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Opening device for opening fibre bales

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INT CL[4] D01G
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FIG.1

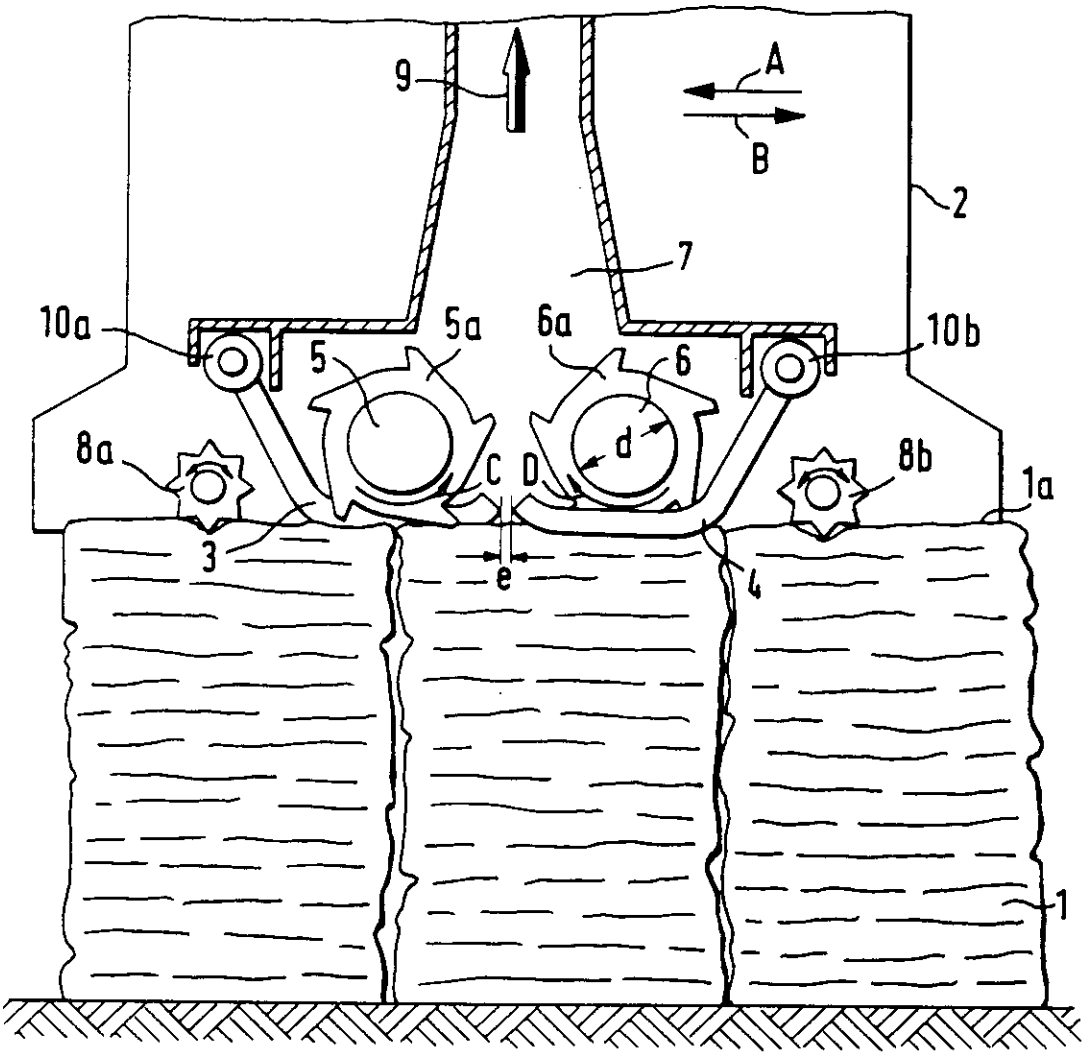

FIG. 2

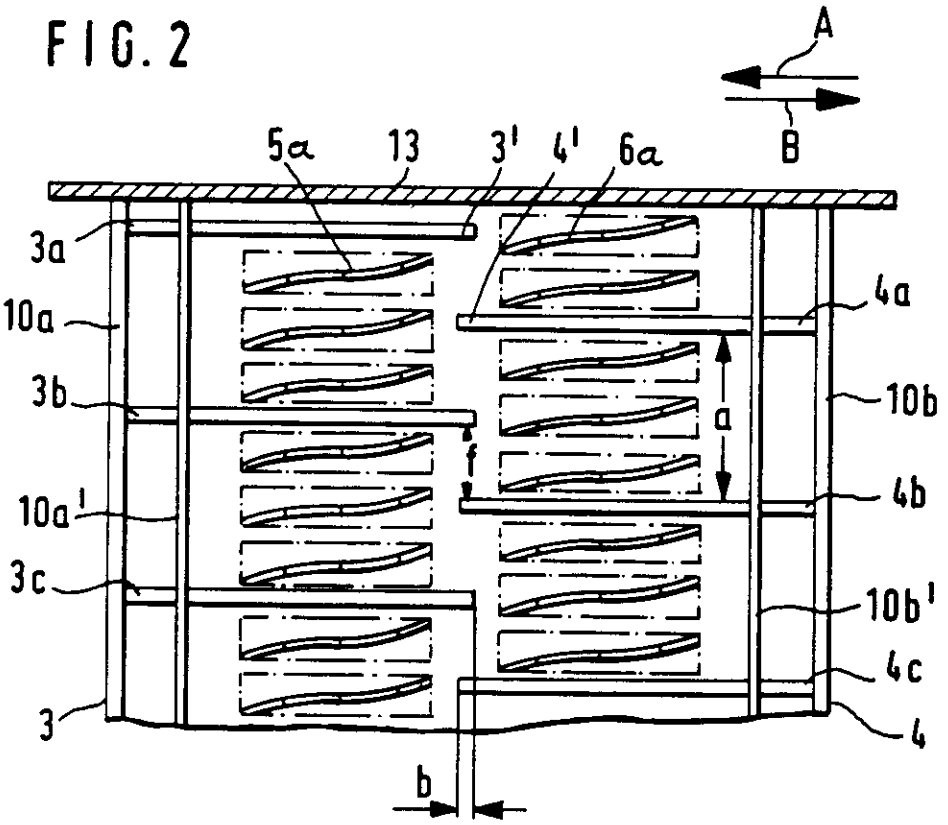
A
B
5a
13
3'
4'
6a
3a
10a
3b
10a'
3c
3
4a
10b
4b
10b'
4c
4
a
f
b

FIG. 3

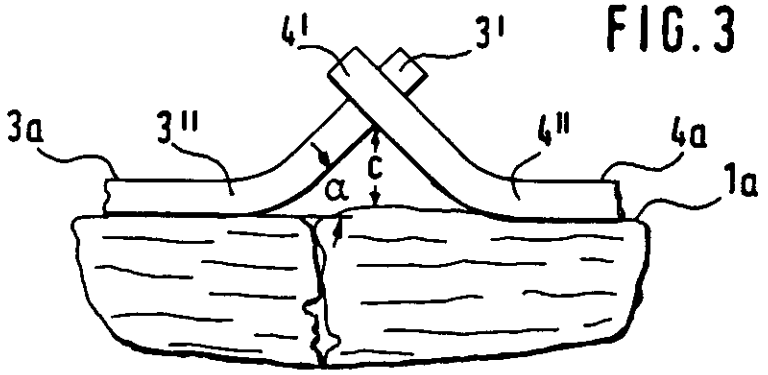
4'
3'
3a
3''
4''
4a
1a
α
c

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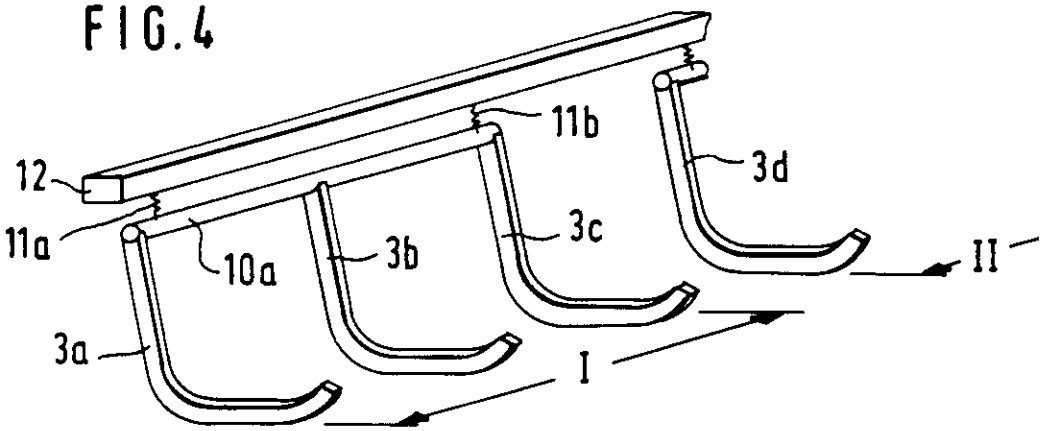
FIG.4



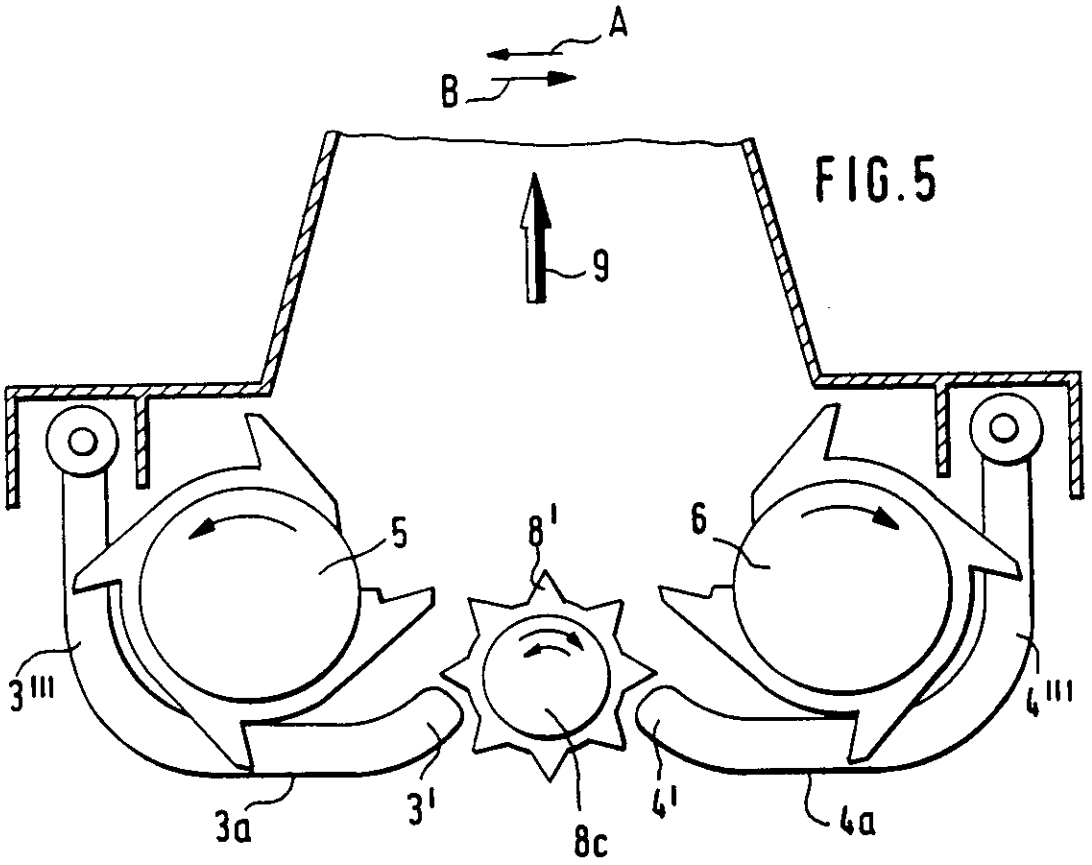
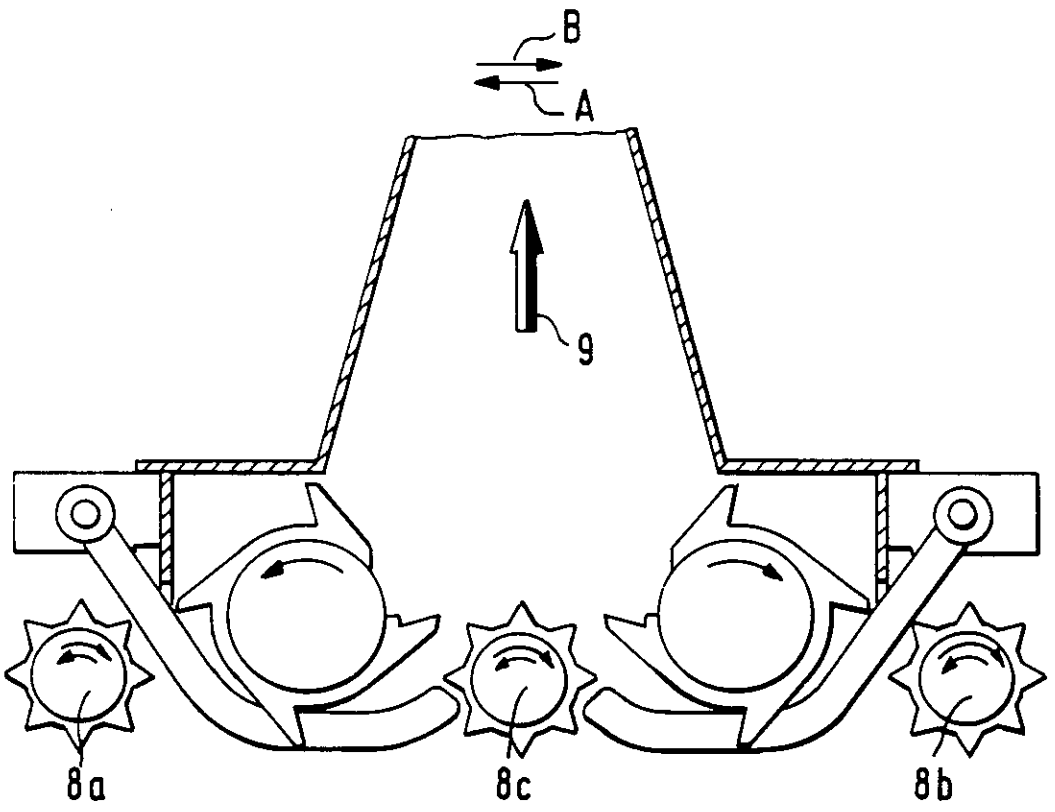


FIG.5

FIG.6



Opening Device for Opening Fibre Bales

The invention relates to an opening device for opening fibre bales, for example cotton and rayon staple bales and the like.

In a known device (DE-OS 33 34 069) two high-speed opener rollers having toothed discs are provided and engage with a grid, the grid bars of which lie between the toothed discs, and the teeth of the opener discs, or the needles, cut into the fibre bales. The grid bars have in their course an inclined step in a direction transverse to the direction of movement of the opening device, at least one opener disc being arranged in front of and behind the step. It is a disadvantage of this device that the force that the inclined step exerts on the surface of the bale has a component that differs from the direction of movement (working direction) of the device. Also the stepped centre portions of the grid bars tend to obstruct the fibre as it is removed from the bales by the opener disc.

In contrast, it is an object of the invention to provide an opening device for opening fibre bales which mitigates the disadvantages mentioned and, in which, especially, the take-off action is improved.

The present invention provides an opening device for opening fibre bales, the device including a pair of high speed take-off devices arranged in tandem, each

having an associated grid for engaging a surface of a fibre bale and including take-off elements which extend through openings formed between adjacent bars of the associated grid for removing fibre from a bale, wherein the openings formed between the bars are open at the ends of the grids that are adjacent one another and the end portions of the bars of each grid defining the open ends are arranged such that when, during use, the grids engage a surface of a bale the end portions are inclined upwardly at an angle to the surface of the bale.

Preferably, each high-speed take-off device comprises an opener roller and the take-off elements comprise parts which project from the body of the roller. The direction of rotation of each opener roller is preferably towards the other opener roller in the region of the surface of the fibre bale. The projecting parts may be defined by toothed discs or needle-like elements.

According to the invention, the grid bars of the grids are oriented in the direction of movement. As a result of the fact that the end regions of the grids, which are located opposite one another, are open and are not connected, as in the known case, by an inclined step, the exertion of a force on the surface in a direction that differs from the direction of movement can be avoided. The fact that the open end regions of the grid bars project upwards from the surface of the fibre bales

at an angle has the advantage that the device can operate in two opposite directions, the open end of the grid that is pointing in the working direction sliding over the surface of the bales without digging into them.

The grid bars of the grids are preferably laterally offset from one another such that a bar of one grid is aligned with an opening in the other grid. Undesired ridges and grooves in the bale surface in the working direction are thus avoided. The lateral offset may be up to approximately 100 mm.

Preferably, the lateral spacing between adjacent bars of the same grid is up to approximately 100 mm. There may be a gap between the bars of one grid and the bars of the adjacent grid. The end portions of the grid bars are advantageously arranged to overlap one another. The overlap of the ends of the grid bars is advantageously up to approximately 40 mm. The angle of inclination of the end portions to the surface of the bale may be approximately from 35° to 45°. Preferably, the bars of each grid have substantially flat portions for engaging a surface of a bale, the end portions of the bars being inclined at an angle to the flat portions. The flat portions of the grid bars may have a length corresponding approximately to the diameters of the bodies of the rollers from which the take-off elements project. That is the outside diameter (beating circle) of the opener roller minus the height of the teeth. The horizontal

region is advantageously approximately from 50 to 80 mm or even 90 mm long. Advantageously, the open end region of the grid bars is approximately from 60 to 80 mm long. The opening device may further comprise a roller for resting on a fibre bale, the resting roller being provided between the grids of the high speed take-off devices. This roller presses on the surface of the fibre bales and thus performs a supporting and retaining function. Tipping of the fibre bales and undesired displacement of the uppermost layers, or tiers, is avoided. They are held firmly in place. Especially in the case of the last remnants that remain behind on the floor after the bale has been worked off, the drawing in (carrying along) of thicker residual layers by the opener rollers is avoided, so that the device cannot misfeed. According to a further preferred embodiment, the opening device may include rollers for resting on a fibre bale, the resting rollers being provided at the outer end of each grid. The pressing rollers are driven or turn freely (not being driven) on the bale surface. If the pressing rollers are located only between the ends of the grid bars, the outermost limiting line of the grid bars on the opposite side can advantageously extend close to the cutting roller and the overall length of the devices thus shortened, so that the device can more readily be moved in the vertical direction into gaps in the row of bales. That is useful for example where bales of different

heights are arranged directly adjacent to one another. Preferably, the diameter of a main body of the or each pressing roller is approximately from 100 to 150 mm. The pressing roller is advantageously provided with projecting parts for engaging in a bale, for example teeth or needle-like elements (star roller). As a result, the roller engages firmly in the bale surface. Advantageously, the end portions of the bars project into gaps formed between projecting parts of the resting roller. The grid bars may be resiliently mounted. Each grid may be individually resiliently mounted. Each grid bar of a grid may be individually resiliently mounted. The grid bars of a grid may be mounted in at least two groups, each group of bars being individually resiliently mounted. Advantageously, at least three groups of bars are provided, a first and third group of bars being located at opposite sides of the grid and a second group of bars being located in a central region of the grid. The degree of resilience of the mounting of the second group of bars may differ from that of the first or third groups. The groups may be mounted by means of springs or other resilient means of different stiffnesses. The opening device preferably further includes a device for sucking off fibres removed from a bale by the high speed take-off devices.

The present invention further provides a method

of opening fibre bales in which a pair of high speed take-off devices arranged in tandem are moved longitudinally relative to the bale and remove flocks from a face thereof, each device having an associated grid which engages the face of the bale and including take-off elements which extend through openings formed between adjacent bars of the associated grid and remove flocks from the bale, wherein the openings formed between the bars are open at the ends of the grids that are adjacent one another and the end portions of the bars of each grid defining the open ends are inclined upwardly at an angle to the face of the bale.

By way of example, certain illustrative embodiments of the invention will now be described with reference to the accompanying drawings, of which:

Fig. 1 is a diagrammatic side view of an opening device for opening fibre bales,

Fig. 2 shows a plan view of an opening device similar to Fig. 1 but with overlapping grid bar ends,

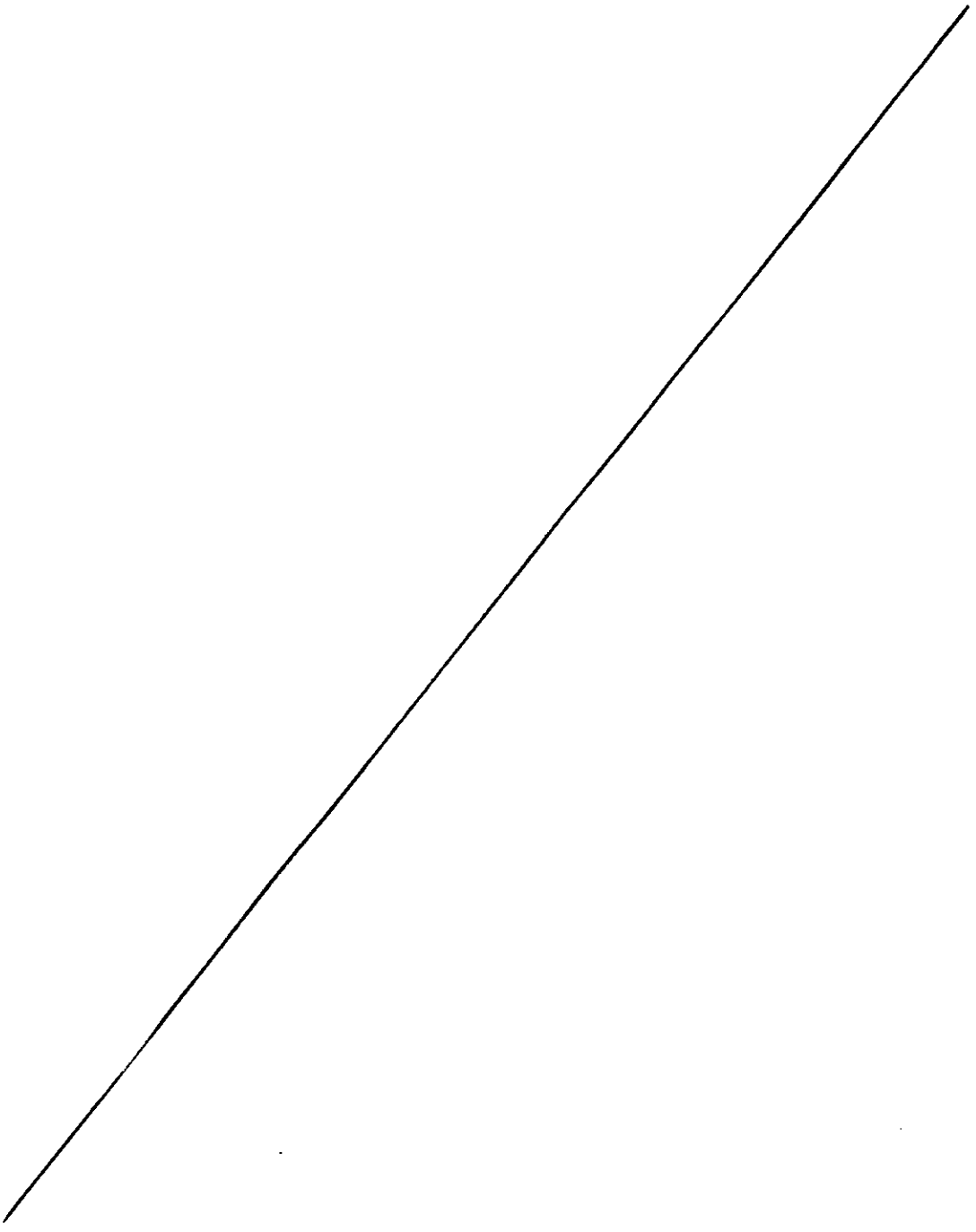
Fig. 3 shows a side view of the overlapping grid bar ends of the device of Fig. 2,

Fig. 4 shows an arrangement for the resilient support of grid bars in an opening device for opening fibre bales,

Fig. 5 shows an opening device similar to the device of Fig. 1 but with an inner

pressing roller provided between the open grid bar ends, and

Fig. 6 shows an opening device similar to the device of Fig. 5 but with two additional outer pressing rollers.



Referring first to Fig. 1, there is shown a row of fibre bales 1 which are free-standing in a stationary arrangement. A car (not shown), which is movable to and fro horizontally, runs on rails (not shown) alongside the row of bales. A vertically adjustable fibre opening device is attached to the car and comprises a housing 2, two grids 3, 4, two cutting or plucking rollers 5, 6 (opener rollers) and a suction duct 7 to which a suction device (not shown) is connected. The opening device moves in the direction shown by arrows A and B and is able to operate while moving in either direction. The grids 3, 4 pass through gaps between teeth 5a, 6a on the cutting rollers 5, 6 (see Fig. 2). The grids 3, 4 rest on the surface 1a of the fibre bales 1 and serve to hold down fibre in the bale. Pressing rollers 8a, 8b (supporting or retaining rollers), the axes of which are parallel to the axes of the cutting rollers 5, 6, are provided in front of and behind the cutting rollers 5, 6 which pressing rollers press on the surface 1a of the fibre bales 1. As a result, and as a result of the engagement of teeth 8' of the pressing rollers 8a, 8b in the fibre bales, the bales 1 are held in place and secured against moving and tipping over. In addition, the layers, or tiers, of the fibre bales 1 are secured against being torn away horizontally by the opener rollers or pushed away by the grids 3, 4. The direction of rotation of the cutting rollers 5, 6, which is

indicated by arrows C and D, respectively, is directed inwards in the region of the surface 1a of the fibre bales 1. The suction duct 7 for sucking off fibre flocks is arranged above the cutting rollers 5, 6. During operation, the take-off device with the cutting rollers 5, 6 moves to and fro above the free-standing fibre bales 1, the teeth 5a, 6a of the cutting rollers 5, 6 extending through the gaps between the grids 3 and 4. The fibre flocks detached from the surface 1a of the fibre bales 1 are thrown inwards by the cutting rollers 5, 6. They pass directly into an air stream 9 and are sucked away into the suction duct 7 of the flock suction device.

The grids 3, 4 each comprise several grid bars or grid rods (3a to 3c; 4a to 4c; see Fig. 2). Each grid bar consists essentially of three portions: a first end (free end) 3', 4'; a middle portion 3'', 4''; and a second end 3''', 4'''. The first ends 3', 4' project from the surface 1a at an angle α (marked in Fig. 3 but not in Fig. 1), the middle portions 3'', 4'' lie substantially horizontally on the surface 1a of the bale (the bales themselves resting on a horizontal surface), and the second ends 3''', 4''' project from the surface 1a at an angle. The free ends 3', 4' are open; at the ends 3''', 4''', the grid bars are fastened to holding members 10a, 10b. Each opener roller 5, 6 has its own associated grid 3 and 4, respectively, the free ends 3', 4' of the grid bars 3a to 3c; 4a to 4c facing one another.

Fig. 2 shows grid bars 3a to 3c and 4a to 4c of the grids 3 and 4, respectively, the bars extending parallel to one another over the width of the surface 1a of the fibre bales 1. Between the grid bars 3a to 3c and 4a to 4c there are shown diagrammatically the cutting rollers 5, 6, the region in which they come into contact with the surface 1a as they rotate being shown by chain dotted lines. The grid bars 3a to 3c and 4a to 4c are offset relative to one another in the lateral direction. As a result, the ridge formed on the bale surface 1a by one grid bar can be worked off by a cutting roller 5 or 6 that is located opposite the bar in the working direction. The outer ends 3''', 4''' of the grid bars 3a to 3c and 4a to 4c are fastened to a common holding member 10a and 10b, respectively, which is attached to the side walls 13 (only one of the side walls 13 being shown in Fig. 2) of the housing 2. The outer ends 3''', 4''' of the bars of the grids 3, 4 are at a distance from the cutting rollers 5, 6. The distance a between adjacent staggered grid bars 3a to 3c and 4a to 4c of the same grid measured transversely to the direction of movement A, B of the opening device is approximately 100 mm. The distance b, measured in the direction of movement A, B of the opening device, between the ends 3', 4' of the grid bars 3a to 3c and 4a to 4c when arranged to overlap is approximately 40 mm. Reference numerals 10a' and 10b' denote stop members, which prevent the grid bars 3a

to 3c and 4a to 4c striking the opener rollers 5 and 6, respectively.

As shown in Fig. 3, the open ends 3', 4' of the grid bars 3a and 4a, respectively, are arranged to overlap. The distance between the overlap and the bale surface 1a is denoted by c. The angle between the middle horizontal portion 3'' of the grid bar 3a and the end 3' is denoted by α. The angle between the horizontal portion 4'' of the grid bar 4a, or the bale surface 1a, and the open end 4' corresponds to the same angle α.

Fig. 4 shows a resilient suspension arrangement for a grid 3. (The grid 4 may be suspended in like manner). The grid bars 3a, 3b, 3c, are fastened to the holding member 10a, which is resiliently mounted by way of springs 11a, 11b on a carrier member 12. The grid bars 3a to 3c form an outer group I, adjacent to which there is a middle group II. The group II may be spring-mounted differently from the group I. A third group (group III) may be provided on the other side of the middle group II and may be spring-mounted in a similar manner to the group I.

In the arrangement shown in Fig. 5, there is between the open ends 3', 4' of the grid bars 3a, 4a a pressing roller 8c that is provided with teeth 8'. The outermost limiting line of the grid bars 3a, 4a in the region of their outer ends 3''' or 4''' is close to the cutting rollers 5 and 6, so that the device can be moved

in the vertical direction into gaps between the bales 1 of a row of bales and edges of bales adjacent to other bales 1 can be worked off.

Fig. 6 shows an embodiment in which there are two outer pressing rollers 8a, 8b and an inner pressing roller 8c. The pressing or retaining rollers 8a to 8c have the advantageous effect of preventing undesired movement of either layers of the fibre bales 1 or the fibre bales 1 as a whole.

In the embodiment described, each opener roller 5, 6 has its own associated grid 3, 4. Its own grid 3, 4 is to be understood as meaning that the grids 3 and 4 are independent of one another, that is to say that there is in each case a gap (e; f) between the open ends 3', 4', which face (are opposite) one another, of the grid bars 3a to 3c; 4a to 4c. The open grid bar ends 3', 4', which face one another, are not connected together in a mechanical sense.

Claims:

1. An opening device for opening fibre bales, the device including a pair of high speed take-off devices arranged in tandem, each having an associated grid for engaging a surface of a fibre bale and including take-off elements which extend through openings formed between adjacent bars of the associated grid for removing fibre from a bale, wherein the openings formed between the bars are open at the ends of the grids that are adjacent one another and the end portions of the bars of each grid defining the open ends are arranged such that when, during use, the grids engage a surface of a bale the end portions are inclined upwardly at an angle to the surface of the bale.

2. An opening device according to claim 1 in which each high speed take-off device comprises an opener roller and the take-off elements comprise parts which project from the body of the roller.

3. An opening device according to claim 2 in which the direction of rotation of each opener roller is towards the other opener roller in the region of the surface of the fibre bale.

4. An opening device according to claim 2 or claim 3 in which the projecting parts are defined by toothed discs or needle-like elements.

5. An opening device according to any preceding

claim in which the bars of the grids are laterally offset from one another such that a bar of one grid is aligned with an opening in the other grid.

6. An opening device according to claim 5 in which the lateral offset is up to approximately 100 mm.

7. An opening device according to any preceding claim in which the lateral spacing between adjacent bars of the same grid is up to approximately 100 mm.

8. An opening device according to claim 7 in which the lateral spacing between the adjacent bars of the same grid is approximately 100 mm.

9. An opening device according to any preceding claim in which there is a gap between the bars of one grid and the bars of the adjacent grid.

10. An opening device according to any of claims 1 to 8 in which the end portions of the grid bars overlap one another.

11. An opening device according to claim 10 in which the overlap is up to approximately 40 mm.

12. An opening device according to claim 11 in which the overlap is approximately 40 mm.

13. An opening device according to any preceding claim in which the angle of inclination of the end portions to the surface of the bale is approximately from 35^{o} to 45^{o}.

14. An opening device according to any preceding claim in which the bars of each grid have substantially

flat portions for engaging a surface of a bale, the end portions of the bars being inclined at an angle to the flat portions.

15. An opening device according to claim 14 when dependent directly or indirectly upon claim 2 in which the flat portions of the bars have a length corresponding approximately to the diameters of the bodies of the rollers from which the take-off elements project.

16. An opening device according to claim 14 or 15 in which the flat portions of the bars are approximately from 50 to 90 mm long.

17. An opening device according to any preceding claim in which the end portions of the bars are approximately from 60 to 80 mm long.

18. An opening device according to any preceding claim, further including a roller for resting on a fibre bale, the resting roller being provided between the grids of the high speed take-off devices.

19. An opening device according to any preceding claim further including rollers for resting on a fibre bale, the resting rollers being provided at the outer end of each grid.

20. An opening device according to claim 19 in which the diameter of a main body of the or each resting roller is approximately from 100 to 150 mm.

21. An opening device according to any of claims 18 to 20 in which the resting roller is provided with

projecting parts for engaging in a bale.

22. An opening device according to claim 21 in which the projecting parts comprise teeth or needle-like elements.

23. An opening device according to claim 21 or 22 when dependent upon claim 18 in which the end portions of the bars project into gaps formed between projecting parts of the resting roller.

24. An opening device according to any preceding claim in which the grid bars are resiliently mounted.

25. An opening device according to claim 24 in which each grid is individually resiliently mounted.

26. An opening device according to claim 24 or 25 in which each grid bar of a grid is individually resiliently mounted.

27. An opening device according to claim 24 or 25 in which grid bars of a grid are mounted in at least two groups, each group of bars being individually resiliently mounted.

28. An opening device according to claim 27 in which each group of bars comprises several bars.

29. An opening device according to claim 27 or 28 in which at least three groups of bars are provided, a first and third group of bars being located at opposite sides of the grid and a second group of bars being located in a central region of the grid.

30. An opening device according to claim 29 in which

the degree of resilience of the mounting of the second group of bars differs from that of the first or third groups.

31. An opening device according to any preceding claim, further including a device for sucking off fibres removed from a bale by the high speed take-off devices.

32. An opening device substantially as herein described with reference to and as illustrated by Figs. 1 to 3, or by Fig. 5 or by Fig. 6 of the accompanying drawings.

33. A bale opener including an opening device as claimed in any preceding claim.

34. A method of opening fibre bales in which a pair of high speed take-off devices arranged in tandem are moved longitudinally relative to the bale and remove flocks from a face thereof, each device having an associated grid which engages the face of the bale and including take-off elements which extend through openings formed between adjacent bars of the associated grid and remove flocks from the bale, wherein the openings formed between the bars are open at the ends of the grids that are adjacent one another and the end portions of the bars of each grid defining the open ends are inclined upwardly at an angle to the face of the bale.

35. A method according to claim 34 wherein rollers associated with the high speed take-off devices rest on the surface of the bale on the outer sides of the grids.

36. A method according to claim 34 or claim 35 wherein a roller associated with the high speed take-off devices rests on the surface of the bale between the devices.

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Title OPENING DEVICE FOR OPENING FIBRE BALES

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