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(54) Device for at least partially removing waste particles from fibrous material

(57) Device for at least partially removing waste particles from fibrous material, characterized in that it contains at least one combing roll (5), provided with fingers (6) on its perimeter, means (13-14) to rotate the combing roll (5), a wall (7) erected opposite the combing roll and a feed mechanism (4) to supply a mat (44) of fibres to be cleaned between the combing roll (5) and the wall (7), in the same direction as the movement of the surface of the rotating combing roll (5), but at a speed which is lower than the peripheral velocity of this rotating combing roll (5).

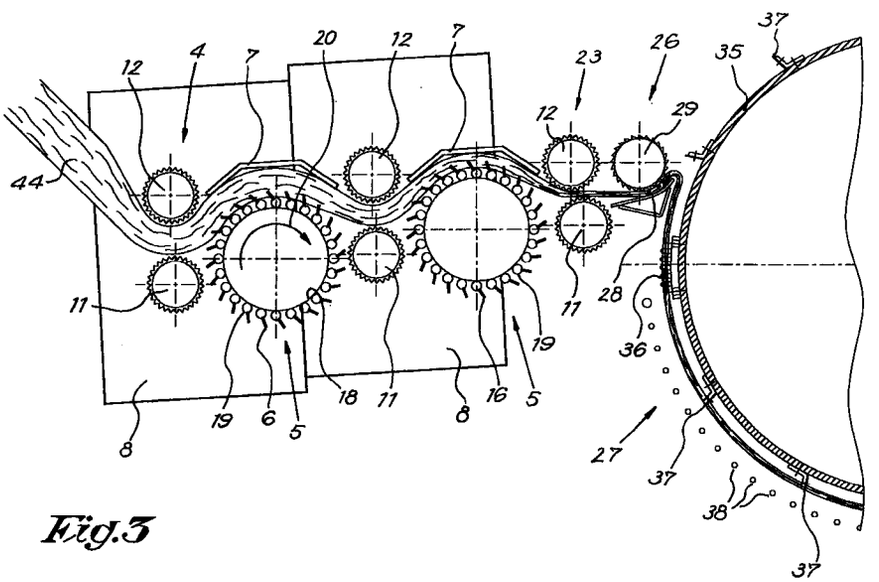


Fig.3

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Description

The present invention concerns a device for at least partially removing waste particles from fibrous material, in particular bark particles or ligneous particles from fibrous material on the basis of bark such as flax, hemp, ramee, etc.

Such bark fibres have a woody stalk on whose outside are situated fibres which are connected to the pith by means of collagen.

By dissolving the collagen, the fibres are loosened. In the case of flax, this can be done by means of retting, for example dew retting in the field.

By means of swingling, the pith is broken in ligneous particles which are partly separated from the fibres. The ligneous particles which are already formed before the swingling, for example during the transport and when the bales of raw fibrous material are loosened, and the other ligneous particles which remain after each swingling manipulation are usually removed by a device for at least partially removing the waste particles which lets the ligneous particles through, but not the fibres.

Such known devices are shaking tables, i.e. perforated tables upon which is provided a mat of fibrous material. This mat is vibrated, so that the loose ligneous particles fall through it due to their own weight. Due to said vibration, the fibres are also evenly spread over the mat before they are submitted to a following swingle treatment.

Such shaking tables are used among others in what are called swingle lines in which ripple waste and clots of the manipulation are treated in what is called a turbine of long, raw fibrous material and/or short, raw fibrous material, in particular oil flax, straw flax and low-quality textile flax. After said swingle line, the fibres are chopped and used in mixed yarns and technical yarns.

These known swingle lines contain a number of units with successively a shaking table and a swingle drum.

The construction of these known shaking tables is relatively complex and expensive, however, whereas the separation of the ligneous particles is restricted. Moreover, a lot of fibres are lost. The wear of the shaking tables is relatively important, and a lot of time is lost due to maintenance and cleaning.

The present invention aims a device for at least partially removing waste particles from fibrous material which does not has the above-mentioned and other disadvantages, and which has a relatively simple construction, a relatively long life and especially a good separation of the waste particles.

This aim is reached according to the invention in that the device for removing waste particles has at least one combing roll, provided with fingers on its perimeter, means to rotate the combing roll, a wall erected opposite the combing roll and a feed mechanism to supply a mat of fibres to be cleaned between the combing roll and the wall, in the same direction as the movement of the surface of the rotating combing roll, but at a speed which is lower than the peripheral velocity of this rotating combing roll.

Preferably, the fingers of the combing roll are directed, in relation to the radial, slantingly in the opposite direction of the sense of rotation of the combing roll.

The distance between the wall, which for example forms a cap above the combing roll, and the combing roll may be adjustable.

The feed mechanism may contain two feed rollers and means to drive at least one of these feed rollers.

The device may contain several combing rolls with fingers and a cap opposite to it, whereby according to one embodiment, each combing roll is preceded by a feed mechanism, and according to another embodiment, the combing rolls are situated immediately one after the other without a feed mechanism in between.

The device may have a swingle drum on the discharge end, whereby this swingle drum preferably differs from the known ones in that, apart from swingle knives, it also has at least one comb on its perimeter.

In order to better explain the characteristics of the invention, the following preferred embodiments of a device for at least partially removing waste particles from fibrous material according to the invention, are described hereafter as an example only without being limitative in any way, with reference to the accompanying drawings, in which:

figure 1 schematically shows a section of a device according to the invention;
figure 2 shows a top view of the device from figure 1;
figure 3 shows a part of the section of figure 1, but to a larger scale and with the material being transported through the device;
figure 4 shows a schematic section analogous to that of figure 1, but with reference to another embodiment of the invention.

The device represented in figures 1 to 3 is a device for removing ligneous particles from raw flax fibres or other bark fibres, clots or ripple waste, and it consists of two main particles, namely a separating device 1 performing the same function as the known shaking tables and removing a part of the ligneous particles, and a swingle group 2.

The separating device 1 consists of a frame 3 upon which a number of units, two in the example represented, are erected. Each of these units contains a feed mechanism 4, a combing roll 5 with fingers 6 and a wall 7, situated opposite the combing roll 5, which are mounted on the frame 3 by means of a supporting structure 8-9.

This supporting structure 8-9 consists of two standing walls 8 situated at the ends of the combing roll 5 and the feed mechanism 4 which are fixed to the frame 3, for example by means of bolts, and of two brackets 9-10

which span this feed mechanism 4 and the combing roll 5 crosswise and which are fixed to the standing walls 8 with their legs, for example which are screwed onto it.

The feed mechanism 4 contains two ribbed rolls 11 and 12 situated on top of one another whose axis is directed in the cross direction of the device.

The lower roll 11 is bearing-mounted with its ends in the walls 8 and is driven via a chain transmission 13 by a motor 14 provided on the frame 3.

The top roll 12 can be freely rotated but is bearing-mounted with its ends in bearing blocks 15 which can be shifted in height in guides 16 provided on the sides of the wall 8 which are directed towards one another.

Both bearing blocks 15 are suspended on the front bracket 9 by means of piston mechanisms 17. The piston rods of these piston mechanisms 17 are hinge-mounted to these bearing blocks 15 by means of fork-shaped ends.

The combing roll 5 is bearing-mounted with its ends in the standing walls 8. It contains a cylindrical body 18 onto which the fingers 6 are fixed evenly spread over its surface.

The fingers 6 have a pointed end and stick with their base in shafts or pipes 19 which are screwed in the axial direction on the cylindrical body 18. These fingers 16 are thus erected in parallel rows.

However, the fingers 6 are not directed radially but slantingly backwards in relation to the sense of rotation of the combing roll 5. They are directed such that the ligneous particles come loose when they are moved through the fibres. They form for example an angle with the radial which is about equal to 45°.

This sense of rotation, which is indicated by the arrow 20 in figures 1 and 3, is the same as that of the roll 11, namely such that the top part of the combing roll 5 moves away from the feed mechanism 4.

This combing roll 5 is also driven by the above-mentioned motor 14, but by means of another chain transmission 21 having such a transmission ratio that the peripheral velocity of the combing roll 5 is significantly higher than the peripheral velocity of the roll 11.

The wall 7 is a folded plate forming a cap on top of the combing roll 5. This wall 7 is fixed to the bracket 10 in an analogous manner as the rolls 12 by means of two piston mechanisms 22, and thus it can be adjusted in height. To this end, the wall 7 is provided with protrusions on its ends which can be shifted in guides fixed on the walls and which are hinge-mounted to fork-shaped ends of the piston rods of the piston mechanisms 22.

The two units are mounted on the frame 3 one directly after the other.

The driven rolls 11 of the two units are driven by one and the same motor 14 via their chain transmission 13.

The piston mechanisms 22 of the two units are also connected to one and the same compressed air source which is not represented in the figures, but they can be controlled separately.

Further, the two units are followed by a discharge mechanism 23 whose construction is similar to a feed mechanism 4 and thus contains a driven lower ribbed roll 11 and a top ribbed roll 12 which can be freely rotated but is adjustable in height by means of piston mechanisms 17.

These rolls 11 and 12 are provided between two walls 24 which are fixed to the frame 3.

The piston mechanisms 17 are suspended to a bridge 25 erected between the walls 24.

The driven roll 11 is driven via a chain transmission 13 by the above-mentioned motor 14 in the same sense of rotation as the rolls 11 of the feed mechanisms 4.

At each pair of piston mechanisms 17 can be situated a level detector which measures the height of the rolls 12 or the wall 7. This level detector may be linked to a control which controls among others the motor 14. If the height differs from the set height, this may indicate that there is a congestion in the device, and the control may then stop the device as soon as the divergence in height exceeds a certain value. A congestion may also be detected by means of speed control.

The swingle group 2 mainly consists of a feed mechanism 26 and a swingle drum 27.

The feed mechanism 26 consists of a knife 28 extending in the cross direction and which is fixed with its ends to the walls 24, and also of a toothed roll 29 erected on top of it.

This roll 29 is bearing-mounted with its ends in the two walls 24 and is equally large as the rolls 11 and 12, but it is provided with teeth instead of ribs. These teeth which extend over the entire length of the roll 29 are sharp in the sense of rotation during use, which sense of rotation is the same as that of the rolls 12.

Said roll 29 is driven by a separate motor 31 by means of a chain transmission 30 provided on top of the walls 24, in the same sense of rotation as the rolls 12.

The swingle drum 27 is also bearing-mounted in the walls 24 by means of shafts 32 and is driven by a separate motor 34 via a belt transmission 33.

This swingle drum 27 contains a cylindrical body 35 whose diameter is significantly larger than the diameter of the combing roll 5 and contains, evenly distributed over its perimeter, a number of swingle combs 36 - four in the example represented. These are strips which are provided on the outside with radially protruding pins.

Between every pair of neighbouring swingle combs 36 are situated swingle knives 37 on the perimeter of the body 35. These swingle knives 37 consist of L-shaped irons which extend parallel to the swingle combs 36 and which are fixed to the body 35 with one leg, for example which are screwed to it.

Under the bottom part of the swingle drum 27, between the walls 24, are provided a number of bars 38 situated at short distances from one another and forming a grid which surrounds somewhat more than one quarter of the perimeter of the swingle drum 27.

Several combinations of a separating device 1 and

a swingle group 2 can be placed one after the other.

For the first combination or the only combination as in the example represented, a charging funnel 39 is erected which opens into the feed mechanism 4 of the first unit. This charging funnel 39 is connected to a device 40 for separating air and fibres into which opens a conveyor pipeline 41 on the one hand and an air extraction line 42 on the other hand.

The device 40 for separating air and fibres forms a sort of lock with rotating bulkheads and separates the fibrous material from the air used for the transport.

In the charging funnel 39 may possibly be provided a volume controller, for example a level detector, which is coupled to the above-mentioned control so as to stop the device whenever an insufficient amount of material is supplied and is present in the charging funnel 39, and to activate the device when a sufficient amount of material is present in the charging funnel 39.

To the last combination, or the sole combination as in the example represented, is connected an exhaust pipe 43.

The working of the device is simple and as follows.

The raw fibres to be treated are supplied through the conveyor pipeline 41 by means of an air flow. In the device 40 for separating air and fibres, they are separated from the air which escapes via the air extraction line 42, after which they fall into the charging funnel 39 due to the gravitational force and are supplied as a mat 44 to the first feed mechanism 4.

When a sufficient amount of fibrous material is present in the charging funnel 39, the separating device 1 is activated.

In the first feed mechanism 4, the mat of fibrous material 44 is compressed and conveyed to the combing roll 5 as is represented in figure 3.

As the peripheral velocity of this combing roll 5 is significantly higher than the peripheral velocity of the roll 11, and thus also the speed of movement of the mat of fibrous material 44, this mat 44 is stretched and is reduced in thickness, so that the ligneous particles come loose and fall out of the mat 44 and through the frame 3, partly due to the combing of the combing roll 5.

As the wall 7 is pressed down above the combing roll 5, the stretching of the mat 44 can be increased.

Thanks to the direction of the fingers 6, the mat 44 can easily come off the combing roll 5 when it is taken over by the subsequent feed mechanism 4 which feeds it to the combing roll 5 of the second unit.

The discharge mechanism 23 and the feed mechanism 26 further stretch the mat 44, make it thinner and feed it to the swingle drum 27.

The belt transmission 33 and the motor 34 drive the swingle drum 27 such that for every cm of fibrous material or mat 44 supplied, about six to eight swingle knives 37 pass this cm of supply.

Thanks to these swingle knives 37, the ligneous particles are cut loose and they are combed out of the fibrous material of the mat 44 by the swingle combs 36.

When the remaining fibres come loose from between the knife 28 and the roll 29 of the feed mechanism 26, they are lowered along with the swingle drum 27, over the bars 38 between which the loosened and combed out ligneous particles and short pieces of fibre fall.

The fibres which are stripped from the loose ligneous particles and other loose waste are then fed to a following device for the subsequent removal of ligneous particles and such, and they are swingled or, as represented in the figures, extracted through the exhaust pipe 43.

As the mat 44 is supplied as a relatively thin, stretched layer, a faster supply to the swingle drum 27 and a better separation effect of ligneous particles/fibres is obtained.

The embodiment as represented in figure 4 only differs from the above-described embodiment in that the separating device 1 only has one unit, but a unit with several combing rolls 5, namely three in the example represented, which are erected immediately one after the other, i.e. without any intermediate feed mechanisms 4.

They are erected under separate walls 7 which can be adjusted in height by means of piston mechanisms 22.

According to a variant, they can be erected under a common wall 8.

They can be driven at the same or at different speeds via chain transmissions 21.

With all the embodiments can be obtained a very efficient separation of the fibres and the ligneous particles or other waste particles. The construction of the device is relatively simple.

The present invention is by no means limited to the above-described embodiments represented in the accompanying drawings; on the contrary, such a device for removing waste particles from fibrous material can be carried out according to various embodiments while still remaining within the scope of the invention.

Claims

1. Device for at least partially removing waste particles from fibrous material, characterized in that it contains at least one combing roll (5), provided with fingers (6) on its perimeter, means (13-14) to rotate the combing roll (5), a wall (7) erected opposite the combing roll and a feed mechanism (4) to supply a mat (44) of fibres to be cleaned between the combing roll (5) and the wall (7), in the same direction as the movement of the surface of the rotating combing roll (5), but at a speed which is lower than the peripheral velocity of this rotating combing roll (5).

2. Device according to claim 1, characterized in that the fingers (6) of the combing roll (5) are directed, in relation to the radial, slantingly in the opposite

direction of the sense of rotation of the combing roll (5).

3. Device according to claim 2, characterized in that the fingers (6) form an angle of about 45° with the radial.

4. Device according to any of the preceding claims, characterized in that the distance between the wall (7) and the combing roll (5) can be adjusted.

5. Device according to claim 4, characterized in that the wall (7) is connected to a part of the frame by means of piston mechanisms (22).

6. Device according to any of the preceding claims, characterized in that the wall (7) is erected on top of the combing roll (5) and forms a cap.

7. Device according to any of the preceding claims, characterized in that the feed mechanism (4) contains two rolls (11 and 12) and means (13-14) to drive at least one of these rolls (11-12).

8. Device according to any of the preceding claims, characterized in that one of the rolls (11 and 12) can be adjusted in relation to the other.

9. Device according to claim 8, characterized in that the rolls (11 and 12) are situated one on top of the other and in that the rolls (11 and 12) can be adjusted in relation to one another by means of piston mechanisms (17).

10. Device according to any of the preceding claims, characterized in that it contains several combing rolls (5) with fingers (6) and a wall (7) opposite to it.

11. Device according to claim 10, characterized in that each combing roll (5) is preceded by a feed mechanism (4).

12. Device according to claim 10, characterized in that a number of combing rolls (5) are situated immediately one after the other without any intermediate feed mechanism (4).

13. Device according to any of claims 10 to 12, characterized in that it contains a discharge mechanism (23) following the combing rolls (5) which is similar to the feed mechanism (4).

14. Device according to any of the preceding claims, characterized in that it contains a swingle drum (27) on the discharge end and means (33-34) to drive this swingle drum (27).

15. Device according to claim 14, characterized in that this swingle drum (27) contains a cylindrical body (35) which has at least one swingle comb (36) on its perimeter, apart from swingle knives (37).

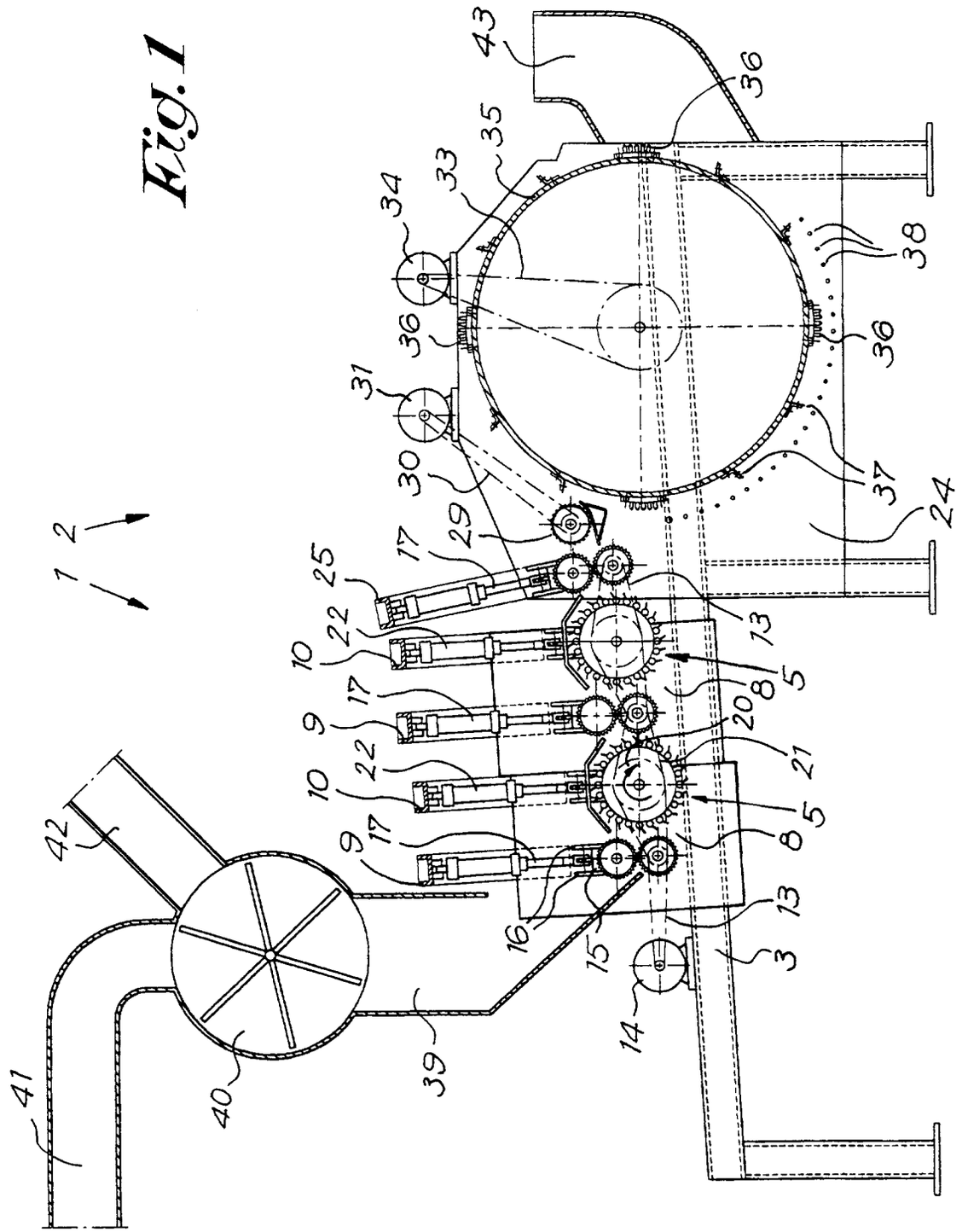
16. Device according to claim 15, characterized in that the swingle drum (27) contains several swingle combs (36) divided over its perimeter and at least one swingle knife (37) between each pair of neighbouring swingle combs (36).

17. Device according to claim 16, characterized in that the means (33-34) to drive the swingle drum (27) are means which drive it such that for every centimetre of supplied mat (44) of fibrous material, six to eight swingle knives (37) pass this centimetre of mat (44).

18. Device according to any of claims 14 to 17, characterized in that it contains a feed mechanism (26) in front of the swingle drum (27) which consists of a stationary knife (28), a roll (29) erected above it and means (30-31) to drive this roll (29).

19. Device according to any of the preceding claims, characterized in that a charging funnel (39) is erected in front of the feed mechanism (4), at the beginning, onto which is connected a conveyor pipeline (41) via a device (40) for separating air and fibres.

Fig. 1


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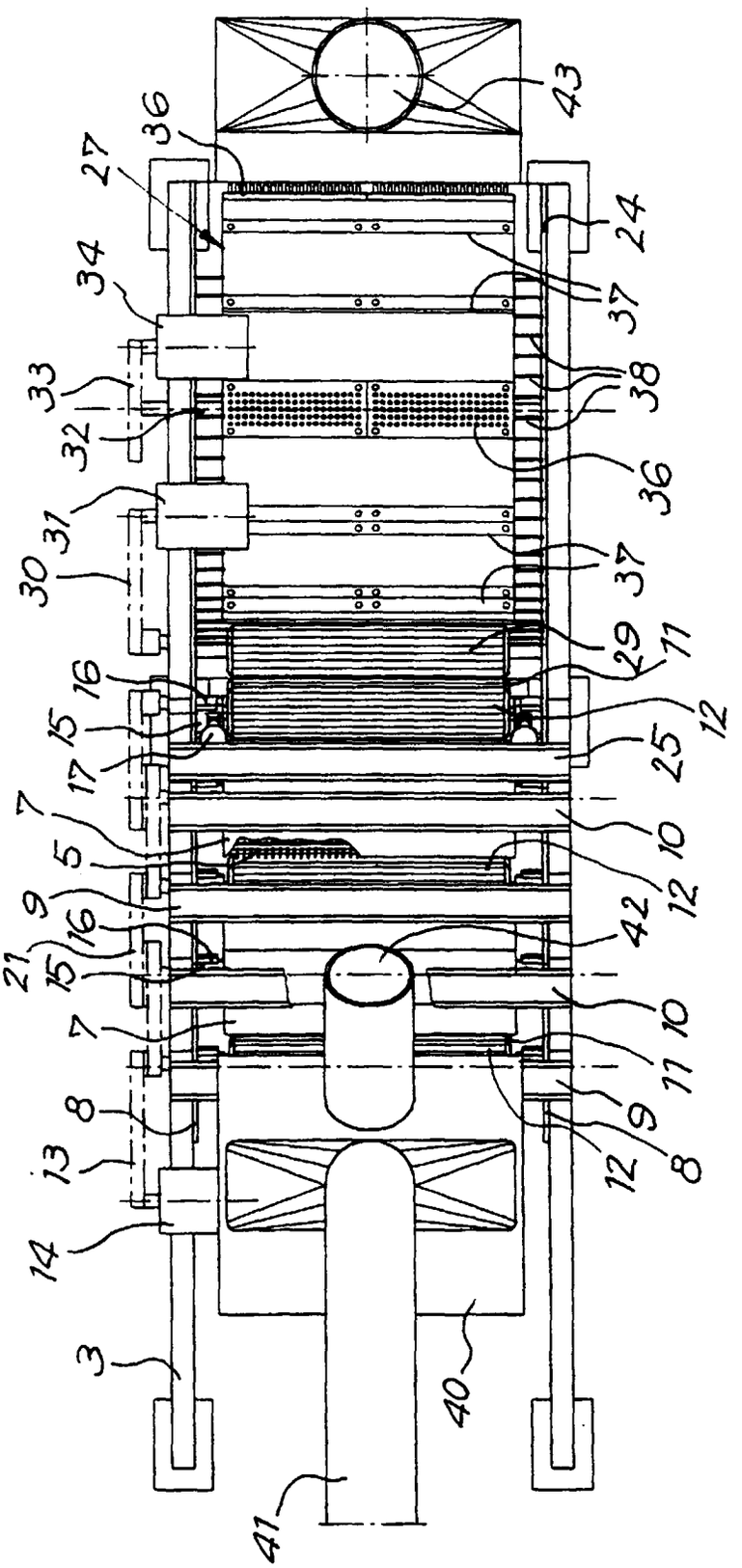

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Fig.2

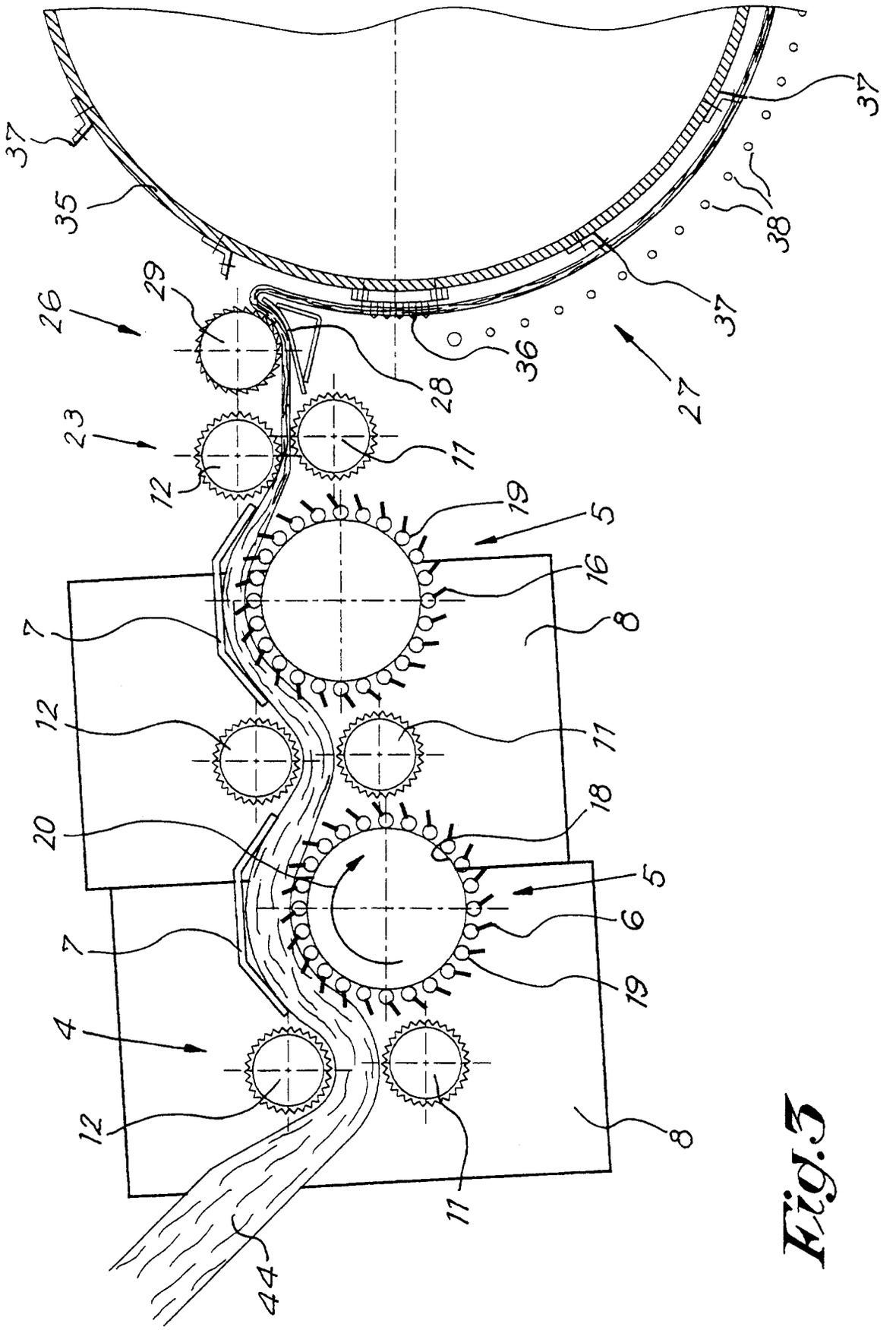
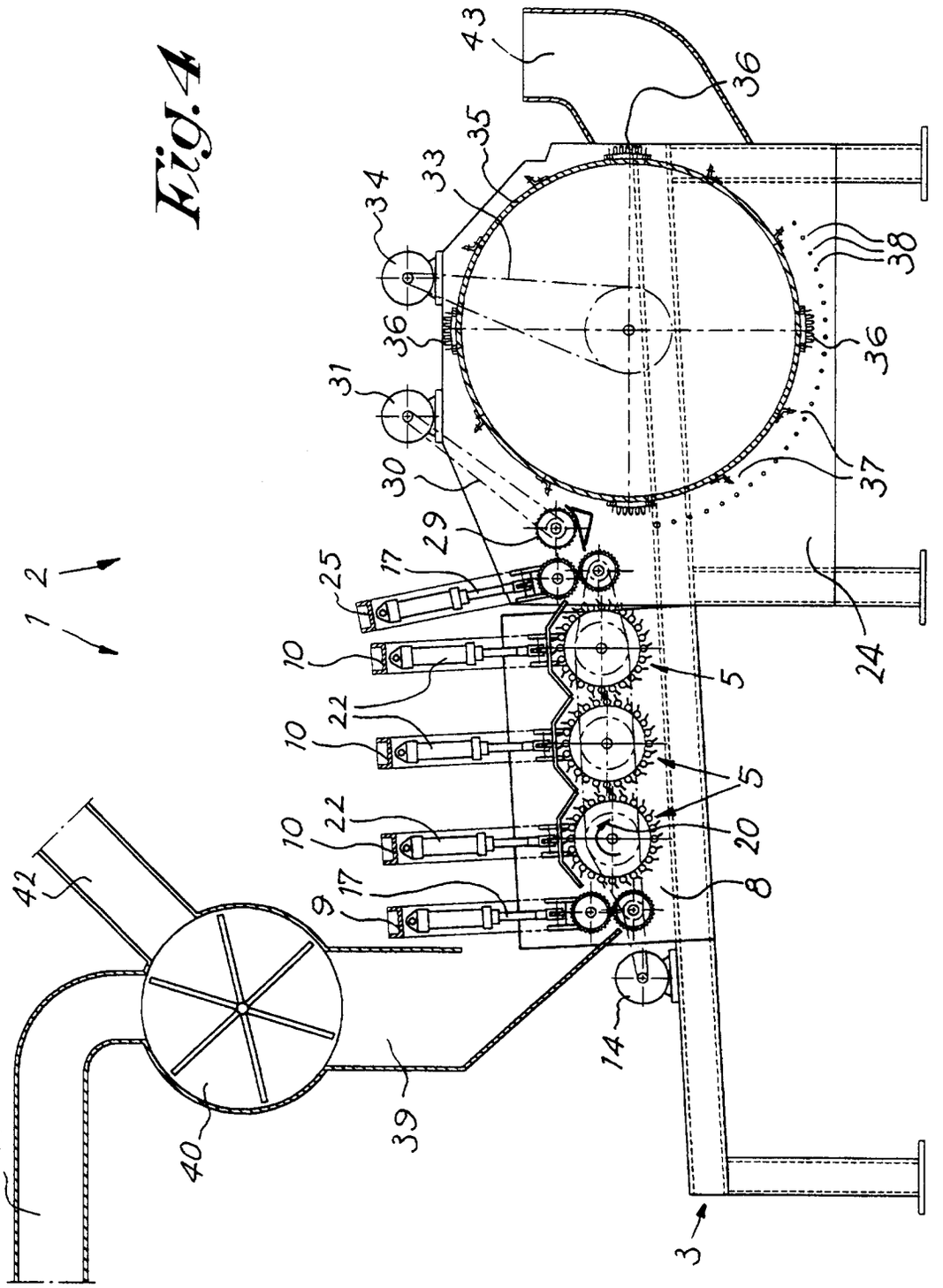

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Fig.3

Fig. 4



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 20 1658

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 324 802 A (STUTZER,W.I.) 27 February 1930 * page 1, line 9 - line 65 * * page 1, line 101 - page 2, line 50; claims 1-3; figure 1 *	1,2,6,7, 10,12	D01B5/00 D01B5/02
X	WO 92 13985 A (DIMITRIEV,A.V.ET AL) 20 August 1992 * abstract; figures 1,4 *	1,2,10, 12	
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A	BE 498 714 A (GMINDER,E.) 15 February 1951 * page 2, line 17-32; claim 1; figure 2 *	1,2,7	
A	EP 0 222 532 A (JAMES MACKIE & SONS LTD) 20 May 1987 * the whole document *	1	
A	EP 0 016 709 A (PACQUET,D.) 1 October 1980		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 September 1998	Munzer, E

CATEGORY OF CITED DOCUMENTS

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