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(54) **Sorting system for postal items**

(57) A sorting system for flat postal items (3) wherein an input transport system (4) provides a feed path (5) for postal items (3) which are supplied to a selector device (7) that is configured to route the items alternatively to a first or to a second output transport system (9 and 10), respectively comprising a first output belt (20) that extends from at least one first end pulley (21) close to selector device (7) and a second output belt (22) that ex-

tends from at least one second end pulley (23) close to selector device (7). The first and the second end pulley (21 and 23) are mounted in alignment in the axial direction on a single support element (30) and in an eccentric manner; the distance between the axis (21h) of the first pulley (21) and the axis (23h) of the second pulley (23) is less than the respective radii R1 and R2 of the two pulleys (21, 23).

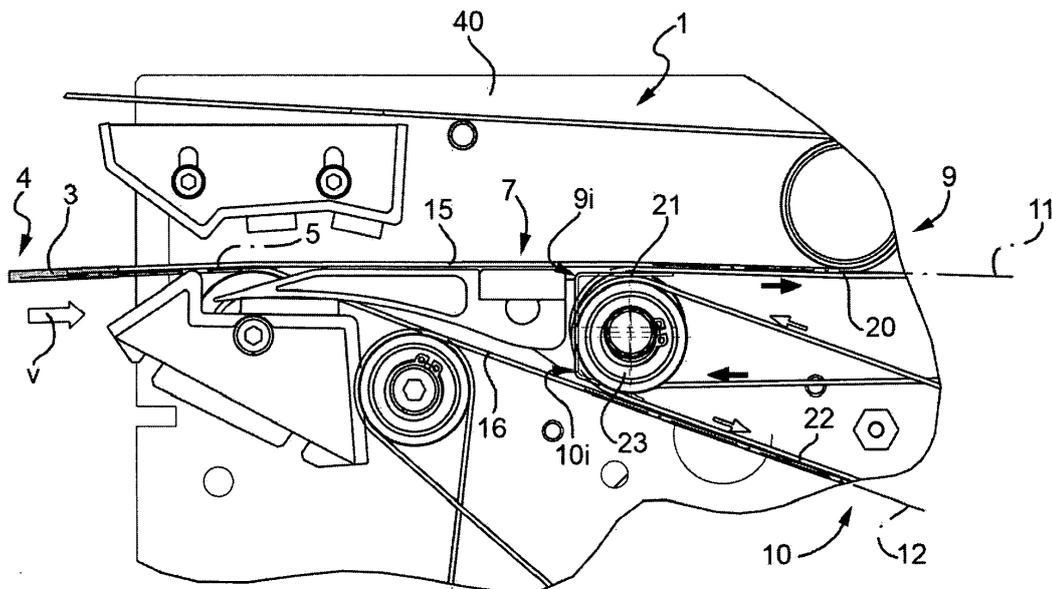


FIG. 2

Description

[0001] The present invention relates to a sorting system for postal items.

[0002] Sorting systems (see Figure 1, which illustrates the known art) are known where an input transport system provides a feed path for postal items supplied to a selector device that can route the items to a first or second output transport system providing first and second output paths. Typically, the first output path is aligned with the feed path and the second output path is transversal to it.

[0003] The input transport system is normally made with a first and a second belt, parallel to and facing each other in a contact area that defines the feed path; the belts extend between return pulleys and move in the same direction, transferring the postal items interposed between them to the selector device.

[0004] The first output path comprises a first output belt that extends from at least one first end pulley close to selector device and has a portion facing the first belt to define the first output path and a second output belt that extends from at least one second end pulley close to the selector device and has a portion facing the second belt to define the second output path.

[0005] The first and the second end pulleys are placed side by side, arranged with their axes parallel to each other and separated by a distance D, greater than the radius of the pulleys in order to prevent contact between the first and the second output belt.

[0006] In fact, the first and the second pulley must not be brought closer together beyond a certain limit to avoid the respective belts mounted on them from rubbing against each other and damaging themselves.

[0007] The selector device is angularly movable between two positions:

- a first position wherein it does not interfere with the movement of postal items coming from the feed path so that these are routed to the first output system, positioning itself between the facing portions of the first feed belt and the first output belt; and
- a second position wherein it interferes with the movement of postal items coming from the feed path so that these are transversely deviated to the second output system, positioning itself between the facing portions of the second feed belt and the second output belt.

[0008] When placed in the second position, the selector plate device deviates the item by an angle of deviation Y that is quite significant (for example, $Y = 38^\circ$) and is proportional to the distance D existing between the axes of the two side-by-side pulleys.

[0009] In particular, with regards to the above-mentioned feature, a series of problems are introduced due to the values of the angle of deviation Y employed by known systems, of which the following may be noted:

- wear on the postal item being handled, due to the forces applied to the postal item which are proportional to the angle γ and to the bending applied to the postal item. The bending is proportional to the angle of deviation Y and causes deformation and possible damage to the postal item, especially for thicker items;
- the dimensions of the selector plate device, the rear part of which (i.e. that opposite to the motion of the items being fed) must have a transverse dimension K greater than the distance D between the axes of the pulleys to prevent any direct impact of the items against the two pulleys; and
- the movement time of the selector plate device (this time increases with the angle of deviation γ).

[0010] The object of the present invention is that of providing a sorting system for postal items that allows the above-stated drawbacks to be reduced in a manner qualitatively and quantitatively superior to that feasible with known systems.

[0011] The foregoing object is achieved by the present invention, in so far as it regards a sorting system for flat postal items wherein an input transport system provides a feed path for postal items which are supplied to a selector device that is configured to route the items alternatively to a first or to a second output transport system (9 and 10) providing respective first and second output paths; said input transport system comprising at least a first and at least a second feed belt; the sorting system further comprising: - a first output belt that extends from at least one first end pulley close to the selector device and has a portion facing said first feed belt to define a first output path; - a second output belt that extends from at least one second end pulley close to the selector device and has a portion facing an output belt to define a second output path; the selector device being angularly movable between two positions: - a first position wherein the selector device does not interfere with the movement of the postal items coming from the feed path so that the postal items are routed to the first output path; and - a second position wherein the selector device interferes with the movement of the postal items coming from the feed path so that the postal items are transversely deviated from their direction of movement to the second output path, **characterized in that** the first and the second end pulley are mounted in alignment in the axial direction on a single support element and arranged in an eccentric manner; the distance between the axis of the first pulley and the axis of the second pulley is less than the respective radii R1 and R2 of the two pulleys.

[0012] The invention will now be described with reference to the accompanying drawings, which represent a non-limitative embodiment, where:

- Figure 1 shows a top view of a sorting system made according to the know art;
- Figure 2 shows a top view of a system made accord-

ing to the present invention and arranged in a first operating position;

- Figure 3 shows a top view of a system made according to the present invention and arranged in a second operating position;
- Figure 4 shows, in cross-section, a detail of the system according to the present invention;
- Figure 5 shows a variant of the device in Figures 2-4;
- Figure 6 shows a detail of the device.

[0013] With reference to Figures 2 and 3, reference numeral 1 indicates, as a whole, a sorting system for flat rectangular postal items 3 (for example, letters, post-cards, documents in envelopes, etc).

[0014] The sorting system 1 comprises an input transport system 4 that provides a feed path 5 (shown straight in the example) for postal items 3 which are supplied individually at the output of the transport system 4 to a selector device 7 that can route the items to a first or second output transport system 9 and 10 providing respective first and second output paths 11 and 12.

[0015] In the embodiment shown, the first output path 11 is aligned with the feed path 5 and the second output path 12 is transversal to the feed path 5.

[0016] The input transport system 4 comprises a first and a second belt 15 and 16 parallel to and facing each other in a contact area that defines the feed path 5; the belts 15 and 16 extend between return pulleys (not shown) and move in the same direction (see arrow v) in the overlap area, moving the postal items 3, interposed between the belts 15 and 16 arranged in contact with each other, to the selector device 7.

[0017] The system 1 comprises a first output belt 20 that extends from at least one first end pulley 21 close to selector device 7 (see enlargement in Figure 3) and has a portion 20f facing the first belt 15 to define the first output path 11.

[0018] The system 1 further comprises a second output belt 22 that extends from at least one second end pulley 23 close to selector device 7 and has a portion facing 22f the second belt 16 to define the second output path 12.

[0019] As shall become clear from the following description, the belts 20 and 22 are carried by pulleys 21 and 23, which are axially aligned with each other (see Figure 4) and are therefore arranged at different heights with respect to a horizontal support plate 40 that carries the pulleys 21 and 23. Belts 20 and 22 normally have the same band height h, while belts 15 and 16 have a band height H equal to the sum of the band heights of belts 20 and 22 (and the space between them). In this way, a postal item 3 consequently remains pinched between the high belt 22 and nearby belt 15 and the low belt 20 and nearby belt 16 (in this regard, see Figure 4).

[0020] The band heights of belts 20 and 22 and of belts 15 and 16 depend on the geometry of the system and the size of the postal items 3.

[0021] in the description, belts 20, 22, 15 and 16 are represented, for simplicity, as single ones.

[0022] It is also possible to provide for the use of one (or more) "multiple" belts 20 and 22, i.e. each one can be formed by several belts (typically two) that lie on the same plane, are carried by the same pulleys and move in a synchronous manner. Each of these belts has a different distance with respect to the plate 40.

[0023] For example, Figure 5 shows a belt 22 formed by a first and a second belt 22a and 22b that are carried by respective coaxial pulleys 23a and 23b, lie on the same plane and move in a synchronous manner. Figure 5 also shows a single-type belt 20 carried by a pulley 21 inserted between pulleys 23a and 23b. Pulleys 23a, 21 and 23b are aligned in the axial direction; in particular, the distance between the axis (21h) of the first pulley (21) and the axis (23h) of the second pulleys 23a and 23b is less than the respective radii R1 and R2 of pulley 21 and the two pulleys 23a and 23b.

[0024] In this way, belt 20 has a lower edge facing an upper edge of belt 22b (below belt 20) and an upper edge facing a lower edge of belt 22a (above belt 20).

[0025] In Figure 5, each pulley 21 and 23 is of the crowned type, i.e. having a diameter that grows from the sides to a central portion of greater diameter.

[0026] A multi-crowned pulley 41 can be used to provide the return of belts lying at different distances from the plate 40. This pulley is shown in Figure 6, in this example having different crowns for the various belts 18, constituted by belts 18a, 18b and 16.

[0027] The "multiple" belts configuration is particularly advantageous when the postal item 3 has a stiffening element at one end (typically, the spine of a magazine) which necessitates greater bending freedom in a localized area on which the belts do not overlap (in this case, the multiple belts press against opposite central areas of the postal item); in this way, if the multiple belts move along a curved section, the stiffened part is not forced to bend in a significant manner, allowing the postal item to "cut the bend" without the constriction of the belts.

[0028] The application of pressure, also due to the crowns of the return pulleys, on the stiffened part of the postal item, which could tend to bend the postal item, bringing it into contact with the pulley rotating in the opposite direction, is also avoided.

[0029] The selector device 7 is angularly movable between two positions:

- a first position (shown in Figure 2) wherein the selector device 7 does not interfere with the movement of postal items 3 coming from the feed path so that the postal items 3 are routed to an input 9i of the first output system 9, positioning itself between the facing portions of the first feed belt 15 and the first output belt 20; and
- a second position (shown in Figure 3) wherein the selector device 7 interferes with the movement of the postal items 3 coming from the feed path 5 so that the items 3 are transversely deviated from their direction of movement to an input 10i of the second

output transport system 10, positioning itself between the facing portions of the second feed belt 16 and the second output belt 22.

[0030] The selector device 7 is operated by an actuator (not shown) that operates a movable output shaft between two angular positions. For example, a motor (of 200W, not shown) or an electromagnet could be used as an actuator.

[0031] In accordance with the present invention (see Figure 4 in particular), the first and the second end pulley 21 and 23 are shown aligned in the axial direction on a single support element 30 and mounted in an eccentric manner; the distance between the axis 21h of the first pulley 21 and the axis 23h of the second pulley 23 is less than the respective radii R1 and R2 of the two pulleys 21 and 23.

[0032] Typically, (but not exclusively) the radii R1 and R2 of the two pulleys 21 and 23 are the same.

[0033] The support element 30 and pulleys 21 and 23 are shown in detail in Figure 4. In particular, the support element 30 comprises a first cylindrical element 32 and a second cylindrical element aligned in the axial direction and arranged in an eccentric manner to each other; each cylindrical element 32 and 33 carries a respective pulley 21 and 23 through the interposition of a respective ball bearing 34 and 35. Pulleys 22 and 23 have a more or less cylindrical structure that is smooth or crowned so as to maintain correct centring of the belts and usually have the same diameter.

[0034] Always with reference to the embodiment in Figure 4, each cylindrical element 32 and 33 has an eccentric axial hole 32h and 33h engaged by a shaft 38 that supports both cylindrical elements 32 and 33, each of which has an end portion arranged in contact with a respective end portion of the other cylindrical element.

[0035] The shaft 38 has a threaded lower end 38d suitable for engaging a hole made in a horizontal support plate 40 that carries the various components of the sorting system 1 and an upper end equipped with a head 39 (for example, with a hexagonal shape suitable for engaging with an associated tool) suitable for allowing the clamping of the cylindrical elements 32 and 33 by screwing the lower end 38 into the hole.

[0036] The shaft 38 has a smooth central portion to ensure precise positioning of the pulleys 21 and 23.

[0037] The shaft 38 could also be equipped with elastic rings or shoulders (not shown) suitable for spacing out the pulleys 21 and 23.

[0038] The selector plate device 7 could be provided on one of its rear walls with a fairing (not shown) that prevents the postal item from rubbing on a belt that runs in the opposite direction; this fairing could also be fixed and unconstrained by the selector plate device 7.

[0039] According to the invention, the two side-by-side pulleys used in known systems are substituted by two eccentric pulleys 21 and 23 offset on different vertical planes.

[0040] Thanks to this layout, the selector device 7 can have smaller transversal dimensions with respect to those of a selector plate used in a sorting system of a known type.

[0041] Furthermore, the angle of deviation γ (Figure 1) that the second output path 12 forms with respect to the feed path 5 is smaller (up to 40%, e.g. 19.8°) with respect to that achieved in similar sorting systems of known type:

[0042] The reduction of the angle of deviation γ results in:

- a heavy reduction in the stresses imposed on the items 3; these stresses are particularly intense in the case of thick or transparent-film-wrapped postal items;
- a reduction in the travel and therefore of the movement time of the selector device 7; and
- the possibility of arranging the actuator of the selector device 7 beneath the support plate 40; in this way, the geometry of the sorting system 1 is also unfettered by the dimensions of the actuator.

Claims

1. A sorting system for flat postal items (3) wherein an input transport system (4) provides a feed path (5) for postal items (3) which are supplied to a selector device (7) that is configured to route the items alternatively to a first or to a second output transport system (9, 10) providing respective first and second output paths (11, 12); said input transport system (4) comprising at least a first and at least a second feed belt (15, 16); the sorting system (1) further comprising:

- a first output belt (20) that extends from at least one first end pulley (21) close to selector device (7) and has a portion (20f) facing said first feed belt (15) to define a first output path (11);
- a second output belt (22) that extends from at least one second end pulley (23) close to selector device (7) and has a portion (22f) facing an output belt to define a second output path (12);

the selector device (7) being angularly movable between two positions:

- a first position wherein the selector device (7) does not interfere with the movement of the postal items (3) coming from the feed path (5) so that the postal items (3) are routed to the first output path (11); and
- a second position wherein the selector device (7) interferes with the movement of the postal items (3) coming from the feed path (5) so that the postal items (3) are transversely deviated

from their direction of movement to the second output path (12),

- characterized in that** the first and the second end pulley (21, 23) are mounted aligned along the axial direction on a single support element (30) and arranged in an eccentric manner; the distance between the axis (21h) of the first pulley (21) and the axis (23h) of the second pulley (23) is less than the respective radii R1 and R2 of the two pulleys (21, 23).
2. The system according to claim 1, wherein the first output path (11) is aligned with feed path (5) and the second output path (12) is transversal to the feed path (5).
 3. The system according to claim 1 or 2, wherein the support element (30) comprises a first cylindrical element (32) and a second cylindrical element (33) aligned along the axial direction and arranged in an eccentric manner to each other; each cylindrical element (32, 33) carries a respective pulley (22, 23) through the interposition of a respective ball bearing (34, 35) .
 4. The system according to claim 3, wherein each cylindrical element (32, 33) has an eccentric axial hole engaged by a shaft (38) that supports both cylindrical elements (32, 3.3) , each of which has an end portion arranged in contact with a respective end portion of the other cylindrical element.
 5. The system according to claim 4, wherein said shaft has a lower end (38d) able to engage a hole made in a support plate (40) and an upper end equipped with a head (39) able to engage with an associated tool to allow the clamping of said cylindrical elements (32, 33).
 6. The system according to claim 5, wherein said shaft (38) has a smooth central portion to ensure precise positioning of said pulleys (21, 23).
 7. The system according to any of the preceding claims, wherein the first and the second pulley (21, 23) have respective radii R1 and R2 equal to each other.
 8. The system according to any of the preceding claims, wherein said first output belt and said second output belt (20, 22) are arranged at different heights with respect to a horizontal support 40 that carries the pulleys (21 and 23); the first and second belt (20, 22) having a band height (h) which is smaller than the band height of said feed belts (15, 16).
 9. The system according to any of the preceding claims, wherein at least one of said first output belt and second output belt is of the "multiple" type and comprises several belts, typically two, which lie on the same plane, are carried by the respective pulleys and move in a synchronous manner.
 10. The system according to claim 9, wherein an output belt (22) is formed by a first and a by a second belt portion (22a and 22b) that are carried by respective second pulleys coaxial with each other (23a, 23b), lie on the same plane and move in a synchronous manner; the other output belt (20) being of the single type carried by said first pulley (21) interposed between the second pulleys (23a and 23b); said second pulleys and said first pulley (23a, 21 and 23b) are aligned along the axial direction so that the belt (20) has a lower edge facing an upper edge of the second belt portion (22b) and an upper edge facing a lower edge of the first belt portion (22a) .
 11. The system according to one of the preceding claims, wherein at least one of said first or second pulley is of the crowned type and has a diameter that grows from the sides to a central portion of greater diameter.
 12. The system according to one of the preceding claims, wherein at least one return is made using a multi-crowned pulley (41).

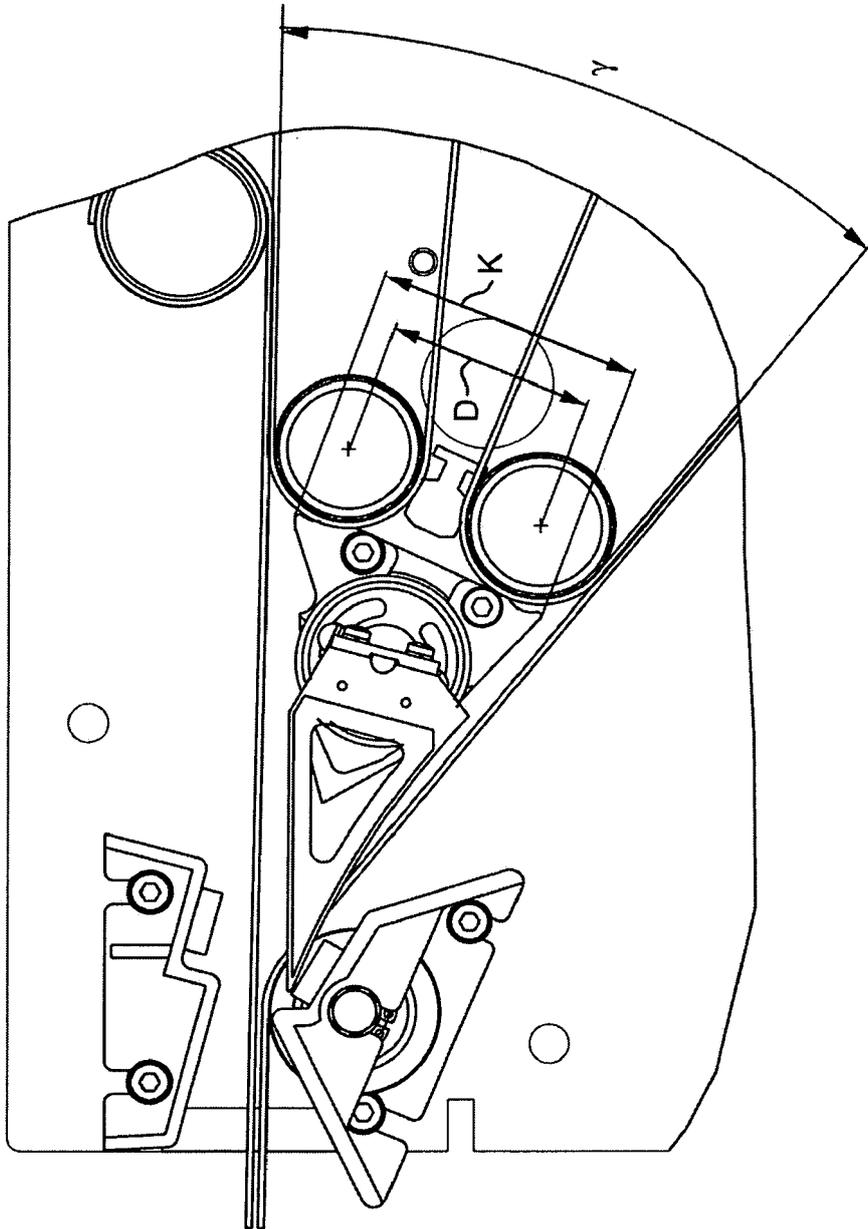


FIG. 1

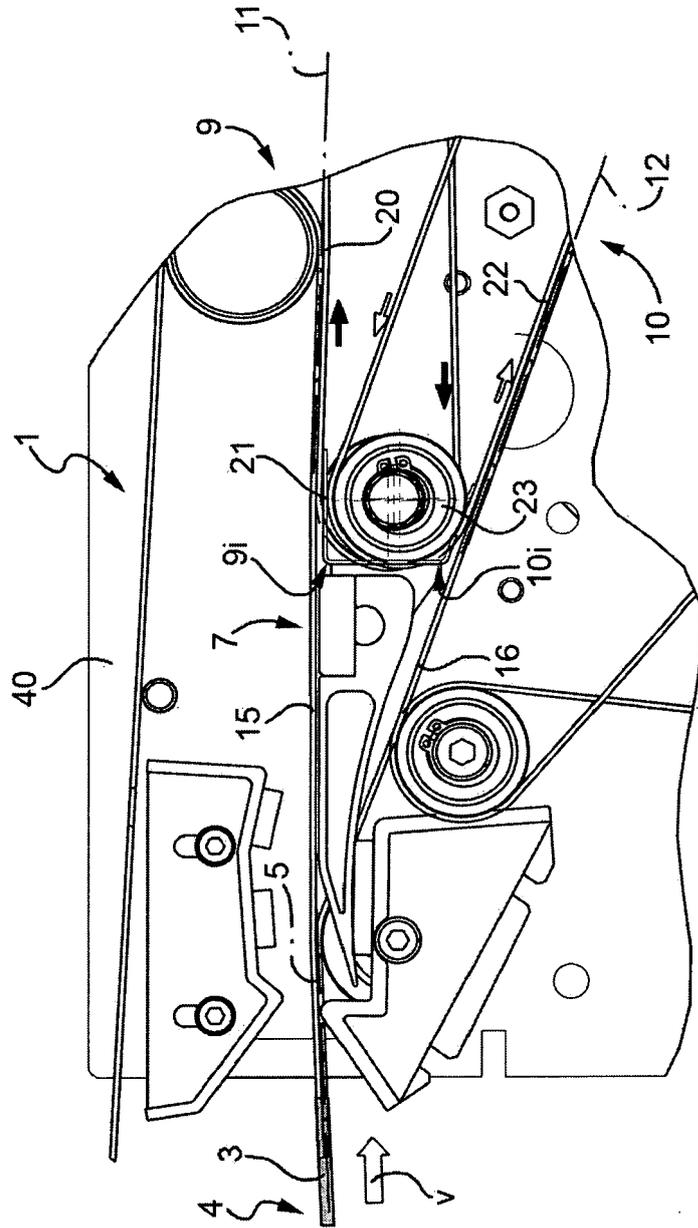


FIG. 2

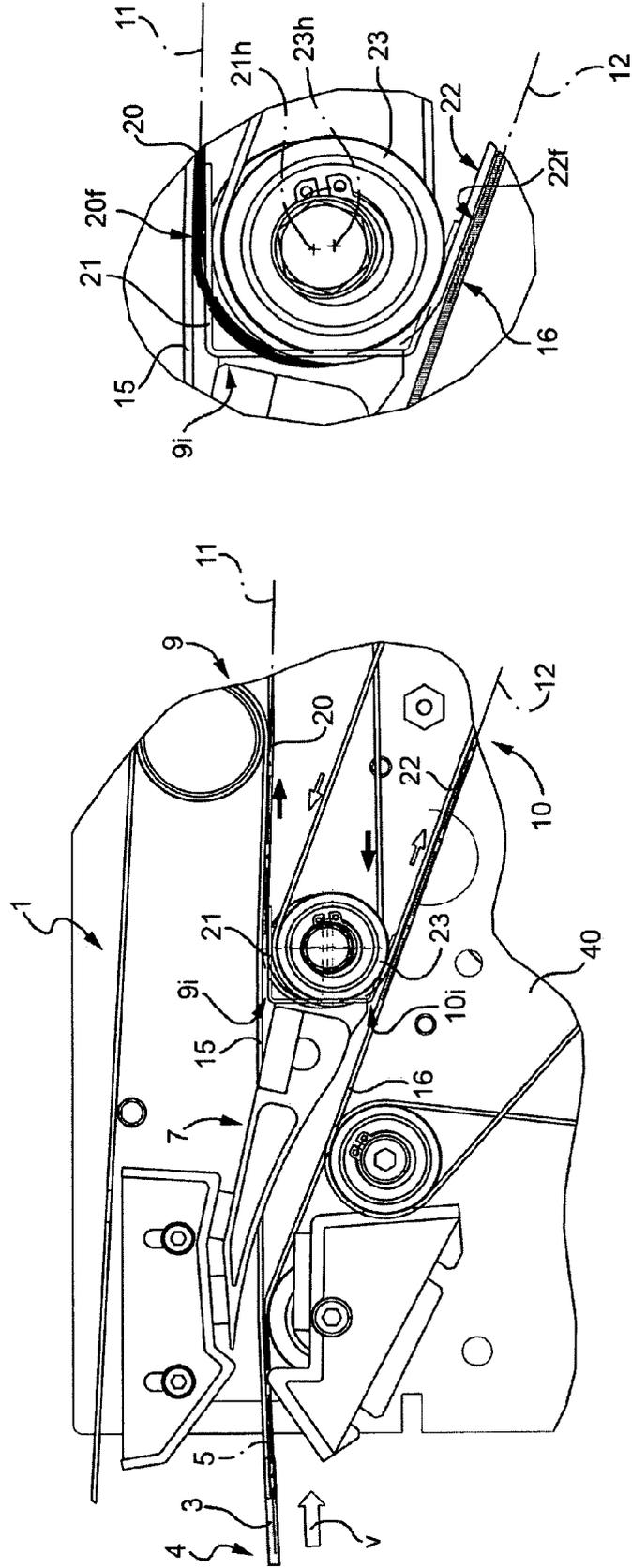


FIG. 3

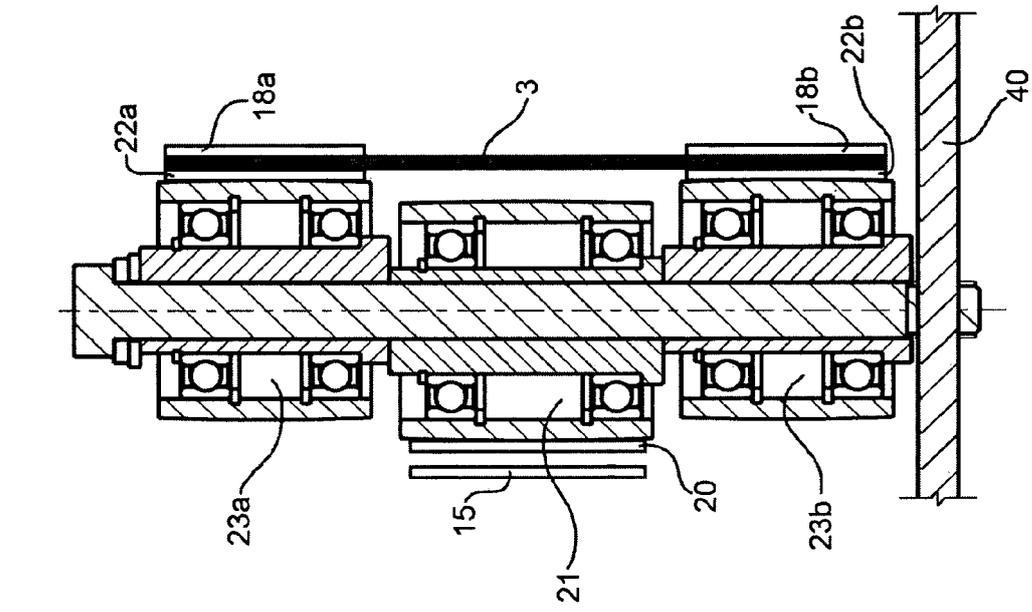


FIG. 4

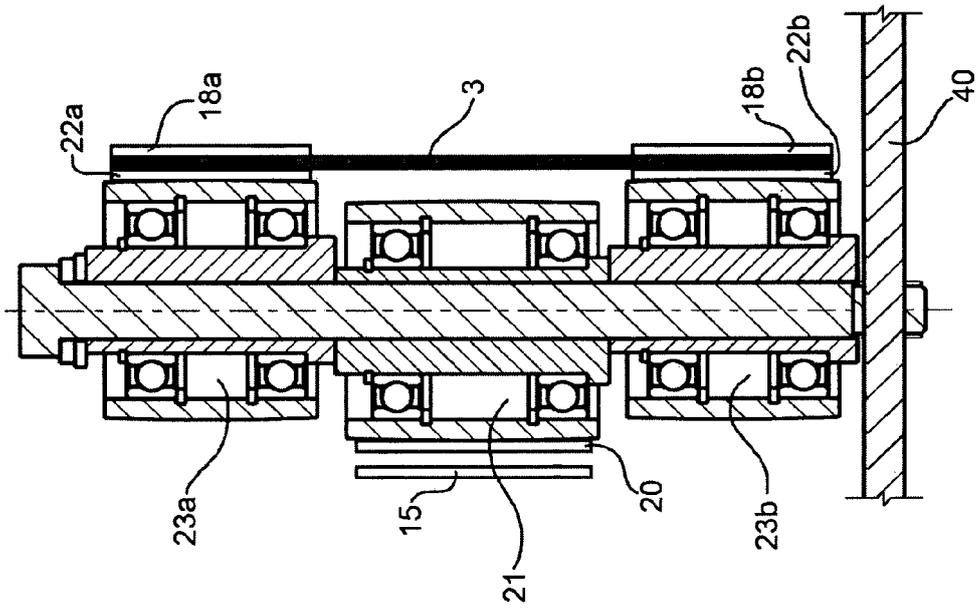


FIG. 5

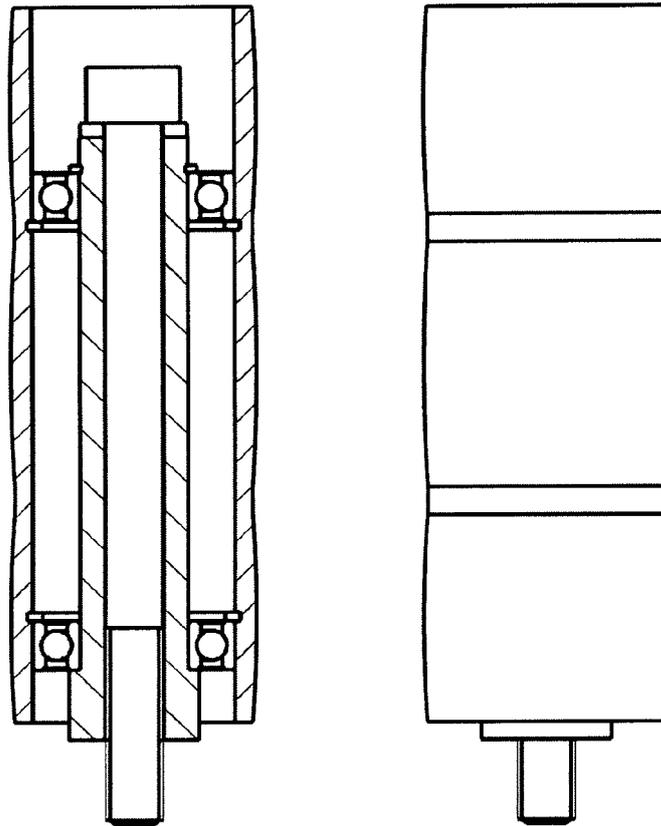


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 11 42 5155

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 34 24 389 A1 (POLYGRAPH LEIPZIG [DD]) 14 March 1985 (1985-03-14) * figures * -----	1,2	INV. B07C3/06
			TECHNICAL FIELDS SEARCHED (IPC)
			B07C B65H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 November 2011	Examiner Wich, Roland
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 (P04/C01)



Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

- Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
- No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- 1, 2
- The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**LACK OF UNITY OF INVENTION
SHEET B**Application Number
EP 11 42 5155

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1, 2

Feed path alignment

2. claims: 3-6

Support element

3. claim: 7

Equal radii

4. claim: 8

Heights of belts

5. claims: 9, 10

Multiple belt type

6. claims: 11, 12

(Multi) crowned pulleys

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

EP 11 42 5155

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 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-11-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3424389 A1	14-03-1985	CH 666466 A5	29-07-1988
		DD 222866 A1	29-05-1985
		DE 3424389 A1	14-03-1985

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82