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(54) **AUTOMATIC SYSTEM AND METHOD FOR FILLER INSERTION INTO PACKAGE, USING CUTTING MODULES AND GLUE APPLICATOR**

(57) This invention relates to an automatic system for inserting fillers into packaging, using cardboard cutters and glue applicators. The process begins with loading cardboard sheets (1, 2) onto a table, which are then fed by linear units (3, 4) to oscillating cutting modules (11, 12). These units, driven by stepper motors (5, 6, 7, 8), precisely cut the sheets into the required filler sizes. The cut fillers are transported via belt conveyors (9, 10) to a robot's working area (13, 14), where grippers (15, 16) pick them up and move them to an adhesive injection unit (20). Glue is applied, and the fillers are then inserted into moving boxes stabilized by holding mechanisms (18, 19). The entire system, mounted on wheels, can be easily transported and positioned along the packaging line for flexibility. This method enhances efficiency, reduces manual labor, and improves precision and consistency in packaging operations, with the filled boxes continuing along the conveyor for further packaging steps.

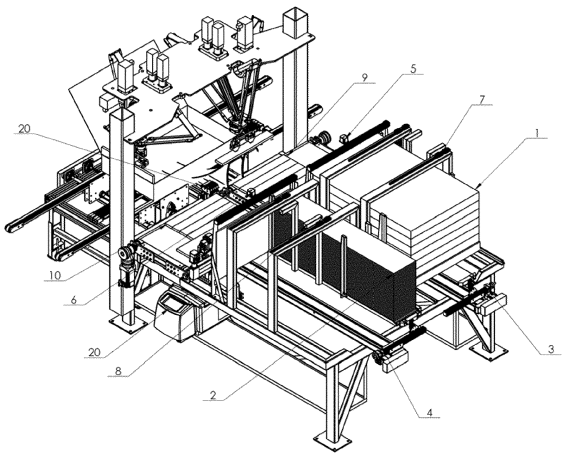

Fig. 1

EP 4 545 428 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a system and method for carton filler insertion into packages, using an cutter and glue applicator. This invention is applicable in all industries where packaging of solid materials is used, particularly in furniture packaging.

BACKGROUND

[0002] The object of the present invention is to provide a compact and efficient solution for the complex furniture packaging problem by integrating a system that combines the cutting of specific size and shape corrugated or honeycomb cartons using an oscillating knife, and precisely placing these cut cartons into packaging boxes as they move along a conveyor line.

[0003] Today, the operator in these industries is manually inserting carton fillers, which is a labor-intensive and time-consuming process. This manual operation significantly hampers the performance and efficiency of the entire line. Additionally, the current lack of flexibility in cutting carton fillers to exact sizes on demand creates logistical challenges and inefficiencies within the factory.

[0004] A document DE4232155 (A1) describes frame elements cut from thick cardboard with an inner honeycomb structure, which are assembled to create supporting or spacer holders. These elements can be cut using laser beams or guillotines to ensure dust-free surfaces, crucial for packing delicate items like electronics.

[0005] This solution requires manual assembly, which is labor-intensive and time-consuming. Also, logistics for pre-cutting of the materials is inefficient and cumbersome.

[0006] A document WO2017153291 discloses a machine and method for producing packaging inserts. There is represented only a single step in the packaging process.

[0007] A document US2019161223 (A1) discloses gripping head (15) for insert sheets (11) for inserting between rows of folding boxes (3) in a receptacle (2), characterized in that it comprises at least one first aspiration element (17a, 17b) designed to grasp an insert sheet (11),at least one second aspiration element (18a, 18b) designed to grasp an insert sheet (11),at least one linear element (19a, 19b) on which at least the first aspiration element (17a, 17b) is mounted and able to slide, a controllable actuating mechanism (20), designed to displace at least the first aspiration element (17a, 17b) by sliding on the at least one linear element (19a, 19b) into a position of grasping in which the at least one first aspiration element (17a, 17b) and the at least one second aspiration element (18a, 18b) are positioned at a spacing from each other in order to grasp an insert sheet (11). There is represented only a single step in the packaging process.

[0008] The proposed invention is a big advantage for the industry for the following reasons: automated cutting and precise placement of carton materials, reducing manual labor and enhancing operational efficiency. It provides flexibility by cutting cartons to exact sizes on demand, minimizing material waste and logistical complexities. Compact and space-efficient, it optimizes factory layouts while improving overall packaging line performance and supporting environmentally responsible practices through efficient material usage.

SUMMARY OF THE DISCLOSURE

[0009] The invention concerns a system designed for the automated preparation of boxes for packaging furniture parts. It efficiently transforms solid sheets into cut fillers of required sizes using cutting modules (oscillating cutting modules, guillotine or rotating disk). Additionally, it includes a glue station to secure these fillers on the short sides of packaging boxes, managed by a robot. This comprehensive system eliminates manual processes, enhances operational efficiency, optimizes factory space, minimizes material wastage through on-demand cutting, and streamlines packaging logistics.

[0010] The table is used for loading cardboard sheets, which serve as the raw material for the packaging fillers. The lines on the left and right sides enable continuous and efficient operation, allowing each line to function independently without interruptions. Linear units feed the bottom sheet from each stack to the oscillating cutting modules, ensuring precise and controlled movement for accurate alignment. Stepper motors automatically adjust the height and width of the cardboard sheets, ensuring correct positioning according to the size specifications of the fillers. Oscillating cutting modules use oscillating blades to cut the cardboard sheets into fillers of the required width, providing precise and clean cuts. Belt conveyors transport the cut fillers from the cutting area to the robot's working area, ensuring smooth and efficient movement and minimizing the risk of damage or misalignment. Robots with grippers to securely hold and manipulate the fillers, enabling precise handling and placement. Adhesive injection unit applies a small amount of glue to the fillers, ensuring controlled application to prevent waste and ensure strong adhesion. The conveyor moves the boxes into the system, positioning them for filler insertion. Holding mechanisms stabilize the boxes during filler insertion, ensuring they remain steady and correctly aligned. Robots place the glued fillers into the moving boxes with high precision, ensuring they are securely attached to the short sides of the boxes.

[0011] The entire system is mounted on wheels, allowing it to be easily transported and positioned at any location along the packaging line. This mobility provides flexibility in configuring the packaging line, enabling quick adjustments and reconfigurations to meet varying production needs.

[0012] The filled and secured boxes continue along the

conveyor for further packaging steps.

[0013] A method for automated filler insertion into packaging, comprising the steps of:

Loading cardboard sheets onto a designated table, wherein said cardboard sheets serve as the raw material from which the packaging fillers will be cut. Providing independent feeding lines on both the left and right sides to facilitate continuous and efficient operation, ensuring that each line can operate independently without interruptions. Feeding the bottom sheet from each stack to oscillating cutting modules using linear units driven by motors, wherein said motors ensure precise and controlled movement of the sheets, aligning them correctly for the cutting process. Automatically adjusting the height and width of the cardboard sheets using motors, wherein this adjustment is crucial to ensure that the sheets are positioned correctly according to the size specifications of the fillers to be cut. Cutting the cardboard sheets into fillers of the required width using oscillating cutting modules, wherein the oscillating motion of the blades provides precise and clean cuts, ensuring that the fillers are accurately sized for their intended use. Transporting the cut fillers from the cutting area to a robot's working area via belt conveyors, wherein the conveyors ensure smooth and efficient movement of the fillers, minimizing the risk of damage or misalignment. Picking up the cut fillers from the conveyor using robots equipped with grippers, wherein the grippers securely hold the fillers without causing any damage, enabling precise handling and placement. Moving the fillers to an adhesive injection unit using robots, wherein a small amount of glue is applied to the appropriate areas of the fillers, ensuring controlled application to prevent waste and ensure strong adhesion. Positioning boxes for filler insertion, wherein the boxes are moved along a belt conveyor and stabilized by holding mechanisms, ensuring the boxes remain steady and correctly aligned during the filler insertion process. Inserting the glued fillers into the moving boxes using robots, wherein the fillers are securely attached to the short sides of the boxes with high precision. Transporting the entire system mounted on wheels, allowing the system to be easily transported and positioned at any location along the packaging line, thereby providing flexibility in configuring the packaging line and enabling quick adjustments and reconfigurations to meet varying production needs. Continuing the boxes with fillers along the conveyor for further packaging steps, such as placing the production items into the box.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 Automatic system for filler insertion into package, using cardboard cutter and glue applicator layout view from back.

Fig. 2 Automatic system for filler insertion into package, using cardboard cutter and glue applicator layout view from front.

1, 2 - cardboard sheets, 3, 4 - linear units, 5, 6, 7, 8 - stepper motors, 9, 10 - belt conveyor 11, 12 - cutting modules, 13, 14 - robot's, 15, 16 - gripper, 17 - belt conveyor, 18, 19 - holding mechanisms, 20 - adhesive injection unit.

DETAILED DESCRIPTION OF THE INVENTION

[0015] For a better explanation of the essence and the characteristics of the invention, the detailed description of the system and the method of the automated filler preparation and insertion into package is described. It should be understood that numerous specific details are presented to provide a complete and comprehensible description of the invention embodiment. However, the person skilled in the art will understand that the embodiment examples do not limit the application of the invention, which can be implemented without these specific instructions.

[0016] This invention is applicable in the flat board furniture manufacturing industry. This is a modular solution, where different variants could be used to build fully automated packaging line, performing different tasks such as cutting and placing fillers as well as placing items into the box. Or automating packaging in other industries.

[0017] Cardboard sheets 1, 2 are loaded onto a designated table, serving as the raw material for creating packaging fillers. Independent linear units 3, 4 equipped with servo motors feed the bottom sheet (first sheet) from each stack towards the cutting modules 11, 12 (Fig. 1). These linear units 3, 4 ensure precise and controlled movement of the sheets 1, 2, aligning them correctly for the cutting process. Stepper motors 5, 6, 7, 8 automatically adjust the height and width of the cardboard sheets. This adjustment is crucial to position the sheets correctly according to the required dimensions of the fillers to be cut. Once the cardboard sheets are correctly positioned, the cutters transport them on a belt conveyor 9, 10 to the working area of the robots 13, 14. Cutting modules 11, 12 cut the cardboard sheets into fillers of the required width (Fig. 2). The oscillating motion of the blades ensures precise and clean cuts, maintaining accuracy in filler size. Robots 13, 14 equipped with needle grippers 15, 16 pick up the cut fillers from the conveyor 9, 10. These robots 13, 14 handle the fillers with precision and efficiency. Needle grippers 15, 16 securely grip the fillers without causing damage, facilitating precise handling during the transfer to subsequent processing stages. A belt conveyor 17 moves the boxes into the system. The robots 13, 14 move the fillers to an adhesive injection unit 20, which applies a controlled amount of adhesive to the fillers. Holding mechanisms 18, 19 stabilize the moving boxes during the insertion process, ensuring they remain steady and correctly aligned, this ensures secure attachment of the fillers inside the moving boxes. After picking up the fillers, a belt conveyor 17 moves the boxes with

fillers into the packaging system for further processing.

[0018] A method for automated filler insertion into packaging, comprising the steps of:
Loading cardboard sheets 1, 2 onto a designated table, wherein said cardboard sheets 1, 2 serve as the raw material from which the packaging fillers will be cut.

[0019] Feeding the bottom sheet from each cardboard sheets 1, 2 stack to cutting modules 11, 12 using linear units 3, 4 driven by motors, wherein said motors ensure precise and controlled movement of the sheets 1, 2, aligning them correctly for the cutting process.

[0020] Automatically adjusting the height and width of the cardboard sheets using stepper motors 5, 6, 7, 8, wherein this adjustment is crucial to ensure that the sheets 1, 2 are positioned correctly according to the size specifications of the fillers to be cut. This adjustment is crucial to ensure that the sheets are positioned correctly according to the size specifications of the fillers to be cut.

[0021] Cutting the cardboard sheets 1, 2 into fillers of the required width if using oscillating cutting modules 11, 12, wherein the oscillating motion of the blades provides precise and clean cuts, ensuring that the fillers are accurately sized for their intended use.

[0022] Transporting the cut fillers from the cutting area to a robot's 13, 14 working area via belt conveyors 9, 10, wherein the belt conveyors 9, 10 ensure smooth and efficient movement of the fillers, minimizing the risk of damage or misalignment.

[0023] Picking up the cut fillers from the conveyor 9, 10 using robots 13, 14 equipped with needle grippers 15, 16, wherein the grippers securely hold the fillers without causing any damage, enabling precise handling and placement.

[0024] Moving the fillers to an adhesive injection unit 20 using the robots 13, 14, wherein a small amount of glue is applied to some areas of the fillers, ensuring controlled application to prevent waste and ensure strong adhesion.

[0025] Transporting boxes for filler insertion, wherein the boxes are moved along a belt conveyor 17 and stabilized by holding mechanisms 18, 19, ensuring the boxes remain steady and correctly aligned during the filler insertion process.

[0026] Inserting the fillers into the moving boxes using the robots 13, 14, wherein the fillers are securely attached on provided place in the box like the short sides of the boxes with high precision.

[0027] Continuing the boxes with fillers along the conveyor for further packaging steps, such as placing the production items into the box.

[0028] The system is mounted on wheels, allowing the system to be easily transported and positioned at any location along the packaging line, thereby providing flexibility in configuring the packaging line and enabling quick adjustments and reconfigurations to meet varying production needs. When the boxes continue along the conveyor for further packaging steps.

[0029] This invention will replace routine manual operation by human workforce, where carton filler must be inserted at the beginning of packaging line.

[0030] Increase the performance of the entire line.

[0031] Increase flexibility in materials, meaning that exact length and size carton filler will be cut on demand in place, just before placing it into the box. This will make carton material suppliers produce certain length and width honeycomb sheets, avoiding slicing process in advance. The carton slicing process, just before gripping with robot will ensure stable filler supply and production on demand in case of change of recipe or package model. At the same time this will increase efficiency in logistics and transportation inside the factory. Rate increase of 20% of entire packaging line.

[0032] Automatic system for carton filler insertion into package, using cardboard cutter and glue applicator is a modular solution, where different variants could be used to build fully automated packaging line, consisting of 10-20 variation, performing different tasks such as cutting and placing fillers as well as placing items into the box. Or automating packaging in other industries.

Claims

1. A system for automated filler preparation for insertion into packaging, comprising:

   a table for loading cardboard sheets (1, 2);
   linear units (3, 4) for feeding cardboard sheets (1, 2) towards the cutting modules (11, 12);
   characterized in that,
   stepper motors (5, 6, 7, 8) for automatic height and width adjustment of the cardboard sheets (1, 2);
   cutting modules (11, 12) for cutting fillers from the sheets (1, 2);
   conveyors (9, 10) for transporting the cut fillers to robots (13, 14);
   robots (13, 14) with grippers (15, 16) for picking up the fillers and moving them to an adhesive injection unit (20), which applies a controlled amount of adhesive to the fillers, and for inserting and attaching the filler steadily and correctly aligned into the box.

2. A system for automated filler preparation for insertion into packaging according to claim 1, **characterized in that** cutting modules (11, 12) are oscillating cutting module, guillotine or rotating disk.

3. A system for automated filler preparation for insertion into packaging according to any of claims 1-2 **characterized in that** grippers (15, 16) are needle grippers (15, 16).

4. A system for automated filler preparation for insertion into packaging according to any of claims 1-3 **characterized in that** conveyors (9, 10) are belt

conveyors (9, 10).

5. A system for automated filler preparation for insertion into packaging according to any of claims 1-4, **characterized in that** system also comprises: wheels, allowing the system to be easily transported and positioned at any location along the packaging line.

6. A system for automated filler insertion into packaging comprises:

a belt conveyor (17) for moving boxes next to the system according to any of claims 1-5;
holding mechanisms (18,19) ensuring smooth box movement during filler insertion.

7. A method for automated filler insertion into packaging using the system according to claim 6, comprising the steps of:

loading cardboard sheets (1, 2) onto the table;
feeding the sheets (1, 2) to cutting modules (11, 12) using linear units (3, 4) driven by motors, aligning them for the cutting process;
characterizes in that,
adjusting the height and width of the cardboard sheets using motors (5, 6, 7, 8);
cutting the cardboard sheets into fillers of the required width using cutting modules (11, 12);
transporting the cut fillers from the cutting area to the robots' (13, 14) working area via conveyors (9, 10);
picking up the cut fillers from the conveyor using robots (13, 14) equipped with grippers (15, 16), wherein the grippers securely hold the fillers without causing any damage, enabling precise handling and placement;
moving the fillers to an adhesive injection unit (20) by using the robots (13, 14), and applying a small amount of glue to the appropriate areas of the fillers;
moving the boxes on a conveyor (17) and stabilizing them using holding mechanisms (18, 19) to ensure the boxes remain steady and correctly aligned during the filler insertion process;
inserting the fillers with glue layer into the moving boxes using the robots (13, 14), and securely attaching the fillers to the designated places in the box;
moving the boxes with fillers along the conveyor (17) for further packaging steps.

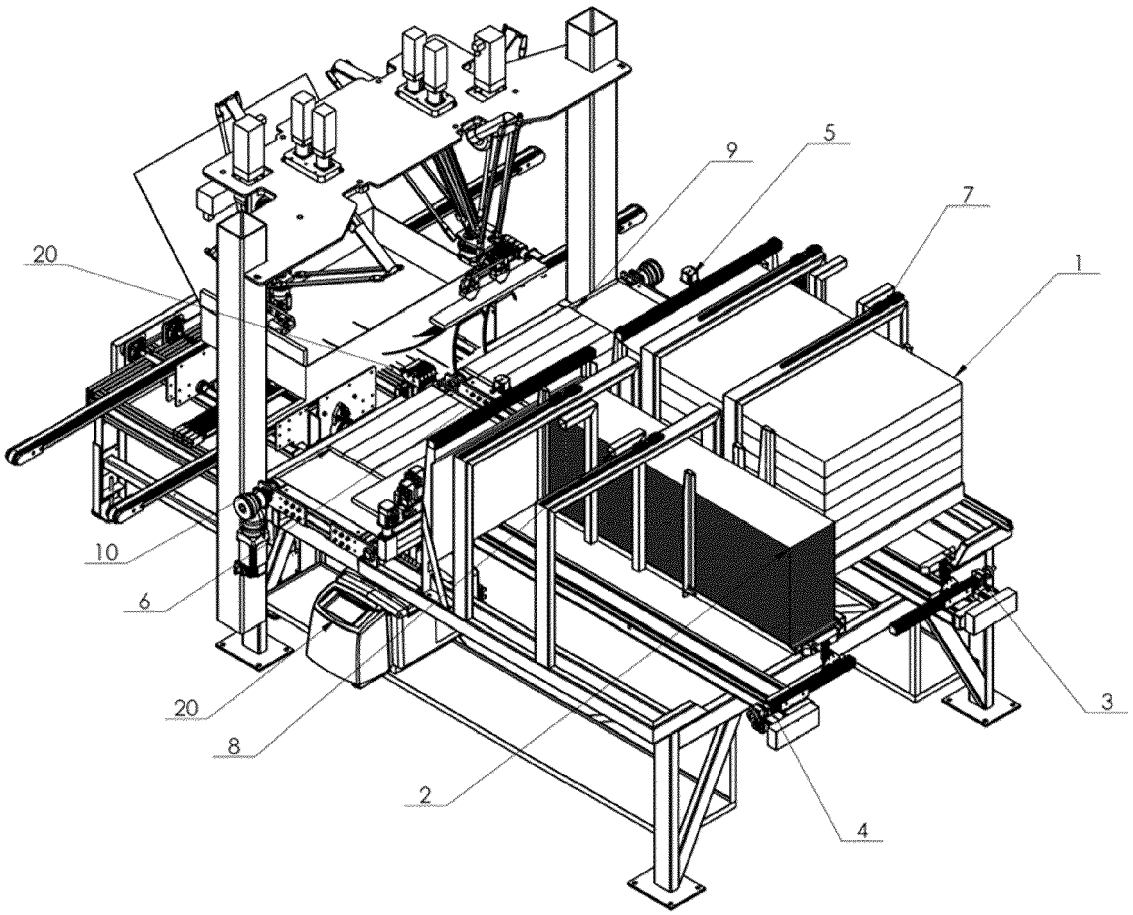

Fig. 1

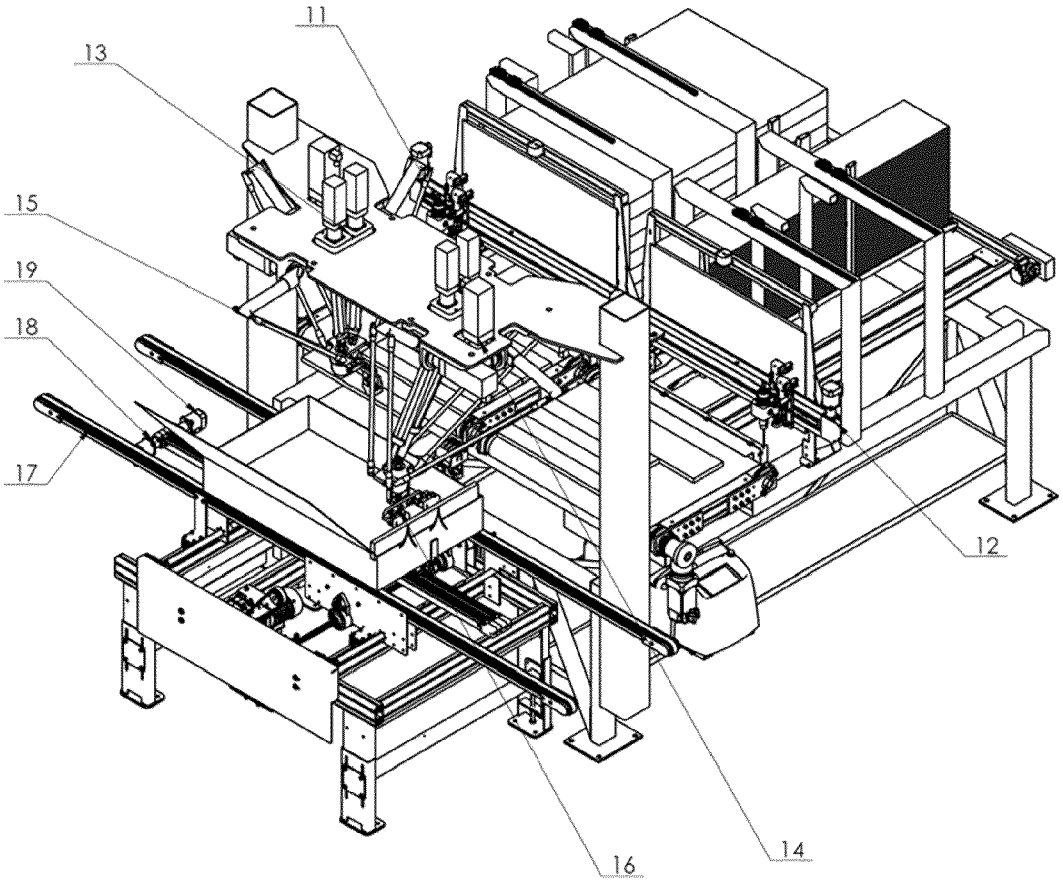

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 2427

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2021/031479 A1 (SPÖRKE SEBASTIAN [DE] ET AL) 4 February 2021 (2021-02-04) * paragraphs [0001], [0002], [0021], [0025], [0037] - [0046], [0052], [0056] - [0058] * * figures 1-2b * -----	6 1-5,7	INV. B65B55/20 B65B41/04 B65B59/00 B65B43/52 B65B43/54 B31D5/00
X	Homag (english): "Packaging solution with 3-side sealing and automated insertion stations", , 13 May 2023 (2023-05-13), XP093248675, Retrieved from the Internet: URL:https://www.youtube.com/watch?v=9aTZs366Ols [retrieved on 2025-02-10]	1-6	ADD. B31B105/00 B31B110/35
Y	* minutes 0:14-0:21 * -----	7	
Y A	EP 2 360 103 A1 (L C R MACCHINE AUTOMATICHE S R L [IT]) 24 August 2011 (2011-08-24) * paragraphs [0001], [0047] - [0049], [0059] - [0065], [0082] - [0085] * * figures 4-17 * -----	1-5,7 6	TECHNICAL FIELDS SEARCHED (IPC) B65B B31B B31D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 February 2025	Zeiler, Johannes

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 19 2427

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
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REFERENCES CITED IN THE DESCRIPTION

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