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(54) Cross-lapping machine for continuisly creasing, folding and cross-lapping corrugated board material

(57) The present invention relates to a cross-lapping machine (6) for creasing, folding and cross-lapping a corrugated board material fed as a continuous web (3), characterized in that the machine comprises a rotary element, having, in elevation view, a polygonal cross-section (10'), preferably an octagonal cross-section, including, at the apex of the octagon, a creasing contour (32) pressing the corrugated board material layers, the creasing contour (32) cooperating with a counter-roller (7) including a second creasing contour (32), and so timed that the mentioned creasing contours (32) deform, at a cross direction and opposite positions, but coinciding with one another, the corrugated board material strip (3) conveyed into the machine body.

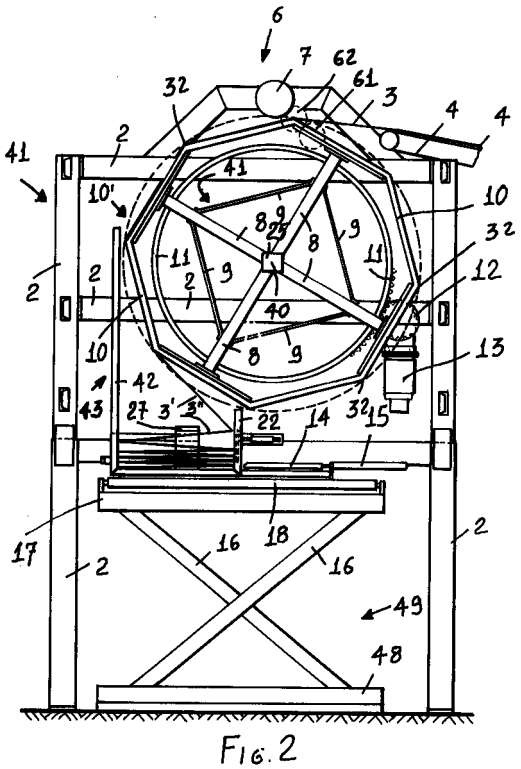


Fig. 2

EP 1 065 162 A2

Description

BACKGROUND OF THE INVENTION

[0001] The presente invention relates to a cross-lapping machine, which has been specifically designed for creasing, folding and cross-lapping, as well as collecting corrugated board materials.

[0002] The corrugated board material, in particular, is conveyed by conveyor belts, which are slidably supported on drive rollers and tension means.

[0003] The subject machine is very different from prior commercially available corrugated board folding machines.

[0004] The inventive machine, moreover, is adapted to perform not only creasing operations, but also folding, cross-lapping and collecting operations on the corrugated board material, the latter being conveyed into the subject cross-lapping machine as a continuous strip or web.

[0005] In this connection it should be pointed out that creasing, folding and cross-lapping operations are performed as a continuous process, to process comparatively high amount of corrugated board material, with a comparatively high yield much greater than that of prior batch operating cross-lapping machines.

[0006] A further advantage of the cross-lapping machine according to the present invention is that it is very simple construction-wise, and very competitive from a mere economic standpoint, the machine being moreover very safe and reliable in operation.

SUMMARY OF THE INVENTION

[0007] The above mentioned advantages, as well as yet other advantages, of functional and constructional nature, are achieved by the subject cross-lapping machine, specifically designed for creasing, folding, cross-lapping and collecting a corrugated board material, which is continuously fed, said cross-lapping machine being characterized in that it comprises a rotary member having, in an elevation view, a polygonal cross-section, preferably an octagonal cross-section, including, at the octagon apex points, a creasing contour, pressing the corrugated board material layers.

[0008] The mentioned creasing contour cooperates with a counter-roller, having a second creasing contour which is perfectly timed with respect to the first creasing contour, thereby the mentioned two creasing contours deform, at a cross direction and at opposite, but coinciding positions, the corrugated board material strip conveyed into the body of said cross-lapping machine.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above mentioned and other characteristics, of functional and constructional nature, of the cross-lapping machine according to the present invention will become more apparent hereinafter from the following detailed disclosure with reference to the figures of the accompanying drawings, illustrating, by way of a not limitative and illustrative example, the inventive cross-lapping machine, where:

Figure 1 is a side view illustrating the cross-lapping machine including therein a plurality of conveyor belts for conveying a preformed continuous corrugated board material strip;

Figure 2 is a further side view illustrating an enlarged detail of a cross-lapping device and members performing the creasing, folding and collecting operating steps on a continuous corrugated board material web or strip;

Figure 3 is a further side view illustrating a further enlarged detail of the cross-lapping machine according to the present invention;

Figure 4 is yet another side view of the subject cross-lapping machine, clearly showing two different positions assumed by the octagonal grid construction and by the elements forming said construction;

Figure 5 is a detail view of the creasing contours, cooperating with a counter-cylinder, covered by a resilient rubber or plastic material layer;

Figure 6 is a further detail view illustrating two cross-creasing contours, respectively applied at apex points of the mentioned octagonal grid construction and on a top counter-roller;

and

Figure 7 is a side perspective view illustrating conveyor belts for conveying creased and 180° folded corrugated board material packs, onto one another, to provide cross-lapped flaps, in continuous strip or web form.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] With reference to the number reference of the figures of the accompanying drawings, the cross-lapping machine 6 according to the present invention is characterized in that it comprises an octagonal construction or structure 10', which can turn about a cross horizontal shaft 40.

[0011] Said construction 10' is provided, as seen from a side, with a polygonal cross-section, preferably an octagonal cross-section, and comprises moreover, at the apex points of the octagon, creasing contours 32, provided for pressing the corrugated board material layers, in cooperation with a top counter-element 7 or 7".

[0012] The mentioned counter-element, or biassing-abutment element, comprises, as is shown in Figure 5, a top cylinder 7, covered by a layer of rubber or any other suitable resilient material, adapted to operate as a counter-biassing element for a creasing contour 32 applied at the apex points of said octagonal or polygonal grid construction 10'.

[0013] The sides 10 of said grid construction are coupled and supported by diametrical arms 8, which extend spoke-like and are pivoted about the horizontal and cross shaft or axis 40.

[0014] Alternatively, and as is shown in Figure 6, the creasing contours 32 are successively engaged at set positions coinciding with further contours 7'' applied to a cylinder 7'.

[0015] The perimetrical extension of the cylinder 7 has been so designed as to correspond to the length of each side 10 of the octagonal construction 10'.

[0016] The latter, in particular, is supported by a grid construction or structure 41, which supports, at a variable height, both the octagonal structure 10' and a top cradle 43, defined by the side walls 42, the bottom wall 14 and levelling side walls 22 and 27 which can perform a small reciprocating rectilinear movement.

[0017] The mentioned top cradle 43 can be raised and lowered, since it is supported by the arms 44 in turn coupled to the supporting elements 45 and 46.

[0018] The raising and lowering of said top cradle 43 is driven by hydraulic or pneumatic pistons 50, fixed, at an end thereof, to said structure 2 and pivoted, at their other ends, to the swinging arms 44.

[0019] In this connection it should be pointed out that the octagonal structure or construction 10' comprises a vacuum pump, coupled to a rotary metering device 25, for metering air, coaxial with the rotary axis or shaft 40 of the octagonal structure 10'.

[0020] At the other end of said rotary axis or shaft 40 a rotary metering device 24 and electrovalves coupled to an air compressor are arranged.

[0021] The mentioned central rotary metering devices 24 and 25, through suitable ducts 33 and 34, as formed in and/or applied to the octagonal structure 10', are respectively coupled to suction suckers 30 and two blowing nozzles 31, which are suitably arranged on the arms 10 forming the above mentioned octagonal structure 10'.

[0022] The suckers 30 and nozzles 31 provided respectively for holding the starting portions of the laps 3', 3'', 3''' and blowing on the opposite ends of said laps 3', 3'', 3''', allow to fold as a continuous strip the mentioned laps, as preliminarily creased.

[0023] The mentioned corrugated board material laps or flaps 3', 3'', 3''' are collected on a supporting element 49 which is arranged, at the start, at a high position, thereby supporting, on its top rollers 18, the cross-lapped board material flaps.

[0024] Said supporting and conveying device 49 is so designed as to assume variable heights, tending to reduce as the overlapped laps 3', 3'', 3''' are accumulated, said laps being folded by 180° onto one another, thereby providing a cross-lapping arrangement.

[0025] As the lap stack 60 achieves a set height, a piston 15 is driven for operating a separating wall 14, to close the bottom of the mentioned cradle 43.

[0026] Simultaneously with the closing operation, a cross movable blade transversely cuts the cross-lapped board laps or flaps 3' and 3'' at a folding line thereof.

[0027] Upon cutting, the cross-lapped board material supporting device 49 is aligned, at the bottom, with a platform 35 including conveyor chains 37, pushing the bottom cross-lapped board material 60 in suitable directions A and B as shown in Figure 7.

[0028] The conveyor chains, in particular, are driven by suitable motor-reducing units 54, 55, 56 and 57.

[0029] Thus, the board laps or flaps 3 are collected on the cradle 43 which, as the stack height increases, tend to be lowered.

[0030] The conveyor device 49, which is vertically movable, upon having unloaded the cross-lapped board stack 60, tend to rise and being arranged under the cradle 43 at a high position.

[0031] As the conveyor device 49 arrives at its top dead point, the piston 15 will drive the separating wall 14 thereby opening the bottom of the cradle 43.

[0032] In this operation, the cross-lapped board material portion collected on the bottom of the cradle, will be again arranged on the conveyor device 49, by falling on the rollers 18 of the platform 17.

[0033] In this connection it should be pointed out that, during the creasing, folding and cross-lapping operations, a motor-reducing unit 19 will cause, through a rod-crank system 20 and 21, a levelling wall 22 to be displaced by a reciprocating type of movement.

[0034] A further guide and holding wall 27 is moreover provided on a side of the cradle 43, for guiding and holding the creased, folded and cross-lapped board material.

[0035] The cradle element 43, as stated, included a movable bottom wall 14, driven by a pneumatic cylinder 15.

[0036] The stack 60 conveying and unloading device 49 comprises, in turn, a plurality of top rollers 18 which are supported by a perimetrical frame 17, in turn supported by swinging arms 16 pivoted to a bottom construction 48.

[0037] The subject cross-lapping machine includes, according to a feature of the invention, a conveyor device including therein a plurality of conveyor chains 37 and motorized conveyor rollers.

[0038] The octagonal construction 10' is rotatively driven by a motor-reducing unit or assembly 13, in turn rotatively driving a gear 12 meshing with a large diameter toothed wheel 11, coupled to said octagonal construction 10'.

[0039] The toothed wheel 11, in turn, meshes with a further toothed wheel 61 engaging with a gear 62 rotatively driving yet another toothed wheel 63 coaxial with the creasing roller 7.

[0040] It should be apparent that the cross-lapping machine according to the present invention has been disclosed and illustrated exclusively by way of an illustrative but not limitative example.

[0041] Thus, while the inventive cross-lapping

machine has been disclosed and illustrated with reference to a preferred embodiment thereof, it should be apparent that the disclosed embodiment is susceptible to several modifications and variations all of which will come within the scope of the invention as defined in the accompanying claims.

Claims

1. A cross-lapping machine, for creasing, folding, cross-lapping and collecting a corrugated board material, fed in the form of a continuous web or strip, characterized in that said cross-lapping machine comprises a rotary element, having, as seen in a side view, a polygonal cross-section, preferably an octagonal cross-section, provided at the apex points thereof, with a creasing contour, pressing the corrugated board material layers, and that said creasing contour cooperates with a counter-roller, provided with a second creasing contour, which is so timed that said two creasing contours deform in a cross direction and opposite but coinciding positions the corrugated board strip material conveyed into the body of said cross-lapping machine.

2. A cross-lapping machine, according to Claim 1, characterized in that said corrugated board material layers are creased by a top counter-cylinder, covered by a layer of rubber or other resilient material, and adapted to operate as a counter-biassing element for a creasing contour applied to said apex points of said octagonal construction, or grid-like polygonal construction, the sides of which are coupled or supported by diametrical arms, arranged in a spoke-like arrangement and pivoted about a cross horizontal axis.

3. A cross-lapping machine, according to Claims 1 and 2, characterized in that said creasing contour engages, at set opposite but coinciding positions, with a second creasing contour applied to a cylinder the perimetrical extension whereof corresponds to the length of each side of said octagonal construction.

4. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said octagonal construction is supported by a grid construction supporting, at a variable height, both said octagonal construction and a top cradle formed by side walls, a bottom wall and further levelling side walls, which can perform a reciprocating rectilinear movement.

5. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said top cradle is supported by swinging arms to be raised and lowered.

6. A cross-lapping machine, according to one or more of the preceding claims, characterized in that the raising and lowering of said top cradle is driven by hydraulic or pneumatic pistons having one end thereof coupled to said construction and pivoted, at the other end thereof, to said swinging arms.

7. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said octagonal construction is provided with a vacuum pump coupled to a rotary metering device and electrovalves, and that said metering device is arranged at one end of said rotary axis of said octagonal construction.

8. A cross-lapping machine, according to one or more of the preceding claims, characterized in that at the other end of said axis of said octagonal construction, a second rotary metering device coupled to a plurality of valves and to an air compressor is arranged.

9. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said central rotary metering devices, through a plurality of ducts formed in or applied to said octagonal construction, are respectively coupled to suckers and blowing nozzles, arranged at set positions on said arms forming said octagonal construction.

10. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said suckers and nozzles hold for a set time a start portion of some board laps and blow on opposite portions of said board flap thereby providing a cross-lapping with foldings at 180° of said board laps, as preliminarily creased, which are folded as a continuous strip.

11. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said cross-lapping machine is provided with a cradle which can be raised and lowered.

12. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said cross-lapping machine is provided with a motor-reducing unit, which, through a coupling rod-crank system, causes a reciprocating displacement of a levelling wall.

13. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said machine comprises, on a side of said cradle, a guiding and holding wall for said creased and cross-lapped corrugated board material.

14. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said cradle is provided, at the bottom thereof, with a movable bottom wall driven by a pneumatic cylinder.

15. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said machine comprises a cross-movable blade, which is transversely driven on the longitudinal axis of said machine, to perform a cross cut of a cross-lapped board material flap, at a folding or creasing line.

16. A cross-lapping machine, according to one or more of the preceding claims, characterized in that in said machine the cross-lapped corrugated board material stacks are cut and unloaded on a conveyor device, which can be lowered.

17. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said conveyor device comprises a plurality of top rollers, supported by a perimetrical supporting frame in turn supported by swinging arms pivoted to a bottom construction.

18. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said machine comprises a platform and a plurality of rollers on said platform, for supporting said paperboard material stack as the movable bottom wall of said cradle is opened and progressively lowered.

19. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said conveyor device operates also as an unloader device, being aligned, at the bottom thereof, with a platform including a plurality of conveyor chains pushing a bottom cross-lapped paperboard material stack, in set displacement directions.

20. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said conveyor device comprises therein a plurality of conveyor chains and motorized conveyor rollers.

21. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said rollers are designed for achieving, in addition to a top dead point, also a bottom dead point, thereby assuming progressively lowered positions, as the thickness of said folded and 180° bent lap stack is increased.

22. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said octagonal construction is rotatively driven by a motor-reducing unit, which turns a gear meshing with a large diameter toothed wheel, fixed to said octagonal construction.

23. A cross-lapping machine, according to one or more of the preceding claims, characterized in that said octagonal construction comprises a toothed gear wheel engaging with a gear for rotatively driving a top creasing roller.

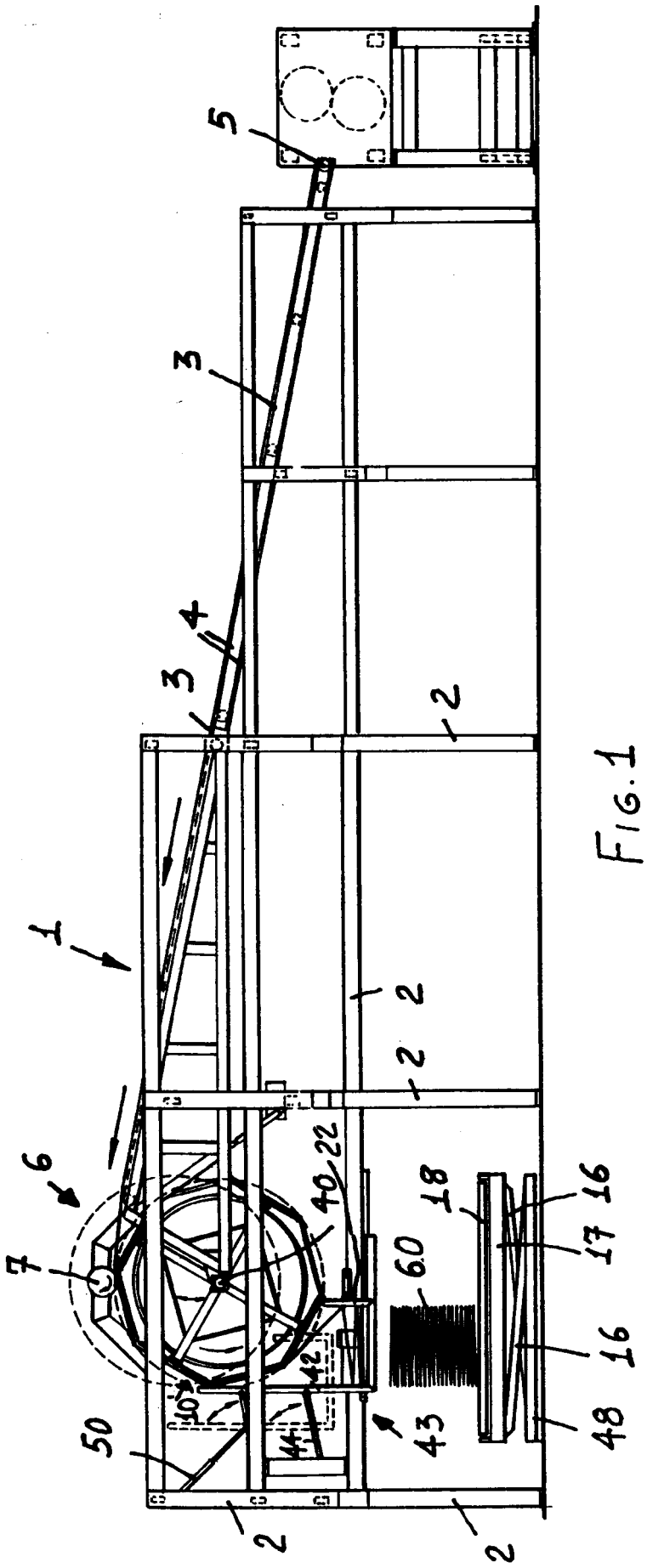


FIG. 1

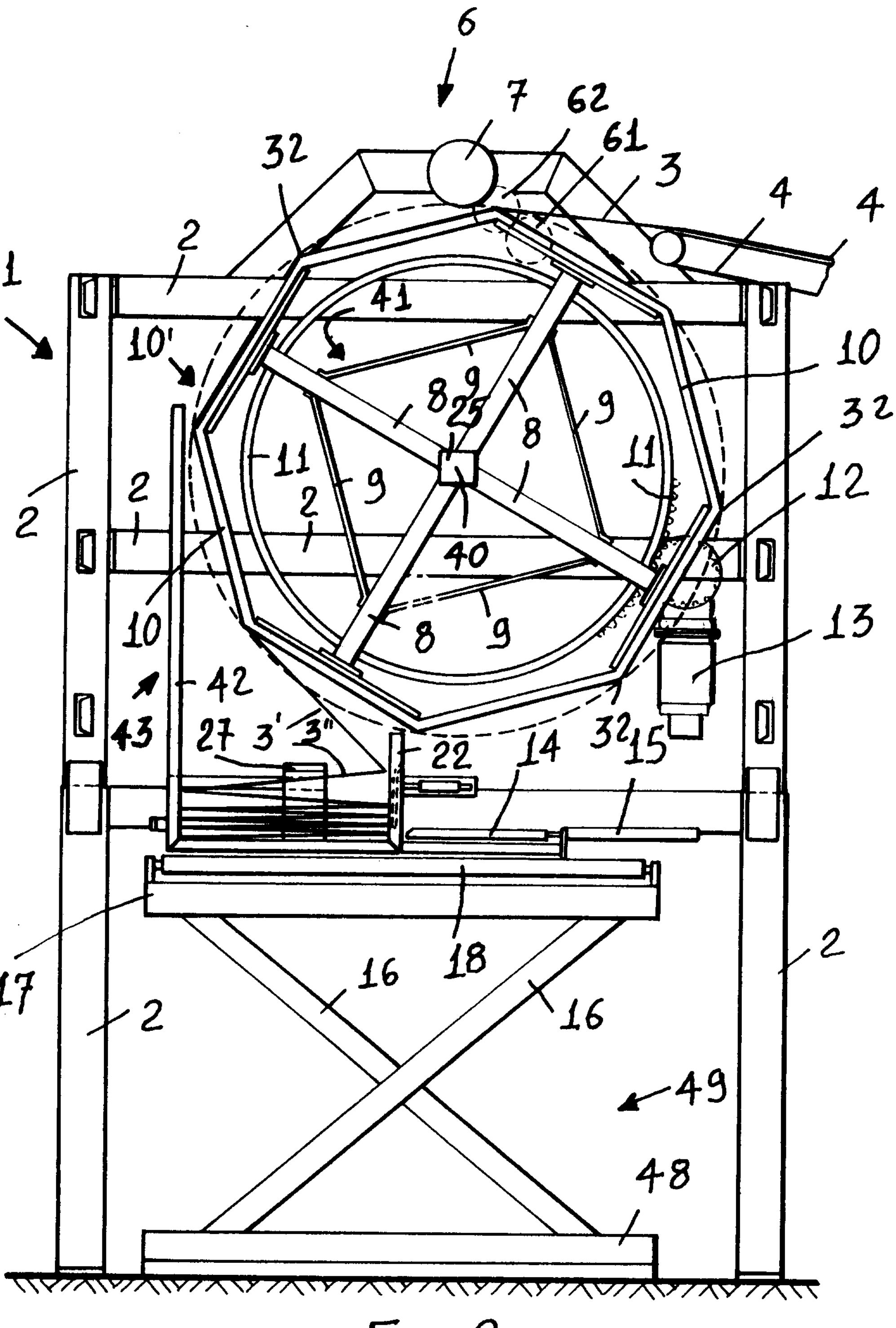
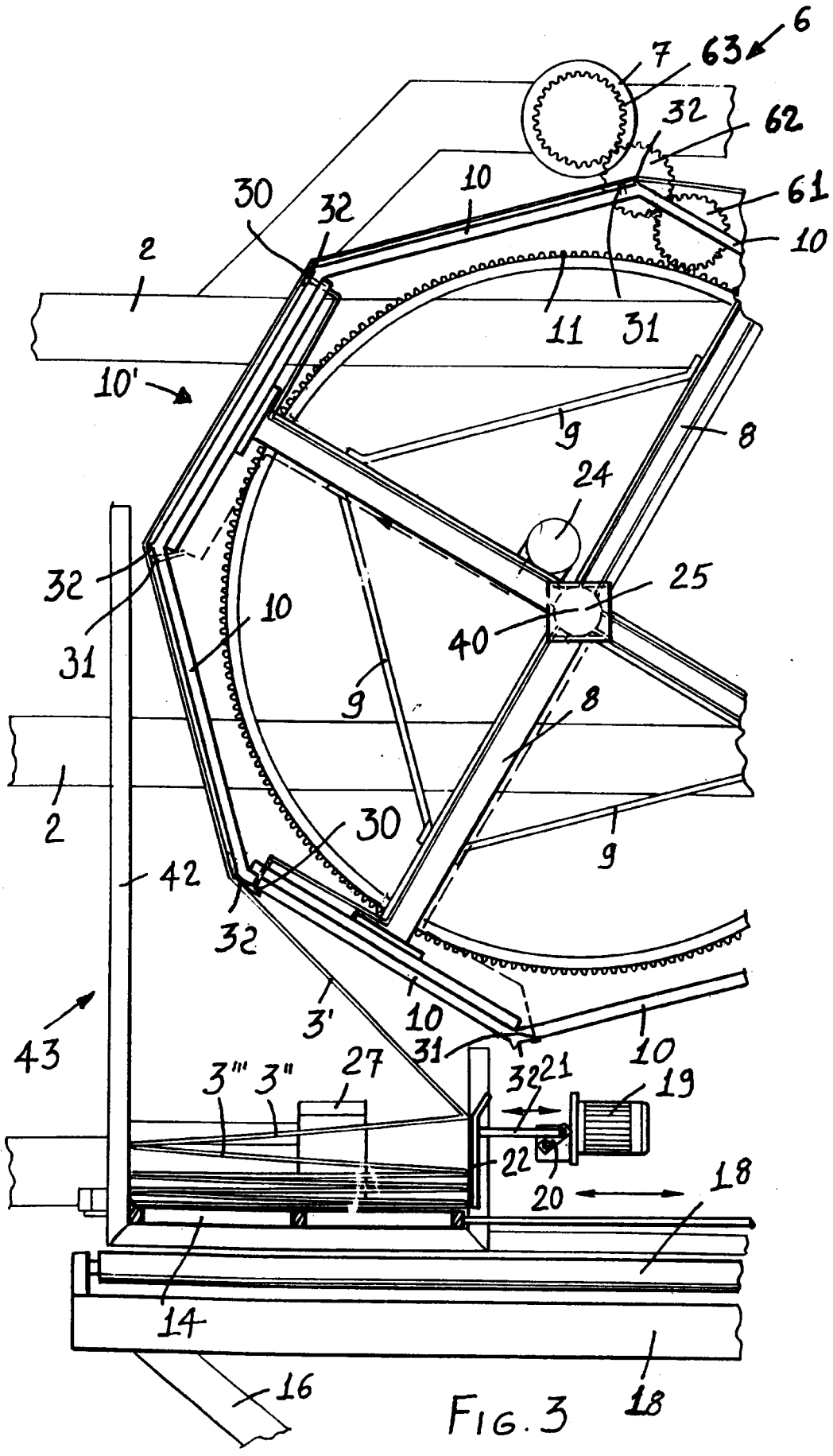

6
7
62
61
3
4
4
32
2
41
41
10'
10
9
8
25
8
9
32
11
11
12
2
2
9
2
2
40
10
10
9
8
9
13
42
43
27
3'
3"
22
32
14
15
17
18
16
16
2
2
49
48

Fig. 2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32
62
61
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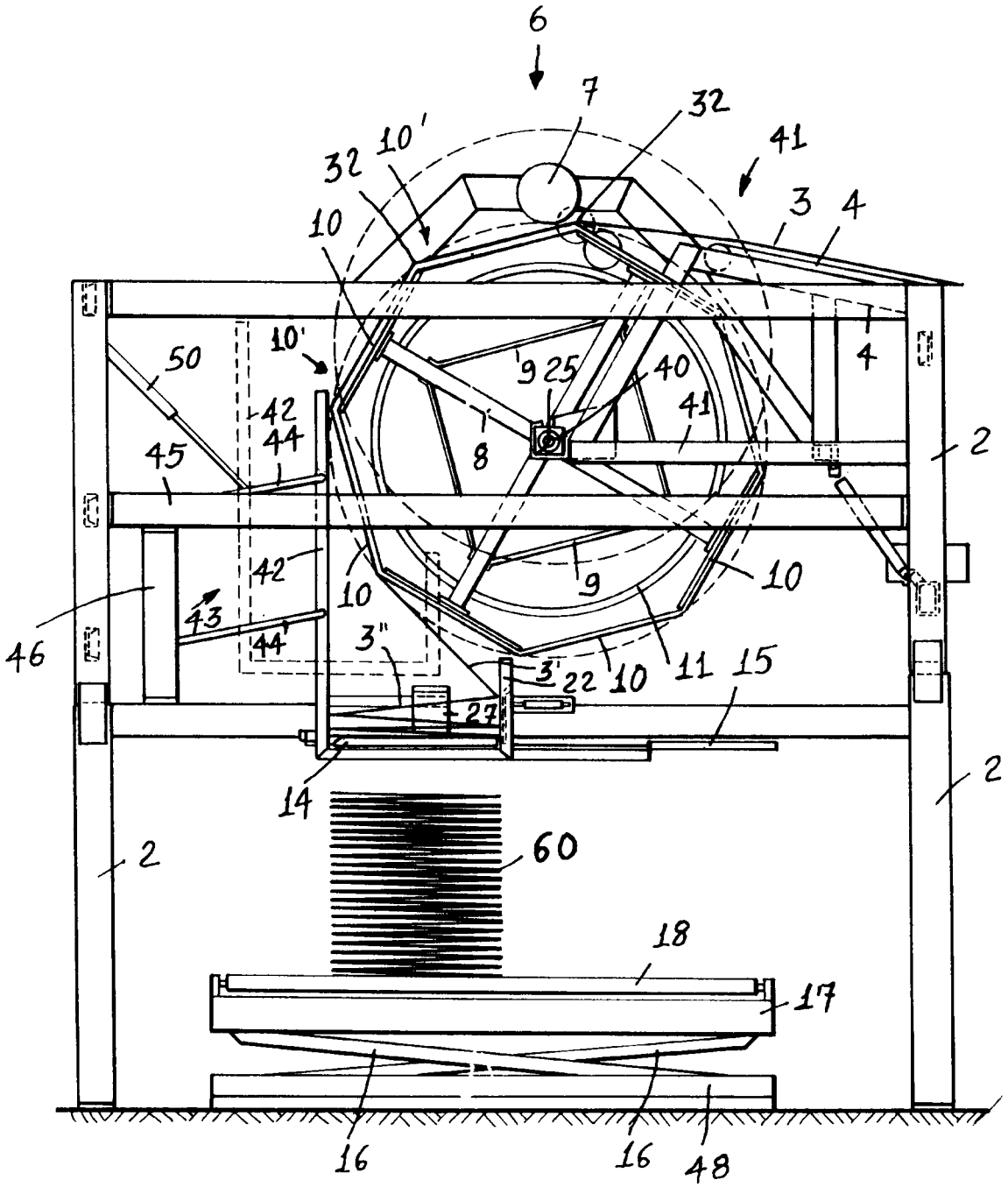
32
10
2
11
31
10'
9
8
24
25
40
32
31
10
9
8
2
30
42
32
9
3'
10
43
31
10
3''' 3''
27
32
21
19
22
20
18
14
16
18

FIG. 3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7
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41
32
10'
10
3
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50
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44
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9
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42
10
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10
46
43
44'
3"
3'
22
10
11
15
27
14
2
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60
18
17
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16
48

FIG. 4

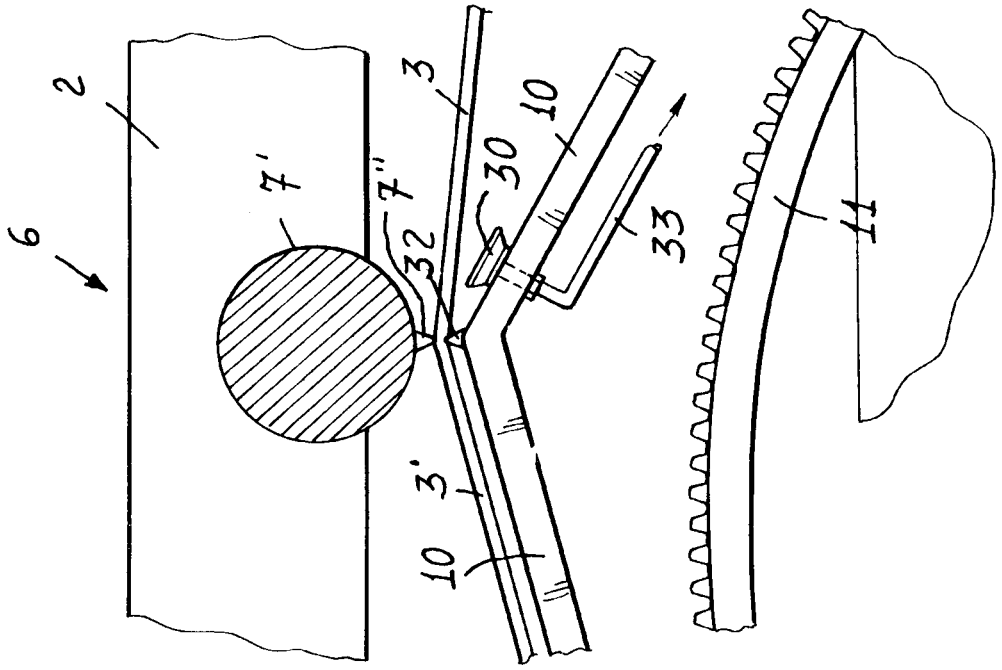

FIG.6

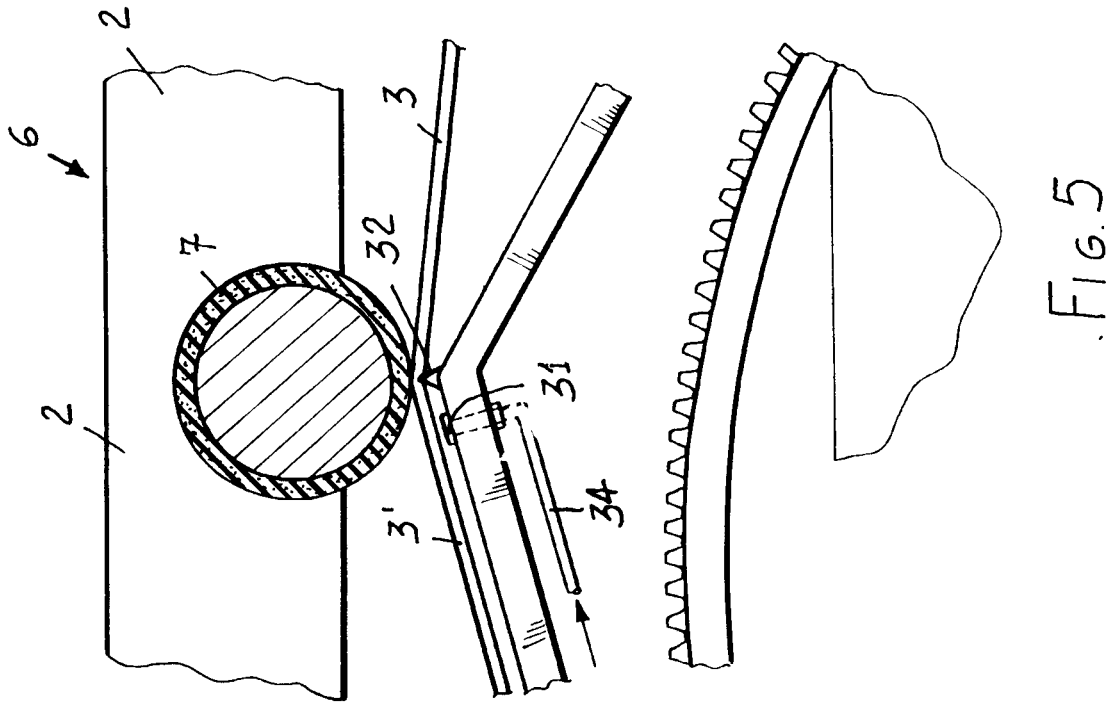

FIG.5

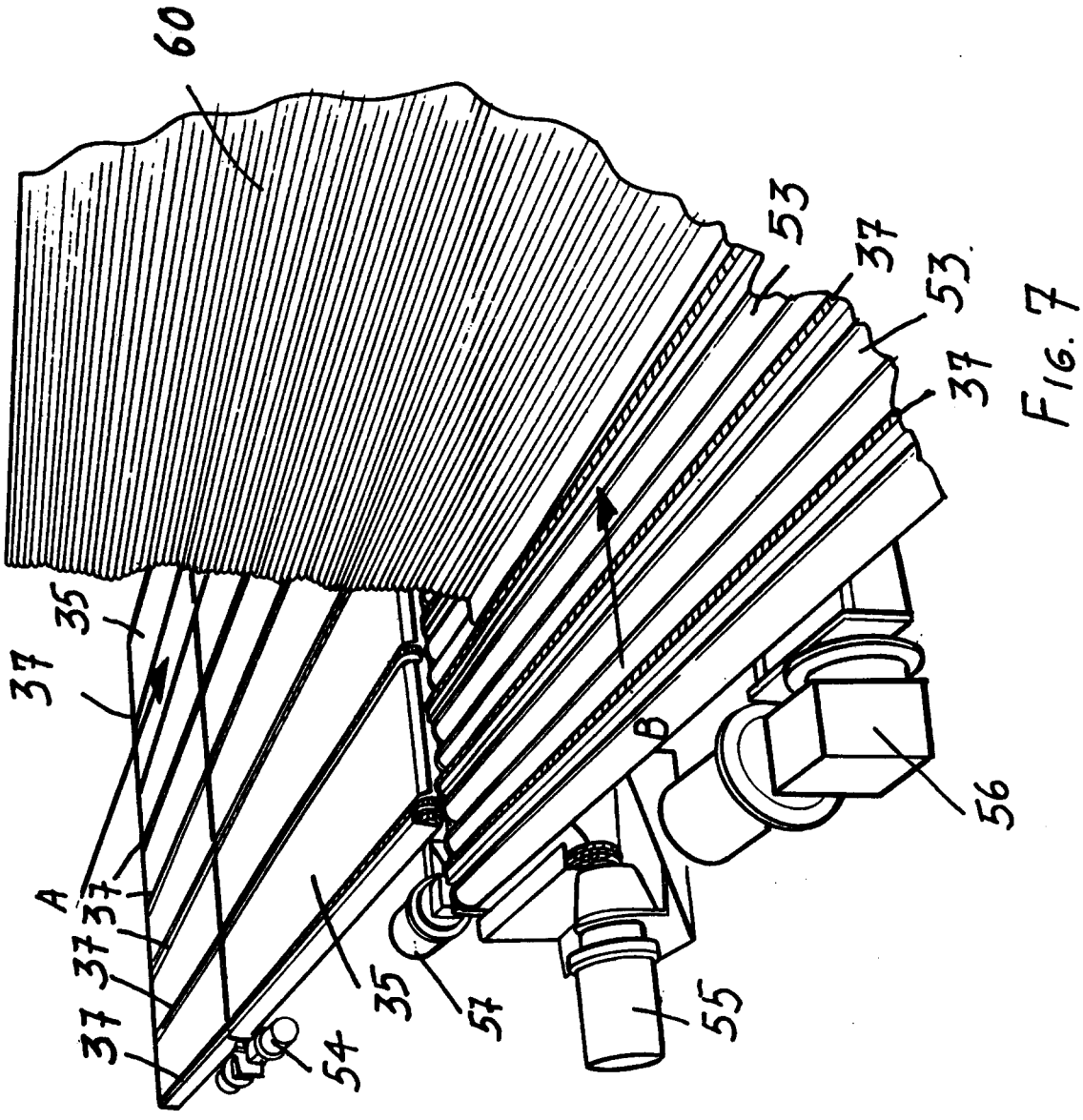

FIG. 7