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(54) **Star body for a star screen for sorting waste**

(57) A star body (3) for a star screen (1) extends around a central passage (7) for receiving a shaft (2) to which the star body (3) is to be fixed, the star body (3) further having a plurality of star fingers (4) projecting radially outwardly from the central body portion and oriented along a common plane of rotation. Each star finger (4) has a curved leading surface (10) in a circumferential sense opposite to a sense of rotation, wherein the curvature of the leading surfaces (10) is such that along the

leading surface (10) from the proximal end (8) to the distal end (9), angles at which planes intersecting the central axis (6) intersect the leading surfaces (10) are larger than 45°. Such a star screen (1) allows waste material to be separated into fractions, while largely preventing string material from winding around the shaft (2) and/or star finger (4).

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Description

FIELD AND BACKGROUND OF THE INVENTION

[0001] The invention relates to a star body for a star screen for sorting waste, to a star screen including such star body and to a method for sorting waste material.

[0002] Star screens for sorting material generally comprise a row of rotatable, driven shafts mutually spaced in a conveying direction. The shafts each extend transversally to the conveying direction and each carry a row of radially extending star bodies for intermittently urging material on the star screen upward and in conveying direction. The star bodies of each of the rows are mutually spaced in longitudinal direction of the respective shaft and rotary trajectories of the star bodies carried by each of the shafts project between rotary trajectories of the star bodies carried by a neighbouring one of the shafts.

[0003] Such screens are known from European patent 0 773 070 and European patent 0 925 847 and for instance used for sifting waste, in which the waste has to be separated in a crude and fine fraction or in a stiff (e.g. cardboard) and flexible (e.g. paper) fraction. The sizes and shapes of the passages between most adjacent star bodies and between the star bodies and most adjacent shafts determine the maximum dimensions and/or stiffness of the objects which are let through by the star screen. Usually the shafts of the star screen all rotate in the same sense of rotation, so that the material moves over the screen and the fraction which is left on the screen is discharged. In this way it is also effected that an object which is too large for the passage will not block the passage, because adjacent every passage a star body section is present which moves upwardly, so that the object is engaged and entrained upwardly away from the passage.

[0004] However, when sorting material containing flexible, elongated material, such as fibre, tape, ribbon, rope and/or string material, such materials tend to wind around the shafts and/or the star fingers and eventually hampers operation of the star screen. Therefore, such materials wound around the shafts and the star bodies have to be removed regularly. To allow the materials to be unwound and cut from the shafts and the star bodies, the star screen has to be stopped, so that an operator can remove the entangled material manually. The removal of wound material is cumbersome and time consuming.

SUMMARY OF THE INVENTION

[0005] It is an object of the invention to provide a solution which allows to at least reduce the frequency at which a star screen has to be stopped for removing material wound around the shafts and/or the star bodies.

[0006] According to the invention, this object is achieved by providing a star body according to claim 1. The invention can also be embodied in a star screen according to claim 5. The invention can further be embodied

in a method according to claim 6.

[0007] Because the curvature of the leading surfaces of the star fingers is such that along the leading surface from the proximal end to the distal end, angles at which planes intersecting the central axis intersect the leading surfaces are larger than 45° , elongate flexible waste material prone to being caught by the star fingers and to be entrained and wound around the shaft and/or the star body does to an increased extent slide along the leading star finger surface towards its distal end and off the star finger. Thus, the extent to which flexible elongate material tends to wind around the shafts and/or star fingers is reduced.

[0008] Particular embodiments of the invention are set forth in the dependent claims.

[0009] Further objects, features, effects and details of the invention are described below.

BRIEF DESCRIPTION OF THE DRAWING

[0010]

Fig. 1 is a schematic top view of a part of an example of a star screen according to the invention; and Fig. 2 is a schematic side view of an example of a star body according to the invention.

DETAILED DESCRIPTION

[0011] In Fig. 1 shows a part of a star screen 1 for separating material, which comprises a row of rotatable, driven shafts 2 mutually spaced in a conveying direction 18. Each shaft extends transversally to the conveying direction 18. For driving rotation of the shafts, the shafts are coupled to a motor via a drive train. Each of the shafts 2 carries a row of radially extending star bodies 3 for intermittently urging material on the sorting conveyor upward and in conveying direction 18. The star bodies 3 of each of the rows are mutually spaced in longitudinal direction 19 of the respective shaft 2. In operation, each star body 3 moves rotationally along a rotary trajectory and the rotary trajectories of the star bodies 3 carried by each of the shafts 2 project between rotary trajectories of the star bodies 3' carried by a neighbouring one of the shafts 2. Between neighbouring star bodies and between star bodies and shafts, open passages are left through which waste material that is sufficiently small and/or flexible can drop. The star screen 1 operates in a manner similar to a sieve.

[0012] In Fig. 2 a star body 3 with a hub 5 and a number of star fingers 4 is shown. The hub 5 forms a central body portion extending around a square hole 7 forming a central passage for receiving a shaft 2. The square shape of the hole 7 locks the star body 3 against rotation relative to the square shaft 2, so that the star body 3 is reliably entrained with rotation of the shaft 2. In operation, the star body 3 rotates with the shaft 2 around a central axis 6 of the shaft 2, the star body 3 and the square hole 7.

Instead of a square hole⁷, the central passage may have any other form. However, a form other than circular, such as hexagonal or triangular, is advantageous for providing a form locked fixation about a shaft that is suitably shaped to project outside a largest circular contour within the passage.

[0013] The star body 3 according to the present example is provided with six star fingers 4 projecting radially outwardly from the hub 5 and oriented along a common plane of rotation. Instead of with six star fingers, the star body may be provided with a different number of star fingers 4. However, to keep variations in the size of the passage along the perimeter of the star bodies fairly limited, while providing a high frequency of upward impulses to material on the screen adjacent each passage, it is preferred that the number of star fingers of each star body is at least four and more preferably, at least five or six.

[0014] In operation, the star screen 1 can sort waste material, such as general household waste, dry co-min-gled waste mainly composed of paper, cardboard, glass and plastic waste, or waste paper and cardboard, including flexible, elongated, material, such as fibre, tape, ribbon, rope, cable, wire and/or string material. The shafts 2 and the star bodies 3 mounted thereto are rotated in the first sense of circulation 11 in which upper portions of the star bodies move in the direction of transport 18. When waste material is deposited onto an upstream end portion 20 of the star screen 1, the rotating shafts 2 convey the waste material in the conveying direction 18. A first, relatively fine and/or flexible fraction of the material falls through the star screen 1 and is collected underneath and a second, relatively coarse and/or stiff fraction of the material is displaced over the star screen 1 and discharged from a downstream end portion 21 of the star screen 1.

[0015] Each star finger 4 has a proximal end 8 from where the star finger 4 projects from the hub 5 and a distal end 9 opposite its proximal end 8. Between the proximal end 8 and the distal end 9, each star finger 4 has a leading surface 10 facing in a first circumferential sense 11, and a trailing surface 12 facing in a second circumferential sense 13 opposite to the first circumferential sense 11 as well as side surfaces between the leading and trailing surfaces 10, 12. For waste sorting, the leading surface of the star body preferably has a width larger than 5 mm and more preferably larger than 10 mm. The width is preferably smaller than 100 mm and more preferably smaller than 70 mm. At least an outside portion of the star body that contacts material being sorted is preferably made of rubber or other elastomeric material having a hardness of 55 - 100 Shore A. The star body may include a carrier frame of a harder material covered by the rubber or other elastomeric material. For waste sorting, the diameter of the rotary trajectory of the star body is preferably larger than 100 mm and more preferably larger than 150 mm and preferably smaller than 1000 mm and more preferably smaller than 700 cm.

[0016] Each leading surface 10 is curved in the second

circumferential sense 13 from at least closely adjacent the proximal end 8 to the distal end 9. Seen in side view, planes 14-16 intersecting the central axis 6 intersect the leading surface 10 at angles α , α' and α'' respectively.

These angles are measured relative to a respective tangent of the curved leading surface 10 at the point of intersection with the respective intersecting plane 14-16. The curvature of the leading surfaces 10 is such that along each leading surface 10, from the proximal end 8 to the distal end 9, the angles α , α' and α'' are continuously larger than 45° . Because of the relatively large minimum angle between the leading surfaces of the star fingers and the planes intersecting the axis of rotation of the star body, during rotation, the angle between each leading surface portion and its current direction of movement is relatively small, so any stringy material prone to clinging to the star fingers easily slides along the leading surface 10 towards the distal end of the respective star finger and off that star finger. Thus, the extent to which stringy material tends to cling to the star fingers is reduced.

[0017] The distal ends 9 of the star fingers 4 define a circumference of a rotary trajectory 17 of the star body 3 if the star body 3 is rotated about the central axis 6 and are evenly distributed over the circumference of the rotary trajectory 17. Thus, the maximum distance between successive star fingers of a star body at a given number of star fingers of given dimensions is minimized.

[0018] For each star finger 4, the distal end 9 is parallel to a nearest section of the circumference of the rotary trajectory 17. Thus, each star finger has a distal end that constitutes a cylindrical roller surface portion over which waste can move in conveying direction temporarily without being imparted any vertical displacement. This results in a more smooth movement of the waste, which is also advantageous for reducing the tendency of material to cling to the star fingers and to be wound

[0019] An even more smooth movement of the waste can be achieved if, for each star finger 4, the distal end 9 coincides with a section of the circumference of the rotary trajectory 17.

[0020] The extent to which the tendency of flexible elongated material is reduced will vary depending on many variables, such as the composition of the waste material and the flexible elongated material contained therein. During testing, a markedly reduced tendency of the flexible elongated material to wind about the shafts and star bodies was found. In a waste sorting test with a star screen generally as shown in Figs. 1 and 2, the rotary trajectories of the star bodies having an outer diameter of 330 mm and a width of 45 mm, approximately 10 % of the flexible elongated material wound about the shafts and star bodies, whereas in a comparable set-up with conventional star bodies of which the star fingers have leading surfaces that were at least partially more parallel to intersecting radially oriented planes, generally about 50 % of the flexible elongated material ended up wound about the shafts and the star bodies.

[0021] While the invention has been illustrated and described in detail in the drawing and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments. For example, seen in side view (i.e. parallel to the axis of rotation), the smallest angles between the planes 14-16 intersecting the central axis and the curved leading surfaces 10 can be larger than 46°, 47°, 50° or even 55°.

[0022] Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims.

Claims

1. A star body for a star screen, comprising:

a central body portion (5) extending around a central passage (7) having a central axis (6) for receiving a shaft (2) to which the star body (3) is to be fixed;

a plurality of star fingers (4) projecting radially outwardly from the central body portion (5) and oriented along a common plane of rotation; each star finger (4) having:

a proximal end (8) from where the star finger (4) projects from the central body portion (5) and a distal end (9) opposite the proximal end (8);

a leading surface (10) facing in a first circumferential sense (11), and

a trailing surface (12) facing in a second circumferential sense (13) opposite to said first circumferential sense (11);

wherein each leading surface (10) is curved in said second circumferential sense (13) from at least closely adjacent the proximal end (8) to the distal end (9);

wherein, the curvature of the leading surfaces (10) is such that along the leading surface (10) from the proximal end (8) to the distal end (9), angles (α , α' , α'') at which planes intersecting (14-16) the central axis (6) intersect the leading surfaces (10) are larger than 45°.

2. A star body according to claim 1, wherein the distal ends (9) of the star fingers (4) define a circumference of a rotary trajectory (17) of the star body (3) if the star body (3) is rotated about the central axis (6) and are evenly distributed over the circumference of the rotary trajectory (17).

3. A star body according to claim 1 or 2, wherein, for each star finger (4), the distal end (9) extends parallel

to a most adjacent section of the circumference of the rotary trajectory (17).

4. A star body according to claim 3, wherein, for each star finger (4), the distal end (9) coincides with a section of the circumference of the rotary trajectory (17).

5. A star screen for sorting material, comprising a row of rotatable, driven shafts (2) mutually spaced in a conveying direction (18) and each extending transversally to said conveying direction (18), said shafts (2) each carrying a row of radially extending star bodies (3) according to any one of the preceding claims for intermittently urging material on the star screen (1) upward and in conveying direction (18), the star bodies (3) of each of said rows being mutually spaced in longitudinal direction (19) of the respective shaft (2) and rotary trajectories of the star bodies (3) carried by each of said shafts (2) projecting between rotary trajectories of the star bodies (3) carried by a neighbouring one of said shafts (2).

6. A method for separating waste material including flexible, elongated material, such as fibre, tape, ribbon, rope and/or string material, comprising providing a star screen (1) according to claim 4, rotating the shafts (2) of the star screen (1) in a sense of circulation (11) in which upper portions of the star bodies move in the direction of transport (18); depositing the waste material including flexible, elongated material, such as fibre, tape, ribbon, rope and/or string material onto an upstream end portion (20) of the star screen (1); collecting a first fraction of the material falling through the star screen (1) underneath; collecting a second fraction of the material discharged from a downstream end portion (21) of the star screen (1).

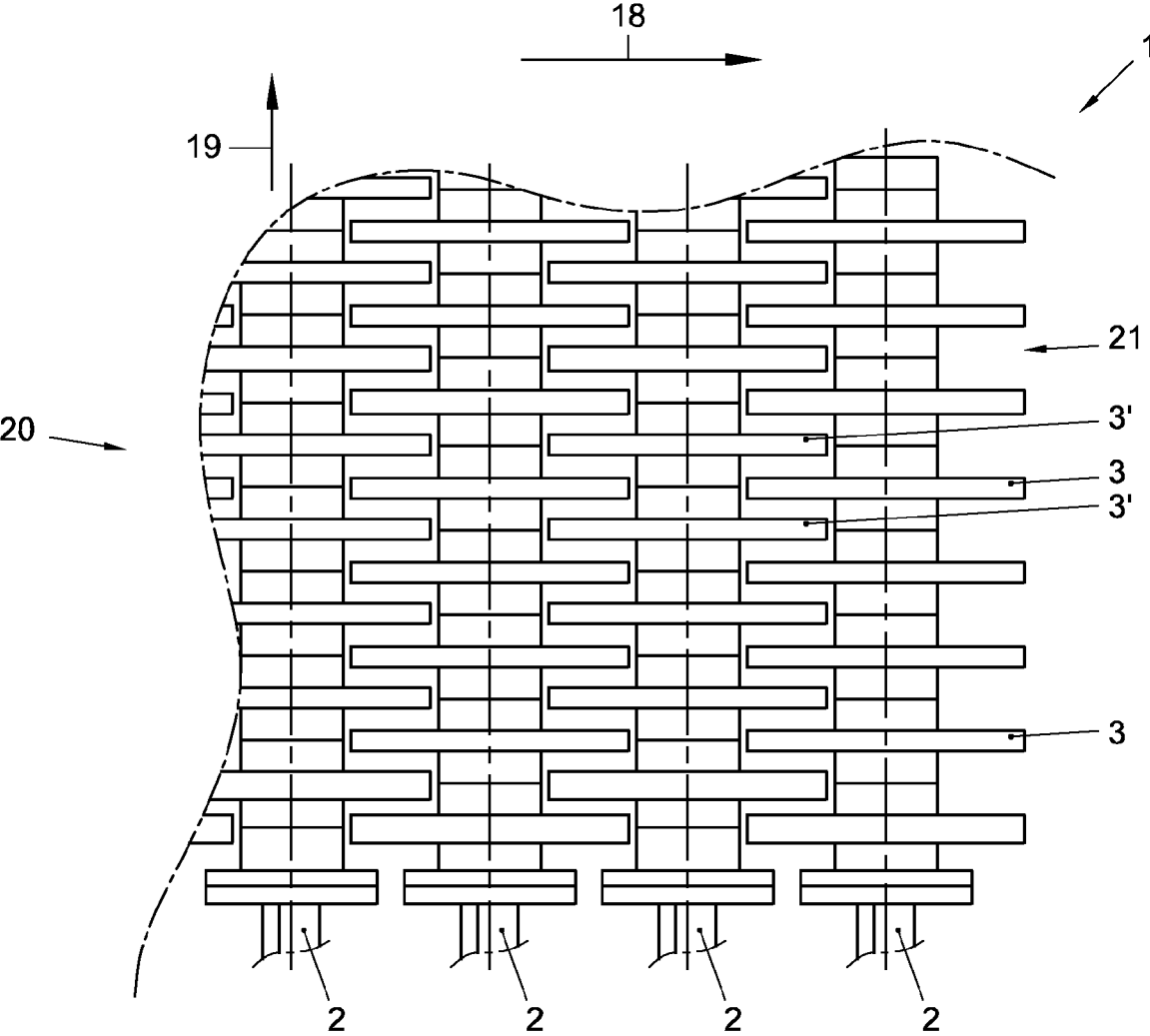


Fig. 1

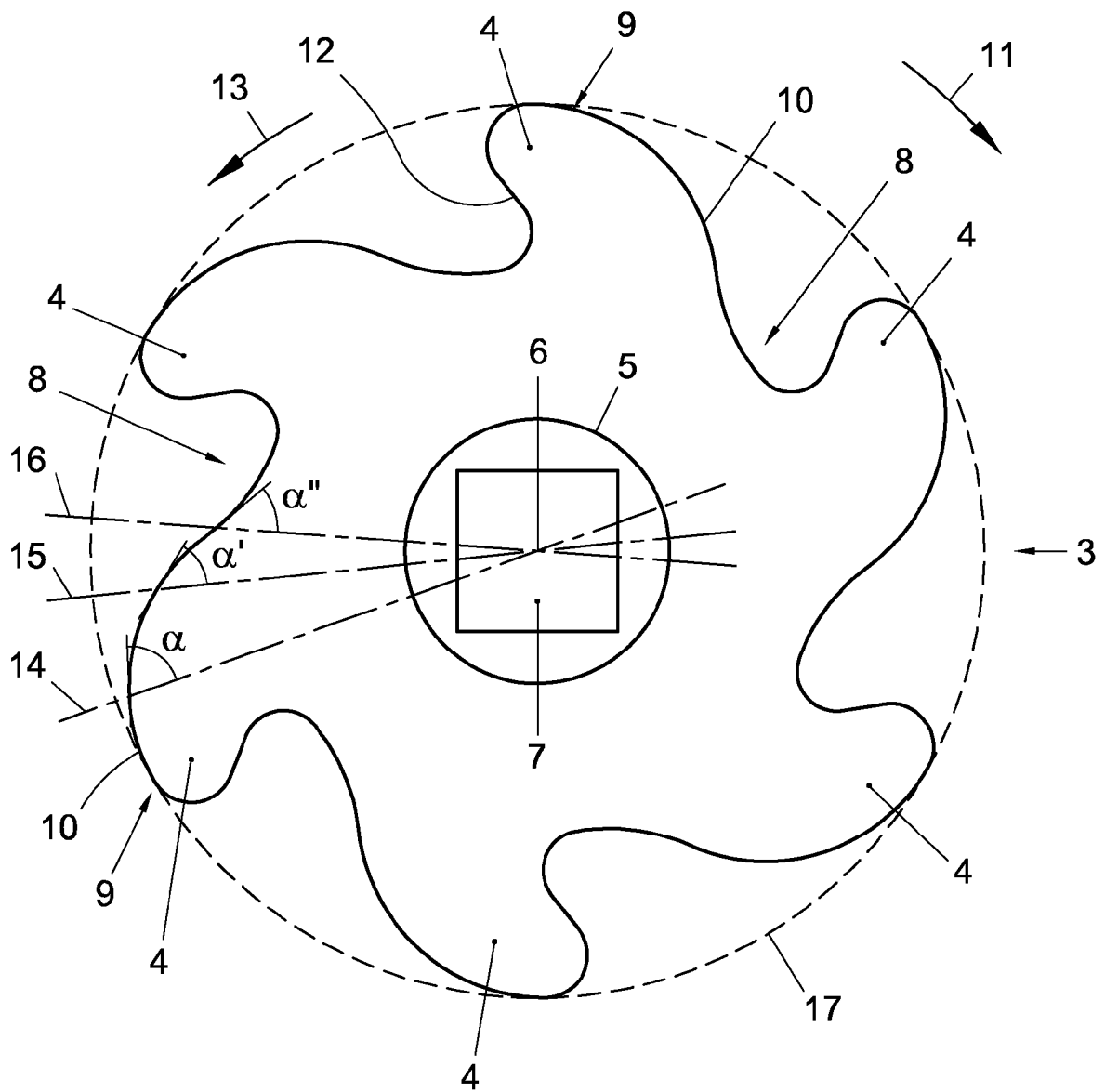


Fig. 2



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Application Number
EP 09 15 9538

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Place of search The Hague		Date of completion of the search 12 November 2009	Examiner van der Zee, Willem
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EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 09 15 9538

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Place of search The Hague		Date of completion of the search 12 November 2009	Examiner van der Zee, Willem
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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