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## (54) Method for conveying sheets to an accumulating apparatus and a device carrying out this method

(57) The proposed method for conveying sheets to a accumulating apparatus includes the following working steps:

- longitudinal cutting of a webstream (1), moved in a first feeding direction (A), to obtain at least two longitudinal sections;
- partial overlapping of the above longitudinal sections;
- transversal cutting of the longitudinal sections, to obtain a pair (20) of sheets (21, 22), partially overlapped;
- placing of the pairs (20) of sheets (21, 22) on a conveyor (3), moved in a second feeding direction (B), orthogonal to the first feeding direction (A), to define a plurality of pairs (20) of sheets (21, 22), each of which has at least one accessible portion (22A) of prefixed and constant extension (G).

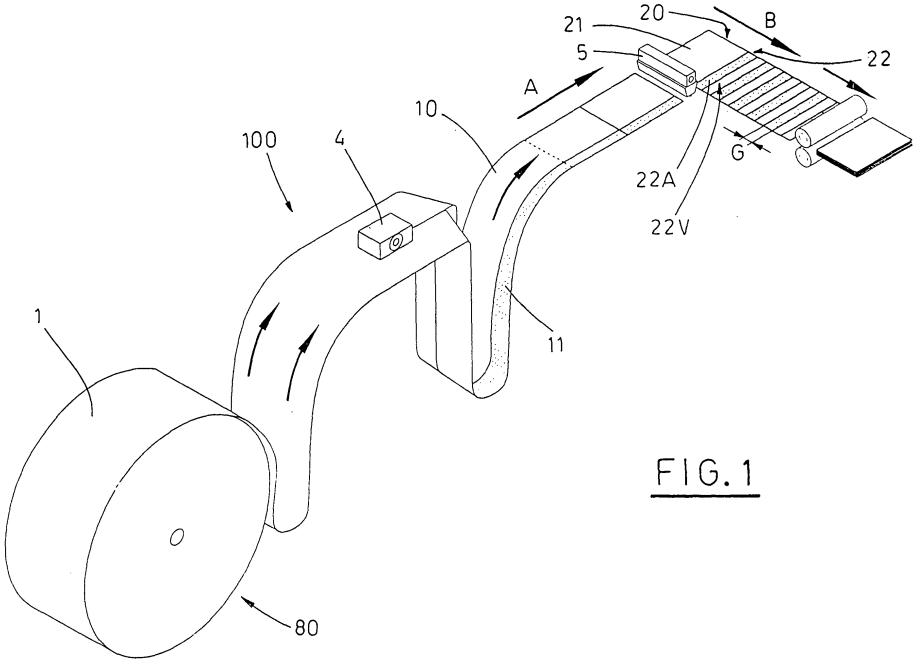


FIG. 1

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## Description

**[0001]** The present invention relates to processing of sheets of paper, documents, correspondence, etc.

**[0002]** In the specific case, the present invention relates to a method for conveying sheets to a accumulating apparatus.

**[0003]** The document US 6.467.763 describes a system for obtaining piles of sheets of paper, in which a continuous paper webstream is divided longitudinally, by cutting or bursting, into two portions of equal dimensions, which are then introduced into respective feeders, situated one over the other in a transversal cutting station.

**[0004]** In the cutting station, suitable cutting means cut (or tear) alternately, first one portion, then the other of the webstream, in a transversal direction with respect to the sheets feeding direction.

**[0005]** A double collector, having a pair of conveyors, situated at different levels, receives the sheets leaving the transversal cutting station and piles them up in a collecting area, situated downstream of the double collector.

**[0006]** A bar-code scanner reads the code present on each sheet, thus allowing to pile up a prefixed number of sheets in the collecting area.

**[0007]** After having been suitably piled up, the sheets are ejected from the double collector and sent to stations situated downstream for further treatments.

**[0008]** The document US 5.649.698 describes an apparatus, which receives, in a first direction, sheets cut and arranged one beside the other, obtained by the longitudinal cutting of a continuous webstream.

**[0009]** This apparatus includes a plurality of working means, formed by curved guides, which overturn, rotate by 90° and then guide the sheets in a direction orthogonal to the webstream feeding direction.

**[0010]** Then, the apparatus aligns the sheets and overlaps them to form a stack composed of a prefixed number of sheets.

**[0011]** The document US 6.443.447 describes a method and a device for moving sheets in a accumulating apparatus.

**[0012]** The sheets are obtained by the action of working means, which cut longitudinally a webstream, fed in a first direction, to obtain two sheets of equal dimensions, arranged one beside the other.

**[0013]** Suitable rotating means overturn the so obtained sheets and rotate them by 90°, orienting them in a direction perpendicular to the first feeding direction, in order to overlap them at least partially.

**[0014]** According to a first embodiment, the sheets rotating and overturning means are moved with the same speed, thus obtaining partial overlapping of the two sheets.

**[0015]** According to a second embodiment, the sheets rotating and overturning means are moved with different speeds, still obtaining the sheets partial overlapping, but involving a more extended area with respect to the previous embodiment.

**[0016]** In this way, the insufficient overlapping of the sheets is avoided, which is a typical drawback caused by the situation, in which the difference between the sheet dimensions is reduced. (If the dimension difference between the two sides of the sheet is limited, the machine can jam).

**[0017]** The document US2004/0080097 describes an improvement of the previous device.

**[0018]** The sheets rotating and overturning means are moved with the same speed, but the sheets fed thereto are offset with respect to one another.

**[0019]** Thus, a complete overlapping of the two sheets can be obtained.

**[0020]** The document US 5.203.551 describes a method and a system for feeding cut sheets, having two sheet feeders, which are parallel and arranged one downstream of the other.

**[0021]** The sheets transported by the feeders are conveyed along separate paths, which converge in one path near a double feeder, situated in cascade with respect to the first two.

**[0022]** Downstream of the double feeder, there is a conveyor, which rotates the sheets by 90° (without overturning them) and conveys them in a direction orthogonal to the feeding direction of the two feeders, to a collecting and sorting station.

**[0023]** The document US 5.297.783 describes a system and an apparatus for treating single and webstreams, to form a sheaf of sheets.

**[0024]** This apparatus has two feeders, situated at different levels, aimed at feeding the apparatus respectively with single sheets and a webstream.

**[0025]** A pair of rolls, situated downstream of each feeder, allow to pull the single sheets or webstream.

**[0026]** A pair of conveying plates make the single sheets and webstream join in a single flow, and overlap them.

**[0027]** The conveyors feeding the single sheets are motionless during the time interval, in which a prefixed number of sheets are obtained from the webstream.

**[0028]** Afterward, a prefixed number of single sheets are conveyed downstream, by respective pulling rolls, and in the meantime, the pulling devices of the webstream are motionless.

**[0029]** This way, it is possible to create a sheaf of sheets composed of a selected number of sheets.

**[0030]** The disadvantage of this device lies in the fact that it must stop alternately one of the two sheet pulling systems, which results in obvious negative influence on the production efficiency.

**[0031]** Moreover, the present system has also a considerable longitudinal extension, due to the fact that the sheets processing is performed along a straight path.

**[0032]** The document US 5.947.461 describes and apparatus and a method for piling up sheets obtained by longitudinal and transversal cutting of a webstream, which has removable perforated longitudinal sections.

**[0033]** In order to increase the productivity, the two lon-

gitudinal sections obtained by the longitudinal cutting are overlapped and cut transversely by a suitable device, to obtain pairs of sheets.

**[0034]** The contemporary cutting of the two overlapped longitudinal sections allows to double the productivity at the same operation speed of the cutting device.

**[0035]** The perforated lateral portions of the so obtained sheets are removed, the sheets are piled up in a receiver and stripped out of the bottom of the latter, by a withdrawing member, operating with high speed, to be sent one by one to the colleting system.

**[0036]** The withdrawing member is difficult to adjust and/or set up, due to the high speed, at which it must work.

**[0037]** This is caused by the fact that the withdrawing member acts on one sheet at a time, while a single transversal cutting of the longitudinal sections allows to obtain contemporarily two sheets, because the sheets are overlapped.

**[0038]** It is obvious that the withdrawing member must work at higher speed, in order to avoid the accumulation of excessive number of sheets in the receiver.

**[0039]** Moreover, the present system has also a considerable longitudinal extension, due to the fact that the sheets processing is performed along a straight path.

**[0040]** It appears from what above that known machines of reduced longitudinal dimensions have complicated devices for overturning and/or rotating the sheets.

**[0041]** These devices can be subjected to jams, which require stopping the device, in order to be removed, which obviously affects negatively the system continuity and production efficiency.

**[0042]** On the other hand, known machines which do not have the devices for overturning and/or rotating the sheets, have very big longitudinal dimensions, due to the fact that the sheets processing is performed along a straight path.

**[0043]** Moreover, in the proposed solutions, the bar-codes present on the single sheets must be read at high speed, because the bar-code scanners are usually situated near the transversal cutting means, which operate at high speed and thus treat a high number of sheets per minute.

**[0044]** The object of the present invention is to propose a method, which allows conveyance of sheets to an accumulating apparatus by simple and rapid steps.

**[0045]** Another object of the present invention is to propose a method, which makes it possible to read the codes, present on the sheets, with a relatively low speed.

**[0046]** A further object of the present invention is to propose a method carried out by a device, which allows at least a double number of sheets to be obtained with respect to the transversal cutting operations, performed to obtain the sheets.

**[0047]** A still further object of the present invention is to propose a device, which can process sheets by performing operations, that do not require the temporary stopping of the sheets feeding and/or cutting means.

**[0048]** A yet further object of the present invention is to propose a device, which assures high reliability and productivity standards in any operation condition.

**[0049]** Another object of the present invention is to propose a device obtained by a simple technical solution of limited cost, which is extremely functional and reliable, and which assures an easy and rapid installation and maintenance thereof.

**[0050]** The above mentioned objects are obtained in accordance with the contents of the claims.

**[0051]** The characteristic features of the invention will be pointed out in the following description of some preferred but not exclusive embodiments, with reference to the enclosed figures, in which:

- Figure 1 is a schematic, perspective view of the proposed device carrying out the method proposed by the invention;
- Figure 2 is a schematic, top view of the same device;
- Figure 3 is a schematic, top view of the proposed device, according to another embodiment;
- Figures 4 and 4A are as many schematic views, respectively top and lateral, of a particularly significant portion of the device.

**[0052]** With regards to Figure 1, the reference 100 indicates the proposed device for conveying sheets to an accumulating apparatus.

**[0053]** The device 100 includes working means 4, situated downstream of a webstream 1, which unwinds from a bobbin 80 and is moved in a first feeding direction A, to be cut longitudinally.

**[0054]** Orienting and guiding means (not shown in Figures) partially overlap, in known way, the pair of longitudinal sections, respectively a first longitudinal section 10 and a second longitudinal section 11, obtained by the above mentioned longitudinal cutting of the webstream 1.

**[0055]** According to a preferred embodiment, means 7 are situated downstream of the working means 4, for driving downstream the longitudinal sections 10, 11, in the same direction as the first feeding direction A (Figure 2).

**[0056]** The device 100 includes cutting means 5, situated downstream of the pulling means 7, for cutting transversely and contemporarily the first longitudinal section 10 and the second longitudinal section 11, to obtain a pair 20 of sheets, respectively upper sheet 21 and lower sheet 22, partially overlapped and of the same dimensions.

**[0057]** A conveyor 3, situated in cascade with the cutting means 5, perpendicular to the first feeding direction A, is moved in a second feeding direction B, perpendicular to the first direction A.

**[0058]** The active run of the conveyor 3 receives the pairs 20 of sheets 21, 22, leaving the cutting means 5,

to define a group of pairs 20 of sheets.

**[0059]** The latter are partially overlapped longitudinally with respect to the second feeding direction B and each of them has an accessible portion 22A, of prefixed and constant width G.

**[0060]** In particular, the upper sheet 21 of each pair 20 is positioned upstream, with respect to the second feeding direction B, of the lower sheet 22, which in turn, partially overlaps, longitudinally with respect to the second feeding direction B, the upper sheet 22V of the pair of sheets 25, previously positioned on the conveyor 3.

**[0061]** The device 100 includes centering means 6, situated near the area, in which the sheets 21, 22, cut by the cutting means 5, are received by the conveyor 3.

**[0062]** The centering means 6 are aimed at allowing the correct positioning of the pairs 20 of sheets 21, 22 on the active run of the conveyor 3.

**[0063]** The centering means include preferably a pair of idle rolls 6, situated crosswise with respect to the plane defined by the active run of the conveyor 3 and partially touching the latter, to define an abutment area 65 for at least one edge of the sheets 21, 22 leaving the cutting means 5.

**[0064]** The idle rolls 6 are operated to rotate by the friction effect existing between the portion of the lateral, outer surface thereof, which touches the upper surface of the active run of the conveyor 3, and the active run (Figures 4, 4A).

**[0065]** Reading means 8 are situated near the conveyor 3 for reading, in step relation with the conveyor 3 feeding, a corresponding code 8A, present on each sheet 21, 22 forming the pair 20 of sheets.

**[0066]** Now the working way of the proposed device will be explained, although it is easily understood.

**[0067]** The operation of the pulling means 7 allows, by the friction executed thereby on the upper surface of each of the longitudinal sections 10, 11, the webstream 1 to unwind and be fed in the first feeding direction A.

**[0068]** The working means 4 cut longitudinally the webstream 1, to obtain the two longitudinal sections 10, 11 and subsequently overlap the latter partially.

**[0069]** The partially overlapped longitudinal sections 10, 11 are then driven, by friction, by the pulling means 7, toward the cutting means 5, which cut transversely and contemporarily the longitudinal sections 10, 11, to obtain a pair 20 of sheets 21, 22, of the same dimensions, partially overlapped transversely with respect to the first feeding direction A.

**[0070]** Then, the pairs 20 of sheets 21, 22 are placed on the active run of the conveyor 3 and their correct positioning thereon is assured by the presence of the above mentioned abutment area 65, obtained by the contact between the idle rolls 6 and a portion of active run of the conveyor 3.

**[0071]** The latter is moved with a speed considerably lower than the movement speed of longitudinal sections 10, 11, which allows to arrange, on the conveyor active run, a plurality of pairs 20 of sheets 21, 22, partially overlapped longitudinally with respect to the second feeding direction B, and having an accessible portion 22A with a constant width G (Figure 2).

**[0072]** Acting in this way, the lower sheet 22 of each pair 20 partially overlaps the upper sheet 22V of the pair 25 of sheets, placed previously on the active run of the conveyor 3, leaving accessible a portion 22A of the sheet 22, with of prefixed and constant width G.

**[0073]** The reading means 8 read the code, e.g. bar-code, present on the portion 22A, allowing to pile up the sheets destined for the same sheaf.

**[0074]** According to a second embodiment, the pulling means 7A have toothed wheels, whose teeth engage with corresponding holes made on a pair of perforated removable longitudinal sections, made along the sides of the webstream 1.

**[0075]** The steps characterizing the method carried out by the above described device will be now explained.

**[0076]** First of all, the method includes the longitudinal cutting of the webstream 1, unwinding from the bobbin 80.

**[0077]** This sheet is moved in a first feeding direction A, to obtain two longitudinal sections, respectively a first longitudinal section 10 and a second longitudinal section 11 (Figure 1).

**[0078]** Later, the first longitudinal section 10 and the second longitudinal section 11 are partially overlapped and transversely cut, to obtain a pair 20 of sheets of the same dimensions, partially overlapped transversely with respect to the first feeding direction A (Figures 1, 2).

**[0079]** Then, the pairs 20 of sheets 21, 22 are placed on the active run of a conveyor 3, operated to move in a second feeding direction B, orthogonal to the first feeding direction A, to define a plurality of pairs 20 of sheets 21, 22.

**[0080]** The sheets, the upper sheet 21 and the lower sheet 22 respectively, are offset longitudinally with respect to the second feeding direction B.

**[0081]** Each sheet 21, 22 is placed on the active run of the conveyor 3, so as to have at least one accessible portion 22A, with prefixed and constant width G.

**[0082]** In particular, the lower sheet 22 of each pair 20 partially overlaps the upper sheet 22V of the pair 25 of sheets, situated downstream and previously placed on the active run of the conveyor 3.

**[0083]** Advantageously, the proposed method allows to convey sheets to a accumulating apparatus in a rapid way and without using devices like withdrawing member and/or magazines.

**[0084]** Moreover, the positioning of the conveyor orthogonal to the sheets feeding direction allows to reduce the device longitudinal dimension.

**[0085]** The particular arrangement of the pairs of sheets on the active run of the conveyor and the low movement speed of the latter allow a considerable reduction of the speed of the bar-code reading, with respect to the situation, in which the reading takes place near the longitudinal sections transversal cutting, where the sheets are moved with high speed.

**[0086]** It is to be added that the longitudinal sections transversal cutting means can work always with the maximum speed and without stops, because sorting and grouping of the documents occur downstream of the conveyor.

**[0087]** Advantageously, the contemporary transversal cutting of the two partially overlapped longitudinal sections allows to obtain a double number of sheets with respect to the number of performed transversal cutting operations.

## Claims

1. Method for conveying sheets to an accumulating apparatus, **characterized in that** it includes the following working steps:

   - longitudinal cutting of a webstream (1), moved in a first feeding direction (A), to obtain at least two longitudinal sections, a first longitudinal section (10) and a second longitudinal section (11), respectively;
   - partial overlapping of the first longitudinal section (10) and the second longitudinal section (11);
   - transversal cutting of the first longitudinal section (10) and the second longitudinal section (11), to obtain a pair (20) of sheets (21, 22), partially overlapped transversely with respect to said first feeding direction (A);
   - placing said pairs (20) of sheets (21, 22) on the active run of a conveyor (3), moved in a second feeding direction (B), to define a plurality of pairs (20) of sheets (21, 22), offset with respect to one another, longitudinally with respect to said second feeding direction (B), so that each sheet (21, 22) has at least one accessible portion (22A).

2. Method, as claimed in claim 1, **characterized in that** said first feeding direction (A) and said second feeding direction (B) are orthogonal.

3. Method, as claimed in claim 1, **characterized in that** each of said pairs (20) of sheets includes an upper sheet (21) and a lower sheet (22), with the latter partially overlapping the upper sheet (22V) of the pair (25) of sheets downstream, previously placed on the active run of said conveyor (3).

4. Method, as claimed in claim 3, **characterized in that** said lower sheet (22) is situated downstream of said upper sheet (21), with respect to said second feeding direction (B).

5. Method, as claimed in claim 1, **characterized in that** said conveyor (3) is moved with such a speed, as to allow previous selection of the longitudinal dimension (G) of said accessible portion (22A) of each of said sheets (21, 22, 22V), with respect to the second feeding direction (B).

6. Method, as claimed in claim 5, **characterized in that** the conveyor (3) movement speed is lower than the movement speed of the longitudinal sections (10, 11).

7. Method, as claimed in claim 1, **characterized in that** it includes reading of a code present on the accessible portion (22A) of each sheet, to allow to group a selected number of sheets (21, 22).

8. Device for conveying sheets to a accumulating apparatus, **characterized in that** it includes: working means (4), cutting longitudinally a webstream (1), which is moved in a first feeding direction (A); orienting and guiding means, which are situated downstream of said working means (4) and which partially overlap a pair of longitudinal sections, respectively a first longitudinal section (10) and a second longitudinal section (11), thus obtained; pulling means (7, 7A), which are situated downstream of said working means (4) and which pull said longitudinal sections (10, 11) downstream in said first feeding direction (A); cutting means (5), which are situated downstream of said working means (4) and which cut transversely said first longitudinal section (10) and said second longitudinal section (11), to obtain a pair (20) of sheets (21, 22), partially overlapped transversely with respect to said first feeding direction (A); a conveyor (3), situated downstream of said cutting means (5) and operated in a second feeding direction (B), the active run of said conveyor (3) receiving said pairs (20) of sheets, to define a plurality of pairs (20) of sheets (21, 22), which are partially overlapped longitudinally with respect to said second feeding direction (B), and each of which has an accessible portion (22A); centering means (6) for the correct positioning of the pairs (20) of sheets (21, 22) on said conveyor (3); reading means (8), situated near said conveyor (3) and reading a corresponding code (8A) present on said portion (22A) of each sheet (21, 22) forming said pair (20) of sheets.

9. Device, as claimed in claim 8, **characterized in that** said centering means (6) include a pair of idle rolls, partially touching said conveyor (3) and operated to rotate by the friction of the latter, said rolls being arranged angularly with respect to the plane defined by the active run of the conveyor (3), so as to define an abutment area (65) for at least one edge of each pair (20) of sheets (21, 22) leaving said cutting means (5).

10. Device, as claimed in claim 8, **characterized in that**

the active run of the conveyor (3) is perpendicular to said first feeding direction (A).

**11.** Device, as claimed in claim 8, **characterized in that** said conveyor (3) is moved with such a speed that said accessible portion (22A) of each of said sheets (21, 22, 22V) has a longitudinal extension, with respect to said second feeding direction (B), which is pre-determined and constant.

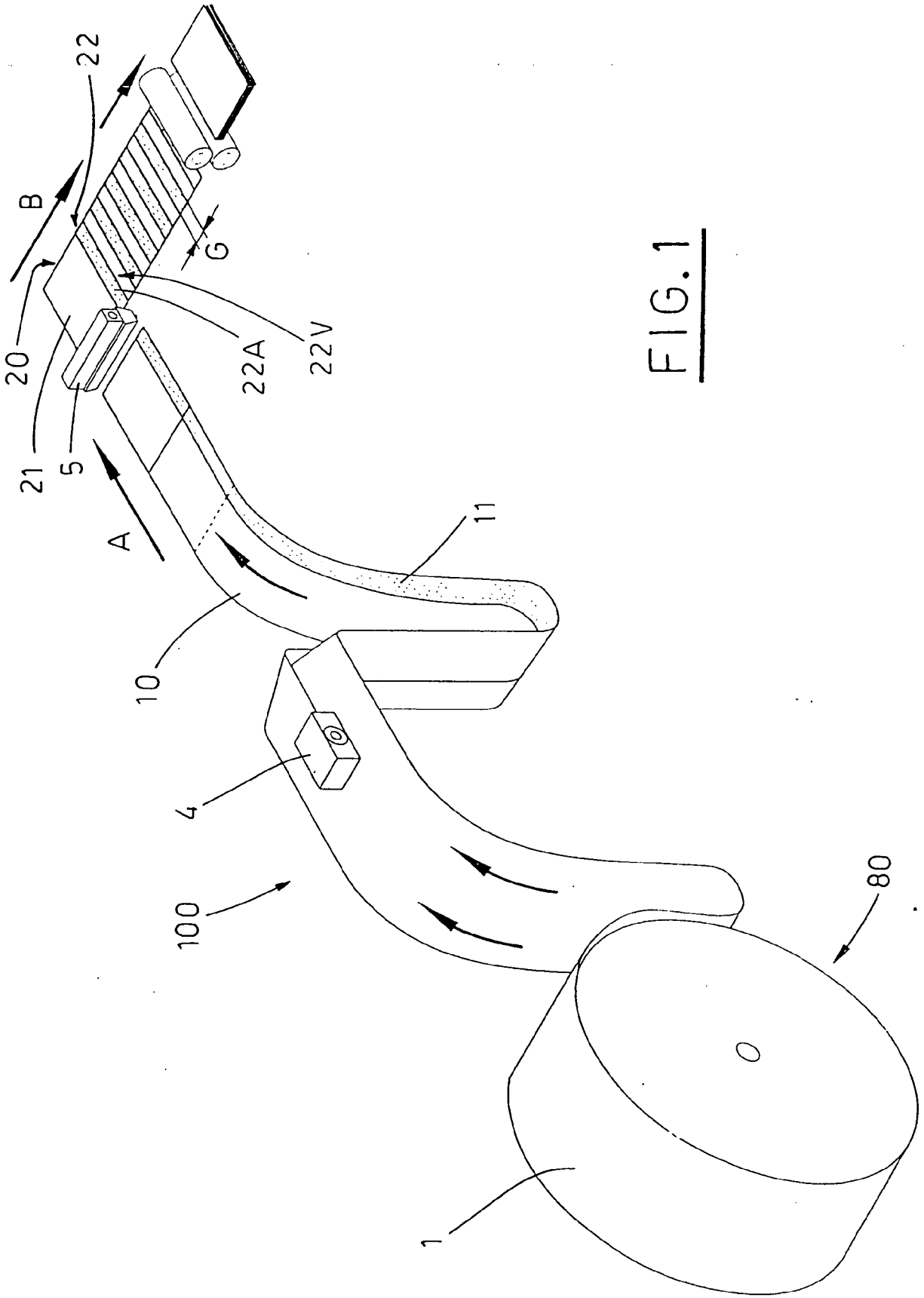



FIG.1

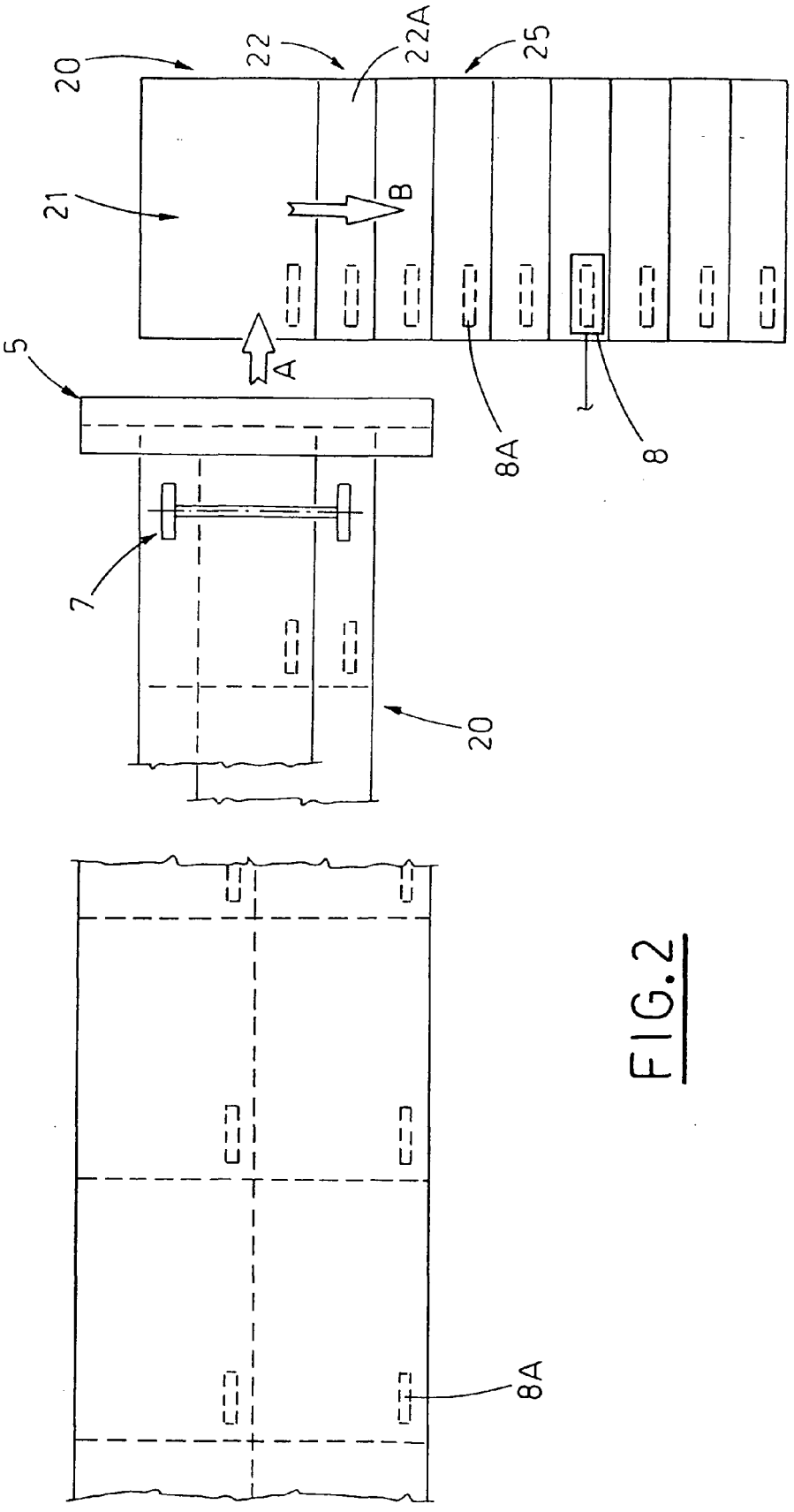



FIG.2

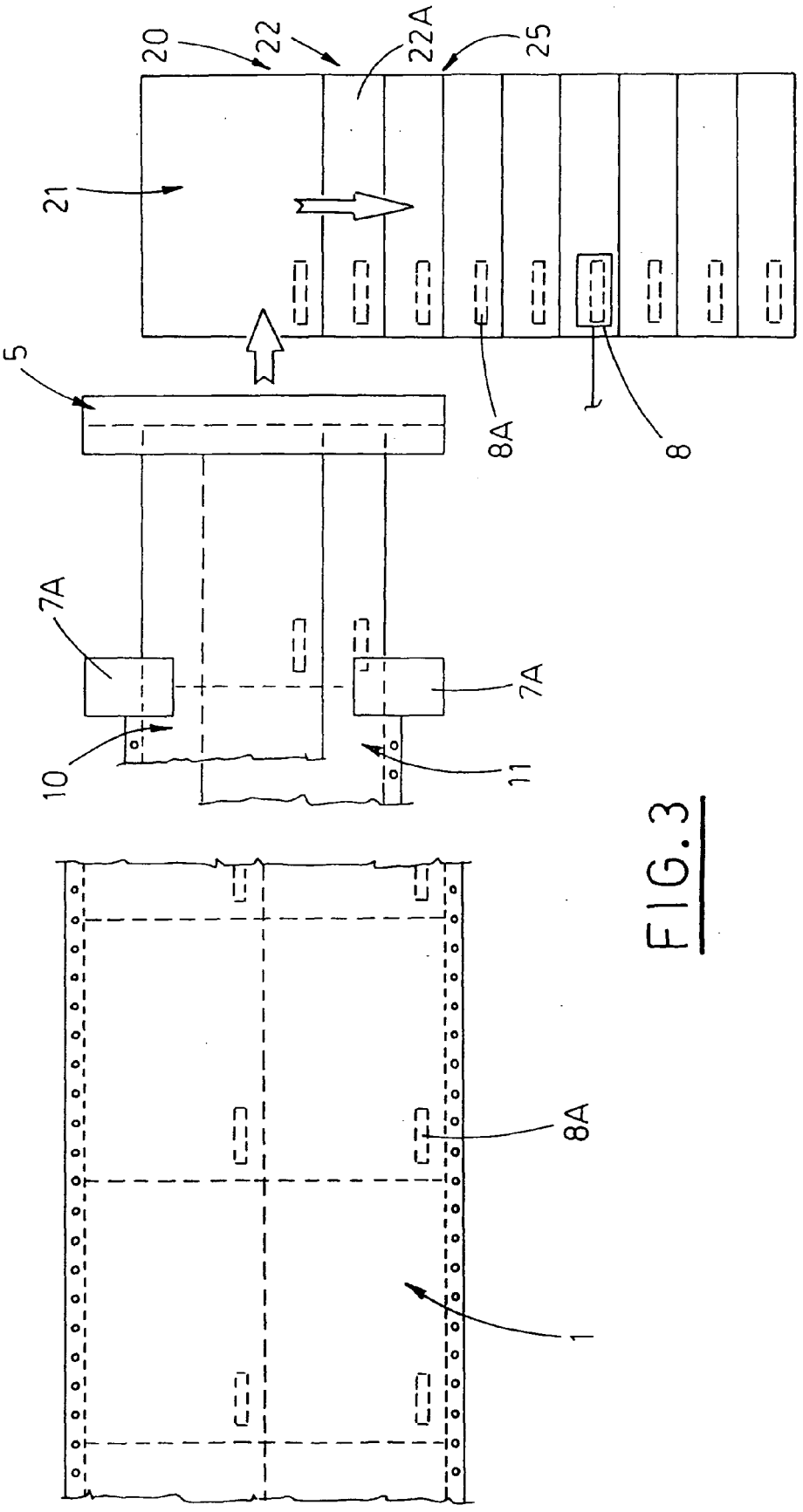
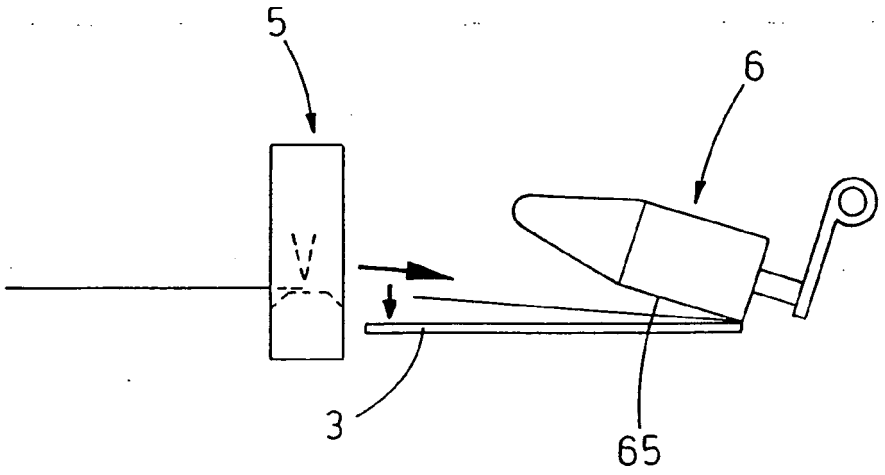



FIG.3

FIG.4A



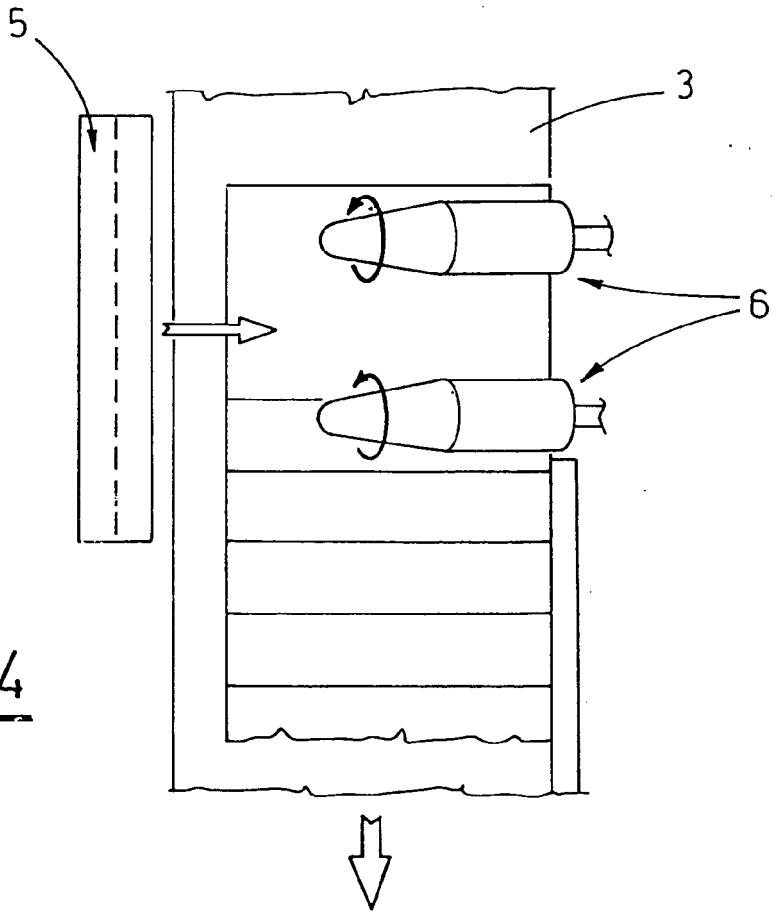




FIG.4

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# EUROPEAN SEARCH REPORT

Application Number
EP 05 02 2490

## DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | US 2004/056406 A1 (GUNTHER WILLIAM H)<br>25 March 2004 (2004-03-25)<br>* figures 1-3 *<br>----- | 1-3,8,10 | |
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 8 December 2005 | Kising, A |

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