Abstract: The invention relates to a sheet diverter for a printing machine (100) and a method for diverting a sheet. The sheet diverter comprises a first transport unit (1) that defines a first transport path; a second transport unit (2) that defines a second transport path being at an angle relative to said first transport path; a pressure roller (3) that can be moved between a first and a second position, said pressure roller (3), when in its first position, being in contact with the first transport unit (1), and, when in its second position, being in contact with the second transport unit (2); a deflecting element (5) that can be moved between a first and a second position, said deflecting element (5), when in its first position, enabling a sheet to be transported along the first transport path and blocking said sheet from being transported along the second transport path, and, when in its second position, blocking said sheet from being transported along the first transport path and deflecting said sheet to the second transport path; an actuating device (9) for simultaneously moving the pressure roller (3) and the deflecting element (5) between their respective first and second positions.
SHEET DIVERTER AND METHOD FOR DEFLECTING A SHEET

FIELD OF THE INVENTION

The invention relates to a sheet diverter for a printing machine and to a method for deflecting a sheet out of a first transport path, in which a sheet is transported through a first transport unit, to a second transport path, in which a sheet is transported through a second transport unit.

BACKGROUND OF THE INVENTION

When processing individual sheets in a printing machine, it is frequently necessary to guide successive sheets to different transport paths. Regarding this, it is known to provide sheet diverters at different locations of a printing machine, where sheets are transported along a first transport path or are deflected from the first transport path to a second transport path. To accomplish this, the sheet diverter, as a rule, comprises first and second transport units that are able to guide the sheets along separate transport paths. Transport units with belt drives interacting with respective counter rollers for receiving sheets between them are known. As a rule, a deflecting element determines whether a sheet is received and transported by the first or the second transport unit, said deflecting element clearing one transport path and blocking the other.

In the region of the sheet diverter, the first and the second transport units are arranged, as a rule, at a small distance relative to each other, and there is only very limited design space for the accommodation of the deflecting element, in particular when belt drives with counter rollers are used.

DE 195 30 052 A shows a known sheet diverter comprising first and second transport units, each comprising a belt drive. Furthermore, so-called deflecting belts are provided, each cooperating with the belt drives. The deflecting belts are guided at least partially via a deflecting element in order to align the deflecting belt with the belt drive of the one or the other transport unit. This results in a complex design for the belt arrangement of the deflecting belt. Furthermore, separate means for deflecting the deflecting belt are provided, thus resulting in a complex design of the sheet diverter.
SUMMARY OF THE INVENTION

Therefore, it is the object of the present invention to provide a simple, space-saving and functionally reliable assembly for the sheet transport in the branching region of a sheet diverter.

This object is achieved with a device displaying the features of claim 1 and a method displaying the features of claim 19. Additional modifications of the invention are represented in the subclaims.

In accordance with a preferred embodiment, a sheet diverter for a printing machine is provided, said sheet diverter being arranged in a sheet path of the printing machine. The sheet diverter comprises a first transport unit that defines a first transport path and a second transport unit that defines a second transport path, said second transport path being at an angle relative to said first transport path. Furthermore, the sheet diverter comprises a pressure roller that can be moved between a first and a second position, said pressure roller, when in its first position, being in contact with the first transport unit, and, when in its second position, being in contact with the second transport unit, and comprises a deflecting element that can be moved between a first and a second position, said deflecting element, when in its first position, enabling a sheet to be transported along the first transport path and blocking said sheet from being transported along the second transport path, and, when in its second position, blocking said sheet from being transported along the first transport path and deflecting said sheet to the second transport path. The sheet diverter comprises an actuating device for simultaneously moving the pressure roller and the deflecting element between their respective first and second positions. The movable pressure roller enables an assignment of said roller to the first or the second transport unit and thus enables a reliable receipt of a sheet in a transition region between the first and second transport units requiring little space. The simultaneous movement of the pressure roller and the deflecting element simplifies the design of the sheet diverter, on the one hand, and, in addition, ensures a reliable switching between the transport paths.

Preferably, the movements of the pressure roller and the deflecting element are mechanically coupled in order to ensure a reliable and simultaneous
movement of both elements via a single actuator. For a space-saving coupling of movements, the pressure roller and the deflecting element are preferably mounted so as to be pivotable about separate centers of rotation. In a first embodiment, the actuating device comprises a lifting unit and a lever, said lever bearing the pressure roller, the lever end opposite the pressure roller being connected to the lifting unit. The lever may have two legs at an angle relative to each other and may be supported about a center of rotation at the vertex of the two legs. This allows the arrangement of an actuator of the actuating device at a location remote from the elements that are to be moved, in particular, the movable pressure roller.

Furthermore, the lever can be used to select the adjustment path of the actuator in a different way, in particular, so as to be smaller than the required movement of the pressure roller. Preferably, the angle subtended by the two legs is 90°.

The deflecting element is supported so as to be pivotable about a center of rotation and is coupled to a movement of the pressure roller so that a movement of the pressure roller causes the deflecting element to be pivoted about an axis of rotation of the center of rotation. The center of rotation of the deflecting element is located between the pressure roller and a tip of the deflecting element, said tip being disposed to receive the sheets.

The angle between the first transport path and the second transport path is preferably at most 30° - 35° in order to be able to also transport heavier-weight papers. Angles beyond that could excessively stress heavier-weight paper. The main conveying direction along the first transport path preferably extends in a straight line, so as to minimize the angling of the sheets.

In one embodiment, a transport element of the second transport unit is in contact with a transport element of the first transport unit and is driven thereby, thus enabling a synchronized movement of the two transport elements with a simple design comprising only one drive.

Preferably, the deflecting element comprises two elements, with a first element being arranged on the one side of the belt drive of the second transport unit and a second element being arranged on the other side of the belt drive of the second transport unit.
The deflecting element has the form of a fork in the region of the pressure roller. Consequently, simple mounting to a shaft of the pressure roller is possible. The pressure roller and the deflecting element are coupled by means of a shaft of the pressure roller and are optionally also connected by said shaft with the lever. Preferably, the transport units comprise belt drives that cooperate with the pressure rollers because they are cost-effective and allow a flexible arrangement of the transport paths. Preferably, each of the transport units comprises at least one centrally arranged transport belt.

Preferably, there is also provided a method for diverting a sheet out of a first transport path in which a sheet is transported through a first transport unit, into a second transport path in which a sheet is transported through a second transport unit, wherein a deflecting element is moved into the first transport path in such a manner that a sheet being moved along said first path is deflected to the second transport path. While the deflecting member is being moved, a pressure roller is being moved out of a first position where it is in contact with the first transport unit, and into a second position where it is in contact with the second transport unit. As a result of this, it is possible for the sheet to be reliably received in the respective transport path while requiring little space.

Preferably, the movements of the pressure roller and the deflecting element are mechanically coupled with each other, and the movement of the two elements is accomplished by means of a single actuator. The movement of the pressure roller may be accomplished by means of a pivotable lever, said lever being coupled with the actuator, on the one hand, and with the pressure roller, on the other hand.

Preferably, the movement of the pressure roller and the deflecting element, respectively, comprises a pivoting motion.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Exemplary embodiments that may result in additional features, with the invention not being restricted to their scope however, are shown by the drawings. They show in

Fig. 1 a schematic side view of a printing machine;
Fig. 2 a schematic side view of a sheet diverter for a printing machine;

Fig. 3 a schematic plan view of a partial region of a sheet diverter.

DETAILED DESCRIPTION OF THE INVENTION

In the description hereinafter, information regarding location and/or direction relates primarily to the representations in the drawings and should thus not be viewed as being restrictive. However, it may also relate to a preferred final arrangement.

Fig. 1 shows a schematic side view of an exemplary printing machine 100, said printing machine being designed for sheet printing. The printing machine 100 comprises a housing 101, in which or on which different elements are mounted. These elements are, for example, sheet feeders in the form of sheet cassettes 102, 103, various transport units 104 for transporting sheets inside the printing machine 100, a plurality of printing units 105, a fusing unit 106, a first sheet diverter 107, a first output unit 108, a second sheet diverter 109, a second output unit 110, as well as a turning unit 111.

In order to simplify the illustration, housing components that would prevent a view of the inside of the printing machine 100 have been left off. The depicted printing machine 100 is a printing machine for multi-color printing. The plurality of transport units 104 are arranged in the printing machine 100 in such a manner that they define a main transport direction P through the printing machine. In particular, they are arranged so as to transport individual sheets from the sheet cassettes 102, 103 along the plurality of printing units 105 and the fusing unit 106 to one of the output units 108, 110. The sheet diverters 107, 109 enable a flexible path through the printing machine. Thus, the sheets can be guided, for example, after printing a recto side of said sheets, into one of the output units 108, 110. However, they can also be selectively guided again to the printing units by way of a turning unit 111 for printing the verso side of the sheets. For this, the sheet diverters 107, 109 define the respective path followed by a sheet. The sheet diverters 107, 109 may be of the same type or of different types.
With reference to Figures 2 and 3, the sheet diverter 107 will be explained in detail hereinafter. Fig. 2 being a schematic side view of the sheet diverter and Fig. 3 being a plan view of the components of the sheet diverter 107. The sheet diverter 107 comprises a first transport unit 1, a second transport unit 2 (left out in the plan view according to Fig. 3), a movable pressure roller 3, a deflecting element 5 and a movement unit 9.

The first transport unit 1 essentially comprises an upper part 23 and a lower part 24. The upper part 23 of the first transport unit 1 comprises a holding profile 13 and a plurality of stationary pressure rollers 19. The holding profile 13 essentially has a U-shaped cross-section that is open in downward direction and has seats for the shafts of the plurality of pressure rollers 19. The plurality of pressure rollers 19 is seated in the holding profile in such a manner that said pressure rollers project beyond the holding profile 13 in downward direction.

The lower part 24 of the first transport unit 1 comprises a pair of stationary deflecting and/or driving rollers 17 that are circumscribed by a tensioned transport belt 22. One of the deflecting and/or driving rollers 17 is coupled with a driving unit 14 in order to move the deflecting and/or driving rollers 17 and, via said rollers, the transport belt 22 in a circulating manner in the direction of arrow A. The deflecting and/or driving roller coupled with the drive is located opposite a pressure roller 19 in such a manner that a transport gap for the transport belt 22 is formed in such a manner that said transport belt is in contact with both rollers 17, 19.

A plurality of stationary guide rollers 18 is arranged between the deflecting and/or driving rollers 17 and inside the transport belt. The guide rollers 18 have a smaller diameter than the deflecting and/or driving rollers 17 and are in contact with one inside of the transport belt 22. The guide rollers 18 are arranged in such a manner that each guide roller is located opposite a pressure roller 19 of the upper part 23, so that a transport gap is formed for moving through the transport belt in a contacting manner. Furthermore, another guide roller 18' is provided, said guide roller being located between the deflecting and/or driving rollers 17 and being in contact with one interior side of the transport belt. As will be described in greater detail hereinafter, this guide roller 18' is arranged in the
region of the movable pressure roller 3. The deflecting and/or driving rollers 17, as well as the pressure rollers 18, 18', are held in their positions by a suitable holding device (not illustrated). Adjacent to the lower part 24 of the first transport unit, a guide baffle may be provided for guiding the sheets as indicated at 40.

The second transport unit 2 may essentially be designed in the same manner as the first transport unit; however, it must be provided with a different orientation. In the shown embodiment, the second transport unit has an upper part 25 and a lower part 26.

The lower part 26 of the second transport unit comprises a holding profile 10 and a plurality of stationary pressure rollers 20. The holding profile 10 essentially has a U-shaped cross-section that is open in upward direction and has seats for the shafts of the plurality of pressure rollers 20. The plurality of pressure rollers 20 is seated in the holding profile in such a manner that said pressure rollers project beyond the holding profile 10 in upward direction.

The upper part 25 of the second transport unit 2 comprises a pair of stationary deflecting rollers 16, a transport belt 21 being tensioned around said deflecting rollers. One of the deflecting rollers 16 is arranged in such a manner that the transport belt 21 is in contact with the transport belt 22 of the first transport unit 1 and can thus be moved so as to circulate in the direction of arrow B.

A plurality of stationary guide rollers 11 is arranged between the deflecting rollers 16 and inside the transport belt 21. The guide rollers 11 have a smaller diameter than the deflecting rollers 16 and are in contact with one inside of the transport belt 21. The guide rollers 11 are arranged in such a manner that one guide roller 11, respectively, is located opposite one pressure roller 20 of the lower part 26, so that a transport gap is formed for contacting passage of the transport belt 21. Furthermore, another guide roller 11' is provided, said guide roller being located between the deflecting rollers 16 and contacting one interior side of the transport belt 21. As will be described in detail hereinafter, this guide roller 11' is arranged in the region of the movable pressure roller 3. The deflecting rollers 16, as well as the pressure rollers 11, 11', are held in their positions by a suitable holding device (not illustrated). The first and the second transport units 1, 2 are
arranged relative to each other so that the respective transport belts 22, 21 form an angle of between 20° and 50°, preferably between 30° and 35°, between them.

The first transport unit 1 and the second transport unit 2 define a first or a second transport path. The first transport path extends in a straight line in the transport direction (arrow A) of the transport belt 22 between an input arrow C and an output arrow D of the sheet diverter 107 shown in Fig. 2. The second transport path is at an angle relative to the first transport path and extends in transport direction (arrow B) of the transport belt 21, starting from the contact region between the transport belts 22, 21, to an output arrow E.

A central transport belt is used for the respective transport path, said transport belt being arranged in the center of a sheet 15 to be transported (see Fig. 3). This ensures a certain symmetry so that the sheet 15 is not twisted during transport. Alternatively, the transport units may also comprise two transport belts that are arranged off-center and parallel to each other.

The movable pressure roller 3 is arranged in the angled region between the transport belts 22, 21 of the first and second transport units 1, 2 and kept movable in such a manner that it can be moved in contact with the one or the other transport belt 22, 21. To do so, the pressure roller 3 is rotatably supported on an axle 30, said axle being movable, via a movement mechanism, transversely to the axial direction, as will be still be explained in detail hereinafter.

The deflecting element 5 is also arranged in the angled region between the transport belts 22, 21 of the first and second transport units 1, 2 and extends, at least partially, between the movable pressure roller 3 and the transport belts 22, 21. The deflecting element 5 comprises two elements 35 that have identical form and are each arranged in such a manner that they can receive, at least partially, a transport belt 22, 21 of the first and second transport units 1, 2 between them. Each of the elements 35 is an elongated element that tapers to a point 7 on one end. On the opposite end 6, the elements 35 have the form of a fork. Between the two ends, the elements 35 are supported so as to be rotatable about a rotary axle 8. The rotational axis is located at a point between the axle 30 for the pressure roller 3 and the transport belts 22, 21 of the transport units 1, 2. The fork-shaped end of the elements is dimensioned and arranged in such a manner that it
extends at least partially around the axle 30 of the pressure roller 3. A movement of axle 30 transversely with respect to axial direction causes a pivoting of the respective elements 35 about the rotary axle 8, as will be described in detail hereinafter.

Although the deflecting element 5 was described as consisting of two separate elements 35, it may also consist of one piece and have spaced-apart deflecting fingers that are rigidly connected with each other, for example, in the region of the rotational axis.

The movement unit 9 comprises a lifting unit 41 and two lever arms 42. The lifting unit 41 is mounted to the holding profile 13 and may be of a type that is suitable to perform a linear movement. In the illustrated embodiment, a lifting magnet is provided, said magnet moving a stamp 44 back and forth in linear direction. The stamp 44 of the lifting unit 41 is connected, on its free end, with a connecting rod 45 (see Fig. 3) that connects the two lever arms 42 with each other.

The position shown in Fig. 2 represents a not actuatble position of the lifting unit 41, wherein said lifting unit may be biased, for example, via a spring or another pretensioning element. When the lifting unit is actuated, the stamp 44 is moved by the lifting magnet to the right against the bias.

Each of the lever elements 42 has two legs 46 bent at a right angle relative to each other, each of said legs being supported in the vertex of the two legs about a rotary axle 48. The rotary axle is mounted to the holding profile 13, and the lever elements 42 are arranged in such a manner that the holding profile 13 is received at least partially in between. The free end of one leg 46 is connected with the connecting rod on which the stamp 44 is provided. The free end of the other leg 46 receives one end of the rotary axle 30 for the pressure roller 3. Consequently, the pressure roller 3 is rotatably supported by the lever elements 42 and can be pivoted with said lever arms about the rotary axle 48 in order to be able to provide a movement of the pressure roller transversely with respect to the rotary axle 30. In particular, the pressure roller 3 can be pivoted out of the position shown in Fig. 2, where it is in contact with the transport belts 22 in the region of the guide roller 18', into a position where it is in contact with the transport belts 21 in the region of the guide roller 11'. As is obvious to the person skilled in the art, such a
movement is transmitted via the fork-shaped part of the elements 35 (see Fig. 3) and the rotary axle 8 of the deflecting element 5 to also produce a pivoting movement of the deflecting element 5. In particular, the deflecting element 5 can be pivoted out of the position shown in Fig. 2, where it enables a sheet transport along the first transport unit 1 and blocks it along the second transport unit 2, into a position, where it blocks a sheet transport along the first transport unit 1 and enables it along the second transport unit 2. A transport along the respective transport unit 1, 2 is blocked in that the elements 35 (Fig. 3) of the deflecting element partially extend around a respective transport belt 22, 21.

Hereinafter, the operation of the sheet diverter 107 will now be explained in greater detail with reference to the figures. The sheet diverter is first in the position shown in Fig. 2, where the movable pressure roller 3 is in contact with the transport belts 22 in the region of the guide roller 18'. The deflecting element 5 is in a position, where it enables a sheet transport along the first transport unit 1 and blocks said sheet transport along the second transport unit 2. The transport belt 22 is moved by the drive 14 in a circulating manner in the direction of arrow A. Due to the contact between the transport belts 22 and 21, the transport belt 21 is moved in a circulating manner, as illustrated by arrow B.

A sheet delivered to a sheet diverter 107 in the region of input arrow C is carried along by the transport belt 22 and sequentially conveyed through the transport gaps that are formed between the transport belt 22 and the transport belt 21, the pressure roller 3 and the pressure rollers 19. The sheet leaves the sheet diverter 107 in the region of output arrow D.

If, before the sheet is fed into the sheet diverter, a sheet is to be output by the sheet diverter 107 in the direction of output arrow E, i.e., along the second transport path, the movement unit 9 is actuated before the sheet is supplied. In particular, the lifting magnet is activated in such a manner that the stamp 44 is retracted, i.e., moved to the right in Fig. 2. As a result of this, the lifting elements 42 are pivoted about the rotary axle 48. This causes the pressure roller 3 to be moved out of contact with the transport belt 22 via said pressure roller's rotary axle 30 and into contact with the transport belt 21. When the pressure roller 3 is in contact with the transport belt 21 in the region of the guide roller 11', the pivoting
movement stops; a certain bias of the pressure roller may be generated via the lifting magnet.

Via the fork-shaped part of the elements 35, the above-described movement of the rotary axle 30 of the pressure roller 3 also effects a pivoting of the deflecting element 5 about the rotary axle 8. In particular, the tip 7 of the deflecting element 5 is pivoted out of the position shown in Fig. 2 where it enables a sheet transport along the first transport unit 1 and blocks said sheet transport along the second transport unit 2, into a position where it blocks a sheet transport along the first transport unit 1 and enables said sheet transport along the second transport unit 2.

A sheet that is now delivered to the sheet diverter 107 in the region of input arrow C is again first carried along with the transport belt 22, and, after having passed through the transport gap between the transport belt 22 and the transport belt 21, said sheet is deflected upward by the deflecting element 5. The leading edge of the sheet slides along the deflecting element in the direction of the transport gap between the transport belt 21 and the pressure roller 3 and is then received therein between. Subsequently, the sheet is transported further along the transport belt 21 through the transport gaps between the transport belts 21 and the pressure rollers 20 toward output arrow E, and output there from the sheet diverter 107.

The invention was explained in detail with the use of specific designs without being restricted to any specific embodiment. In particular, the design of the movement unit may deviate from the illustrated form.
CLAIMS

1. Sheet diverter for a printing machine, comprising:
   a first transport unit (1) that defines a first transport path;
   a second transport unit (2) that defines a second transport path being at an angle relative to said first transport path;
   a pressure roller (3) that can be moved between a first and a second position,
   said pressure roller (3), when in its first position, being in contact with the first transport unit (1), and, when in its second position, being in contact with the second transport unit (2);
   a deflecting element (5) that can be moved between a first and a second position,
   said deflecting element (5), when in its first position, enabling a sheet to be transported along the first transport path and blocking said sheet from being transported along the second transport path, and, when in its second position, blocking said sheet from being transported along the first transport path and deflecting said sheet to the second transport path;
   an actuating device for simultaneously moving the pressure roller (3) and the deflecting element (5) between their respective first and second positions.

2. Sheet diverter as in Claim 1, characterized in that the movements of the pressure roller (3) and the deflecting element (5) are mechanically coupled.

3. Sheet diverter as in one of the previous claims, characterized in that the pressure roller (3) and the deflecting element (5) can be pivoted about separate centers of rotation.
4. Sheet diverter as in one of the previous claims, characterized in that the actuating device comprises a lifting unit (4) and a lever (42), said lever bearing the pressure roller (3).

5. Sheet diverter as in Claim 4, characterized in that the lever (42) has two legs at an angle relative to each other and is supported about a center of rotation at the vertex of the two legs.

6. Sheet diverter as in Claim 5, characterized in that the angle formed by the two legs is 90°.

7. Sheet diverter as in Claims 4 through 6, characterized in that one end of the lever (42) supports the pressure roller (3) and the other end of said lever is connected with the lifting unit (4).

8. Sheet diverter as in one of the previous claims, characterized in that deflecting element (5) is supported so as to be pivotable about a rotary axle (8) and is coupled to a movement of the pressure roller (3), so that a movement of the pressure roller (3) causes the deflecting element (5) to be pivoted about an axis of rotation of the rotary axle (8).

9. Sheet diverter as in Claim 8, characterized in that the rotary axle (8) of the deflecting element (5) is located between the pressure roller (3) and a tip (7) of the deflecting element (5), said tip being disposed to receive the sheets.

10. Sheet diverter as in one of the previous claims, characterized in that the deflecting element (5) comprises two elements that can be moved together and, depending on the position of the deflecting element, extend at least partially around transport elements of the first or the second transport units (1, 2).

11. Sheet diverter as in one of the previous claims, characterized in that the deflecting element (5) has at least one recess for the accommodation of a transport element of the first or second transport unit (1, 2).
12. Sheet diverter as in one of the previous claims, characterized in that the deflecting element (5) has a fork-shaped region that at least partially extends around a shaft of the pressure roller (3) in order to couple the movements of the two elements.

13. Sheet diverter as in one of the previous claims, characterized in that the actuating device comprises a lifting magnet that, in a non-switched position, holds the pressure roller (3) in its first position and, in a switched position, holds the pressure roller (3) in its second position.

14. Sheet diverter as in one of the previous claims, characterized in that the angle between the first transport path and the second transport path is at most 30° - 35°.

15. Sheet diverter as in one of the previous claims, characterized in that a transport element of the second transport unit is in contact with a transport element of the first transport unit and is driven thereby.

16. Sheet diverter as in Claim 1, characterized in that the transport units (1, 2) comprise belt drives.

17. Sheet diverter as in one of the previous claims, characterized in that each of the transport units (1, 2) comprises one centrally arranged transport belt.

18. Sheet diverter as in one of the previous claims, characterized in that each of the transport units (1, 2) comprises two transport belts that are arranged off-center and parallel to each other.

19. Method for diverting a sheet out of a first transport path in which a sheet is transported through a first transport unit (1), into a second transport path in which a sheet is transported through a second transport unit (2),
wherein a deflecting element (5) is moved into the first transport path in such a manner that a sheet being moved along said first path is deflected to the second transport path, characterized in that, while the deflecting member (5) is being moved, a pressure roller (3) is being moved out of a first position where it is in contact with the first transport unit (1), and into a second position where it is in contact with the second transport unit (2).

20. Method as in Claim 19, characterized in that the movements of the pressure roller and the deflecting element are mechanically coupled with each other, and the movement of the two elements is accomplished by means of a single actuator.

21. Method as in Claim 20, characterized in that the movement of the pressure roller (3) is accomplished by means of a pivotable lever (42), said lever being coupled with the actuator, on the one hand, and with the pressure roller, on the other hand.

22. Method as in one of the Claims 19 - 21, characterized in that movement of the pressure roller (3) and the deflecting element (5), respectively, comprises a pivoting motion.
A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H29/58 G07D11/00 B41J13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H G07D B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 6 371 473 Bl (SALTSOV LEON [CA] ET AL) 16 April 2002 (2002-04-16) paragraphs [0056], [0058], [0065] - [0067]; figures 3-10</td>
<td>1-9,12, 13,15-22</td>
</tr>
<tr>
<td>X</td>
<td>JP 62 070162 A (HITACHI LTD) 31 March 1987 (1987-03-31) the whole document</td>
<td>1,2,4, 10,11, 13-22</td>
</tr>
<tr>
<td>X</td>
<td>JP 2 092570 U (.) 23 July 1990 (1990-07-23) the whole document</td>
<td>1,2,4, 10,11, 13-17, 19-22</td>
</tr>
</tbody>
</table>

D. Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on the novelty of claimed invention(s) or which is cited to establish the publication date of another document or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search: 7 October 2010
Date of mailing of the international search report: 15/10/2010

Name and mailing address of the ISA/
European Patent Office, P B 5818 Pateltaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040;
Fax (+31-70) 340-3016

Authorized officer

Ureta, Rolando
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AU 2001239049 B2</td>
<td>30-06-2005</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UO 0165493 A2</td>
<td>07-09-2001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CA 2299827 A1</td>
<td>02-09-2001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CN 1440544 A</td>
<td>03-09-2003</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP 1261944 A2</td>
<td>04-12-2002</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JP 2003525505 T</td>
<td>26-08-2003</td>
<td></td>
</tr>
<tr>
<td></td>
<td>US 2002162775 A1</td>
<td>07-11-2002</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JP 62070162 A 31-03-1987</th>
<th>NONE</th>
</tr>
</thead>
</table>