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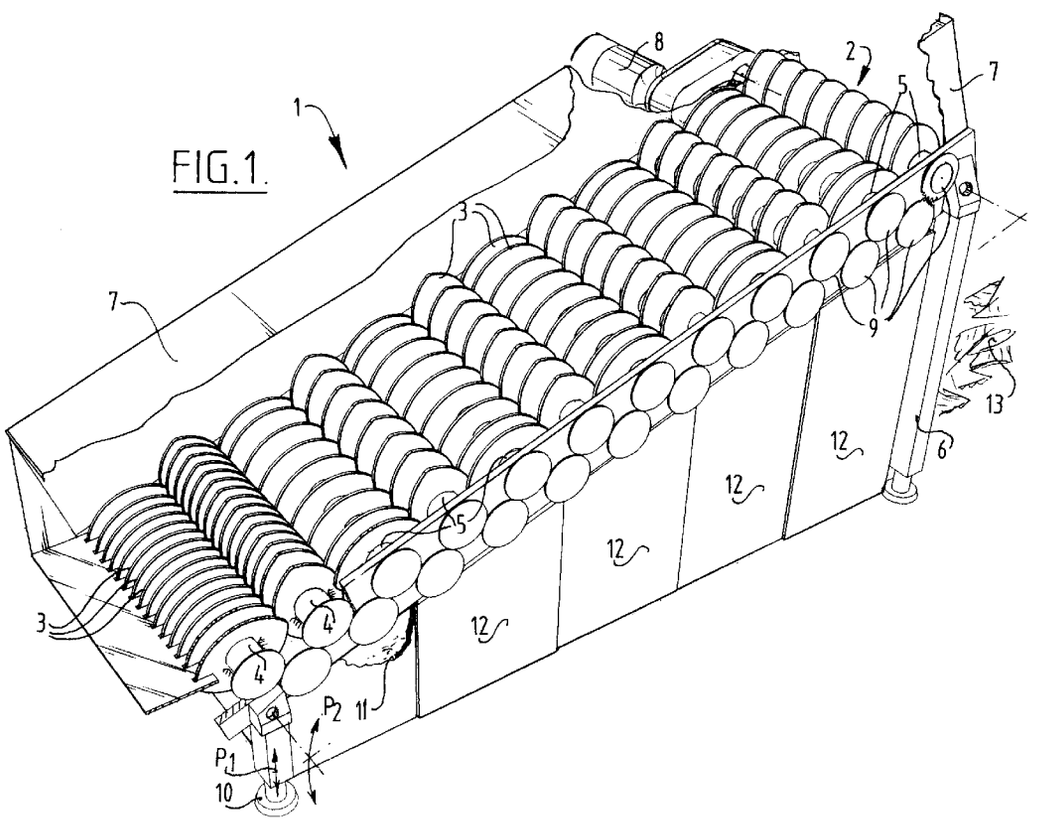
(54) Device and disc for separating materials

(57) The invention relates to a device and disc (16) for separating materials such as for instance paper and cardboard, comprising at least two substantially parallel, rotatable shafts (4) on which discs (16) are mounted, wherein through rotation of the shafts (4) material thrown onto the shafts (4) is displaced over the discs (16) and drops downward partially between the discs (16).

FIG.1.



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Description

The invention relates to a device for separating materials such as for instance paper and cardboard.

Because of the present great interest in reuse of materials and in limiting waste flows, there exists a great need for devices for separating mixed materials. As a result of separation, materials can be processed more easily and usually also to a higher quality. A particular example envisaged here is a mixture of cardboard and paper, which in this mixed form is much less usable than when paper and cardboard are mutually separated.

The present invention has for its object to provide a device for mechanizing separation of materials, in particular paper and cardboard.

To this end the invention provides a device as described in claim 1. The shafts are herein preferably located in one plane, the angular position of which is adjustable. By throwing a quantity of mixed material onto the surface formed by the shafts and the discs connected thereto, this material will be displaced over the surface by rotation of the shafts and the discs rigidly connected thereto. Particularly envisaged herein is a surface which encloses an angle of for instance 18° with the bottom, wherein mixed material is thrown onto a low-lying position and is subsequently transported upward over the surface by the rotation of the shafts until it reaches the edge of the surface and there drops downward. During transport upward over the surface a part of the material will drop down between the spaces left clear by discs and shafts. Particularly when processing a paper/cardboard mixture, the paper will drop downward during this transport, so that substantially only cardboard remains which drops downward over the top edge of the active surface. An optimum angular position of the surface can be adjusted subject to the material for processing and the dimensions of discs and shafts.

In a preferred embodiment the position of at least one shaft is adjustable in axial direction. In another preferred embodiment the number and/or the position of the discs on a rotatable shaft is adjustable. In yet another preferred embodiment it is possible to adjust the mutual distance between two rotatable shafts. By making the positions of shafts and discs adjustable, diverse settings can be chosen subject to the material for processing and the required level of separation. Settings must be particularly envisaged here, wherein the positions of discs and shafts on the lower side of the plane through the shafts differ from the settings on the upper side of the plane through the shafts. A particular choice can herein be made for an even transition from the one extreme positioning of the elements relative to each other to the other extreme setting of the elements relative to each other. Instead of an even progression this progression may also be discrete, whereby for instance more pronounced boundaries of separation can be realized over the surface of the plane.

The option must be envisaged here of only allowing through for instance very small material portions (paper shreddings) at a low position of the surface, while a surface part which is located higher also allows through larger material portions (larger pieces of paper).

Particularly discs as described in claims 7-10 are found to provide favourable results. The for instance rugby ball-shaped discs of adjacent shafts can herein be oriented similarly or, on the contrary, displaced through a determined angular displacement (for instance 90°) relative to each other. In the first case the support surface created by the discs will move reciprocally as a whole, while in the second case the form of the support surface created by the discs will change in more wavelike manner. Here also it should be noted that the most advantageous choice depends upon a number of preconditions.

In a preferred embodiment the first derivative of the periphery of the disc has a continuous character, so that the periphery of the disc does not comprise any angles. The preferred embodiment of the disc which complies with this condition has a shape such that it substantially corresponds with the periphery of a cross-section through the centre line of a rugby ball. The absence of angles has the advantage that the material for separating will not be damaged at all by the discs. Another advantage is that the separating process progresses uniformly and the device is subjected to relatively little load. Particularly advantageous results are obtained with discs with a rugby ball-shaped periphery.

The present invention will be further elucidated with reference to the non-limitative embodiments shown in the following figures. Herein:

Fig. 1 shows a cut-away perspective view of a device according to the invention,
Fig. 2 shows a top view of the device according to the invention, and
Fig. 3 shows a side view of a disc mounted in the device according to figures 1 and 2.

The device 1 shown in figure 1 shows an active surface 2 formed by the upper sides of discs 3 which are mounted on rotatable shafts 4,5. Shafts 4,5 are arranged for rotation in a frame 6 such that the centre lines of shafts 4,5 lie in one plane. Standing walls 7 are placed on the upper longitudinal sides of the active surface 2. For driving of rotatable shafts 4,5 the device 1 is provided with a motor 8 with which the upper shaft 5 is driven. Because all shafts 4,5 are provided with mutually engaging, schematically shown, tooth wheels 9, the shafts 4,5 are rotatable synchronously.

The angular position of active surface 2 relative to the bottom is adjustable in that two legs 10 located close to the lowest lying shafts 4, are height-adjustable as according to arrow P1. The lower side of the active surface is hereby adjustable in height as according to arrow P2.

By rotating shafts 4,5 in clockwise direction a paper/cardboard mixture thrown onto active surface 2 above

the lowest lying shafts 4,5 will be separated and displaced partially over active surface 2 over the upper parts of discs 3. Because the discs 3 on lowest lying shafts 4 are placed closer together than the discs 3 on higher placed shafts 5, only very small paper portions can drop downward through discs 3 on the lower side of active surface 2. On the lower side of active surface 2 small paper fragments can drop downward into a container 11 specially arranged for this purpose. Larger paper portions and cardboard portions will be transported upward over surface 2 by the rugby ball-shaped discs 3. These latter ensure that a paper/cardboard mixture located on active surface 2 is moved reciprocally up and downward whereby it is "shaken out". Thus is prevented that small paper portions lying on a larger cardboard portion are transported upward along active surface 2. During this transport upward along active surface 2 of the remaining paper/cardboard mixture, more and more paper will drop down through discs 3. This paper will be collected in containers 12. The cardboard parts which do not drop down between discs 3 will eventually reach the upper edge of active surface 2 and fall down onto a pile of cardboard 13. It is of course also possible to place a discharge device for cardboard behind the device 1.

Fig. 2 shows a top view of a part of device 1, in which can be seen that the density of discs 3 on shafts 4 is greater than the density of discs 3 on shafts 5. The side walls 7 are arranged to prevent paper or cardboard portions dropping off the active surface at the sides.

The difference in disc distances on the different shafts 4,5 can, as required, also be embodied otherwise than in the embodiment shown here. A differentiation in the separating action of active surface 2 can hereby be obtained. It is also conceivable herein for discs 3 to be mounted displaceably on shafts 4,5 and/or for shafts 4,5 to be displaceable in axial direction. The centre line distance between two adjacent shafts 4,5 can also take an adjustable form.

Finally, fig. 3 shows a disc 15 with a "rugby ball"-shaped appearance. Disc 15 is provided with two top positions 16 which are located further from the point of rotation M of disc 15 than all other peripheral points on disc 15. Disc 15 is provided with a central opening 17 with which it can be mounted on a shaft 4,5 of a separating device 1 according to the invention. For a smooth operation of a device according to the invention the disc 15 can be provided with a resilient material layer 18.

Claims

1. Device for separating materials such as for instance paper and cardboard, comprising at least two substantially parallel, rotatable shafts on which discs are mounted, wherein through rotation of the shafts material thrown onto the shafts is displaced over the discs and drops downward partially between the discs.

2. Device as claimed in claim 1, wherein the rotatable shafts are located in one plane.

3. Device as claimed in claim 2, wherein the angular position of the plane through the shafts is adjustable.

4. Device as claimed in any of the foregoing claims, wherein the position of at least one shaft is adjustable in axial direction.

5. Device as claimed in any of the foregoing claims, wherein the number and the positions of the discs on a rotatable shaft are adjustable.

6. Device as claimed in any of the foregoing claims, wherein the mutual distance between two rotatable shafts is adjustable.

7. Device as claimed in any of the foregoing claims, wherein the periphery of at least one of the discs is such that at least at two top positions mirror-symmetrical relative to the rotation point of the disc the distance to the rotation point is the same and is greater than at all other positions located on the periphery.

8. Device as claimed in claim 7, wherein the shape of the disc is symmetrical relative to a line through the two top positions.

9. Device as claimed in any of the foregoing claims, wherein the first derivative of the periphery of the disc has a continuous character, so that the periphery of the disc does not comprise any angles.

10. Device as claimed in any of the foregoing claims, wherein the periphery of the disc has a shape which substantially corresponds with the periphery of a cross-section through the centre line of a rugby ball.

11. Device as claimed in any of the claims 8-10, wherein the disc also has a line of symmetry which intersects the first line of symmetry perpendicularly in the middle between the top positions.

12. Device as claimed in any of the foregoing claims, wherein the disc is provided on the periphery with a resilient material layer.

13. Device as claimed in any of the foregoing claims, wherein the mutual centre line distance of two adjacent shafts is less than twice the distance from the top position of a disc to the centre line on which this disc is mounted.

14. Disc for use in a device for separating materials such as for instance paper and cardboard, which

disc is formed such that it comprises at least two top positions which are mirror-symmetrical relative to the rotation point of the disc and the distance of which to the rotation point is greater than the distance from every other peripheral point to the rotation point.

15. Disc as claimed in claim 14, wherein the shape of the disc is symmetrical relative to a line through the two top positions.

16. Disc as claimed in claim 15, wherein the disc also has a second line of symmetry which intersects the first line of symmetry perpendicularly between the top positions.

17. Disc as claimed in any of the claims 14-16, wherein the first derivative of the periphery of the disc has a continuous character, so that the periphery of the disc does not comprise any angles.

18. Disc as claimed in any of the claims 14-17, wherein the periphery of the disc has a shape which substantially corresponds with the periphery of a cross-section through the centre line of a rugby ball.

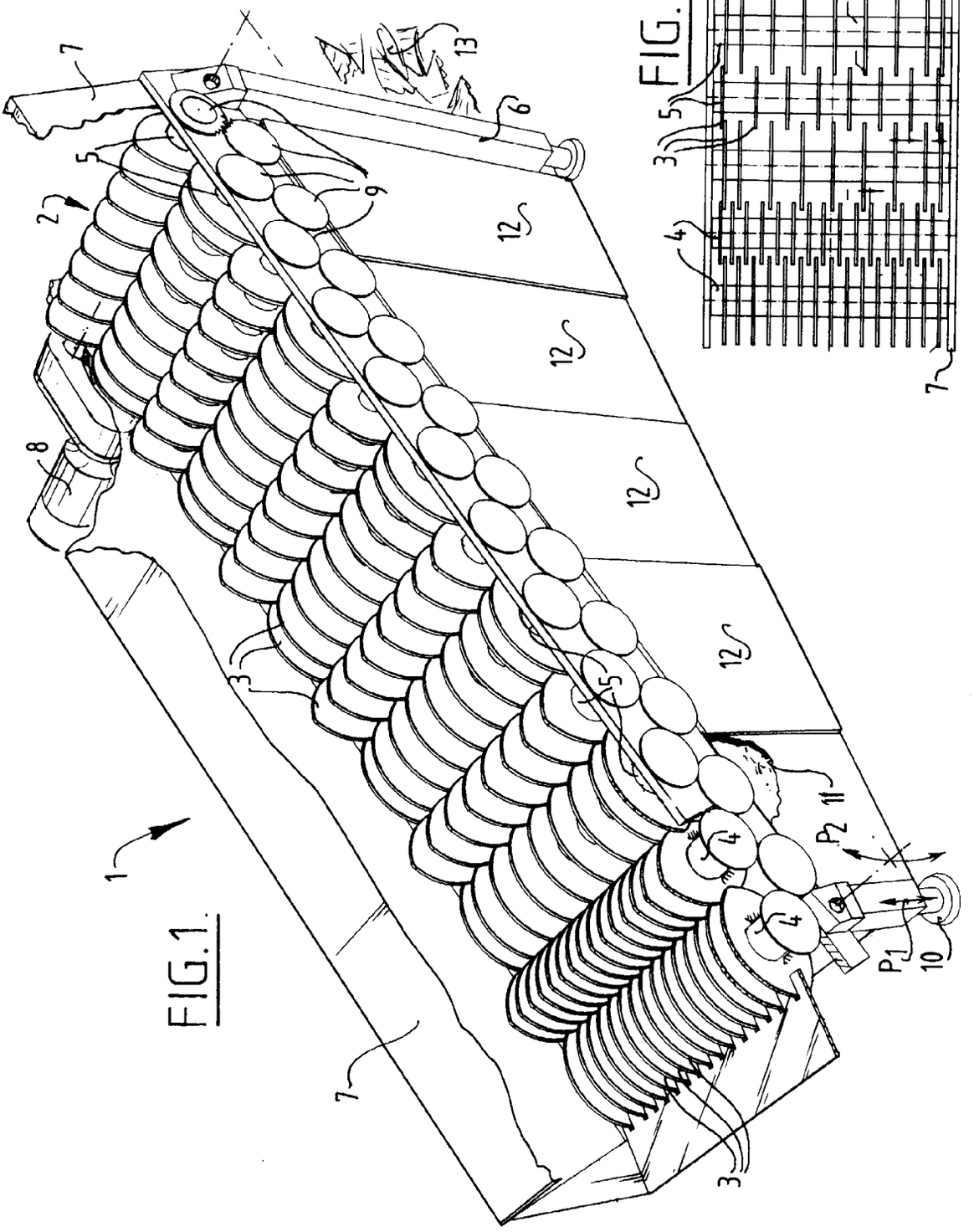

FIG.1.

FIG.2

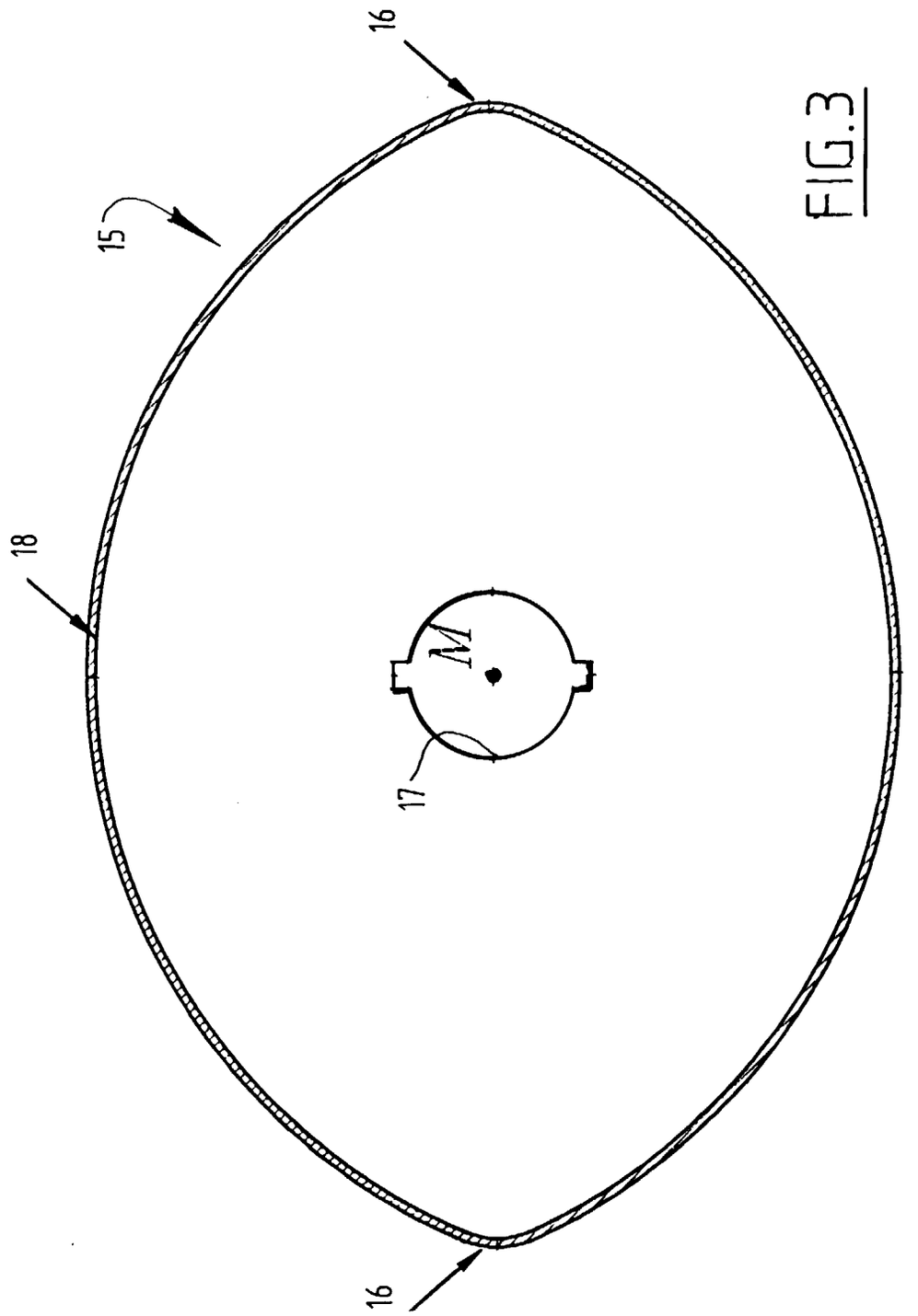

FIG.3

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EUROPEAN SEARCH REPORT

Application Number
EP 97 20 2956

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB 2 267 235 A (BORD NA MONA) 1 December 1993 * page 9, line 1-9; claim 1 *	1-3, 5-11, 13-18	B07B1/15
L	PATENT ABSTRACTS OF JAPAN vol. 096, no. 012, 26 December 1996 & JP 08 196778 A (TEKUNI HAITSU:KK), 6 August 1996, * abstract *	10,18	
X Y	WO 95 35168 A (BULK HANDLING SYSTEMS INC ;CLARK BRIAN K (US); MILLER ROY R (US)) 28 December 1995 * page 6, line 12-22 - page 7, line 15-27; figure 4 *	1,2,5-8, 11,13-16 3	
Y	DE 44 08 903 A (KRONENBERGER ERNST JOSEF) 21 September 1995 * claim 1 *	3	
P,X	EP 0 773 070 A (BOLLEGRAAF APPINGEDAM MASCHF) 14 May 1997 * claim 1 *	1,2,5,6	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B07B
A	US 2 743 813 A (ERICKSON) 1 May 1956 * claim 1 *	7,14	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 December 1997	De Gussem, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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