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(71) Applicants:
- **Cevolani Italia S.r.L.**
  22100 Como (IT)
- **Salvadeo, Stefano**
  40011 Anzola Dell'Emilia (BO) (IT)

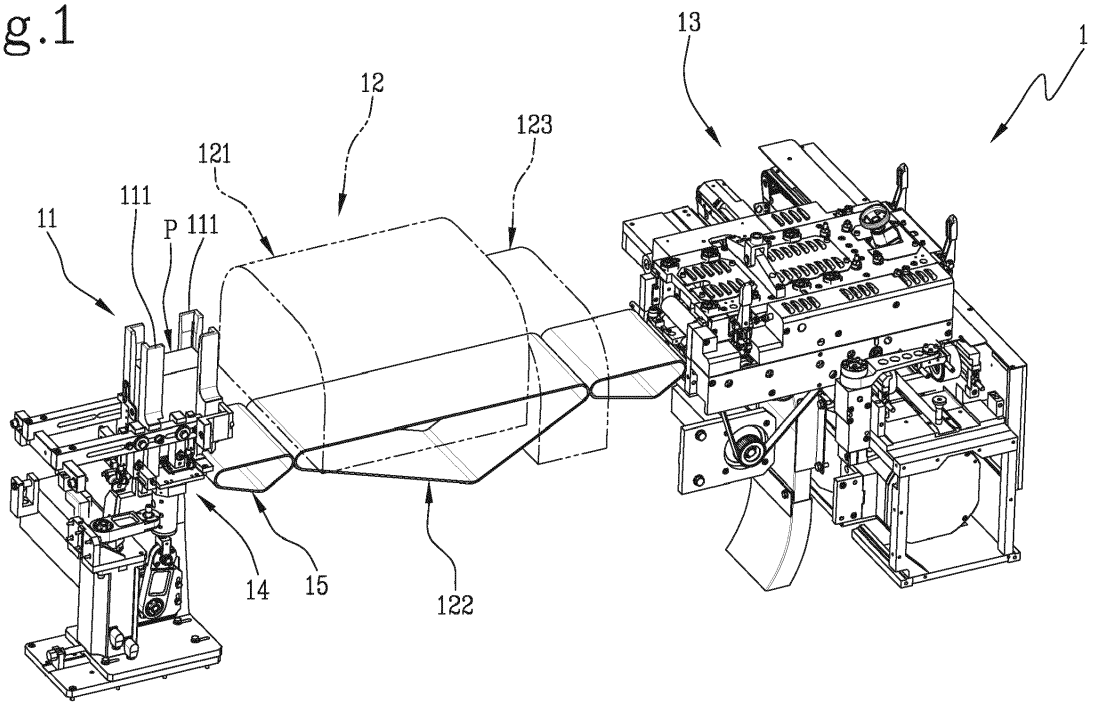
(72) Inventor: **SALVADEO, Stefano**
40011 Anzola dell'Emilia (Bologna) (IT)

(74) Representative: **Milli, Simone**
Bugnion S.p.A.
Via di Corticella, 87
40128 Bologna (IT)

(54) MACHINE FOR PROCESSING METAL PIECES IN THE CONTEXT OF THE PRODUCTION OF CANS AND RELATIVE METHOD

(57) Described is an automatic machine (1) configured to automatically perform a process for processing metal pieces designed to make the respective side walls of cans, with which the machine (1) achieves an improvement in the production flexibility of the cans by means of a station for digital printing (12) of the pieces integrated in the machine upstream of a calendering station (13) for calendering the pieces once they have left the digital printing station (12). The invention also relates to this processing process.

Fig.1



EP 3 753 646 A1

Description

[0001] This invention relates to an automatic machine configured to automatically perform a process for processing metal pieces designed to make the respective side walls of cans, the machine achieving an improvement in production flexibility of the cans by means of a station for digital printing of the pieces integrated in the machine upstream of a calendering station for calendering the pieces once they have left the digital printing station. The invention also relates to the processing process.

[0002] In the field of production of cans with metal side walls, the side wall of the can is currently obtained by cutting a respective metal sheet sector in such a way as to obtain a piece which is subsequently deformed.

[0003] If it is necessary to imprint a desired pattern on the side wall of the can, for example a predetermined colour of the side wall, this pattern is currently imprinted before cutting the respective metal sheet sector.

[0004] Currently, the manufacturers of cans receive the sheet already moulded in a condition such that, before the step of cutting the sheet metal sectors, the desired pattern is already printed on each sector.

[0005] This forces the manufacturers of cans to have a sufficient quantity of sheet metal available for each pattern, in order to meet the possible market requirements. This leads to considerable storage costs correlated with the pattern differences between the types of cans which could be requested by the market.

[0006] A method or process for processing pieces designed to make the respective side walls of cans according to this invention and/or according to any one of the appended claims makes it possible to reduce the storage costs correlated with the pattern differences between the types of cans which could be requested by the market.

[0007] A machine according to the invention and/or according to any one of the accompanying machine claims is configured to automatically perform a method according to the invention and/or according to any one of the accompanying method claims.

[0008] The characteristics of a machine and a method according to the invention will emerge more clearly from the following detailed description of respective example embodiments of the machine and method.

[0009] The following detailed description refers to the accompanying drawings, in which:

- Figure 1 is a view of a possible example embodiment of a machine according to the invention;
- Figure 2 is a schematic view of a part of the embodiment of Figure 1;
- Figures 3A to 3D show the part of Figure 2 in respective successive instants of a possible embodiment of a processing method according to the invention;
- Figure 4 shows a feature of a step of the method following the instants of Figures 3A-3D.

[0010] The accompanying drawings refer to an example embodiment of a method according to the invention. The term "method" used below relates to the example embodiment of the method.

[0011] The method could be defined alternatively as a process.

[0012] The accompanying drawings refer to an example embodiment of a machine according to the invention. The term "machine" used below relates to the example embodiment of the machine. The machine is labelled 1 in Figure 1.

[0013] The machine is configured to automatically perform the method.

[0014] The method is for processing pieces designed to make the respective side walls of cans. This means that each piece will be used to make the side wall of a respective can. The pieces may be, for example, made of metal. This means that each piece could be at least partly or totally metallic.

[0015] Each piece could be a strip or a clip or a band.

[0016] The machine 1 comprises a storage unit 11. The storage unit 11 is configured to perform, for each piece, a respective step for storing the piece. The storage unit 11 is configured to stack the stored pieces in such a way as to define a stack of stored pieces. The stack is labelled P in the drawings. Figures 2, 3A, 3B and 3C show a first piece S1. Figure 3D shows a second piece S2. Figure 4 indicates the first piece S1, the second piece S2, and a third piece S3.

[0017] The storage unit 11 comprises vertical supporting guides 111 to define the stack P.

[0018] The method comprises, for each piece, the respective step of storing the piece.

[0019] The machine 1 comprises a digital printing station 12. The digital printing station 12 is configured to perform, for each stored piece, a respective step of digital printing of a desired pattern on the piece. The printing station 12 in Figures 2, 3A, 3B, 3C, 3D and 4 is schematically represented as dashed blocks.

[0020] The method comprises, for each stored piece, the respective step of digital printing of the desired pattern on the piece. The term "stored piece" means a piece which has already been subjected to the storage step.

[0021] In Figure 4 each of the first piece S1, second piece S2 and third piece S3 may be considered as shown during the respective printing step. Although they are shown during the printing step, each of the first piece S1, second piece S2, and third piece S3 can be considered as a stored piece, since it has been previously stored in the storage unit 11.

[0022] The printing station 12 comprises a digital printing system 121. The digital printing system 121 is configured for performing, on each stored piece, a respective step of imprinting said desired pattern.

[0023] For each stored piece, the respective printing step comprises the respective step of imprinting said desired pattern on the piece.

[0024] According to an aspect of the present invention, the printing station 12 compises a plurality of nozzles,

configured to spray ink, to print the desired pattern. Hence, in said embodiment, the digital printing is made by spring ink. In one embodiment, the pintring station 12 is configured to realize a first print, wherein is realized a print of the derired pattern. In one embodiment, the printing station 12 inlcudes a second print (i.e. a fixing painting) which is overlapped to the first first print ad which has the function of fixing the first print.

[0025] The second print is generally realized with transparent painting.

[0026] In one embodiment, the first print and the fixing painting are both realized by the plurality of nozzle, i.e. by a digital printing with ink spraying.

[0027] In one embodiment, the printing station 12 includes a roller applicator, configured to apply on the pieces ink or paint by means of a roller, rotating around ax axis parallel to a plane defined by the piece itself.

[0028] In said embodiment, the first print is a digital printing with ink spraying while the fixing painting is made trough the roller applicator. This embdiment increase the quality of the digital printing.

[0029] The printing station 12 comprises a transport conveyor 122. The printing station 12 is configured so that the conveyor can perform, for each stored piece, a respective step of transporting the piece through the printing system 121, in such a way that the printing system 121 can perform the respective printing step.

[0030] For each stored piece, the respective printing step comprises the respective step of transporting the piece. For each stored piece, the respective transport step is performed during the respective step of printing the desired pattern on the same piece.

[0031] The printing station 12 could also comprise a drying system 123, to perform a step of drying the printed or imprinted pattern.

[0032] The transport conveyor 122 is configured so that, for each stored piece, the respective transport step is performed by generating a transport movement of the piece. The transport movement comprises at least one main translational component along a transport direction. The transport direction is represented by the direction of the arrow X4 of Figure 4.

[0033] For each stored piece, the respective transport step is performed by generating the respective transport movement of the piece.

[0034] In Figure 4 each of the first piece S1, second piece S2 and third piece S3 may be considered as shown simultaneously during the respective imprinting step and the respective transport step.

[0035] The machine comprises a calendering station 13. The calendering station 13 is configured for performing, for each printed piece, a respective calendering step. The term "printed piece" means a piece which has already been subjected to the printing step.

[0036] The method comprises, for each printed piece, the respective step of calendering the piece.

[0037] The machine comprises a dispensing system 14. The dispensing system 14 is configured for performing, for each stored piece, a respective step of dispensing the piece from the storage unit 11 to the printing station 12. The dispensing system 14 is shown schematically in the detail in Figures 2 to 3D.

[0038] The method comprises, for each stored piece, the respective step of dispensing the piece from the storage unit 11 to the printing station 12. The dispensing system 14 comprises a pick-up element 141. The dispensing system 14 is configured so that the pick-up element 141 can perform, for each stored piece and by means of a movement of the pick-up element 141, a respective step of picking up the piece. The movement of the pick-up element 141 comprises at least one main translational component along a pick-up direction. The pick-up direction is represented by the direction of the arrow X1 of Figure 3A. The pick-up direction could be transversal and/or at right angles to the transport direction.

[0039] The pick-up element 141 could comprise, for example, one or more suction cups.

[0040] For each stored piece, the respective dispensing step comprises the respective step of picking up the piece.

[0041] Figures 2 and 3A refer to an instant of the step for picking up the first piece S1. The direction of the arrow X1 indicates the direction in which the pick-up element 141 moves after coming into contact with the piece.

[0042] Figure 3B relates to a final instant of the pick-up step. In the final instant of the step for picking up the first piece S1, the first piece S1 is above a horizontal supporting guide 112. The horizontal guide is situated, for example, below the vertical supporting guides 111. The storage unit 11 comprises the horizontal guide 112.

[0043] The dispensing system 14 comprises a pushing element 142. The dispensing system 14 is configured so that the pushing element 142 can perform, for each piece picked up and by means of a movement of the pushing element 142, a respective step of pushing the piece picked up. During the respective pushing step, the piece picked up is pushed out from the storage unit 11. The movement of the pushing element 142 comprises at least one main translational component along a pushing direction. The pushing direction is represented by the direction of the arrow X2 of Figure 3B. The pushing direction could coincide with the direction of transport. The pushing direction is transversal and/or at right angles to the pick-up direction.

[0044] The term "piece picked up" means a piece which has already been subjected to the respective pick-up step.

[0045] The pushing element 142 could comprise, for example, a pusher.

[0046] For each stored piece, the method comprises the respective step of pushing the piece picked up.

[0047] For each stored piece, the respective pushing step is performed by the above-mentioned movement of the pushing element.

[0048] Figure 3B shows an initial instant of the step of

pushing the first piece S1.

[0049] Figure 3C shows a final instant of the step of pushing the first piece S1.

[0050] In Figure 3C the arrow X2' indicates a direction of the return movement of the pushing element 142.

[0051] The machine 1 comprises a transfer conveyor 15. The machine 1 is configured so that the transfer conveyor 15 can perform, for each piece pushed outside the storage unit 11, a respective step for receiving the piece.

[0052] The method comprises, for each piece pushed outside the storage unit 11, the respective step of receiving the piece by the transfer conveyor 15. The instant to which Figure 3C refers is both the final instant of the pushing step and an instant during the step of receiving the first piece S1 by the transfer conveyor 15.

[0053] The machine 1 is configured so that the transfer conveyor 15 can perform, for each piece received, a respective step of transferring the piece from the storage unit 11 to the printing station 12. During the respective transfer step, the piece is transferred from the storage unit 11 to the transport conveyor 122.

[0054] The method comprises, for each piece received by the transfer conveyor 15, the respective step of transferring the piece from the storage unit 11 to the printing station 12.

[0055] The instant to which Figure 3D refers is an instant during the step of transferring the first piece S1 from the storage unit 11 to the transport conveyor 122.

[0056] The transfer conveyor 15 is configured so that, for each stored piece, the respective transfer step is performed by generating a movement for transferring the piece. The transfer movement comprises at least one main translational component along a transfer direction. The transfer direction is represented by the direction of the arrow X3 of Figures 3C and 3D. The transfer direction could coincide with the transport direction. The transfer direction could coincide with the pushing direction.

[0057] For each stored piece, the respective transfer step is performed by generating the respective transfer movement of the piece.

[0058] The machine 1 is configured so that, for each stored piece, the trajectory travelled by the pick-up element 141 during the movement of the pick-up element 141 intersects the trajectory followed by the pushing element 142 during the movement of the pushing element 142.

[0059] According to the method, for each stored piece, the trajectory travelled by the pick-up element 141 during the movement of the pick-up element 141 intersects the trajectory followed by the pushing element 142 during the movement of the pushing element 142.

[0060] In this way, the dispensing system 14 is able to operate quickly, to increase the productivity.

[0061] The machine 1 comprises a control system. The control system is configured for automatically controlling at least said transfer conveyor 15 and transport conveyor 122, in such a way that, for each stored piece, the average speed of the transport movement along the transport direction is less than the average speed of the transfer movement along the transfer direction.

[0062] The method comprises, for each stored piece, a respective step of automatic control of the respective transfer step and of the respective transport step. The respective control step is performed in such a way that the average speed of the transport movement along the transport direction is less than the average speed of the transfer movement along the transfer direction.

[0063] It should be considered that the average speed of the transport movement along the transport direction is limited by the characteristics of the printing station 12, and that, considering that the trajectories of the pushing element 142 and of the pick-up element 141 intersect, the pick-up element 141 can start picking up the next piece only once a sufficient space has been freed, along the pushing direction, for the passage of the pick-up element 141.

[0064] For this reason, considering the picking up of a generic piece, such as, for example, the first piece S1 of Figures 3A-3D, before the pick-up element 141 can perform the step of picking up the next piece, as could be the second piece S2 indicated in Figure 3D, the first piece S1 must have freed a sufficient zone along the pushing direction X2 to allow the passage again of the pick-up element 141.

[0065] The difference between the average speed of the transfer movement and the average speed of the transport movement is such that the transfer conveyor can operate as an accelerator of the outlet of the first piece S1 from the storage unit, so as to reduce the stopping time of the pick-up element 141 before starting the new movement for picking up the next piece S2.

[0066] This allows a smaller spacing between the successive pieces, during the printing step, in such a way as to increase the productivity of the method and/or of the machine. The spacing between the successive pieces is labelled d in Figure 4.

[0067] The pushing direction could coincide with the transport direction and/or with the transfer direction.

[0068] The control system is configured for automatically controlling at least said pushing element (142) and transfer conveyor (15) in such a way that, for each stored piece, the average speed of movement of the pushing element (142) along the pushing direction is less than the average speed of the transfer movement of the piece along the transfer direction.

[0069] The method comprises, for each stored piece, a respective step of automatic control of the respective transfer step and of the respective pushing step. The respective control system is performed in such a way that, for each stored piece, the average speed of movement of the pushing element 142 along the pushing direction is less than the average speed of the transfer movement of the piece along the transfer direction.

[0070] In this way, the transfer conveyor 122 produces an effect of acceleration of the outfeed of each piece from the storage unit, to free firstly a space sufficient for the

start of the picking up of the next piece.

[0071] Each of the transport conveyor 122 and transfer conveyor 15 could be a conveyor belt. Each of the transport conveyor 122 and transfer conveyor 15 could be a magnetic conveyor belt.

[0072] A process for making cans according to the invention comprises the method.

[0073] The machine 1, being configured to perform the method, is a machine for processing the pieces in the context of the process for making cans.

[0074] The machine 1, by means of the method which it is configured to perform, allows both the step of printing the pieces and the step of calendering with the same machine to be performed, after the sectors of sheet metal corresponding to the pieces have already been cut. This makes it possible to decide each time, on the basis of market requirements, the pattern to be printed during the printing step, thus reducing storage costs.

[0075] The machine 1, using the method which it is configured to perform, is characterised by an excellent productivity thanks to the transfer conveyor which operates as an accelerator belt to accelerate the outfeed of the pieces from the storage unit, in order to reduce the spacing between the pieces in the printing station.

Claims

1. A machine (1) for processing metal pieces (S1, S2) designed to make respective side walls of cans, comprising:

- a storage unit (11) to perform, for each piece (S1; S2), a respective step for storing the piece (S1; S2);
- a digital printing station (12), to perform, for each stored piece (S1; S2), a respective step of digital printing of a desired pattern on the piece;
- a calendering station (13), for performing, for each printed piece (S1; S2), a respective calendering step.

2. The machine (1) according to claim 1, comprising a dispensing system (14) for performing, for each stored piece, a respective step of dispensing the piece (S1; S2) from the storage unit (11) to the printing station (12); wherein the printing station (12) comprises:

- a digital printing system (121) for performing, on each stored piece (S1; S2), a respective step of imprinting said desired pattern;
- a transport conveyor (122) for performing, for each stored piece (S1; S2), a respective step of transporting the piece (S1; S2) through the printing system (121), in such a way that the printing system (121) can perform the respective printing step;

wherein the dispensing system (14) comprises:

- a pick-up element (141) for performing, for each stored piece (S1; S2) and by means of a movement of the pick-up element (141), a respective step of picking up the piece (S1; S2), said movement of the pick-up element (141) comprising at least one main translational component along a pick-up direction;
- a pushing element (142) for performing, for each picked-up piece (S1; S2) and by means of a movement of the pushing element (142), a respective step of pushing the picked-up piece (S1; S2), during which the picked-up piece (S1; S2) is pushed out from the storage unit (11), said movement of the pushing element (142) comprising at least one main translational component along a pushing direction which is transversal to the pick-up direction;

wherein the machine (1) is configured so that, for each stored piece (S1; S2), the trajectory travelled by the pick-up element (141) during the movement of the pick-up element (141) intersects the trajectory followed by the pushing element (142) during the movement of the pushing element (142);

wherein the machine comprises a transfer conveyor (15) for performing, for each piece (S1; S2) pushed out from the storage unit (11), a respective step for receiving the piece (S1; S2) and, for each received piece (S1; S2), a respective step of transferring the piece (S1; S2) from the storage unit (11) to the transport conveyor (122).

3. The machine according to claim 2, wherein:

- said transfer conveyor (15) is configured so that, for each stored piece (S1; S2), the respective transfer step is performed by generating a transfer movement of the piece, said transfer movement comprising at least one main translational component along a transfer direction, said transfer direction being transversal to the pick-up direction;
- said transport conveyor (122) is configured so that, for each stored piece (S1; S2), the respective transport step is performed by generating a transport movement of the piece (S1; S2), said transport movement comprising at least one main translational component along a transport direction coinciding with said transfer direction;
- the machine (1) comprises a control system configured for automatically controlling at least said transfer conveyor (15) and transport con-

veyor (122), in such a way that, for each stored piece (S1; S2), the average speed of the transport movement along the transport direction is less than the average speed of the transfer movement along the transfer direction.

4. The machine (1) according to claim 3, wherein:

- the pushing direction coincides with said transfer direction;
- the control system is configured for automatically controlling at least said pushing element (142) and transfer conveyor (15) in such a way that, for each stored piece (S1; S2), the average speed of movement of the pushing element (142) along the pushing direction is less than the average speed of the transfer movement of the piece along the transfer direction.

5. The machine according to claim 3 or 4, wherein said transfer conveyor (15) and transport conveyor (122) are mechanically separate from each other.

6. The machine according to claim 3 or 4 or 5, wherein said transfer conveyor (122) comprises a magnetic belt.

7. The machine according to any one of the preceding claims, wherein the printing station comprises a roller applicator and a plurality of nozzles, and wherein the plurality of nozzles id configured to realized the digital print by ink spraying and wherein the roller applicator is configured to apply a painting layer on the digital printing.

8. A method (1) for processing metal pieces (S1, S2) designed to make respective side walls of cans, comprising:

- for each piece, a respective step for storing the piece (S1; S2) in a storage unit (11);
- for each stored piece (S1; S2), a respective step of digital printing of a desired pattern on the piece, said printing step being performed in a printing station (12);
- for each printed piece, a respective step of calendering the piece.

9. The method according to claim 8, comprising, for each piece stored (S1; S2), a respective step of dispensing the piece (S1; S2) from the storage unit (11) to the printing station (12);
wherein, for each piece stored (S1; S2), the respective printing step comprises:

- a step of imprinting said desired pattern on the piece (S1; S2);
- a respective step of transporting the piece (S1; S2), said transport step being performed during the respective step of imprinting the piece;

wherein, for each piece stored (S1; S2), the respective dispensing step comprises:

- a respective step of picking up the piece (S1; S2), said respective pick-up step being performed by means of a movement of a pick-up element (141), said movement of the pick-up element (141) comprising at least one main translational component along a pick-up direction;
- a respective step of pushing the picked-up piece (S1; S2), during which the picked-up piece is pushed out from the storage unit (11), said respective pushing step being performed by means of a movement of a pushing element (142), said movement of the pushing element (142) comprising at least one main translational component along a pushing direction which is transversal to the pick-up direction;

wherein, for each stored piece (S1; S2), the trajectory travelled by the pick-up element (141) during the movement of the pick-up element (141) intersects the trajectory followed by the pushing element (142) during the movement of the pushing element (142);
wherein the method comprises, for each piece (S1; S2) pushed out from the storage unit (11), a respective step for receiving the piece (S1; S2) by a transfer conveyor (15);
wherein the method comprises, for each piece (S1; S2) received by the transfer conveyor (15), a respective step of transferring the piece (S1; S2) from the storage unit (11) to the printing station (12), said transfer step being performed by the transfer conveyor (15).

10. The method according to claim 9, wherein, for each stored piece (S1; S2):

- the respective transfer step is performed by generating a transfer movement of the piece, said transfer movement comprising at least one main translational component along a transfer direction, said transfer direction being transversal to said pick-up direction;
- the respective transport step is performed by generating a transport movement of the piece (S1; S2), said transport movement comprising at least one main translational component along a transport direction coinciding with said transfer direction;

wherein the method comprises for each stored piece (S1; S2), a respective step of automatically controlling the respective transfer step and the respective

transport step, said respective control step being performed in such a way that, for each stored piece (S1; S2), the average speed of the transport movement along the transport direction is less than the average speed of the transfer movement along the transfer direction.

11. The method (1) according to claim 10, wherein:

- the pushing direction coincides with said transfer direction;
- the method comprises for each stored piece (S1; S2), a respective step of automatically controlling the respective transfer step and the respective pushing step, in such a way that, for each stored piece (S1; S2), the average speed of the movement of the pushing element (142) along the pushing direction is less than the average speed of the transfer movement of the piece along the transfer direction.

12. The method according to claim 10 or 11, wherein said transfer conveyor (15) and transport conveyor (122) are mechanically separate from one another.

13. The method according to any of the claims from 8 to 12, wherein the step of digital printing is performed by sprying ink with a plurlaity of nozzles, and comprising the a fixing step, wherein a roller applicator applies a fixing painting on the digital printing.

14. A process for producing cans comprising a method according to any one of claims 8 to 13.

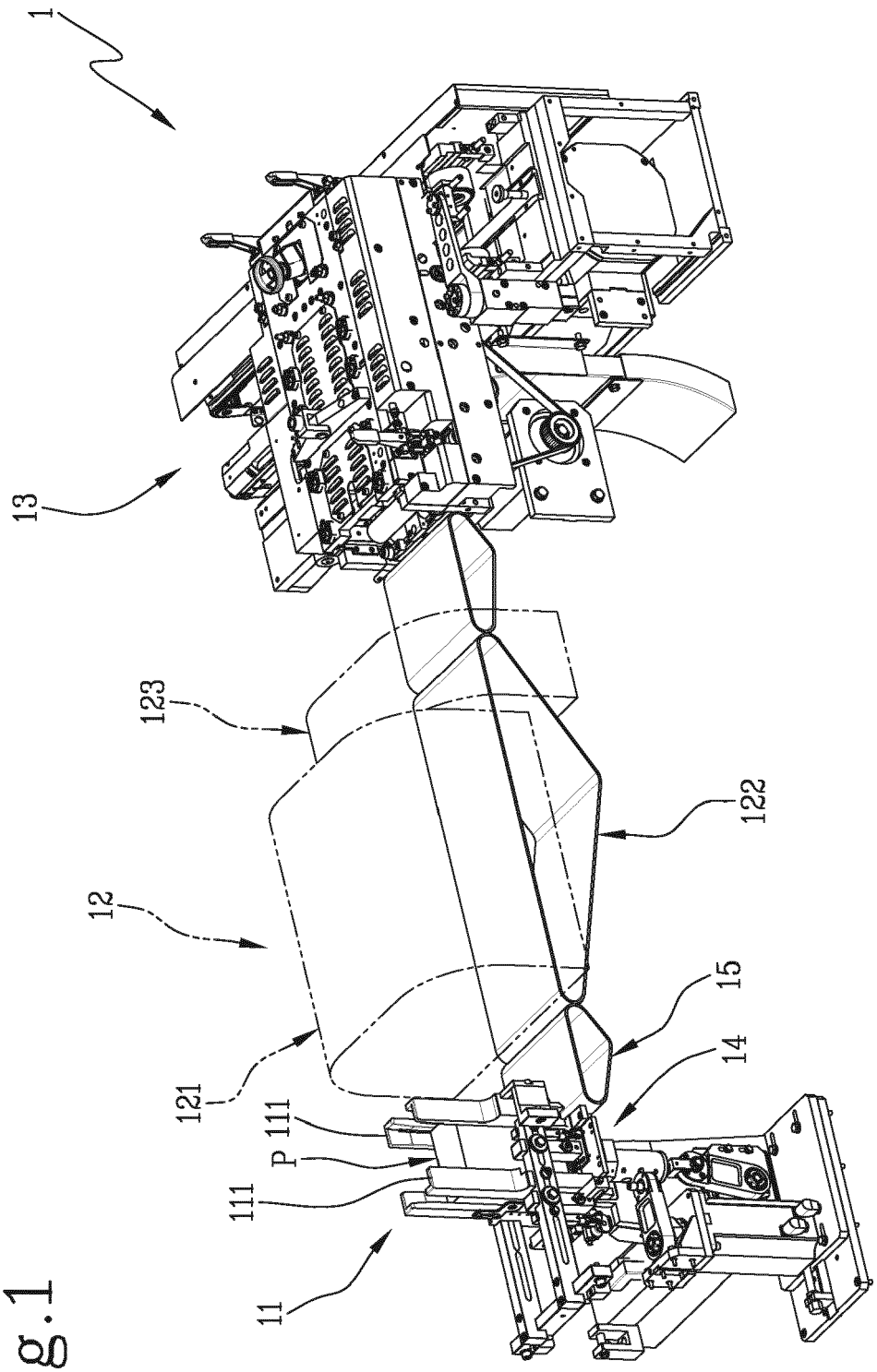
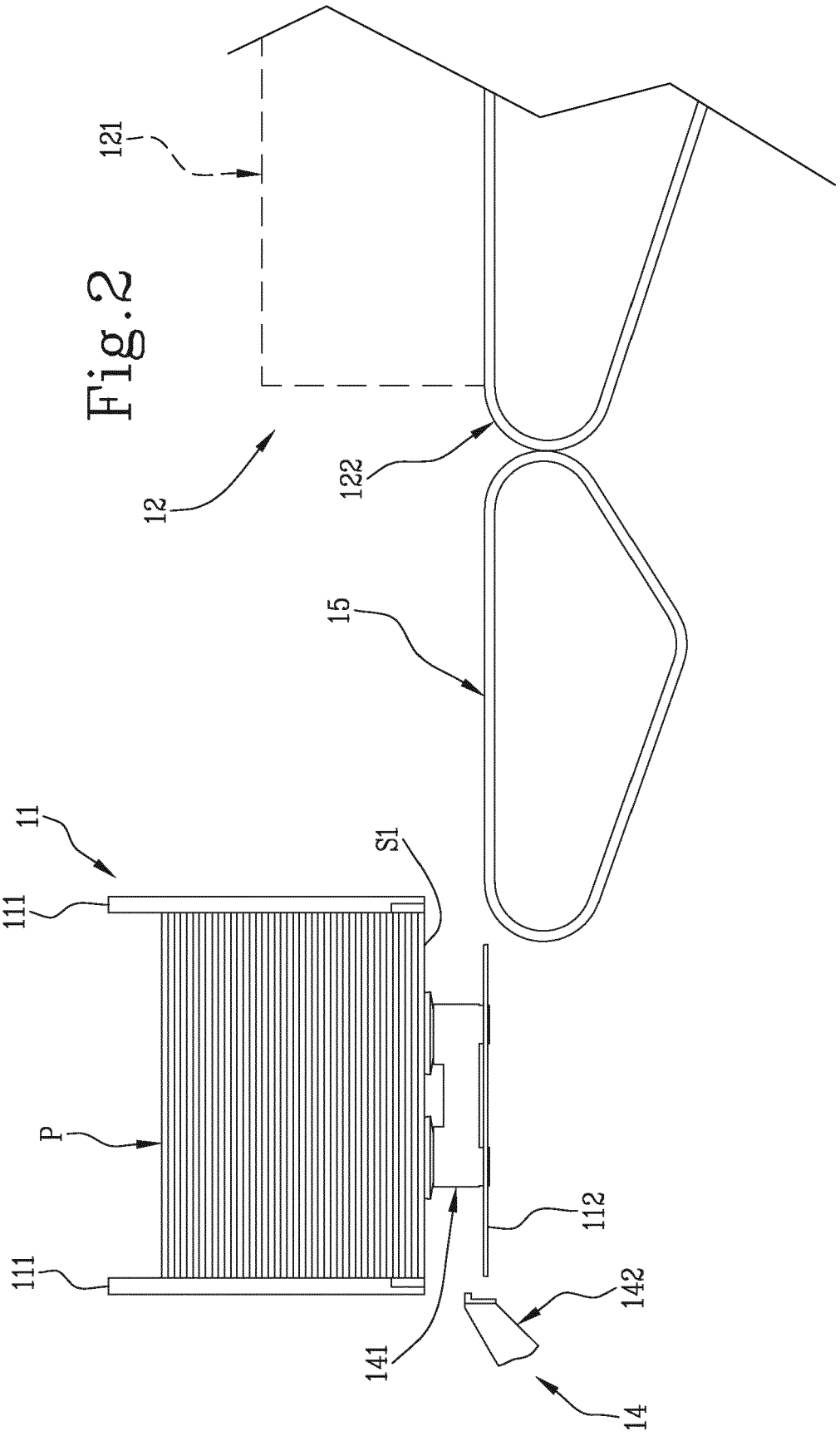


Fig.1

Fig.2



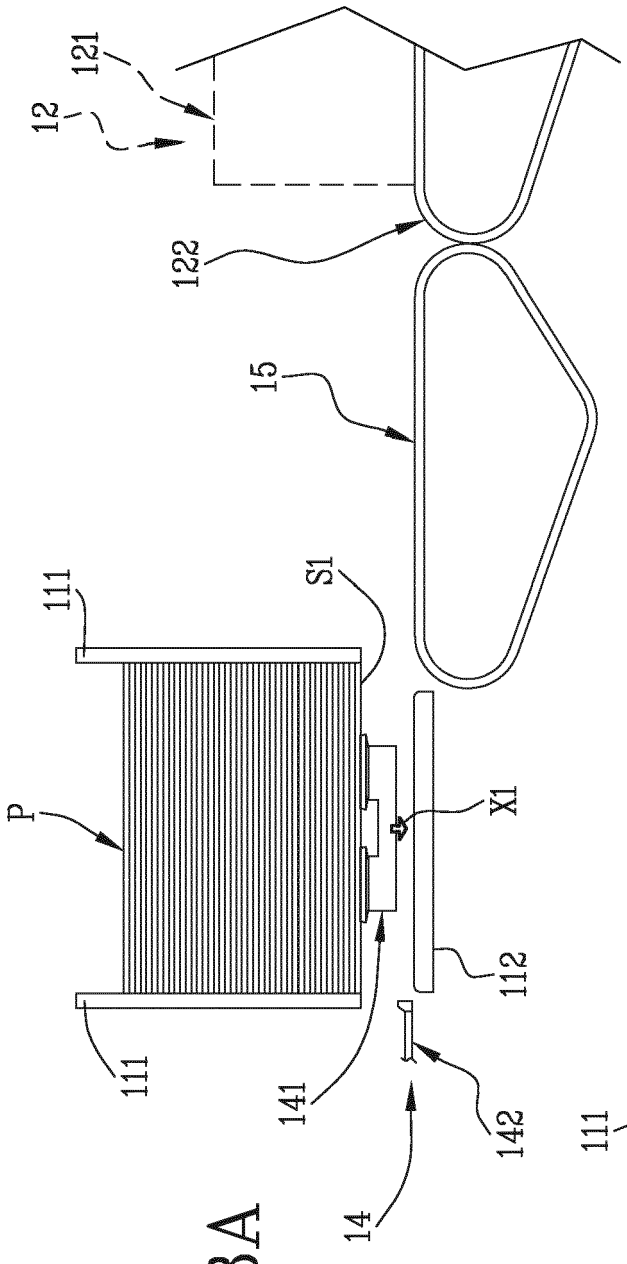

12
121
122
15
111
S1
P
X1
112
111
141
142
14

Fig.3A

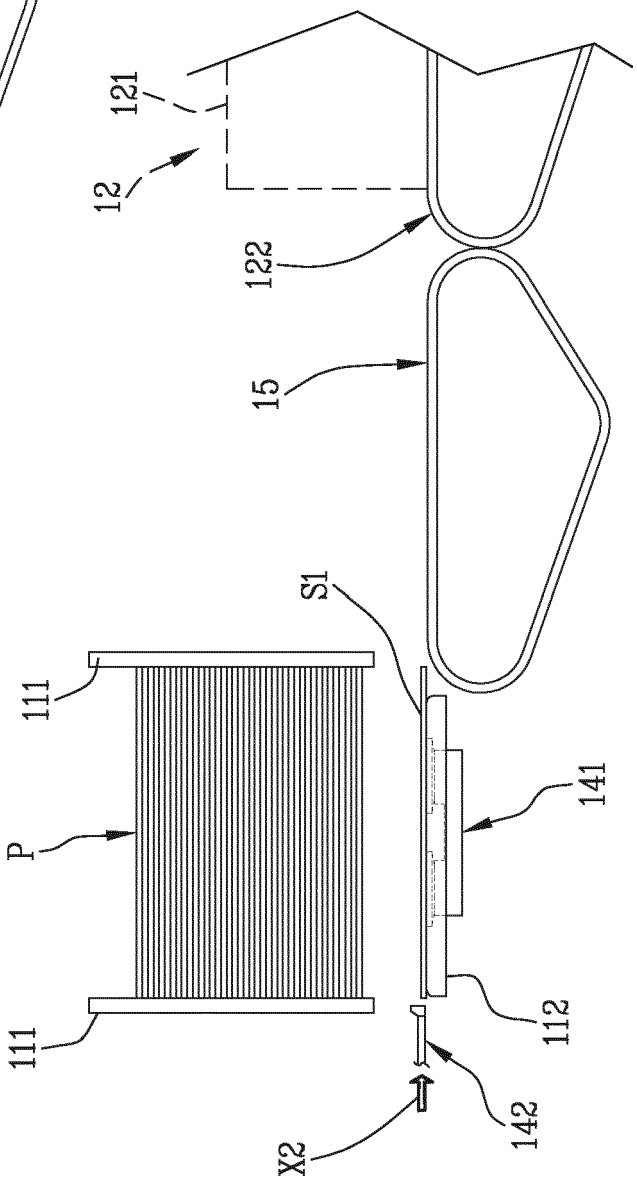

12
121
122
15
S1
111
141
P
112
111
142
X2

Fig.3B

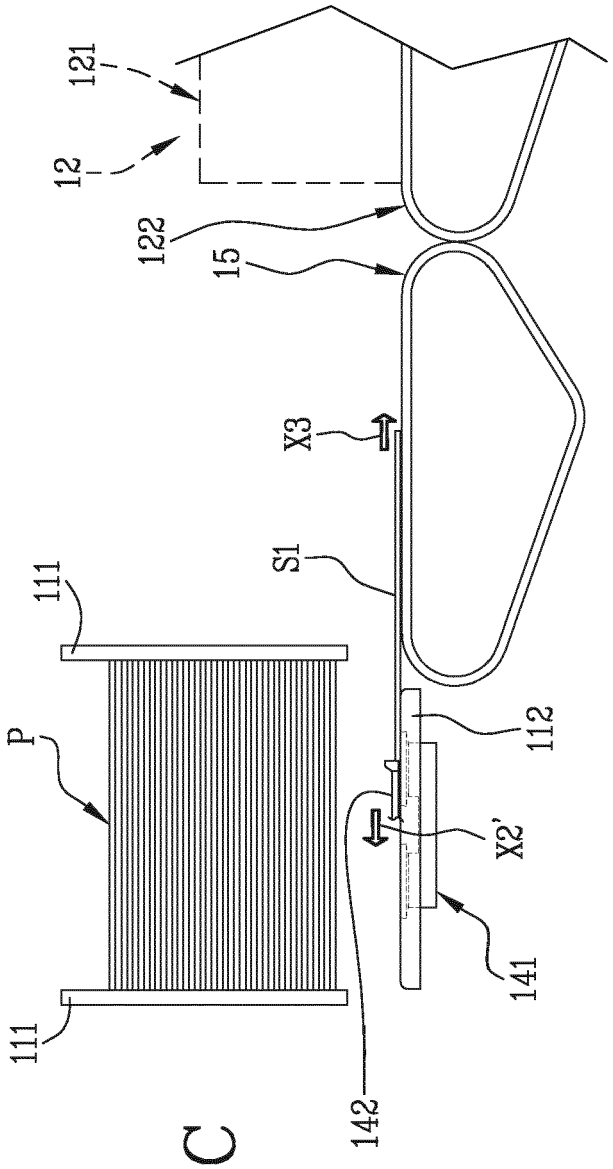

121
12
122
15
X3
S1
111
P
112
X2'
141
111
142

Fig.3C

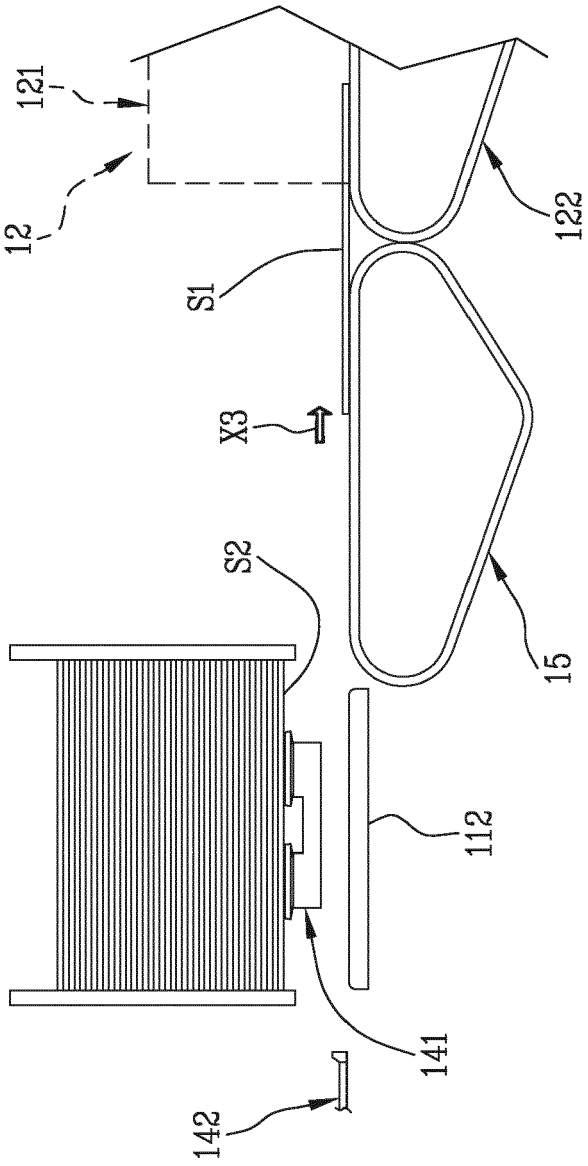
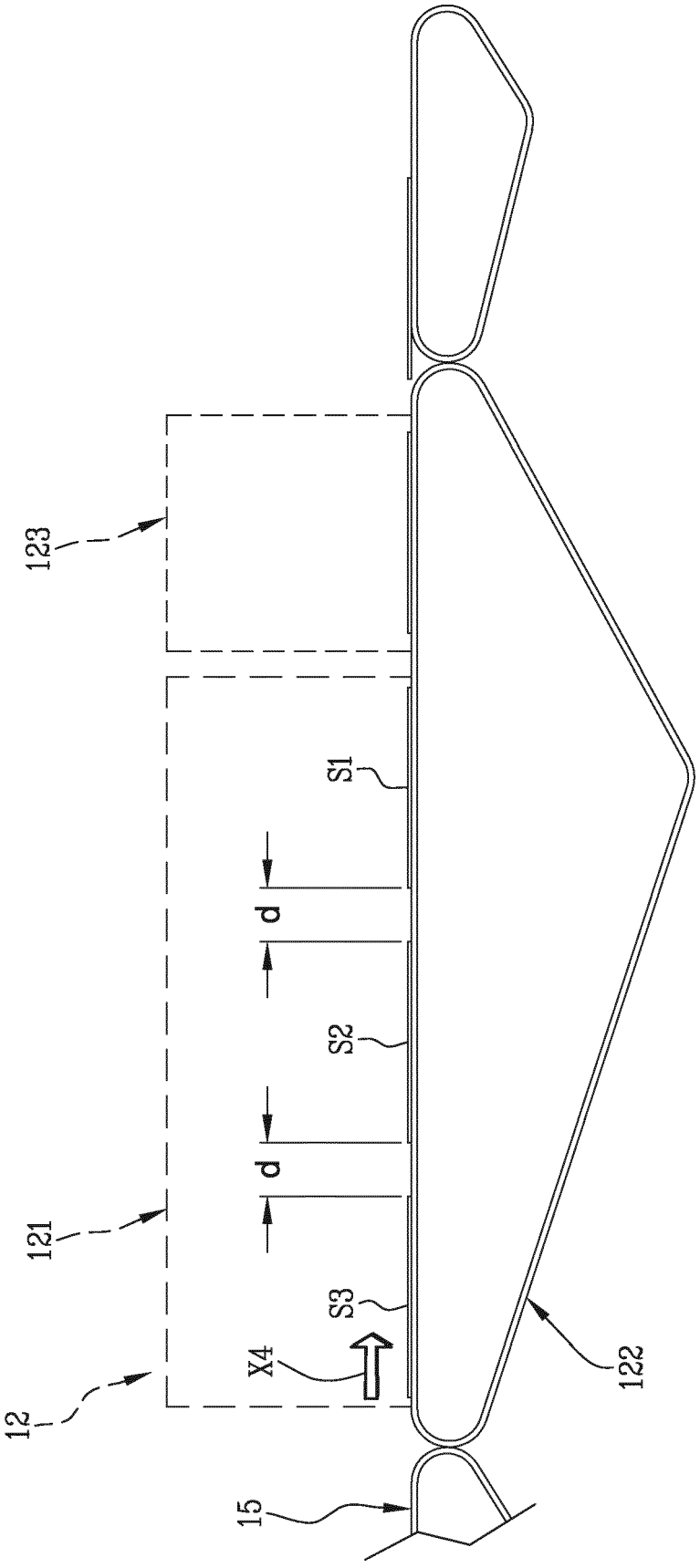

121
12
122
S1
X3
S2
15
112
141
142

Fig.3D

Fig.4



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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 0296

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2010/013879 A1 (SCHENK HANS [CH] ET AL) 21 January 2010 (2010-01-21) * paragraph [0028] - paragraph [0032]; figures 1,2 *	1-14	INV. B21D5/14
Y	WO 2019/092629 A1 (PROMAU SRL [IT]) 16 May 2019 (2019-05-16) * page 28, line 23 - page 30, line 12; figure 1 *	1-14	
Y	US 2012/291642 A1 (BARTON AUGUSTO E [US]) 22 November 2012 (2012-11-22) * paragraph [0023]; figure 1 *	7	
A	WO 2018/005367 A1 (AMAZON TECH INC [US]) 4 January 2018 (2018-01-04) * paragraph [0047] *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 November 2020	Vesterholm, Mika

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