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(54) Sorting device for separating cardboard

(57) The invention concerns a separating device for separating a mixture of cardboard pieces (36) and paper sheets comprising a sorting belt (13), above the sorting belt sorting tines (3) mounted in an inner drum (6) and extending from the inner drum for impaling and picking up cardboard pieces from the sorting belt (13), and drive means for driving the sorting belt and rotating the inner drum so that the sorting tines (3) move approximately

synchronously with the sorting belt.

In accordance with the invention the sorting tines (3) each have a spring (31) for resiliently pushing the sorting tine (3) outwards the inner drum and a shoulder (33) for limiting the extending length to a maximum length and that the distance between the inner drum and the sorting belt is smaller than the maximum length and the sorting belt can push the sorting tines (3) into the inner drum (6).

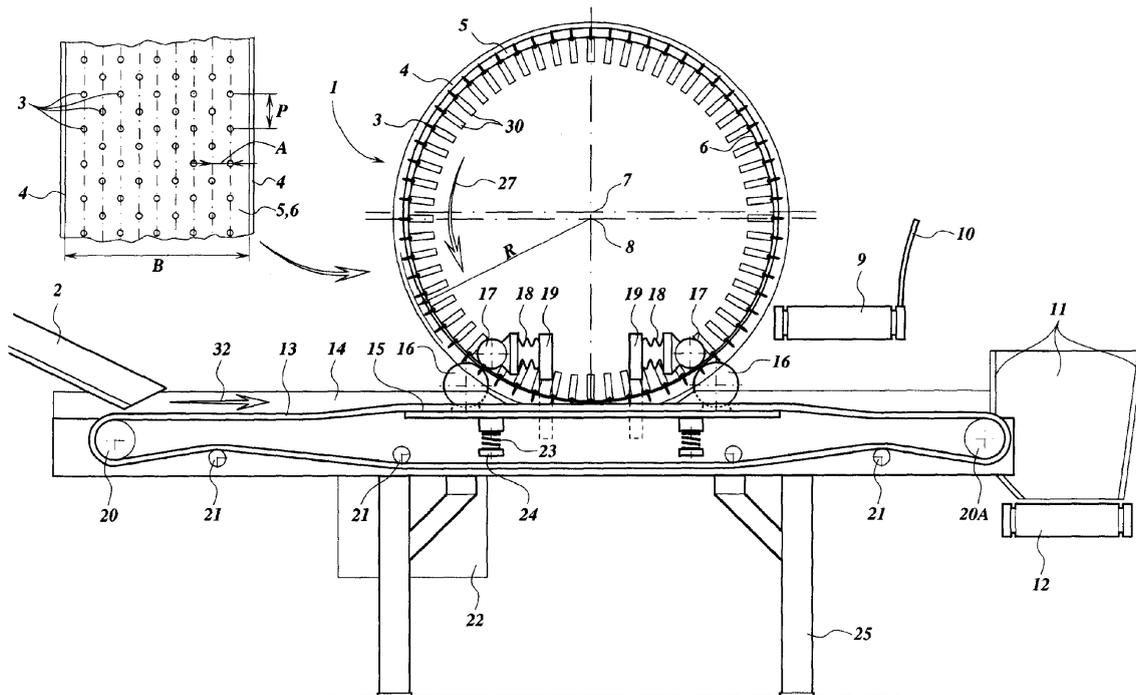


Fig. 1

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Description

[0001] The invention concerns a sorting device in accordance with the preamble of claim 1. Such a device is known from EP 1785200. The disadvantage of the known device is that the sorting belt has ridges that make the belt fairly thick so that it is difficult to fold and guide the belt around the rollers due to the required deformations of the belt, which deformations also lead to undesired wear of the belt.

[0002] In order to overcome this disadvantage the sorting device is according to claim 1. In this way a simple and thin sorting belt is used to move the sorting tines in and out of the inner drum so that the sorting tines pick up cardboard pieces from the sorting belt.

[0003] The invention further concerns an embodiment according to claim 2. This improves the sorting of cardboard pieces from a mixed flow of material.

[0004] The invention further concerns an embodiment according to claim 3. This reduces the number of separate springs.

[0005] The invention further concerns an embodiment according to claim 4. In this way the relative movement of the sorting tines and the sorting belt can be defined to obtain the most advantageous movement for selecting cardboard pieces.

[0006] The invention further concerns an embodiment according to claim 5. This improves the removing of the cardboard pieces from the sorting tines as the outer drum pushes the cardboard piece in axial direction off the sorting tines.

[0007] The invention is explained below with reference to an exemplary embodiment by means of a drawing, in which:

Figure 1 shows a diagrammatic side view of an embodiment of the sorting device and a detail of a front view of the sorting tines and the drum;

Figure 2 shows a cross section of a detail of the embodiment of figure 1 in subsequent steps of interaction of the sorting tines with a front side of a cardboard piece after the front side has passed the narrowest part of gap between the drum the a sorting belt; and

Figure 3 shows a detailed view of two embodiments of a sorting tine.

[0008] The sorting device 1 as shown in figures 1 and 2 comprises a frame 25 having two sidewalls 14 between which a sorting belt 13 can move in a direction of conveyance 32. The sorting belt 13 runs over a drive pulley 20 and a return pulley 20A and is guided by support rollers 21 between the sidewalls 14 and held taut by the return pulley 20A. A drive 22 drives the sorting belt 13. A supply belt 2 supplies a mixture of paper sheets and cardboard pieces 36 (see figure 2) to be sorted to the sorting device 1. In order to improve sorting of the cardboard pieces 36

from the paper sheets, the speeds of the supply belt 2 and the sorting belt 13 are selected in such a way that the supply belt 2 deposits most individual paper sheets and cardboard pieces 36 one after the other in a single layer on the sorting belt 13. Document EP 1785200 gives a more detailed description of a similar device and the skilled man can think of many variations of the design of the sorting belt 13 and/or the sorting device 1.

[0009] The mixture of cardboard pieces 36 and paper sheets lying on the sorting belt 13 are conveyed along underneath sorting tines 3 extending from the outside surface of an inner drum 6 that rotates with an outer drum 5 in a direction of rotation 27. Support rollers 16 support the outer drum 5 and let the outer drum 5 rotate around a top axis of rotation 7. The sorting tines 3 extend from the outside of the inner drum 6 to a maximum radius R from a bottom axis of rotation 8 that is the centre of the inner drum 6 and that is located below the top axis of rotation 7.

[0010] In the area where the inner drum 6 rotates above the sorting belt 13, the sorting belt 13 is supported by a support plate 15 that is resiliently supported by springs 23 that are connected by a bracket 24 to the side walls 14. The support plate 15 supports the sorting belt 13 so that the paper sheets, cardboard pieces 36 and/or the sorting belt 13 will press against the sorting tines 3 and force these to retract in the inner drum 6 over a distance X against the pressure of a spring 31. The spring 31 presses against the sorting tines 3 so that they extend outside the inner drum 6 to the maximum radius R when the sorting belt 13 does not push against them and forces them to retract. The spring 31 is mounted in a holder 30 fixed against the inner surface of the inner drum 6, for instance by welding. The rotation speed of the inner drum 6 and the speed of the sorting belt 13 are synchronized so that the tip of the sorting tines 3 at the radius when the distance X of the retraction has its maximum value, which means the narrowest part of the gap between the inner drum 6 and the sorting belt 13, is approximately equal to the speed of the sorting belt 13.

[0011] In a way described hereafter the sorting tines 3 lift cardboard pieces 36 off the sorting belt 13 and deposit the cardboard pieces 36 on a first discharge belt 9 and the paper sheets remain lying on the sorting belt 13 and are conveyed to a second discharge belt 12. At the point where the paper sheets fall off the sorting belt 13 onto the second discharge belt 12, guide plates 11 are provided in order to prevent the paper sheets from falling onto the ground. The second discharge belt 12 conveys the paper sheets to a storage place and/or a place where the paper is processed further.

[0012] The preceding text has referred to the separation of paper sheets and cardboard pieces 36. It is pointed out here that cardboard pieces 36 include corrugated cardboard and those types of paper that have increased resistance against tearing, which might include books or a bundle of paper sheets.

[0013] The cardboard pieces 36 that the sorting tines

3 lift off the sorting belt 13 move upwards along with the sorting tines 3. The inner drum 6, on which the sorting tines 3 are fixed has a smaller diameter than the outer drum 5 rotating with said inner drum 6 and the outer drum 5 has apertures 35 through which the sorting tines 3 project. This causes that at increasing distance from the bottom area of the inner drum 6 the sorting tines 3, while they are at their maximum radius R from the bottom axis of rotation 8, will project increasingly less far outside the outer drum 5 so that the outer drum 5 pushes the cardboard pieces 36 off the sorting tines 3. As a result, the cardboard pieces 36 fall off the sorting tines 3 onto the first discharge belt 9 placed beside the outer drum 5 for that purpose. A guide plate 10 guides the falling pieces of cardboard. The first discharge belt 9 transports the cardboard pieces 36 to a location where they are further processed.

[0014] Support rollers 16 are provided on the outside of the sidewalls 14 on the frame 25. On these support rollers 16 the outer drum 5 can rotate about a top axis of rotation 7 which is preferably more or less perpendicular to the direction of conveyance 32 of the sorting belt 13. The outer drum 5 is completely open on the inside and has a guide edge 4, as a result of which the outer drum 5 always stays more or less in the same position above the sorting belt 13. The inner drum 6 rests on the bottom part of the outer drum 5, which inner drum 6 rotates with the outer drum 5 around the bottom axis of rotation 8.

[0015] If required in order to ensure that the inner drum 6 rotates with the outer drum 5 and does not move upwards as a result of an upward load on the sorting tines 3, pressure rollers 17 are provided at the position of the support rollers 16, each pressure roller 17 being fixed by means of springs 18 on a support 19. The springs 18 make some movement of the inner drum 6 and/or the outer drum 5 possible. In the region where the inner drum 6 and the outer drum 5 rotate above the sorting belt 13, a support plate 15 supports the sorting belt 13, springs 23 mounted upon a support 24 and fixed on the frame 25 resiliently support the support plate 15. Because of the spring-loaded support plate 15 and also because of the possibility of movement of the inner drum 6, the material on the belt conveyor 13 can have a changing thickness without causing any problem.

[0016] Figure 1 also shows a detail of a front view of the outer drum 5 and the inner drum 6. The drums 5,6 have a width B that is slightly less than the width between the sidewalls 14 and the sorting tines 3 are mounted over the full width B. The sorting tines 3 are mounted in rows that have a distance A and in the direction of rotation 27 a pitch distance P. The distance A is less than half the usual width of a sheet of paper and is for instance 50 mm. The pitch P is less than half the usual width of a sheet of paper and is for instance 100 mm in the situation where the rows of the sorting tines 3 are staggered, so that the sorting tines 3 of a next row of sorting tines 3 is between the sorting tines of the first row of sorting tines 3. This means that during rotation of the drums 5,6 every

50 mm a sorting tine 3 contacts the paper or cardboard on the sorting belt 13. For different applications with different dimensions of the material to be sorted, the distance A and the pitch P are adapted accordingly.

[0017] Figure 2 shows the interaction between the sorting tines 3 and the sorting belt 13 on which a cardboard piece 36 is laying after the sorting tine 3 has passed the narrowest part of the gap between the sorting belt 13 and the inner drum 6. The sorting tine 3 can move in axial direction in a holder 30 and is guided by hole 34 in the inner drum 6. Inside the holder 30 the tine 3 has a shoulder 33, against which the spring 31 can push and which may guide the tine 3 in the holder 30. A locking pin 32 limits the axial movement of the spring 31 in the holder 30. The hole 34 and the shoulder 33 in the holder 30 act as an axial bearing for the sorting tine 3, so that axial movement remains possible when there is a transverse force on a tip 37 of the sorting tine 3. In other embodiments the hole 34 can be designed as axial bearing or the sorting tine 3 can be guided a different way, such as by fixing the sorting tine 3 on a lever and rotating the lever around a hinge.

[0018] As the cardboard piece 36 approaches the gap between the outer drum 5 and the sorting belt 13 in a direction 32 the tip 37 of the sorting tine 3 penetrates the cardboard piece 36 until the tip 37 pushes against the sorting belt 13. The sorting belt 13 then pushes the sorting tine 3 the distance X into the holder 30 against the force of the spring 31. When the tip 37 is part of the first sorting tine 3 to penetrate a cardboard piece 36, which means that it is near the front 38 of the cardboard piece 36, the cardboard piece 36 will get the same speed as the tip 37 and slide over the sorting belt 13. In the gap between the outer drum 5 and/or the inner drum 6 and the sorting belt 13, the tip 37 and/or the outer drum 5 and/or the sorting belt 13 will have the same speed and the distant X will have its maximum value. Figure 2a shows this situation where the cardboard piece 36 and the tip 37 of the sorting tine 3 have the same speed.

[0019] As the cardboard piece 36 continues to move with the sorting belt 13 through the gap between the sorting belt 13 and outer drum 5, as shown in figures 2b and 2c, it will keep the speed of the sorting belt 13 as following sorting tines 3 and the outer drum 5 will keep the speed of the cardboard piece 36 synchronized with the speed of the sorting belt 13. As the sorting tine 3 moves past the gap, the width of the gap increases, the spring 31 pushes the sorting tine 3 out and the distance X will decrease. As the protruding length of the sorting tine 3 increases the tip 37 moves forward relative to the cardboard piece 36. The tip 37 pulls forward relative to the cardboard piece 36, deforms the cardboard piece 36 and creates a hole 39 at the side of the narrowest gap between the sorting belt 13 and the drums 5,6 and forms a raised edge 40 at the side away from the gap.

[0020] Figure 2d shows the situation where the sorting tine 3 has moved further away from the gap and protrudes its maximum length outside the outer drum 5. The dis-

tance X is zero. The cardboard piece 36 pulls against the tip 37. The shape of the tip 37 is such that the direction of pulling keeps the cardboard piece 36 fixed on the tip 37 and especially keeps the raised edge 40 fixed against the tip 37. For that the tip 37 can be partly cylindrical and/or can have a groove 41 as shown in both embodiments of figure 3. The tip 37 of the sorting tine 3 now lifts the front 38 of the cardboard piece 36 from the sorting belt 13 and the rest of the cardboard piece 36 follows. As shown in figure 1 the sorting tines 3 lift the cardboard piece 36 to above the belt 9 and there the outer drum 5 pushes the cardboard piece 36 off the tip 37. If the tip 37 pushes against a paper sheet on the sorting belt 13 the tip 37 might create a hole in the paper sheet, but the tip 37 will not get a grip on the paper sheet as the tip 37 will tear the hole in the paper sheet and there will be no raised edge 40 that can hold the paper sheet on the tip 37 of sorting tine 3. The tip 37 will leave paper or other easily tearing material on the sorting belt 13 but it will lift in the way described earlier the difficult tearing cardboard pieces 36 off the sorting belt 13.

[0021] In another embodiment the cardboard piece 36 can be pushed in other ways from the tip 37, for instance using a comb in case there is no outer drum 5. In another embodiment the inner drum 6 has a central axis that is mounted with spreaders in the inner drum 6 and has bearings in which it rotates. These bearings are so that they make vertical movement of the inner drum 6 possible, so that thick stacks of cardboard pieces 36 can move between the inner drum 6 and the sorting belt 13.

[0022] In the disclosed embodiment each sorting tine 3 is pushed by a separate spring 33. In a further embodiment sorting tines 3 that are side by side in the longitudinal direction of the inner drum 3 can be coupled to form a part that is pushed by a single spring. The part with the sorting tines can be guided so that they move perpendicular to the surface of the inner drum 6, as shown in the figures 1 and 2. In a further embodiment the part with the sorting tines has bars (not shown) that are connected to hinges (not shown) fastened on the inside surface of the inner drum 6 whereby a spring pushes the part with the sorting tines against the inside surface of the inner drum 6. In this embodiment the sorting tines follow an additional movement relative to the longitudinal direction the sorting belt 13 and so relative to the cardboard and paper on the belt which can improve the sorting of the cardboard from the paper.

Claims

1. Separating device for separating a mixture of cardboard pieces (36) and paper sheets comprising a sorting belt (13), above the sorting belt (13) sorting tines (3) mounted in an inner drum (6) and extending from the inner drum for impaling and picking up cardboard pieces from the sorting belt (13), and drive means for driving the sorting belt and rotating the

inner drum so that the sorting tines move approximately synchronously with the sorting belt **characterized in that** the sorting tines (3) each have a spring (31) for resiliently pushing the sorting tine outwards the inner drum (6) and a shoulder (33) for limiting the extending length to a maximum length and that the distance between the inner drum and the sorting belt is smaller than the maximum length and the sorting belt can push the sorting tines (3) into the inner drum.

2. Separating device in accordance with claim 1 wherein the sorting tine (3) has a groove (41) for holding a cardboard piece (36).
3. Separating device in accordance with claim 1 or 2 wherein two or more sorting tines (3) have a common spring for pushing adjacent sorting tines outwards.
4. Separating device in accordance with one of the claims 1 - 3 wherein the sorting tines (3) have guide means (30) to guide them when they move inwards into the inner drum, the guide means preferably guide the sorting tines perpendicular to the surface of the inner drum.
5. Separating device in accordance with one of the previous claims wherein an outer drum (5) surrounds the inner drum (6) and the sorting tines (3) extend through holes (35) in the outer drum.

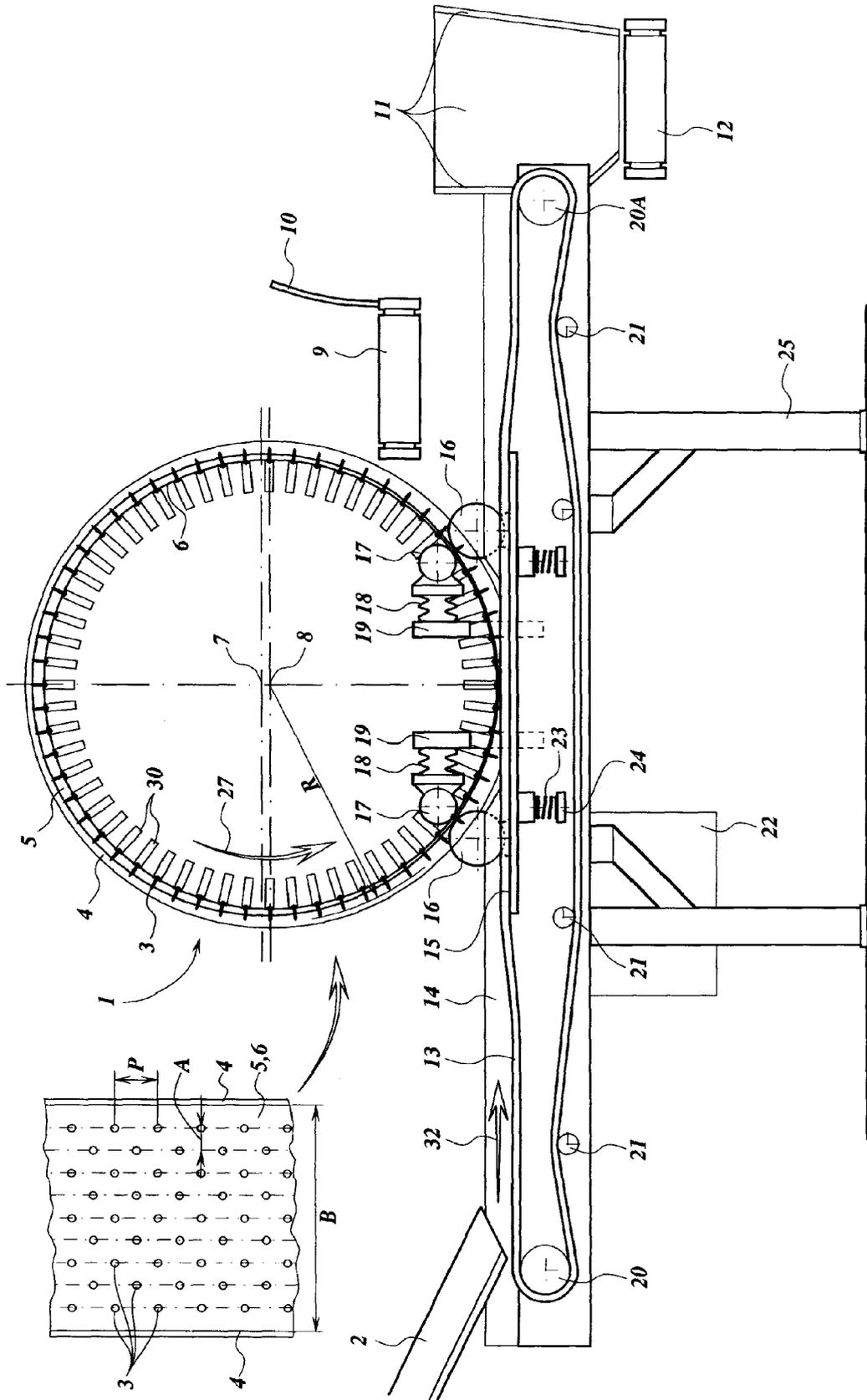


Fig. 1



EUROPEAN SEARCH REPORT

Application Number
EP 10 18 7324

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FR 449 278 A (LEON PAULET FILS) 22 February 1913 (1913-02-22) * the whole document * -----	1-5	INV. B07B13/00
A	US 2 246 851 A (JORDAN HARVEY A) 24 June 1941 (1941-06-24) * column 5, line 29 - line 60; figures 3,5,6 * -----	1-5	
A,D	EP 1 785 200 A1 (WAGENSVELD BV [NL]) 16 May 2007 (2007-05-16) * the whole document * -----	1-5	
A	US 3 793 424 A (HAGA C) 19 February 1974 (1974-02-19) * column 3, line 74 - column 4, line 24; figures 1-5 * -----	1-5	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B07B D21B
Place of search		Date of completion of the search	Examiner
The Hague		20 January 2011	Appelt, Lothar
CATEGORY OF CITED DOCUMENTS		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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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 18 7324

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20-01-2011

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