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(54) **Apparatus for filling objects in boxes**

(57) The invention relates to an apparatus for filling objects (7) in boxes (3) of the lid-and-bottom type, with a filling station (4), means (5) for successively supplying boxes to said filling station, means (6) for opening and closing the lid of a box, means (8) for moving an object into the opened box and means (9) for successively removing the filled boxes from the filling station. This apparatus is characterised in that the means for supplying

the boxes comprise a first conveyor means (10) extending in a first direction, the means for moving an object in the opened box comprise a second conveyor means (14) extending in a second direction differing from the first direction, the means for removing the filled boxes comprise a third conveyor means (9) and the means for opening and closing the lid of a box comprise lid engagement means (6) which substantially are movable upwardly and downwardly above the filling station.

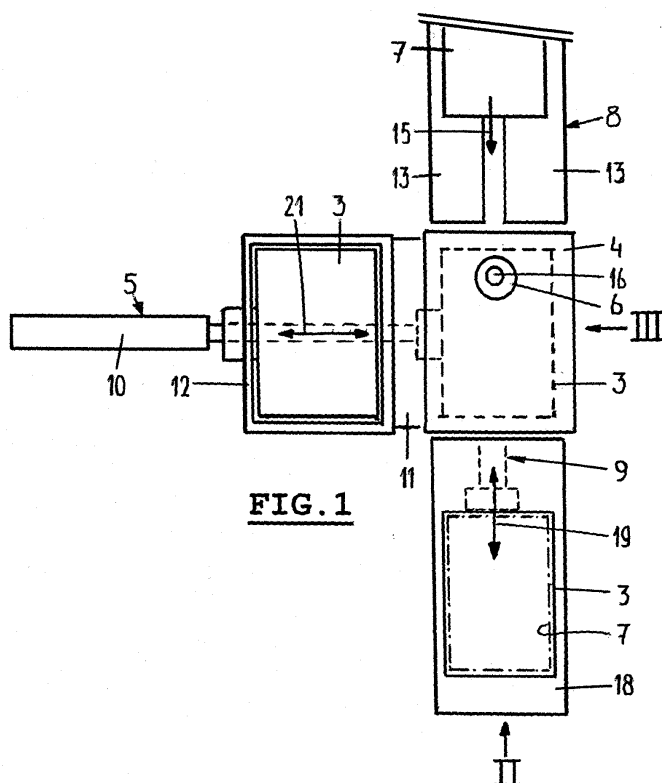


FIG. 1

Description

[0001] The invention relates to an apparatus for filling objects in boxes of the lid-and-bottom type, with a filling station, means for successively supplying boxes to said filling station, means for opening and closing the lid of a box, means for moving an object into the opened box and means for successively removing the filled boxes from the filling station.

[0002] A known apparatus of the above type is already marketed by ETT Verpackungstechnik GmbH in Moringen, Germany as ETT Packroboter TYP SK 16. This known apparatus is provided with a robotic arm which can grip a box for placing it at the filling station. Next the robotic arm removes the lid from the box and picks up an object for positioning it into the box. Finally the robotic arm again closes the box with the lid.

[0003] Thus, the robotic arm of this known apparatus successively functions as means for supplying the boxes to the filling station, means for opening and closing the lid of a box, means for moving an object into the opened box and means for removing the filled boxes from the filling station. Because this robotic arm has to perform all these operations, the known apparatus is rather slow and has a low output.

[0004] It is an object of the present invention to provide an improved apparatus of the type referred to above.

[0005] Thus, in accordance with the present invention an apparatus for filling objects of the type referred to above is characterised in that the means for supplying the boxes comprise a first conveyor means extending in a first direction, the means for moving an object in the opened box comprise a second conveyor means extending in a second direction differing from the first direction, the means for removing the filled boxes comprise a third conveyor means and the means for opening and closing the lid of a box comprise lid engagement means which substantially are movable upwardly and downwardly above the filling station.

[0006] Because in accordance with the present invention the different tasks of the filling operation are carried out by different means, the apparatus is faster in its operation than the known apparatus and thus provides a higher output. Providing different means for different tasks makes it possible to carry out different tasks simultaneously, thus extremely reducing the time needed for filling an object in a box.

[0007] In a preferred embodiment of the apparatus according to the present invention the first direction and the second direction are mutually perpendicular. This solution offers the possibility of supplying the boxes and the objects in an extremely advantageous and economic manner, whereas the apparatus can be built in a compact manner.

[0008] Further, an embodiment can be mentioned in which the third conveyor means also extends in the second direction. Basically this means, that the boxes once

filled are removed in the same direction as the direction in which the empty boxes are supplied to the filling station.

[0009] Preferably, the lid engagement means are meant for engaging and lifting only said side of the lid at which an object arrives on the second conveyor means. A first advantage of this embodiment is, that the opposite side of the lid remains in contact with the box, such that closing the lid is extremely simple without having to align the lid with the box. Further, due to only lifting one side of the lid, the lid assumes an inclined position, in which it defines a guide for the object into the box bottom.

[0010] Although there may be many ways for engaging and lifting the lid, a very reliable, yet nevertheless simple constructive solution is provided by suction means.

[0011] In a still further embodiment of the apparatus according to the present invention box bottom engagement means are provided at the filling station for holding down the bottom when the box lid is lifted by the lid engagement means. Such box bottom engagement means assure, that the box remains in a proper position when the lid is removed and will not be lifted together with the lid. Again, such engagement means could comprise suction means.

[0012] Although it is conceivable that the boxes to be filled are supplied one by one (manually or by mechanical means) to the first conveyor, it is preferred, that the first conveyor means extends between a storage holder for a number of boxes and the filling station. Thus, the first conveyor means can transfer the boxes one at the time from the storage holder to the filling station without any external intervention. A continuous operation thus is ensured. The storage holder itself may be filled at appropriate times by any appropriate means (manually or mechanically). Basically, the storage holder defines a buffer smoothening any irregular supply of boxes to be filled.

[0013] When, in accordance with a preferred embodiment, the storage holder houses a number of stacked boxes and the first conveyor means is adapted to move the lowermost box of the stack towards the filling station, the apparatus can function continuously as long as boxes are present in the storage holder. When the storage holder is about to get empty, a new amount of boxes can be stacked therein, for example manually or by mechanical means. The operation of the apparatus has not to be interrupted for such an operation.

[0014] A very reliable transfer of the boxes from the storage holder towards the filling station is obtained when, in accordance with still a further embodiment, the first conveyor means comprises a pushing member which is movable to end from in said first direction, and a guide track for supporting and guiding a box pushed by said pushing member. Moving the pushing member towards the filling station transfers the lowermost box towards the filling station. When, next, the pushing mem-

ber has been retracted the stack of boxes in the storage holder moves downwardly such that the next lowermost box will be positioned in front of the pushing member, whereafter the cycle can be repeated.

[0015] Preferably, the second conveyor means comprises a support and guide surface for the objects, which support and guide surface at the filling stations ends at the same level or above the surrounding vertically extending wall of the box bottom of a box positioned at the filling station.

[0016] As a result no further measures (such as, for example, lifting the object) should be taken for moving the object correctly into the opened box.

[0017] When a box has been filled, it should be removed from the filling station to make room for a successive box to be filled. For removing such a filled box the third conveyor means may comprise a pushing member, for example a cylinder-piston assembly. However, also other mechanical solutions known per se may be applied.

[0018] The apparatus according to the invention as described above is adapted for successively filling one box after the other. However, it is also possible to amend the apparatus in accordance with the present invention in such a manner, that it is provided with an additional first conveyor means positioned at the opposite side of the filling station and with a conveying direction in parallel with but opposite to the conveying direction of the other first conveyor. The two oppositely positioned first conveyors may then transfer boxes to the filling station simultaneously or alternately, thus increasing the operating speed and output of the apparatus, provided that the second conveyor is able to supply the objects at a corresponding higher speed too.

[0019] In such a case it is possible too to provide an embodiment of the apparatus in which the filling station is adapted to hold simultaneously two boxes positioned alongside each other and supplied by the two oppositely positioned first conveyor means and wherein the second conveyor means is adapted to move two objects in parallel and simultaneously towards the filling station and into the two boxes positioned at the filling station. Of course the lid engagement means should in such a case be able to engage both boxes simultaneously.

[0020] The objects filled in the boxes by the apparatus in accordance with the present invention may comprise a stack of sheets, such as for example paper sheets for inkjet or laser printers, glossy photo paper sheets etcetera. But it is emphasized that the apparatus may also be used for boxing other objects.

[0021] Hereinafter the invention will be elucidated referring to the drawing, in which embodiments of an apparatus in accordance with the present invention are illustrated.

Figure 1 shows, schematically, a top plan view of an embodiment of the apparatus in accordance with the present invention;

figure 2 shows, schematically, a view according to II in figure 1;

figure 3 shows, schematically, a view according to III in figure 1 and

figure 4 shows, again schematically, a top plan view of an alternative embodiment of the apparatus in accordance with the present invention.

[0022] The apparatus in accordance with the present invention is meant for filling objects in boxes of the lid-and-bottom type. An example of such a box is clearly illustrated in figure 3, showing a bottom 1 and lid 2 which, together, define a box 3. In this illustration the lid 2 is partially lifted from the bottom 1.

[0023] Now reference is made to figure 1, which shows a top plan view of an embodiment of the apparatus in accordance with the present invention. It is noted that only a schematic representation of the apparatus is given for illustrating the manner of its operation. On basis of the following description an expert should be able to determine the constructive details of such an apparatus without any further detailed description being offered here. Only those constructive details which seem necessary for the specific operation of the apparatus will be given here.

[0024] The apparatus comprises a central filling station 4, a first conveyor means 5 for successively supplying boxes 3 in a first direction 21 to said filling station 4, lid engagement means 6 for opening and closing the lid 2 of a box 3, second conveyor means 8 for moving an object 7 in a second direction 15 into an opened box 3 at the filling station 4 and a third conveyor means 9 for removing a filled box 3 from the filling station 4 in a direction 19.

[0025] In the embodiment illustrated the first conveyor means 5 basically comprises a pushing member 10 (for example a cylinder-piston assembly such as an air cylinder or alike) and a guide track 11 for supporting and guiding a box 3 pushed by said pushing member 10. The first conveyor means 5 extends between a storage holder 12 for the boxes to be filled and said filling station 4. The storage holder 12 houses a number of stacked boxes 3 (see figure 2), and the first conveyor means 5 is adapted to move the lowermost box 3 of the stack towards the filling station 4 upon activation (in figure 1 and 2 a movement to the right). Thereafter the first conveyor means 5 is moved back (to the left in figure 1 and 2) beyond the storage holder 12 such that the stack of boxes 3 in the storage holder 12 moves down until the lowermost box 3 is positioned on top of the guide track 11 and in front of the pushing member 10 and is ready to be pushed to the filling station 4.

[0026] It is conceivable too that the first conveyor 5 does not operate in the to-and-fro manner as described before, but is provided with pushing fingers or alike following a roundgoing track, as is known per se in the field of conveyors and thus needs no further explanation here.

[0027] The second conveyor means 8 comprises a support and guide surface 13 for the objects 7. As is clearly visible in figure 3, the support and guide surface 13 of the second conveyor 8 ends, at the filling station 4, at the same level as (or above) the surrounding vertically extending wall 20 of the box bottom 1 of a box 3 positioned at the filling station 4. Thus a supplied object 7 will easily pass over the wall 20 of the box bottom 1 for entering the latter without the provision of additional means for temporarily lifting the object.

[0028] In the illustrated embodiment the second conveyor 8 comprises pushing fingers 14 (figure 2 and 3) pushing an object 7 in the second direction 15 towards the filling station 4 in a manner known per se on the field of conveyors. It should be clear however that the second conveyor 8 could have any other constructional shape enabling an object 7 to be moved into an opened box 3 at the filling station 4.

[0029] In the illustrated embodiment the direction 21 of the first conveyor means 5 and direction 15 of the second conveyor means 8 extend perpendicularly. As a result good conditions are created for an effective supply of the empty boxes and the objects to the filling station, enabling a compact design of the apparatus.

[0030] In the illustrated embodiment the lid engagement means 6 is a suction cup. This suction cup 6 is attached to a mechanism 16 (for example a cylinder-piston assembly or a pivot arm not illustrated in detail) for moving it upwards and downwards relative to a box 3 present in the filling station 4. When a box 3 has been positioned at the filling station 4 by means of the first conveyor 5 the suction cup 6 is lowered by the mechanism 16 and is activated upon engagement of the lid 2 of the box 3. Next the suction cup is moved upwards again and it lifts the lid 2 partially from the bottom 1. This is shown in fig. 3.

[0031] In this inclined situation of the lid 2 the second conveyor 8 can easily slid the object 7 into the opened box. The inclined lid 2 hereby additionally acts as a guide for the object into the opened box.

[0032] Next, when the object is filled into the box, the suction cup 6 is lowered again and deactivated, such that the lid closes the box 3. Because only one end of the lid 2 has been lifted, repositioning the lid onto the bottom 1 is very easy without the need for any aligning between these two elements.

[0033] In figure 3 an additional suction cup 17 is shown in dotted lines which equally can engage the bottom 1 of the box 3, such that it remains in its position when the lid 2 is lifted.

[0034] The third conveyor means 9 (which equally can be a cylinder-piston assembly moving to and fro as illustrated here, but which also can comprise any other appropriate conveyor means known per se) then is activated and pushes the filled box 3 towards a platform 18 from which it may be removed mechanically or manually.

[0035] Although in the illustrated embodiment the third conveyor means 9 operates in a direction 19 which

is in parallel to the conveying direction 15 of the second conveyor 8, it is possible too that the third conveyor 9 operates in a different direction.

[0036] Finally, figure 4 shows an alternative embodiment, which basically is comprised of two apparatuses as illustrated in figure 1 positioned alongside each other, one however being a mirror image of the other. As a result two boxes can be filled simultaneously thus substantially doubling the output of the apparatus.

[0037] Starting from the embodiment illustrated in figure 1, it is also possible to apply only an additional first conveyor means 5 at the opposite side (right side in figure 1 and 2) from the filling station 4. In such a case only one second conveyor means 8 will be applied which, of course, should have the capacity of supplying the corresponding increased amount of objects. At the filling station two boxes 3 could be filled simultaneously then, or alternately a box supplied by one first conveyor and a box supplied by the other first conveyor.

[0038] The apparatus according to the present invention may be integrated in a conventional line for forming objects (such as stacks of paper sheets or alike) and for further handling these objects (packing, labeling etcetera).

[0039] The invention is not limited to the embodiments described before, which may be varied widely within the scope of the invention as defined by the claims.

Claims

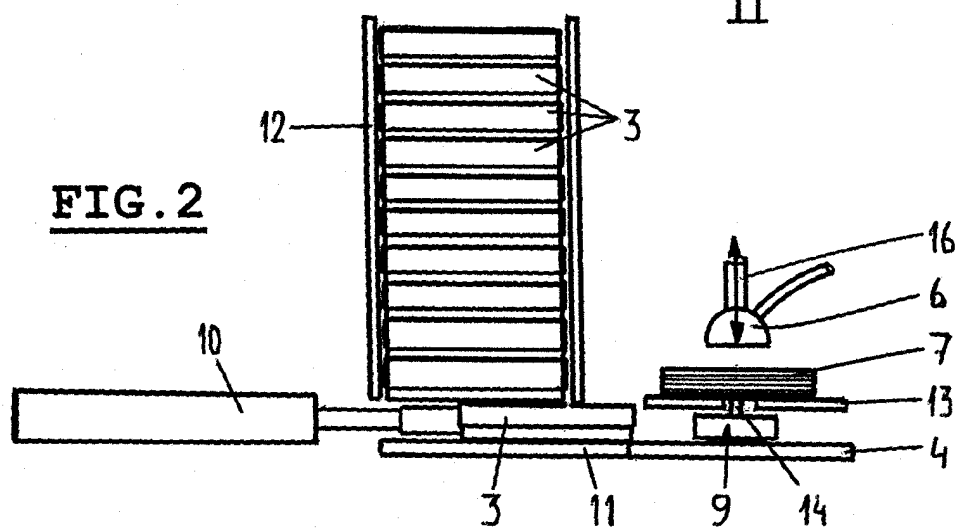
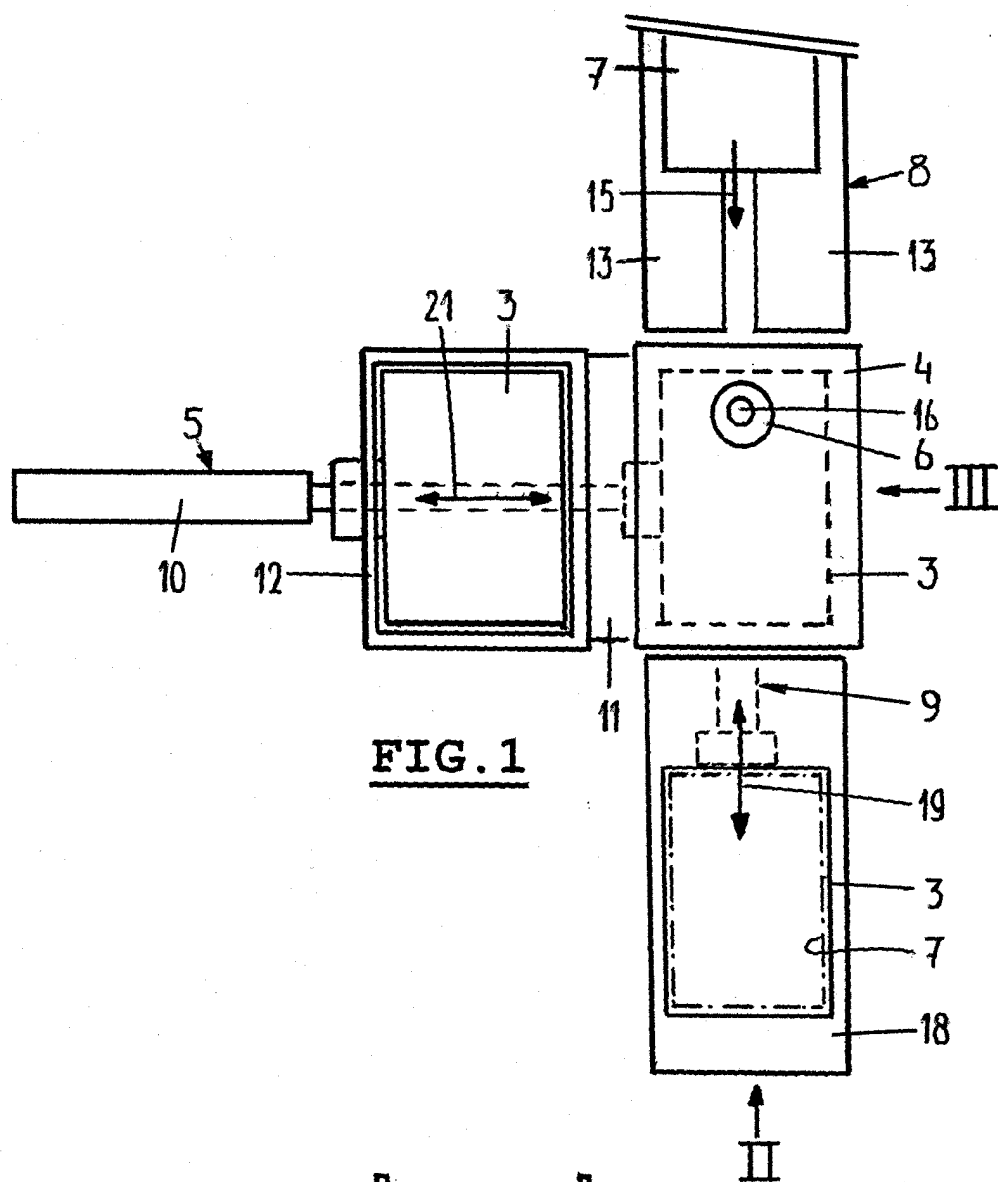
1. Apparatus for filling objects in boxes of the lid-and-bottom type, with

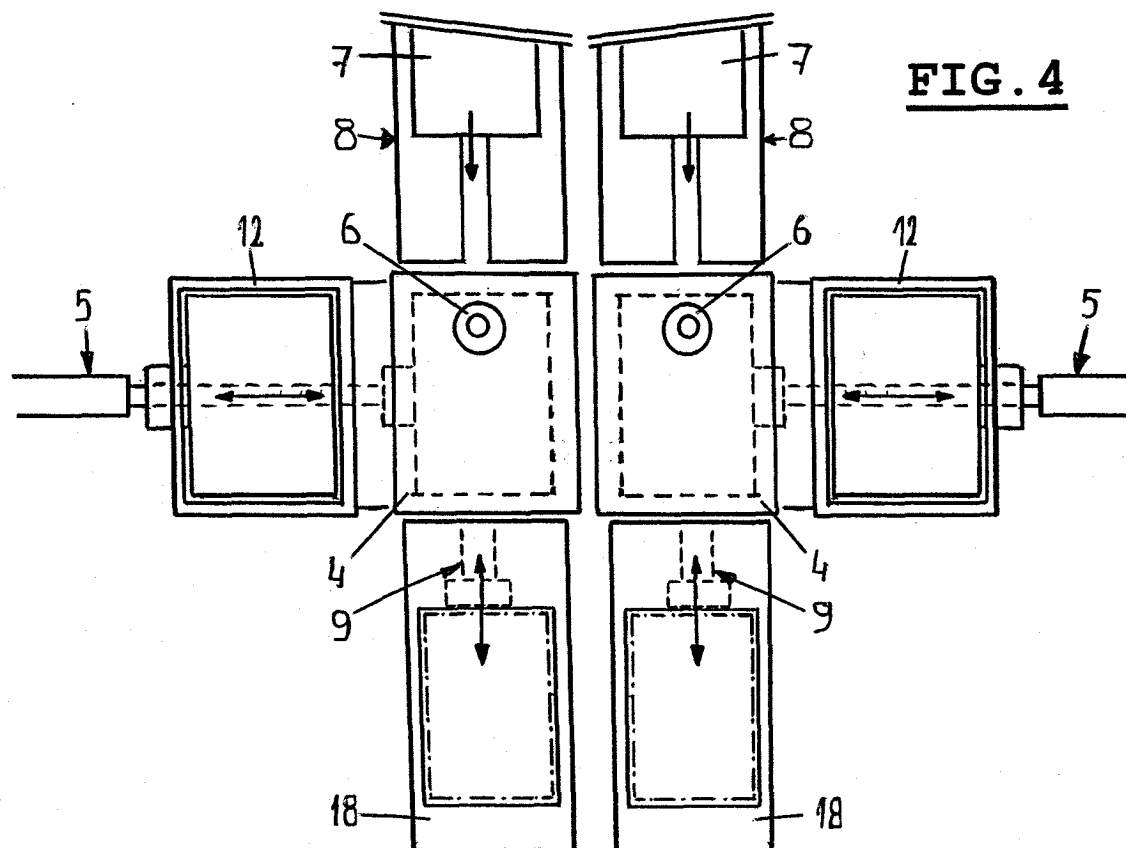
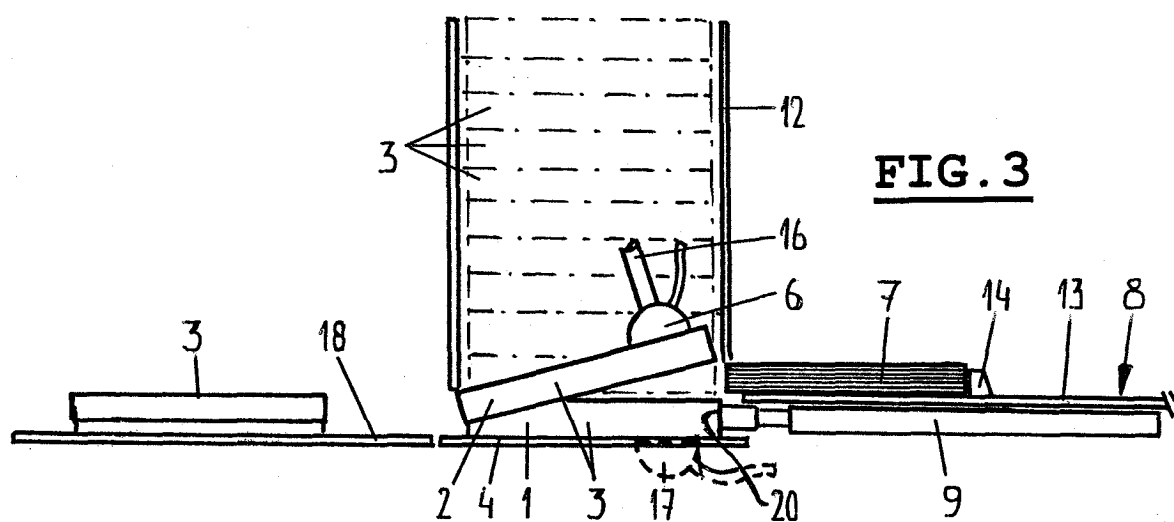
- a filling station,
- means for successively supplying boxes to said filling station,
- means for opening and closing the lid of a box,
- means for moving an object into the opened box and
- means for successively removing the filled boxes from the filling station,

characterized in that

- the means for supplying the boxes comprise a first conveyor means extending in a first direction,
- the means for moving an object in the opened box comprise a second conveyor means extending in a second direction differing from the first direction,
- the means for removing the filled boxes comprise a third conveyor means and
- the means for opening and closing the lid of a box comprise lid engagement means which substantially are movable upwardly and downwardly above the filling station.

2. Apparatus according to claim 1, wherein the first direction and the second direction are mutually perpendicular.
3. Apparatus according to claim 1 or 2, wherein the third conveyor means also extends in the second direction. 5
4. Apparatus according to any of the previous claims, wherein the lid engagement means are meant for engaging and lifting only said side of the lid at which an object arrives on the second conveyor means. 10
5. Apparatus according to any of the previous claims, wherein the lid engagement means comprise suction means. 15
6. Apparatus according to any of the previous claims, wherein box bottom engagement means are provided at the filling station for holding down the bottom when the box lid is lifted by the lid engagement means. 20
7. Apparatus according to claim 6, wherein the box bottom engagement means comprise suction means. 25
8. Apparatus according to any of the previous claims, wherein the first conveyor means extends between a storage holder for a number of boxes and the filling station. 30
9. Apparatus according to claim 8, wherein the storage holder houses a number of stacked boxes and wherein the first conveyor means is adapted to move the lowermost box of the stack towards the filling station. 35
10. Apparatus according to claim 9, wherein the first conveyor means comprises a pushing member which is movable to and fro in said first direction, and a guide track for supporting and guiding a box pushed by said pushing member. 40
11. Apparatus according to any of the previous claims, wherein the second conveyor means comprises a support and guide surface for the objects, which support and guide surface at the filling station ends at the same level or above the surrounding vertically extending wall of the box bottom of a box positioned at the filling station. 45 50
12. Apparatus according to any of the previous claims, wherein the third conveyor means comprises a pushing member. 55
13. Apparatus according to any of the previous claims, provided with an additional first conveyor means positioned at the opposite side of the filling station and with a conveying direction in parallel with but opposite to the conveying direction of the other first conveyor.
14. Apparatus according to any of the previous claims, wherein the filling station is adapted to hold simultaneously two boxes positioned alongside each other and supplied by the two oppositely positioned first conveyor means and wherein the second conveyor means is adapted to move two objects in parallel and simultaneously towards the filling station and into the two boxes positioned at the filling station.
15. Apparatus according to any of the previous claims, wherein each object comprises a stack of sheets such as, for example, paper sheets for inkjet or laser printers, glossy photo paper sheets etcetera.







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 10 3446

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)
A	DATABASE WPI Section PQ, Week 198213 Derwent Publications Ltd., London, GB; Class Q31, AN 1982-D6409E XP002270186 & SU 839 865 A (CHEM IND RES PLAN), 23 June 1981 (1981-06-23) * abstract * ---	1	B65B25/14 B65B5/04
A	US 4 464 880 A (YILMAZ HULUSI ET AL) 14 August 1984 (1984-08-14) * abstract; figures 1-4 * -----	1	TECHNICAL FIELDS SEARCHED (Int.Cl.7) B65B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 February 2004	Examiner Grentzius, W
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)

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

EP 03 10 3446

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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13-02-2004

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