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(54) **Device for separating paper and cardboard**

Vorrichtung zum Trennen von Papier und Karton

Dispositif pour séparer papier et carton

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(56) References cited:
EP-A- 1 291 092
EP-A- 1 785 200
FR-A- 2 725 641

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Description

[0001] The invention concerns a device in accordance with the preamble of claim 1 or claim 2. EP 1 785 200 A1 discloses a device according to the preamble of claim 1, while EP 1 291092 A2 discloses a device according to the preamble of claim 2. The disadvantage of the known devices is that the sorting belt and sorting roll have grooves for the sorting tines and providing these grooves requires additional measures. Also the grooves and the sorting tines have to align which leads to additional costs.

[0002] In order to overcome this disadvantage the device is according to claim 1 or according to claim 2. It appeared that the flexible surface under the sorting tines prevents the paper sheets to be pierced by the sorting tines that press a depression in the flexible surface so that paper sheets are not picked up by the sorting tines. The more stiff cardboard pieces do not bend into the depression and the sorting tines pierce the cardboard pieces sufficiently so that the cardboard pieces attach to the sorting tines and are picked up.

[0003] In accordance with an embodiment, the device is according to claim 3. This embodiment ensures that the shoulder of a sorting tine grips the cardboard piece and this improves lifting the cardboard piece from the support means.

[0004] In accordance with an embodiment, the device is according to claim 4. In this embodiment the sorting belt or the roller keep supporting the paper sheets and have sufficient flexibility to create a depression under the sorting tines for the carboard to be penetrated.

[0005] 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 a first embodiment of the device with a detail of a front view of the sorting tines and the drum;

Figure 2 shows in cross section a detail of the interaction of the sorting tines with a paper sheet;

Figure 3 shows in cross section a detail of the interaction of the sorting tines with a cardboard piece; and

Figure 4 shows in a diagrammatic side view a second embodiment of the device.

[0006] The sorting device 1 as shown in figure 1 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 sheets of paper and cardboard to be sorted to the sorting device 1. In order to improve sorting of the sheets, the speeds of the supply belt 2 and the sorting belt 13 are selected in such a way that preferably the supply belt 2 deposits individual sheets 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 and/or the sorting device.

[0007] The mixture of pieces of cardboard and sheets of paper 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 the sorting belt 13 in a direction of rotation 27 around a bottom axis of rotation 8. The sorting tines 3 extend from the outside of the inner drum 6 at a radius R from the bottom axis of rotation 8. In a way described hereafter the sorting tines 3 lift pieces of cardboard off the sorting belt 13 and deposit these on a first discharge belt 9 and the sheets of paper remain lying on the sorting belt 13 and are conveyed to a second discharge belt 12. At the point where the sheets of paper fall off the sorting belt 13 onto the second discharge belt 12, guide plates 11 are provided in order to prevent the sheets of paper from falling onto the ground. The second discharge belt 12 conveys the sheets of paper to a storage place and/or a place where the paper is processed further.

[0008] The preceding text has referred to the separation of paper and cardboard. It is pointed out here that the terms cardboard and pieces of cardboard also include corrugated cardboard and those types of paper that have an increased stiffness against bending, which might include books or a bundle of paper sheets.

[0009] The pieces of cardboard 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 and an outer drum 5 rotating about said inner drum and having apertures 26 (see Figures 2 - 3) through which the sorting tines 3 project, have a different diameter. This causes during rotation of the inner drum 6 and the outer drum 5, the sorting tines 3 to project increasingly less far outside the outer drum 5 so that the outer drum 5 pushes the pieces of cardboard off the sorting tines 3. As a result, the pieces of cardboard 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.

[0010] 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 rotates with the outer drum 5 about the bottom axis of rotation 8. The sorting tines 3 are fitted in the inner drum 6 in such a way that they can be changed easily in the event of wear and

also for the purpose of fitting the inner drum 6 in the outer drum 5.

[0011] 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 preferably provided at the position of the support rollers 16, each pressure roller being fixed by means of springs 18 on a support 19. The springs 18 make some movement of the inner drum 6 relative to the outer drum 5 possible. In the region where the inner drum 6 and the outer drum 5 rotate above the sorting belt 13, the sorting belt 13 is supported by a support plate 15 which by way of springs 23 rests upon a support 24 fixed on the frame 25. Because of the springloaded support plate 15 and also because of the possibility of movement of the inner drum 6, the sheets of paper and cardboard pieces lying on the belt conveyor 13 can have a changing thicknesses without causing any problem.

[0012] Figure 1 also shows a detail of a front view of the drums 5,6. The drums 5,6 have a width B above the sorting belt 13 in which the sorting tines 3 are mounted. 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 preferably less than half the usual width of a sheet of paper and is for instance 50 mm. The pitch P is preferably 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.

[0013] Figure 2 shows the interaction between the sorting tines 3 and the sorting belt 13 on which a sheet of paper 36 is laying. The sorting belt 13 comprises a stiff belt part 31 that is strong as in the usual transport belts and that is looped around the drive pulley 20 and the return pulley 20A and slides over the support plate 15. The sorting belt 13 further comprises a resilient belt part 30 fastened on the outside surface of the stiff belt part 31 for instance by gluing or on which it is vulcanized. The top of the resilient belt part 30 forms a belt top surface 29 that supports the paper or cardboard to be sorted. The resilient belt part 30 can be from a sheet pararubber, which is an elastic material that can deform easily.

[0014] The bottom axis of rotation 8 of the inner drum 6 with the sorting tines 3 is located at such height above the support plate 15 that the radius R at which the sorting tines 3 rotate intersects the belt top surface 29. The sorting tines 3 have a tine shaft 36, a tine tip 34 with a tip radius 35 and near the tip a reduction in the diameter of the tine shaft 36 so creating a tine shoulder 33 near the tine tip 34. The distance between the tine shoulder 33 and the tine tip 34 is a tip distance T. Where the path of the sorting tines 3 intersects the belt top surface 29 the tine tip 34 presses a depression 38 with a depth D in the resilient belt part 30. In the situation where a paper sheet 37 is on the belt top surface 29, as shown in figure 2, the tip 34 presses the paper sheet 37 in the depression 38 as well. This is a result of the flexibility of the paper sheet 37 so that it follows the belt top surface 29 in the depression 38. Probably because of the support of the paper sheet 37 by the belt top surface 29, the tine tip 34 does not penetrate the paper sheet 37. In the situation where several sheets of paper 37 are on top of one another, the tine tip 34 might penetrate one or more sheets. As a result of the limited penetration, the ease with which paper shears and/or possibly the conical surface of the tine tip 34 the sorting tine 3 does not grip the paper sheet 37 and the paper sheet remains lying on the belt top surface 29.

[0015] Figure 3 shows the interaction of the sorting tines 3 with the sorting belt 13 on which a cardboard piece 39 is transported. The sorting tines 3 impress the depression 38 with the depth D in the resilient belt part 30 in the same manner as indicated in figure 2. As a result of the stiffness of cardboard, the cardboard piece 39 does not bend into the depression 38 and the tine tip 34 makes a hole 40 in the cardboard piece 39. When the sorting tine 3 moves upwards, the cardboard piece 39 remains fastened around the sorting tine 3 and/or hooks behind the shoulder 33 and so the sorting tines 3 move the cardboard piece 39 further upwards and lift the cardboard piece 39 from the belt top surface 29. Figure 3 shows a single cardboard piece 39 that has a certain thickness compared to the paper sheet 37 shown in figure 2. It will be clear from the earlier description that the sorting tines 3 also will pick up thicker cardboard pieces and thicker stacks of paper, for instance sheets or folded boxes from corrugated cardboard, books, etc.

[0016] The sorting tines 3 create the depression 38 with the depth D in the belt top surface 29. In order to prevent damage to the belt top surface 29 the tip radius 34 is preferably at least 4 mm. In another way to prevent damage to the belt top surface 29 this surface can have a tear resistant coating.

[0017] The height of the bottom axis of rotation 8 above the belt top surface 29 is such that the depression 38 has a depth D of approximately 5 mm whereby the depth D is approximately similar or preferably greater than the tip height T so that a the cardboard piece 39 hooks behind the shoulder 33. In order to make this depression possible without undue stress under the tip 34 of the sorting tine 3 the resilient belt part 30 has a thickness that is more than 2 - 3 times the depth D of the depression or approximately 15 mm, although there might be circumstance in which there is an increased thickness. In order to reduce tension in the resilient belt part 30 at the location where the sorting belt is looped around the drive pulley 20 or return pulley 20A there might be relief slits (not shown) in the resilient belt part 30 perpendicular to the length of the belt.

[0018] In the disclosed embodiment, the rotation speed of the inner drum 6 with the sorting tines 3 is such that the tips 34 do not move relative to the belt top surface 29. Preferably, the belt top surface 29 drives the rotation

of the inner drum 6 although coupled drives for the sorting belt 13 and the drums 5,6 are also possible.

[0019] Figure 4 shows a further embodiment of sorting device whereby a sorting roll 41 has a metal cylinder 42 that rotates around an axis and that is covered with a thick flexible layer 43 of pararubber or a similar material. The sorting tines 3 of the inner drum 6 press a depression in the flexible layer 43. A belt 44 can transport paper sheets 37 or cardboard pieces 39 to the sorting roll 41. The sorting tines 3 pick the cardboard pieces 39 up in the similar way as described in figure 3 and the sorting tines 3 do not pick paper sheets 37 up for the same reasons as described with figure 2 and the paper sheets 37 fall downwards from the sorting roll 41.

Claims

1. Device for separating cardboard and paper comprising a sorting belt (13) on which a mixture of cardboard pieces (39) and paper sheets (37) conveyed in a layer, above the sorting belt (13) sorting tines (3) for impaling and picking up cardboard pieces (39) from the conveyed mixture, the sorting belt (13) supporting the conveyed mixture under the sorting tines (3), and further comprising drive means for moving the sorting tines (3) synchronously with the conveyed mixture and towards and from the sorting belt (13) for impaling and picking up the cardboard pieces **characterized in that** the sorting belt (13) comprises a resilient top surface (30) and the drive means move the sorting tines (3) towards the sorting belt (13) till the sorting tines (3) press a depression (38) in said resilient top surface (30).

2. Device for separating cardboard and paper comprising a sorting roll (41), a transport belt (44) on which a mixture of cardboard pieces and paper sheets is conveyed in a layer to the sorting roll (41), above the sorting roll (41) sorting tines (3) for impaling and picking up cardboard pieces from the conveyed mixture, the sorting roll (1) supporting the conveyed mixture under the sorting tines (3), and further comprising drive means for moving the sorting tines (3) synchronously with the conveyed mixture and towards and form the sorting roll (41) for impaling and picking up the cardboard pieces, **characterized in that** the sorting roll (41) comprises a resilient top surface (43) and the drive means move the sorting tines (3) towards the sorting roll (41) till the sorting tines (3) press a depression (38) in said resilient top surface.

3. Device in accordance with claim 1 or 2 wherein the sorting tines (3) have a tip (34) and a shoulder (33) at a tip distance (T) from the tip wherein the tip distance (T) is preferably less than a depression depth (D) of the depression (38) in said resilient top surface (30;43).

4. Device in accordance with any of claim 1 - 3 wherein said resilient top surface (30;43) is from rubber preferably with a thickness of more than 15 mm.

Patentansprüche

1. Vorrichtung zum Trennen von Karton und Papier, umfassend ein Sortierband (13), auf dem eine Mischung aus Kartonstücken (39) und Papierblättern (37) in einer Schicht befördert wird, Sortierzinken (3) über dem Sortierband (13) zum Aufspießen und Aufnehmen von Kartonstücken (39) aus der beförderten Mischung, wobei das Sortierband (13) die beförderte Mischung unter den Sortierzinken (3) trägt, und ferner umfassend Antriebsmittel zum Bewegen der Sortierzinken (3) synchron mit der beförderten Mischung und zu dem Sortierband (13) hin und von diesem weg, zum Aufspießen und Aufnehmen der Kartonstücke, **dadurch gekennzeichnet, dass** das Sortierband (13) eine elastische obere Oberfläche (30) aufweist und die Antriebsmittel die Sortierzinken (3) zu dem Sortierband (13) hin bewegen, bis die Sortierzinken (3) in die elastische obere Oberfläche (30) eine Vertiefung (38) drücken.

2. Vorrichtung zum Trennen von Karton und Papier, umfassend eine Sortierwalze (41), ein Förderband (44), auf dem eine Mischung aus Kartonstücken und Papierblättern in einer Schicht zu der Sortierwalze (41) befördert wird, Sortierzinken (3) über der Sortierwalze (41) zum Aufspießen und Aufnehmen von Kartonstücken aus der beförderten Mischung, wobei die Sortierwalze (1) die beförderte Mischung unter den Sortierzinken (3) trägt, und ferner umfassend Antriebsmittel zum Bewegen der Sortierzinken (3) synchron mit der beförderten Mischung und zu der Sortierwalze (41) hin und von dieser weg, zum Aufspießen und Aufnehmen der Kartonstücke, **dadurch gekennzeichnet, dass** die Sortierwalze (41) eine elastische obere Oberfläche (43) aufweist und die Antriebsmittel die Sortierzinken (3) zu der Sortierwalze (41) hin bewegen, bis die Sortierzinken (3) in die elastische obere Oberfläche eine Vertiefung (38) drücken.

3. Vorrichtung nach Anspruch 1 oder 2, wobei die Sortierzinken (3) eine Spitze (34) und eine Schulter (33) in einem Spitzenabstand (T) von der Spitze aufweisen, wobei der Spitzenabstand (T) vorzugsweise kleiner als eine Vertiefungstiefe (D) der Vertiefung (38) in der elastischen oberen Oberfläche (30; 43) ist.

4. Vorrichtung nach einem beliebigen der Ansprüche 1-3, wobei die elastische obere Oberfläche (30; 43) aus Gummi, vorzugsweise mit einer Dicke von mehr als 15 mm, hergestellt ist.

Revendications

1. Dispositif pour séparer carton et papier, comprenant un tapis de tri (13) sur lequel un mélange de morceaux de carton (39) et de feuilles de papier (37) est transporté dans une couche, au-dessus du tapis de tri (13) se trouvent des dents de tri (3) pour empaler et ramasser des morceaux de carton (39) du mélange transporté, le tapis de tri (13) supportant le mélange transporté sous les dents de tri (3), et comprenant en outre un moyen d'entraînement pour déplacer les dents de tri (3) de manière synchrone avec le mélange transporté à destination et en provenance du tapis de tri (13) pour empaler et ramasser les morceaux de carton, **caractérisé en ce que** le tapis de tri (13) comprend une surface de dessus élastique (30) et le moyen d'entraînement déplace les dents de tri (3) vers le tapis de tri (13) jusqu'à ce que les dents de tri (3) pressent un évidement (38) dans ladite surface de dessus élastique (30).

2. Dispositif pour séparer carton et papier, comprenant un rouleau de tri (41), un tapis de transport (44) sur lequel un mélange de morceaux de carton et de feuilles de papier est transporté dans une couche vers le rouleau de tri (41), au-dessus du rouleau de tri (41) se trouvent des dents de tri (3) pour empaler et ramasser des morceaux de carton du mélange transporté, le rouleau de tri (41) supportant le mélange transporté sous les dents de tri (3), et comprenant en outre un moyen d'entraînement pour déplacer les dents de tri (3) de manière synchrone avec le mélange transporté à destination et en provenance du tapis de tri (41) pour empaler et ramasser les morceaux de carton, **caractérisé en ce que** le rouleau de tri (41) comprend une surface de dessus élastique (43) et le moyen d'entraînement déplace les dents de tri (3) vers le rouleau de tri (41) jusqu'à ce que les dents de tri (3) pressent un évidement (38) dans ladite surface de dessus élastique.

3. Dispositif selon la revendication 1 ou 2, dans lequel les dents de tri (3) ont un embout (34) et un épaulement (33) à une distance d'embout (T) de l'embout, dans lequel la distance d'embout (T) est de préférence inférieure à une profondeur d'évidement (D) de l'évidement (38) dans ladite surface de dessus élastique (30,43).

4. Dispositif selon l'une quelconque des revendications 1 à 3, dans lequel ladite surface de dessus élastique (30 ; 43) est en caoutchouc de préférence d'une épaisseur supérieure à 15 mm.

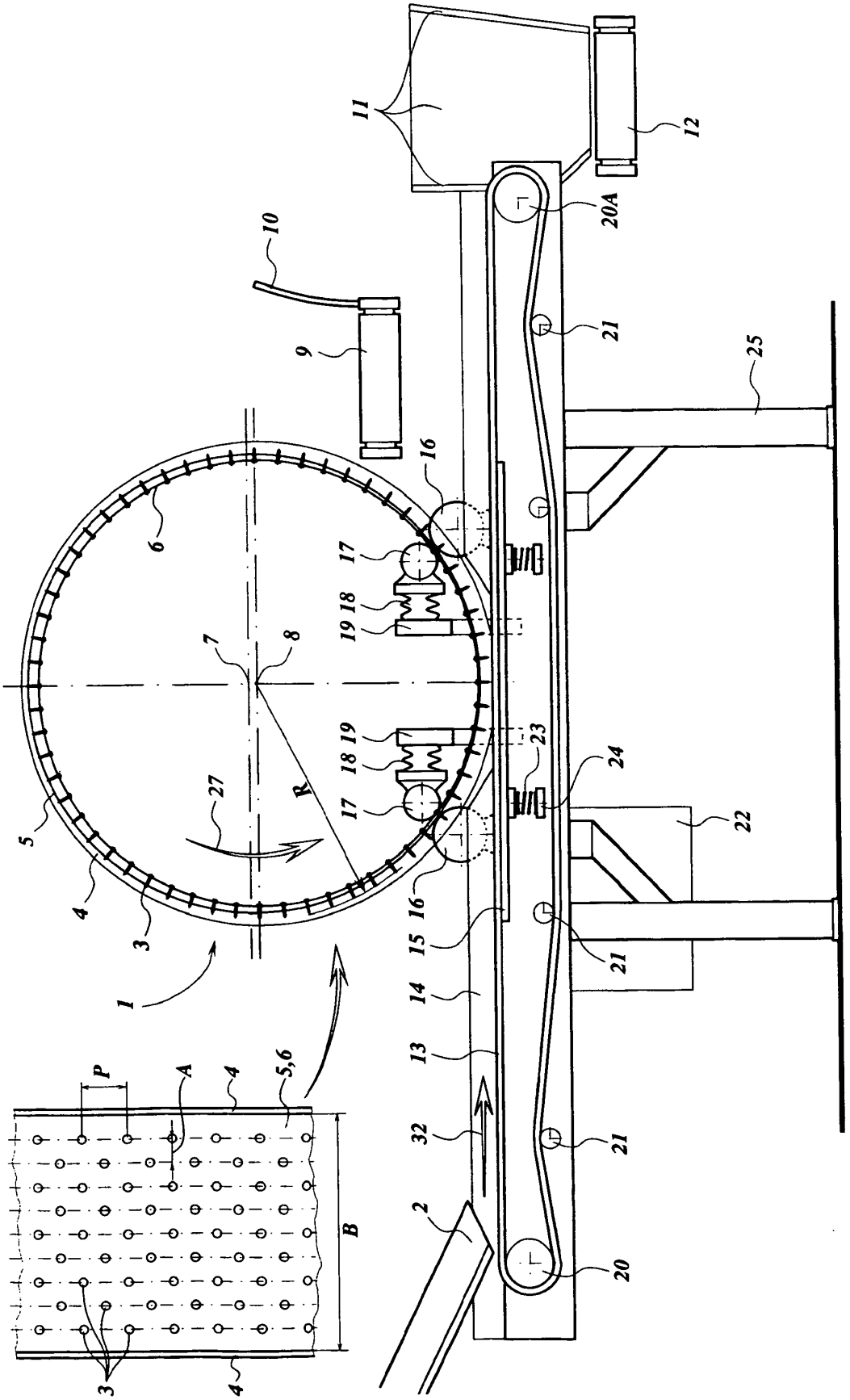

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Fig. 1

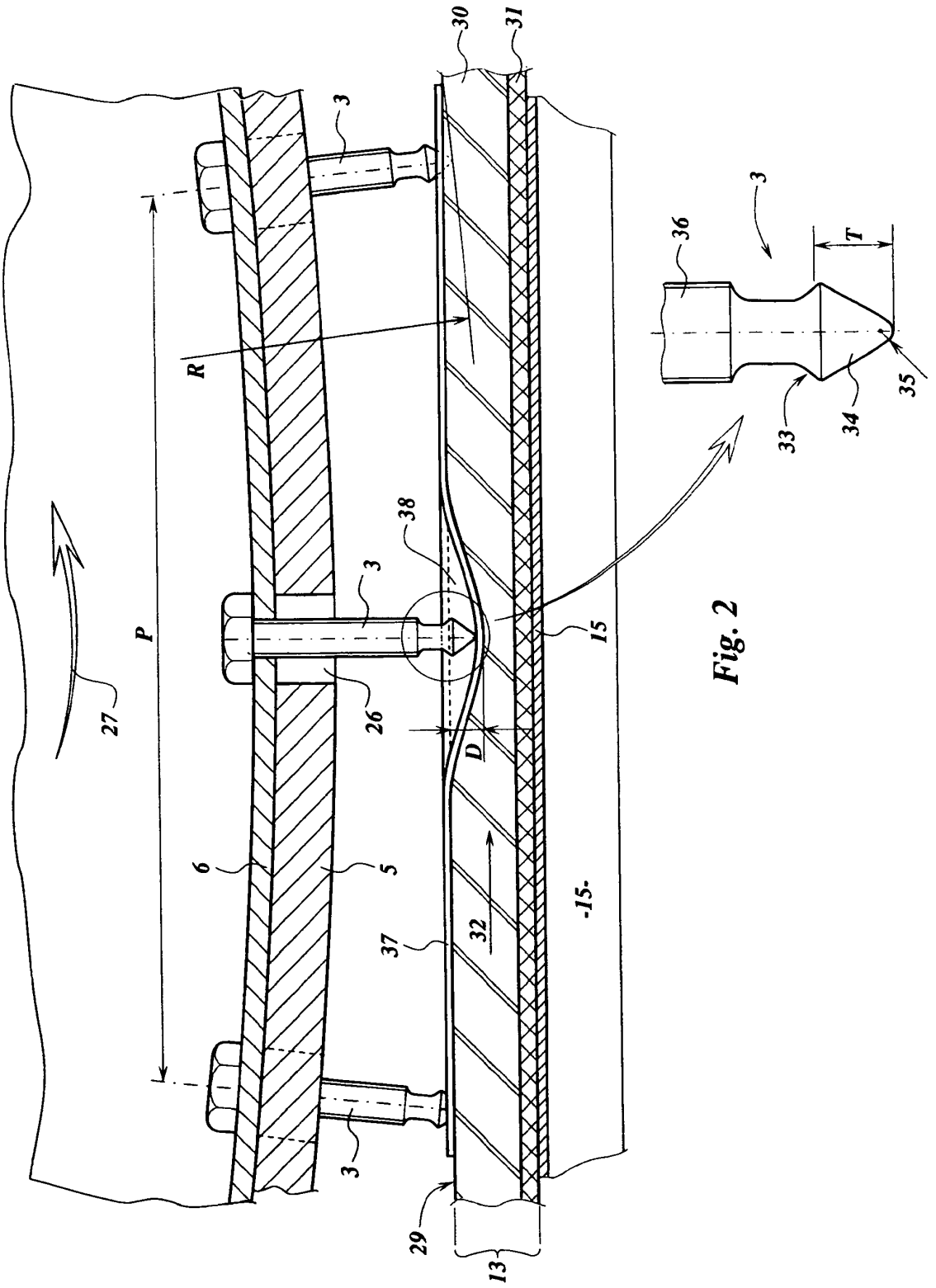


Fig. 2

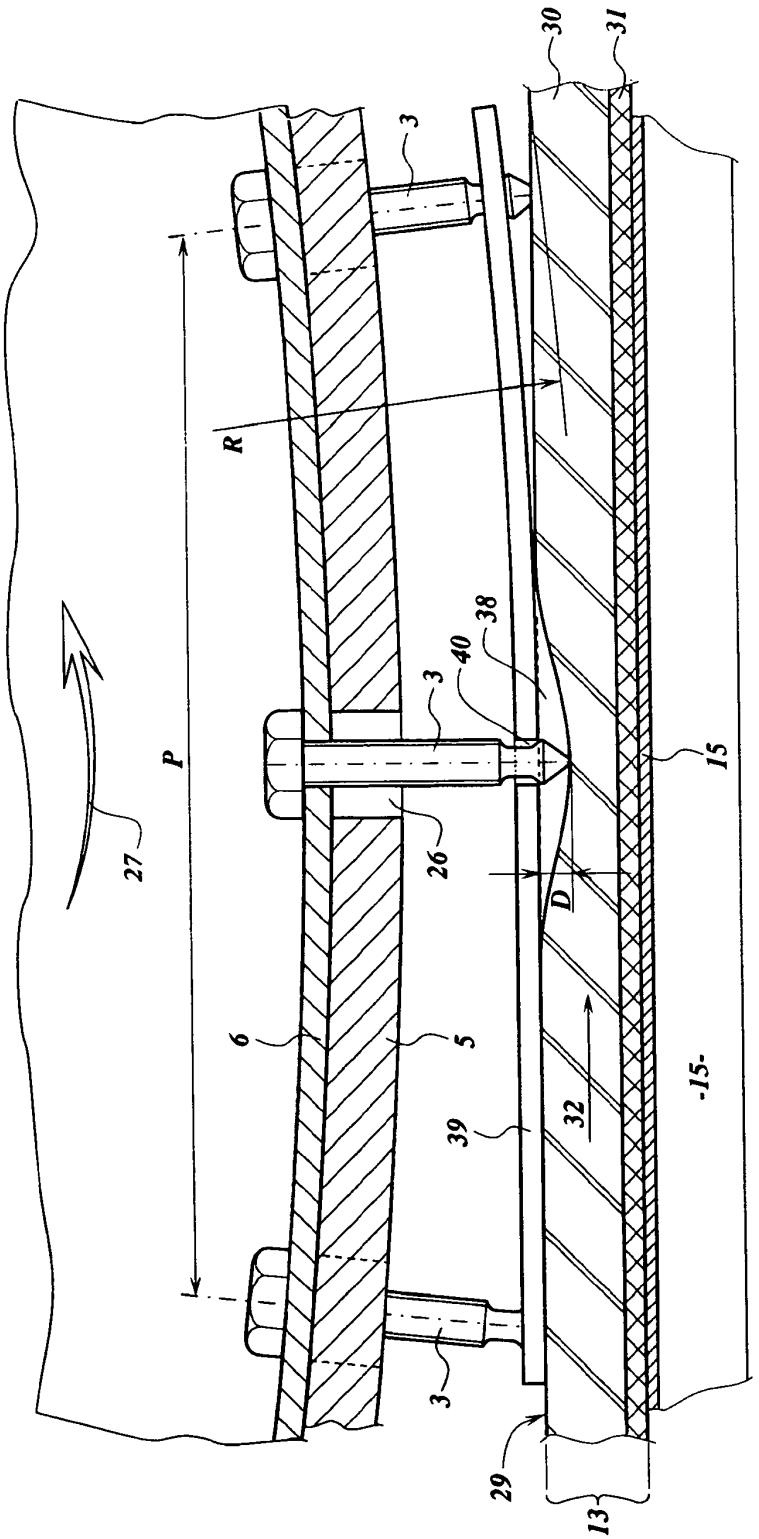


Fig. 3

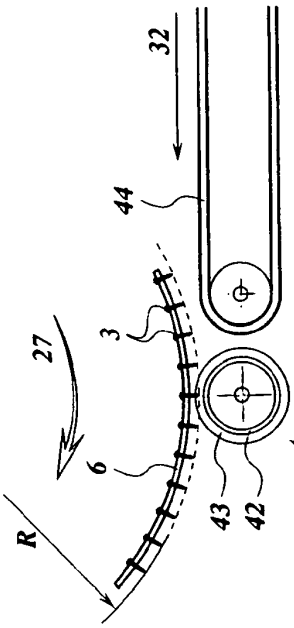


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1785200 A1 **[0001]**
- EP 1291092 A2 **[0001]**
- EP 1785200 A **[0006]**