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(54) Rounding machine for wooden panels

(57) A machine for rounding the edges of wooden panels, comprising a milling head (28) provided with at least one transverse feeler (32) arranged to direct the movement of said head such as to copy the profile of said panel, a resting surface for said panel when being machined by said head, the head being supported by a first carriage (9) slidable on first guide means (8) longitudinal to said panel by first drive means (12, 15, 19A), and a second carriage (20) slidable on second guide means (19) transverse to said longitudinal axis by second drive means (21), the head being supported by said second carriage via a third drive means (24) causing said head to translate parallel to said longitudinal axis, such that said third drive means, when required, can move said head (28) in the direction opposite that imposed by said second drive means (21) in order to prevent separation of said feeler from said profile.

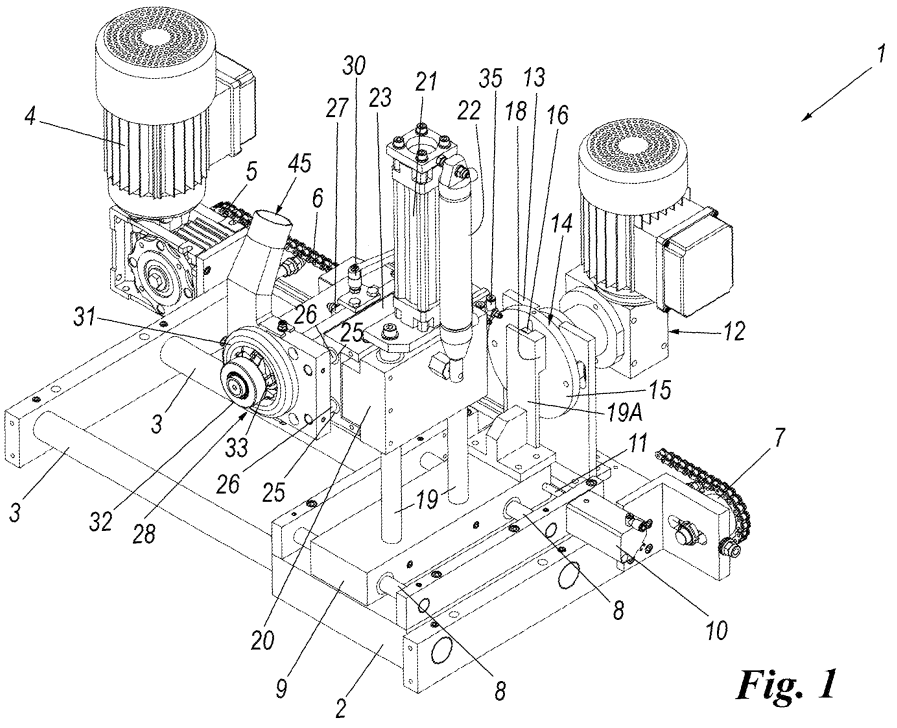

Fig. 1

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Description

[0001] The present invention relates to a machine for rounding the edges of wooden panels and to a method for rounding edges by means of a machining head. It relates in particular to a rounding machine for wooden panels able to effect both front and rear edge rounding, applied to a machine of the type comprising a conveyor belt.

[0002] As is well known, currently available rounding machines are unable to perfectly copy all panel profiles for any radius of edge curvature of such panels.

[0003] In this respect, many rounding machines are able to properly machine either 90° panel edges, or curved panel edges with a radius of curvature between 5 and 15 mm. However no rounding machines currently exist able to perfectly machine both such panels without lengthy and laborious adjustments.

[0004] An object of the present invention is to provide a rounding machine and a rounding method particularly suitable for conveyor belt-type machines, able to machine in an optimal manner panels with very rounded edges and panels with less rounded or sharp edges, to produce perfect copying of the profile of such panels.

[0005] This and other objects are attained by a rounding machine and a rounding method in accordance with the technical teachings of the accompanying claims.

[0006] Further characteristics and advantages of the invention will be more apparent from the description of a preferred but non-exclusive embodiment of the rounding machine of the invention, illustrated by way of non-limiting example in the accompanying drawings, in which:

Figure 1 is a perspective view of a rounding machine of the present invention;
Figure 2 is a side view of the rounding machine of Figure 1;
Figure 3 is a front view of the rounding machine of Figure 1;
Figure 4 is a schematic view of a feeler of the rounding machine of Figure 1 while following the profile of a 90°-edged panel; and
Figure 5 is a view of a feeler of the rounding machine of Figure 1, while following the profile of a rounded edge.

[0007] With reference to said figures, these show a rounding machine indicated overall by the reference numeral 1.

[0008] The rounding machine shown in Figure 1 is intended to be mounted on a panel edging machine equipped with a conveyor belt, not shown, which acts as a support surface for the panel to be machined.

[0009] A translating carriage 2 is movable parallel to the conveyor belt on a pair of guides 3 fixed to the edging machine structure (not shown). The movement of the translating carriage is imposed by a gearmotor 4 which rotates a sprocket 5 engaging a chain 6 stretched between said sprocket 5 and an idle wheel 7; this chain is fixed in known manner to the translating carriage 2. The gearmotor 4 is controlled by a PLC in such a manner as to synchronize the translation speed of the carriage 2 with the translation speed of the panel 50 set by the conveyor belt.

[0010] A first carriage 9 is mounted, slidable on guides 8, on the translating carriage 2. The guides 8 of the first carriage are parallel to the guides 3 of the translating carriage. In this manner the first carriage is movable on the guides 8 along an axis A parallel to one side 51 of the panel being machined (and hence longitudinally to the panel 50), and in particular to that panel side 51 facing the machining head.

[0011] The piston rods 11 of two opposing single-acting pneumatic cylinders 10 are fixed to the first carriage 9.

[0012] On the translating carriage 2 a flange 13 is mounted supporting a gearmotor 12, on the shaft of which a cam element 14 is mounted consisting of a round plate on which a pin 16 with a ball bearing is mounted. When the cam is rotated, the pin cooperates with a projection 18 provided in an appendix 19 rigid with the first carriage 9. In this manner the pin 16 thrusts against the projection 19A and moves the carriage in a controlled manner against the pneumatic cylinder 10 which opposes this movement; these cylinders 10 are always active and under pressure. A pair of further guides 19 are mounted on the first carriage 9, perpendicular to the guides 8 of the first element.

[0013] A second carriage 20 is slidably mounted on these further guides 19 and driven along the axis of these guides 19 (which is transverse to the longitudinal axis of the panel; the transverse axis is represented by B in Figures 4 and 5), by a double-acting pneumatic cylinder 21. The speed of movement of said second carriage is controlled by a hydraulic speed regulator 22 associated with the second carriage 20 and mounted parallel to the pneumatic actuator 21.

[0014] The second carriage 20 supports a pair of guides 25 (of which only one is visible in Figure 3), on which a third carriage 23 slides, translationally driven along said guides 25 by a double-acting pneumatic cylinder 24. The carriage 23 is substantially supported by said pneumatic cylinder 24, which controls its position. As visible in Figure 1, the guides 25 are parallel to the guides 19 of the second carriage.

[0015] The carriage 23 presents a pair of bearings 25 housing guides 26 rigid with a fourth carriage 27 to which a milling head 28 is secured by a dovetail slide 29. The head is fixed in position on the dovetail slide by a quick-release device 30. The carriage 23 is driven by a double-acting pneumatic positioning cylinder 35, which substantially maintains a head aligning feeler 31 substantially abutting against the side of the panel.

[0016] The milling head 28 presents, coaxial to its milling cutter 33, a transverse feeler 32 consisting substantially of a ball bearing. A suction cover 45 is provided about the milling cutter and is connected to a suction

source to remove shavings deriving from the panel machining.

[0017] In use, the rounding machine of the present invention operates in the following manner.

[0018] A panel (for example that shown in Figure 4) is disposed on the conveyor belt which carries it in front of the rounding unit, the panel travelling at constant speed. When the panel passes in front of a suitable position sensor, the PLC which controls the unit operates the translation motor 4. Hence the carriage 2 and consequently the head 28 begin to travel along the side of the panel at its own speed; the sensor is located in a position such that the head travels in proximity to the first edge of the panel, but slightly withdrawn from it. The pneumatic positioning cylinder 35 is then operated to cause the alignment feeler 31 to abut against the panel; at the same time, the panel 21 is pressurized to bring the feeler 32 into contact with the panel surface. At this point the PLC operates the motor 12, and consequently the cam 15, which moves the first carriage 9 in the panel advancement direction, causing the transverse feeler 32 to slide along the panel surface. The milling cutter is rotated by a motor integrated into the head, to machine the panel edge 53. In machining a 90° panel (see Figure 4), the feeler 32 advances until it reaches the panel edge 52, which the milling head machines vertically. As soon as the edge 52 has been exceeded (see Figure 4), the feeler 32 continues to be urged downwards by the pressure present in the cylinder 21, and hence tends to lose contact with the panel lower edge 59. As soon as this occurs, the pneumatic cylinder 24 operates to urge the third carriage 23, i.e. the machining head 28, in the opposite direction to that imposed by the pneumatic cylinder 21, to thus enable the feeler to remain in contact with the lower edge 59 of the panel, and hence carry out perfect machining.

[0019] The aforegoing takes place even if the panel 50 being machined has an edge of different shape, such as a round (Figure 5) or semi-round edge. In this case the contact risks being lost when the feeler 32 exceeds the middle of the workpiece (Figure 5). Consequently in this case the intervention of the cylinder 24 enables the feeler/panel contact along the lower edge to be restored, as soon as the middle has been exceeded.

[0020] Essentially, by moving the milling head in the opposite direction to the drive direction, when a feeler of said head loses contact with the surface of said panel a more accurate and precise machining is obtained.

[0021] Moreover, during the machining of the front part 54 of the edge 52, the hydraulic speed regulator 22 intervenes to enable the head to advance along the machining profile with constant speed along the transverse axis B, whatever the pressure present in the pneumatic cylinder 21.

[0022] When the edge 52 has been machined, the pin 13 disengages from the appendix 18 and the pneumatic cylinder 10 returns the first carriage 9 to its rest position. The milling cutter simultaneously machines the lower edge of the panel 59. When the first carriage 9 has reached its rest position, feed is removed from the double-acting cylinder 21 and the feeler 32 rests in its rest position on a guide (not shown) present on the cover of the edging machine. In this position the milling cutter is distant from the panel.

[0023] The movement of the carriage 2 is then blocked while waiting for the rear edge of the panel 50, transported by the conveyor belt, to reach the milling cutter. When this happens, the cutter carries out the same operations, in a totally similar manner, on the second edge. The only difference from that already described is that during this operation the machining head commences machining from the lower part of the panel, where it had become located on terminating machining on the first edge.

[0024] Variants of the present rounding machine can easily be conceived. Hence if the machine on which the rounding machine is installed does not present a conveyor belt, it is not necessary to provide a translating carriage 2.

[0025] In an alternative embodiment, the gearmotor 12 is not present, in its place there being provided a linkage directly operated by the movement of the translating carriage 2, for example by a pinion/rack engagement operating with a free wheel or with an electromagnetic clutch.

Claims

1. A machine for rounding the edges of wooden panels, comprising a milling head (28) provided with at least one transverse feeler (32) arranged to direct the movement of said head such as to copy the profile of said panel, a resting surface for said panel when being machined by said head, the head being supported by a first carriage (9) slidable on first guide means (8) longitudinal to said panel by first drive means (12, 15, 19A), and a second carriage (20) slidable on second guide means (19) transverse to said longitudinal axis by second drive means (21), **characterised in that** said head is supported by said second carriage via a third drive means (24) causing said head to translate parallel to said longitudinal axis, such that said third drive means, when required, can move said head (28) in the direction opposite that imposed by said second drive means (21) in order to prevent separation of said feeler from said profile.

2. A rounding machine as claimed in claim 1, **characterised in that** said second carriage supports a third carriage (23) on which said head is mounted, the third carriage being secured to a movable end of said third drive means (24).

3. A rounding machine as claimed in claim 1, **characterised in that** said head is supported by a translating carriage (2) drivable parallel to the first carriage

by a translation actuator (4), such as to move said head along said panel in order to machine both its edges.

4. A rounding machine as claimed in claim 1, **characterised in that** said panel resting surface is a conveyor belt which transports said panel towards said milling head.

5. A rounding machine as claimed in claims 3 and 4, **characterised in that** said translating carriage (2) is driven synchronized with said conveyor belt.

6. A rounding machine as claimed in claim 1, **characterised in that** said head (28) presents a further lateral feeler (31) and is supported by a fourth carriage (27) movable perpendicular to the first two, said lateral feeler (31) regulating the position of said fourth carriage.

7. A rounding machine as claimed in claim 1, **characterised in that** a speed regulator (22) is associated with said second carriage to impose on said carriage a drive speed which is substantially constant independently of the drive force to which it is subjected.

8. A rounding machine as claimed in claim 7, **characterised in that** said speed regulator is hydraulic.

9. A rounding machine as claimed in claim 1, **characterised in that** said first carriage (9) is movable against the force of a pair of opposing pneumatic cylinders (10), said drive means comprising a cam (15) rotated by a relative motor (12).

10. A rounding machine as claimed in claim 9, **characterised in that** said cam comprises an eccentric cooperating with at least one projection provided on an appendix (19) rigid with said first carriage.

11. A rounding machine as claimed in claim 1, **characterised in that** said milling head comprises a shavings suction chamber (45) under vacuum.

12. A rounding machine as claimed in claim 1, **characterised in that** said second drive means is a pneumatic cylinder (21).

13. A rounding machine as claimed in claim 1, **characterised in that** said third drive means is a pneumatic cylinder (24).

14. A rounding machine as claimed in claim 3, **characterised in that** said translation actuator (4) comprises a chain (6) linkage with sprocket wheels (5), controlled by an electric motor.

15. A rounding machine as claimed in one or more of the preceding claims, **characterised in that** the translation motor for the translating carriage 2 drives the first carriage 9.

16. An edging machine comprising a rounding machine in accordance with one or more of the preceding claims.

17. A wooden panel machining method comprising the step of moving the milling head in the opposite direction to the drive direction when a feeler of said head tends to lose contact with the surface of said panel.

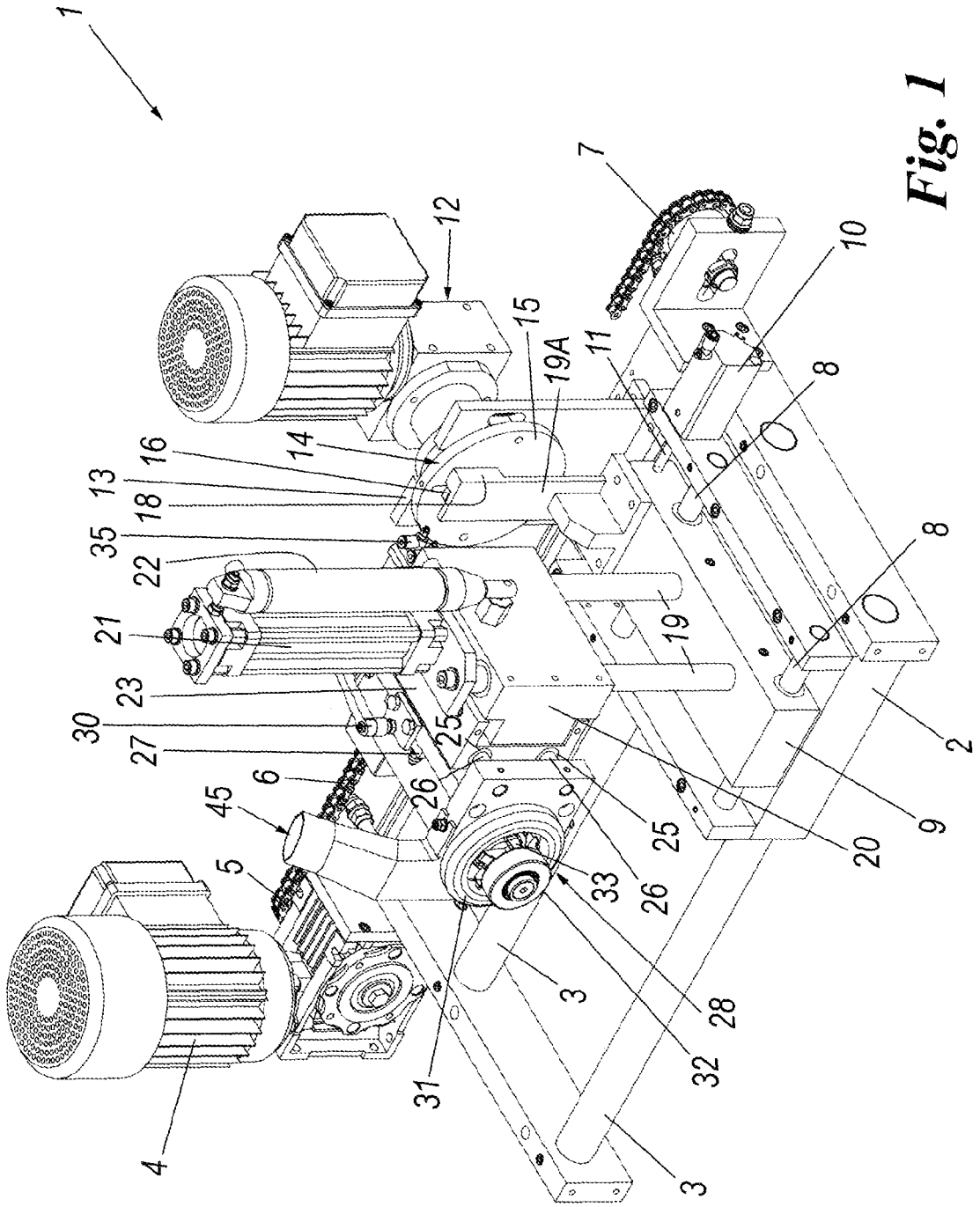
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Fig. 1

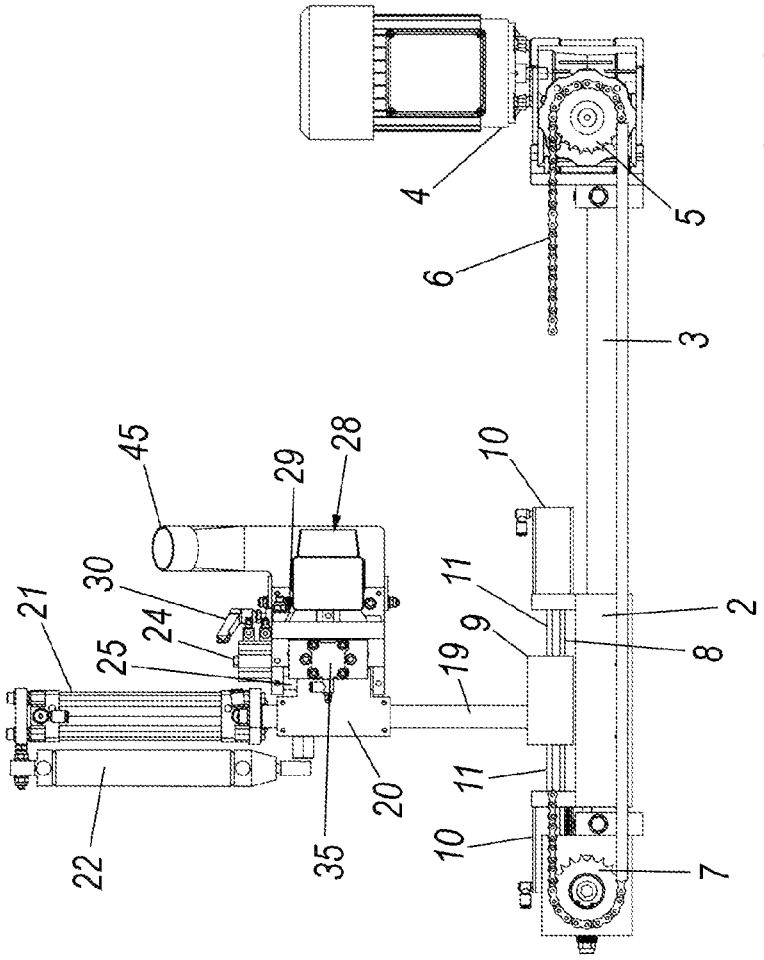
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Fig. 3

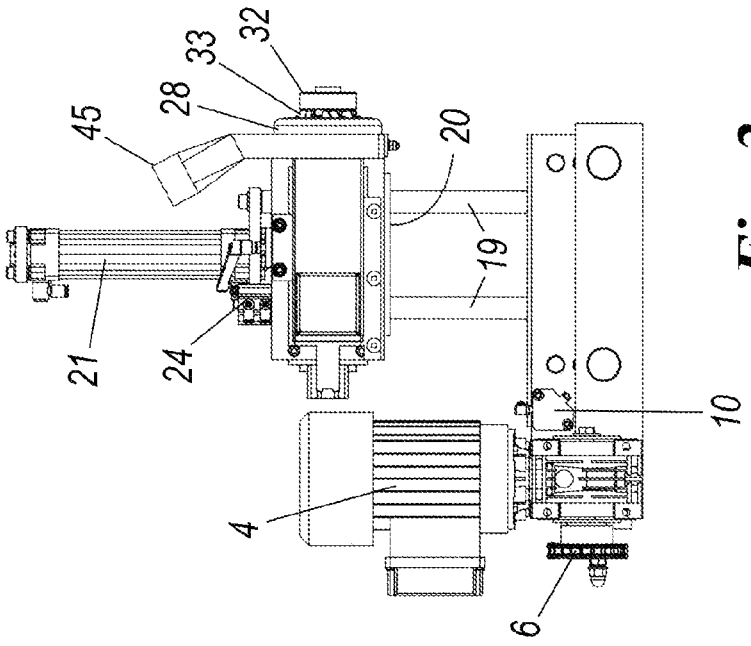
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Fig. 2

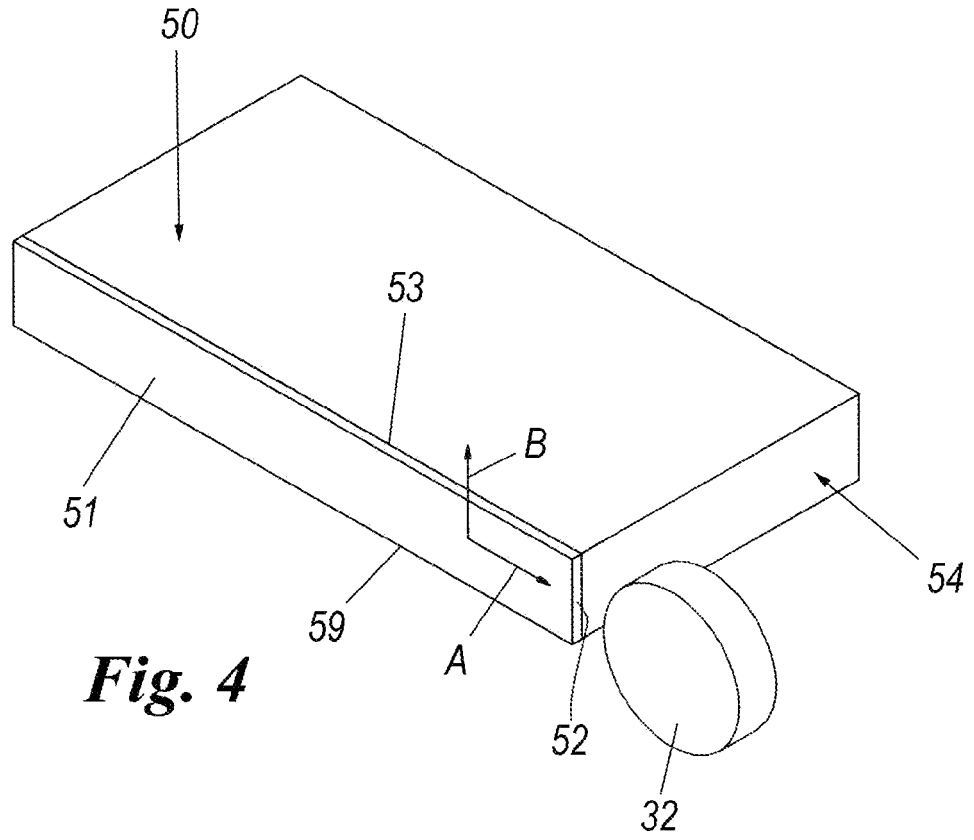

Fig. 4

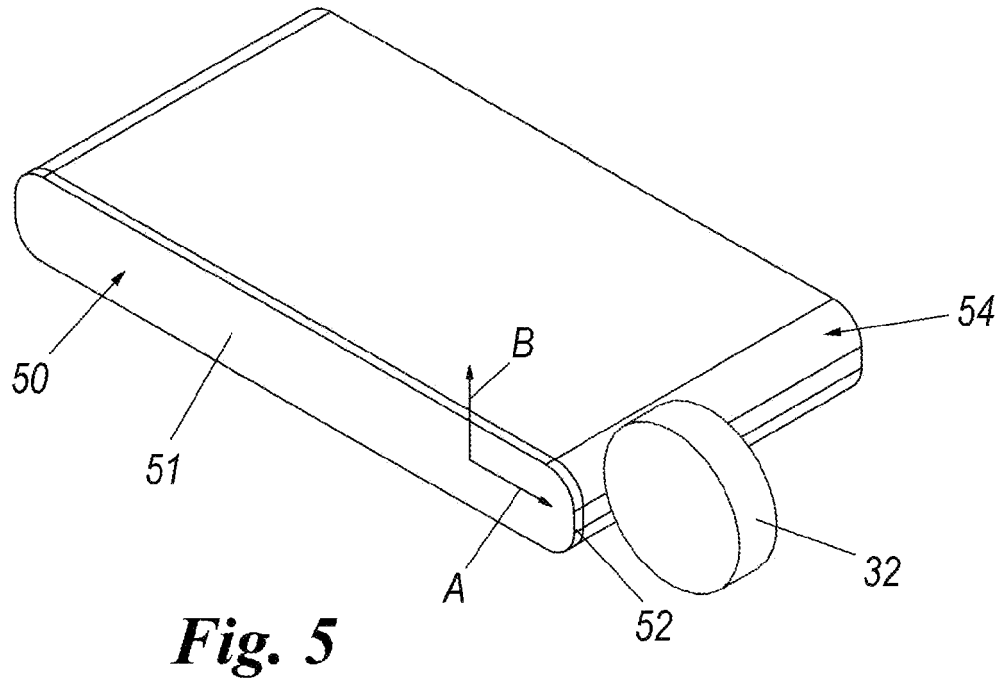

Fig. 5