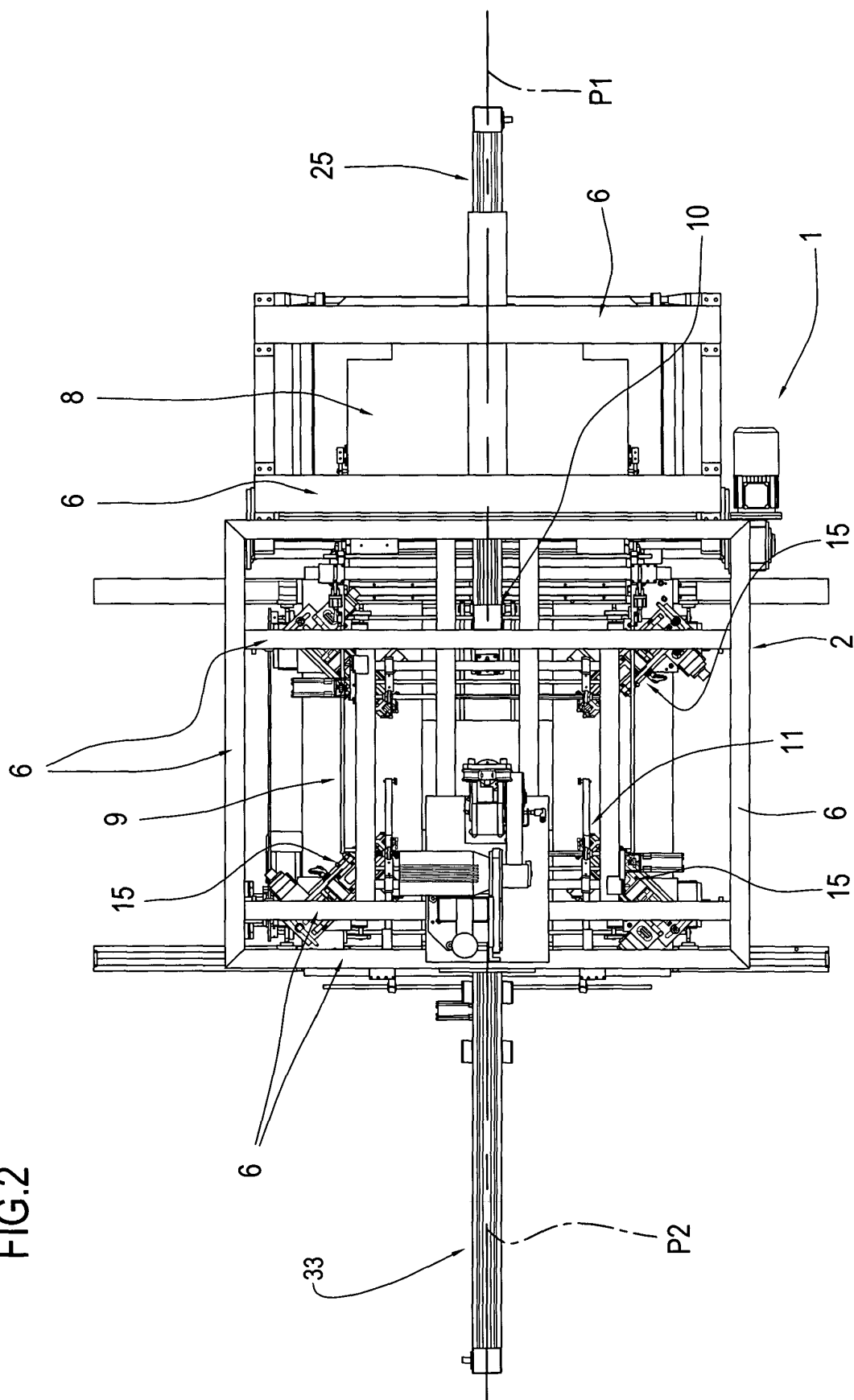
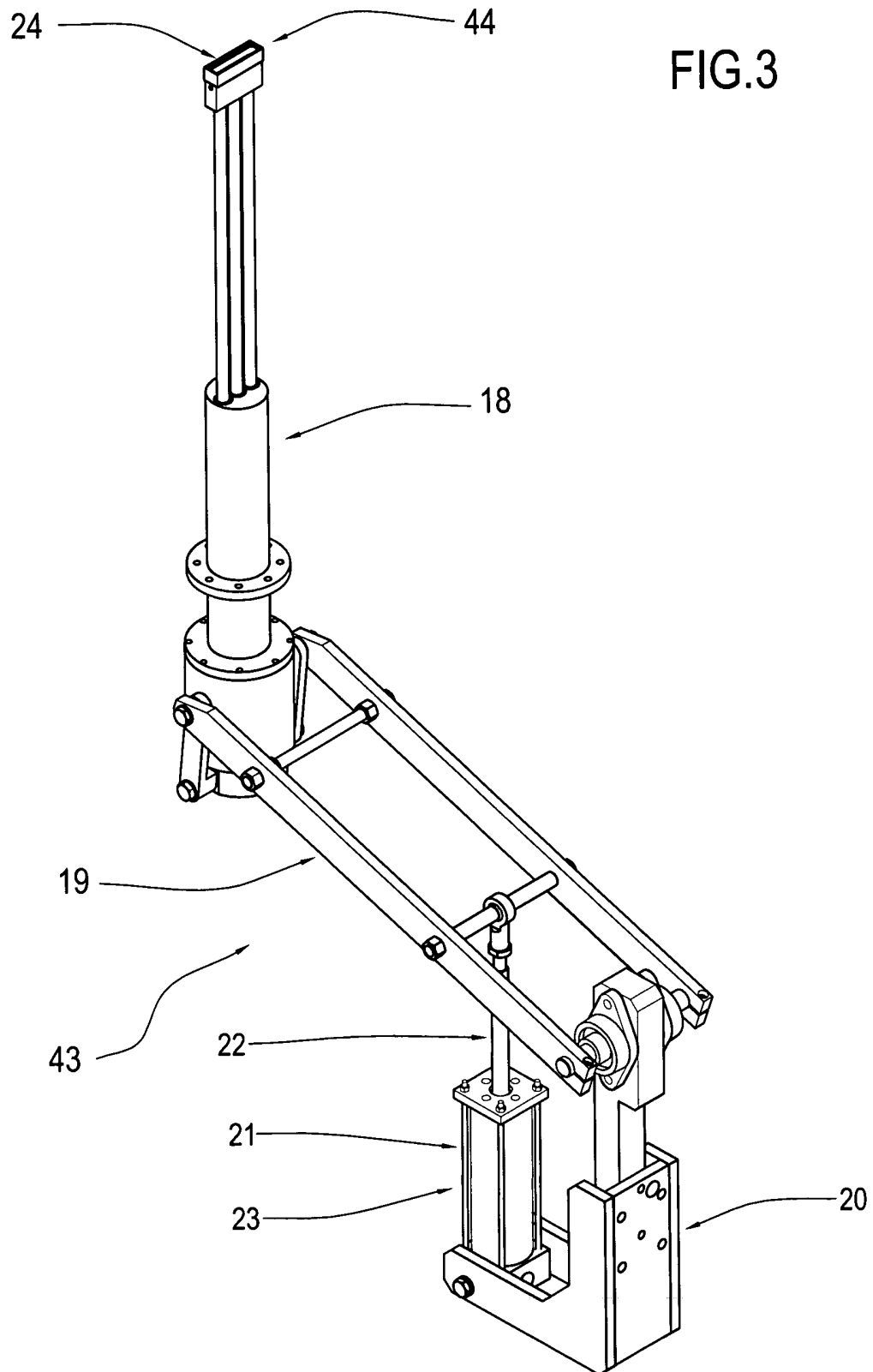


FIG.2





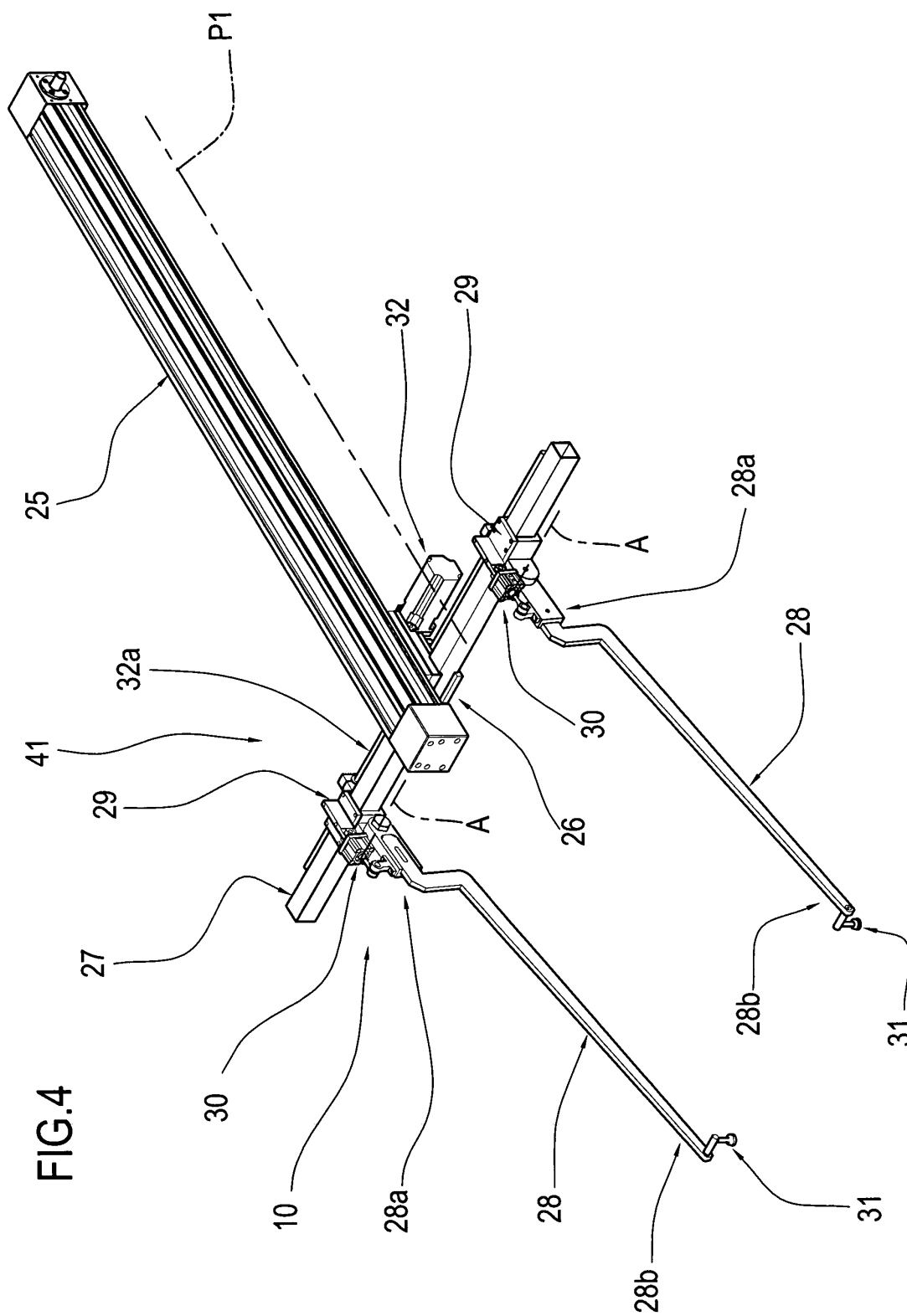


FIG.4

FIG.5

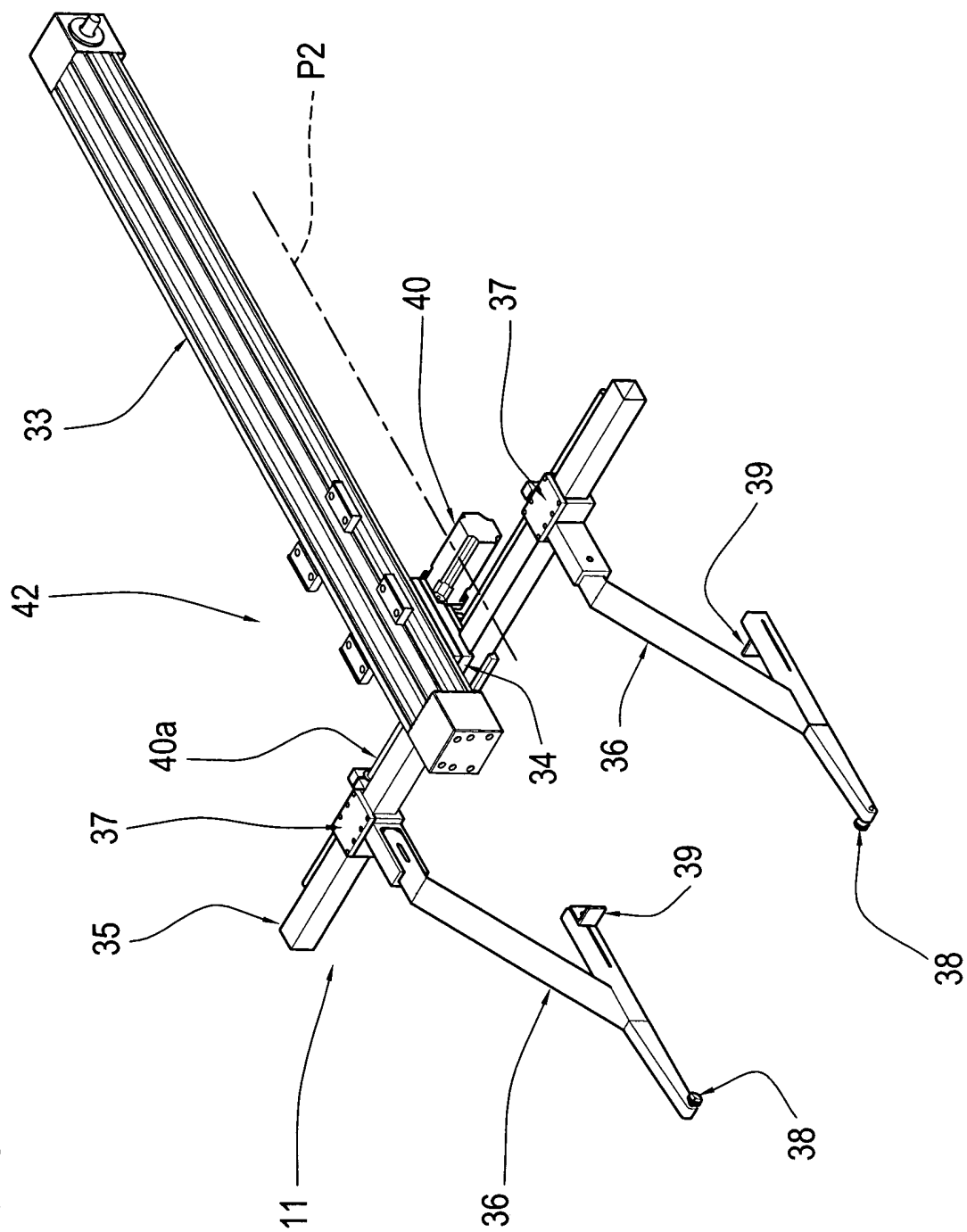


FIG.6

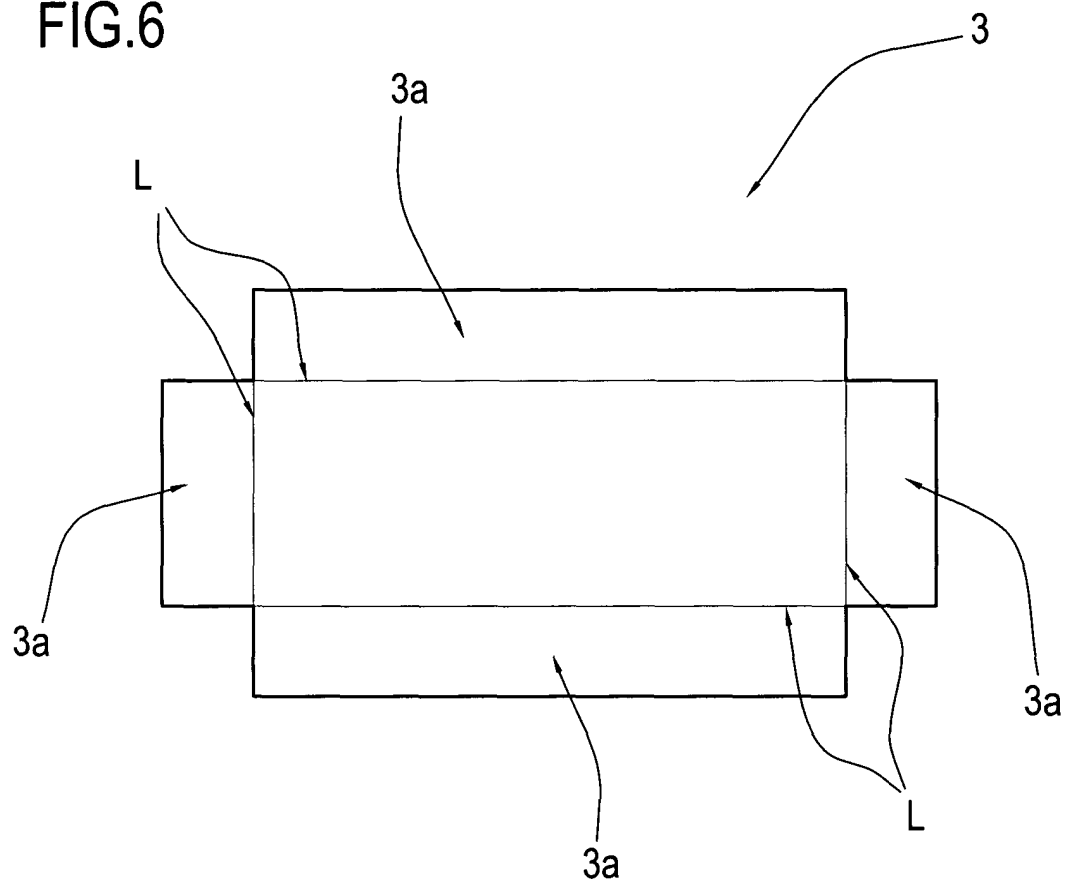
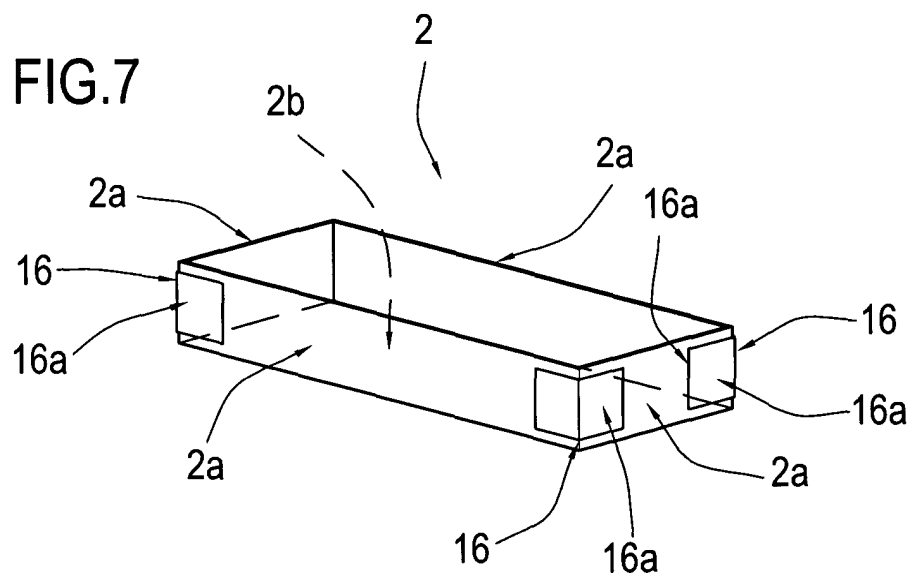


FIG.7





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 42 5445

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	GB 898 364 A (THE METAL BOX COMPANY LIMITED) 6 June 1962 (1962-06-06) * page 2, line 50 - page 3, line 65; figures 1-11 *	1-7,14	B31B3/46 B31B1/12 B31B1/92
X	US 4 368 095 A (GROSS ET AL) 11 January 1983 (1983-01-11) * column 3, line 53 - line 66; figures 1,7 * * column 5, line 1 - line 15 *	1-7,14	
A	US 2 982 188 A (HOFE GEORGE W. VON ET AL) 2 May 1961 (1961-05-02) * column 3, line 49 - line 64; figures 1-4,40 *	1,14	
A	US 3 404 507 A (FEIGEL HAROLD J ET AL) 8 October 1968 (1968-10-08) * column 2, line 35 - column 4, line 9; figures 2,3,6 *	6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B31B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		15 September 2005	Johne, O
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/82 (P04C01)



European Patent
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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-7, 14



European Patent
Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 05 42 5445

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-7,14

means for returning the erected boxes close to the level of
the initial flat blank

2. claims: 8-13,15

means for transporting flat blanks or erected boxes, in
particular suction elements

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 42 5445

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-09-2005

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