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(54) **Method and apparatus for edge grinding of vertically stacked plate items**

(57) There are disclosed a method and an apparatus for edge grinding of plate items in a vertical stack, e.g. laminboards, where a grinding apparatus is used, comprising a number of vertical shafts for a number of abrasive rollers (2,4) forming vertical grinding cylinders with a length adapted to the height of the stacks of items and which are driven by each their drive motor so that the grinding cylinders may be rotated in each their direction of rotation, which grinding cylinders are suspended in a turning ring by a trolley which is displaceable in the transverse direction relative to a support beam displaceable along a rollerpath for the stacks of items and a fixation device for the stacks of items arranged along the rollerpath, and where there is used a compu-

terised, combined electronic and pneumatic control system, where that the programming of the control computer occurs manually by moving a registering wheel for the respective grinding cylinders along the external edges of the item stacks so that the grinding cylinders of the grinding apparatus subsequently automatically may perform the desired edge grinding, as suitable means for regulating pressure controlled pressing of the grinding cylinders against the outer edges of the stacks of items are used. In a simple way it hereby becomes possible to mechanise the work connected with edge grinding of stacks of plate items of any shape, including laminboards with concave sections, and implying bad working environment.

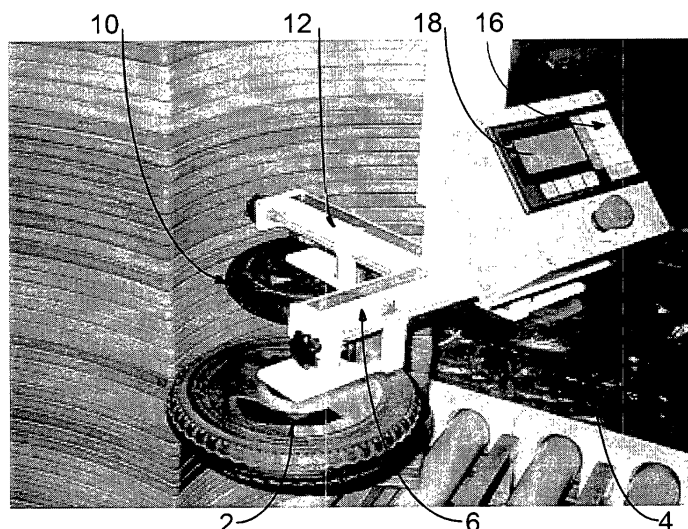


Fig. 4

Description

[0001] The present invention concerns a method for edge grinding of plate items in a vertical stack, e.g. laminboards, where a grinding apparatus is used, comprising a number of vertical shafts for a number of abrasive rollers forming vertical grinding cylinders with a length adapted to the height of the stacks of items and which are driven by each their drive motor so that the grinding cylinders may be rotated in each their direction of rotation, which grinding cylinders are suspended in a turning ring by a trolley which is displaceable in the transverse direction relative to a support beam displaceable along a rollerpath for the stacks of items and a fixation device for the stacks of items arranged along the rollerpath, and where there is used a computerised, combined electronic and pneumatic control system.

[0002] A very large number of laminboards are used in the production of furniture like shelves and bookcases. The laminboards are varnished several times, and an intermediate grinding is to be performed as the surface of the laminboards "rises" by the first varnishing. Usually the laminboards are placed in stacks which are advanced by rollerpaths between the respective varnishing and grinding stations where varnishing and edge grinding is performed manually. Even if protective equipment is used to some extent in connection with the manual varnishing work, e.g. facial mask with breathing protection, the working environment is bad.

[0003] The edge grinding itself which until now also has been performed by means of manual grinding equipment, also implies a serious work environmental strain, as the grinding equipment, even if it is suspended in a resilient carrying strap system and connected with a suction hose, is relatively heavy to operate because the pressing against as well as the lateral movement of the grinding equipment (grinding roller of abrasive strips and intermediate support brushes) along the stack of items occur manually.

[0004] The fact that the grinding work occurs manually furthermore has negative influence on the quality of the grinding work which, in order to achieve a uniform quality, requires very precisely controlled grinding movements in addition to using a certain direction of rotation, namely so that the co-rotating grinding roller (having same direction of rotation and displacement), from being moved inward against the edges of the stack, is moved horizontally outward past the end edges of the plate items.

[0005] The invention is a further development of and is associated with the prior art disclosed in EP-A2-1 034 882 which describes an apparatus for edge grinding plate items in a vertical stack, e.g. laminboards.

[0006] The method according to the invention is characterised in that programming of the control computer occurs by means of a separate registering carriage which is arranged to perform the same pattern of movement as the grinding cylinders, and which has a regis-

tering wheel representing the respective grinding cylinders and preferably a further registering wheel representing a vertical row of air nozzles, where the registering wheel is moved manually along selected sections of the outer edges of the stacks of items so that the grinding cylinders subsequently are performing the same pattern of movement for performing the desired edge grinding and final blowing off of grinding dust, as suitable means for regulating pressure controlled pressing of the grinding cylinders against the outer edges of the stacks of items are used.

[0007] In a simple way it hereby becomes possible to mechanise the work implying working environment detrimental to the operators and connected with edge grinding of stacks of plate items of any shape, including laminboards with concave sections, and to simplify the programming of the control computer.

[0008] The programming may be performed by the machine operator without any knowledge of programming computers by means of a registering carriage with two registering wheels, each positionally representing two grinding cylinders rotating in each their direction of rotation, and with a third registering wheel representing a vertical row of air nozzles which are situated in the middle between the grinding cylinders and serve to blow the outer edges of the items in the stack of items free from grinding dust. The respective registering wheels, each representing a grinding cylinder with a certain direction of rotation, is moved with wheel contact along the external contour of the item stack as the exact pattern of movement is simultaneously registered by impulse counters so that positional co-ordinates of the registering wheel arrangement is registered concurrently. The direction of rotation of the grinding cylinders along sections of the stack of items may furthermore be controlled by means of a keyboard comprising a display which shows the current position co-ordinates for the registering wheel arrangement at any time.

[0009] The invention also concerns an apparatus for edge grinding plate items in a vertical stack, e.g. laminboards, and comprising a number of vertical shafts for a number of abrasive rollers forming vertical grinding cylinders with a length adapted to the height of the stacks of items, and which are driven by each their drive motor so that the grinding cylinders may be rotated in each their direction of rotation, the grinding cylinders being suspended by a turning ring by a trolley which is displaceable in the transverse direction of a support beam displaceable along a rollerpath for the stacks of items and a fixation device for the stacks of items arranged along the rollerpath, and where there is used a computerised, combined electronic and pneumatic control system, where the apparatus is peculiar in comprising a separate registering carriage which is arranged to perform the same pattern of movement as the grinding cylinders, and which has a registering wheel representing the respective grinding cylinders and preferably a further registering wheel representing a vertical row of air

nozzles, registering wheels being arranged to be moved manually with roller contact along selected sections of the outer edges of the stacks of items with the purpose of programming a control computer for the apparatus so that the grinding cylinders subsequently are performing the same pattern of movement for performing the desired edge grinding and final blowing off of grinding dust, as suitable means for regulating pressure controlled pressing of the grinding cylinders against the outer edges of the stacks of items are used.

[0010] The apparatus according to the invention is suitably designed so that the said means for regulating pressure controlled pressing of the grinding cylinders are constituted by mechanical setting screws with measuring rulers for each of the registering wheels so that the actual location of the point of contact of the registering wheels with the side of the stack of items representing the effective periphery of the grinding cylinders may be preset in dependence on empirical parameters such as type of coating, degree of hardening of coating, rigidity of grinding cylinders, grinding capacity of grinding cylinders etc.

[0011] The apparatus according to the invention may be arranged with particular advantage so that in connection with the registering wheel arrangement, the apparatus comprises a keyboard with display for providing control information such as current rotational speed and for showing current location co-ordinates. In a particularly simple way, the separate registering carriage may comprise impulse counters for registering the current position and configuration of the current stack of items.

[0012] In order to ensure optimal holding of the stack of items, the apparatus according to the invention may advantageously be thus designed so that at both sides of the rollerpath on which the stack of items is placed during the grinding process, the apparatus comprises holding cylinders that each are arranged to interact with elevating clamping members situated between the rollers of the rollerpath for lifting free the stack of items while this is held by the holding cylinder located at the side of the stack which faces away from the side ground, i.e. the holding cylinder at the opposite side is automatically deactivated when the grinding cylinder is finished with one side.

[0013] The invention is explained in more detail below in connection with the drawing, on which:

Fig. 1 shows a view of an embodiment of a registering wheel arrangement in an apparatus according to the invention, as seen from the back side of the registering wheel arrangement,

Fig. 2 shows a view of a transom with transversely movable carriage for a support rod for a registering wheel in an apparatus according to the invention,

Fig. 3 shows a view of the registering wheel arrange-

ment of Fig. 1 with one of the registering wheels in contact with a corner of a stack of items, as seen from the front of the registering wheel arrangement,

5 Fig. 4 shows a view of the registering wheel arrangement of Fig. 1 with a third registering wheel in contact with a curved end part of an item stack,

10 Fig. 5 shows a view of the registering wheel arrangement of Fig. 1 with a second registering wheel in contact with an end part of a vertical stack of items, and

15 Fig. 6 shows a view of an upper part of a grinding cylinder arrangement in an apparatus according to the invention.

[0014] In Fig. 1 is seen a registering wheel arrangement comprising two registering wheels 2 and 4, each representing respective vertical grinding cylinders (Fig. 6), and which is mounted on arms 6 and 8 extending end-to-end. A third registering wheel 10 is mounted on an arm 12 which is perpendicular to the arms 6 and 8. The registering wheel 10 is representing a vertical row of pressurised air nozzles which are placed at the middle between the grinding cylinders and which are intended for blowing grinding dust away after the grinding operation. The registering wheel arrangement is suspended in a vertical support arm which upwardly, as shown in Fig. 2, is connected with a separate registering carriage 14 that may be displaced in transverse direction on a transom which may be displaced along a rollerpath for vertical stacks of laminboards to be ground at the edges. The registering wheel arrangement is suspended in such a way that its pattern of movement corresponds completely to the pattern of movement of the associated grinding cylinders, as the registering wheel arrangement is intended for use in programming the associated control computer.

[0015] The machine operator may, without any knowledge of programming the control computer, perform the needed pre-programming by means of the registering wheels arrangement, the movement of which during the programming movements are automatically registered by impulse counters situated on the separate registering carriage, as the operator simultaneously may supplement with certain control commands by means of a keyboard 16 with display 18, which, for example, may show the current positional co-ordinates.

[0016] Most clearly appearing from Figs. 3 and 4, the registering wheels 2 and 4 are marked with arrows corresponding to the direction of rotation of the associated grinding cylinders, i.e. the left registering wheel 2 and the corresponding grinding cylinder are rotating clockwise, whereas the right registering wheel and the associated grinding cylinder rotates counterclockwise.

[0017] It is very important that the direction of rotation

of the grinding cylinders is correct, particularly when grinding out over an end edge of a side where the direction of rotation of the grinding cylinder, in order to avoid damage at the ends, has to be co-rotating compared with the displacing movement.

[0018] The presetting of the registering wheels 2, 4 and 10 occurs manually by means of the carrier arms 6 and 8 being telescopic and comprises a longitudinal setting screw with pointer and ruler so that the current position of the contact point of the registering wheels, which is representative for the position of the active grinding surface of the grinding cylinders, may be adjusted at any time, e.g. under consideration of different parameters like type of varnish, degree of hardening of varnish, rigidity of grinding cylinders, grinding capacity of grinding cylinders, etc.

Claims

1. A method for edge grinding of plate items in a vertical stack, e.g. laminboards, where a grinding apparatus is used, comprising a number of vertical shafts for a number of abrasive rollers forming vertical grinding cylinders with a length adapted to the height of the stacks of items and which are driven by each their drive motor so that the grinding cylinders may be rotated in each their direction of rotation, which grinding cylinders are suspended in a turning ring by a trolley which is displaceable in the transverse direction relative to a support beam displaceable along a rollerpath for the stacks of items and a fixation device for the stacks of items arranged along the rollerpath, and where there is used a computerised, combined electronic and pneumatic control system, **characterized in that** the programming of the control computer occurs by means of a separate registering carriage which is arranged to perform the same pattern of movement as the grinding cylinders, and which has a registering wheel representing the respective grinding cylinders and preferably a further registering wheel representing a vertical row of air nozzles, where the registering wheel is moved manually along selected sections of the outer edges of the stacks of items so that the grinding cylinders subsequently are performing the same pattern of movement for performing the desired edge grinding and final blowing off of grinding dust, as suitable means for regulating pressure controlled pressing of the grinding cylinders against the outer edges of the stacks of items are used.
2. An apparatus for edge grinding of plate items in a vertical stack, e.g. laminboards, and comprising a number of vertical shafts for a number of abrasive rollers forming vertical grinding cylinders with a length adapted to the height of the stacks of items, and which are driven by each their drive motor so that the grinding cylinders may be rotated in each their direction of rotation, the grinding cylinders being suspended by a turning ring by a trolley which is displaceable in the transverse direction of a support beam displaceable along a rollerpath for the stacks of items and a fixation device for the stacks of items arranged along the rollerpath, and where there is used a computerised, combined electronic and pneumatic control system, **characterized in** comprising a separate registering carriage which is arranged to perform the same pattern of movement as the grinding cylinders, and which has a registering wheel representing the respective grinding cylinders and preferably a further registering wheel representing a vertical row of air nozzles, registering wheels being arranged to be moved manually with roller contact along selected sections of the outer edges of the stacks of items with the purpose of programming a control computer for the apparatus so that the grinding cylinders subsequently are performing the same pattern of movement for performing the desired edge grinding and final blowing off of grinding dust, as suitable means for regulating pressure controlled pressing of the grinding cylinders against the outer edges of the stacks of items are used.
3. An apparatus according to claim 2, **characterized in that** the means for regulating pressure controlled pressing of the grinding cylinders are constituted by mechanical setting screws with measuring rulers for each of the registering wheels so that the actual location of the point of contact of the registering wheels with the side of the stack of items representing the effective periphery of the grinding cylinders may be preset in dependence on empirical parameters such as type of coating, degree of hardening of coating, rigidity of grinding cylinders, grinding capacity of grinding cylinders etc.
4. An apparatus according to claim 2, **characterized in that** in connection with the registering wheel arrangement, the apparatus comprises a keyboard with display for giving control information such as current rotational speed and for showing current location co-ordinates.
5. An apparatus according to claim 2, **characterized in that** the separate registering carriage comprises impulse counters for registering the current location and configuration of the current stack of items.
6. An apparatus according to claim 2, **characterized in that** at both sides of the rollerpath on which the stack of items is placed during the grinding process, the apparatus comprises holding cylinders that each are arranged to interact with elevating clamp-

ing members situated between the rollers of the rollerpath for lifting free the stack of items while this is held by the holding cylinder located at the side of the stack which faces away from the side ground, i. e. the holding cylinder at the opposite side is automatically deactivated when the grinding cylinder is finished with one side.

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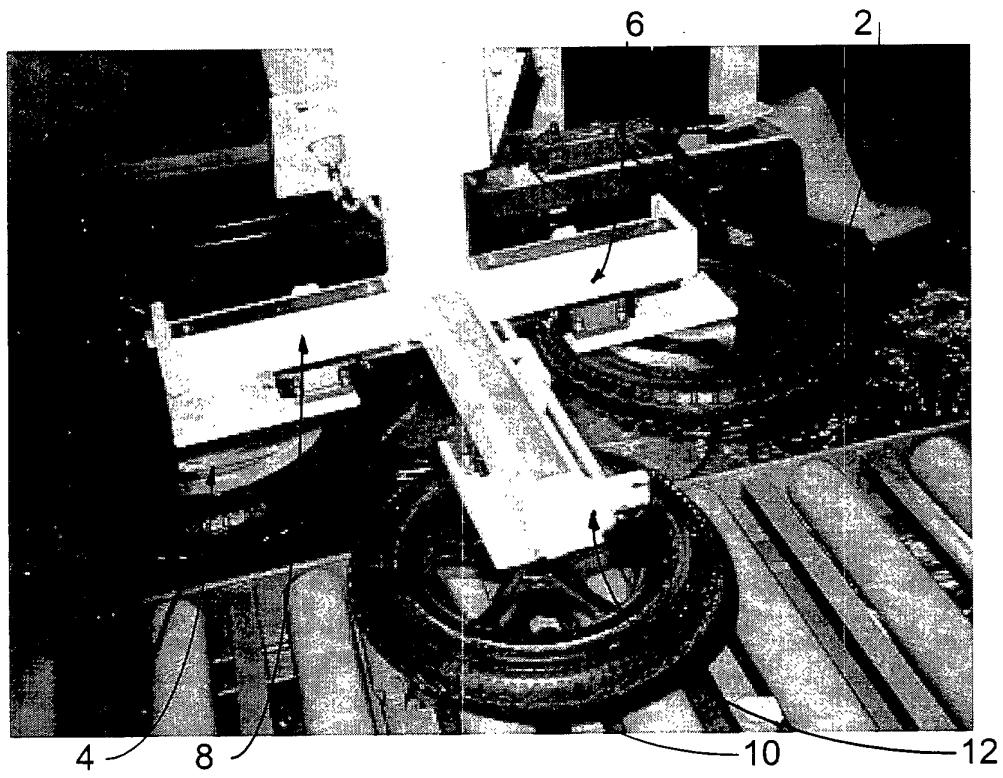


Fig. 1

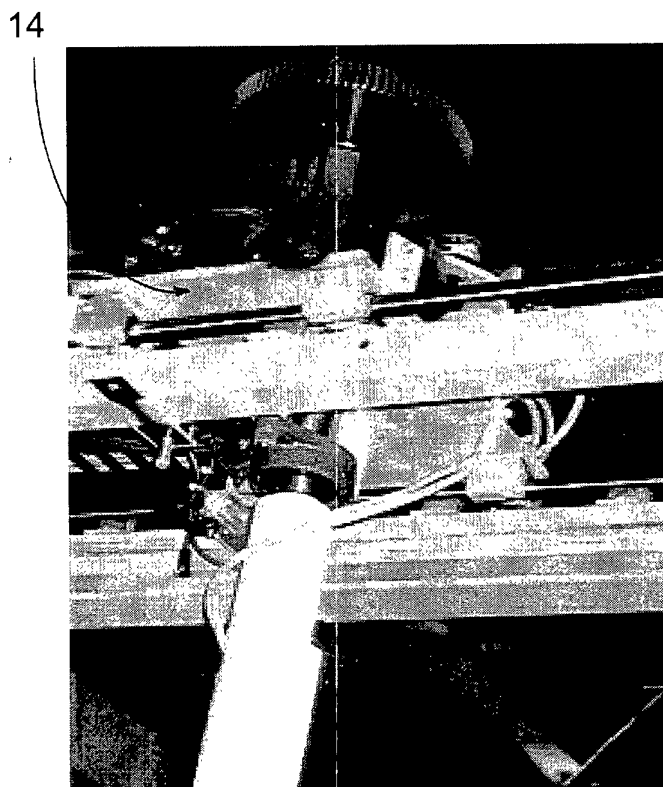


Fig. 2

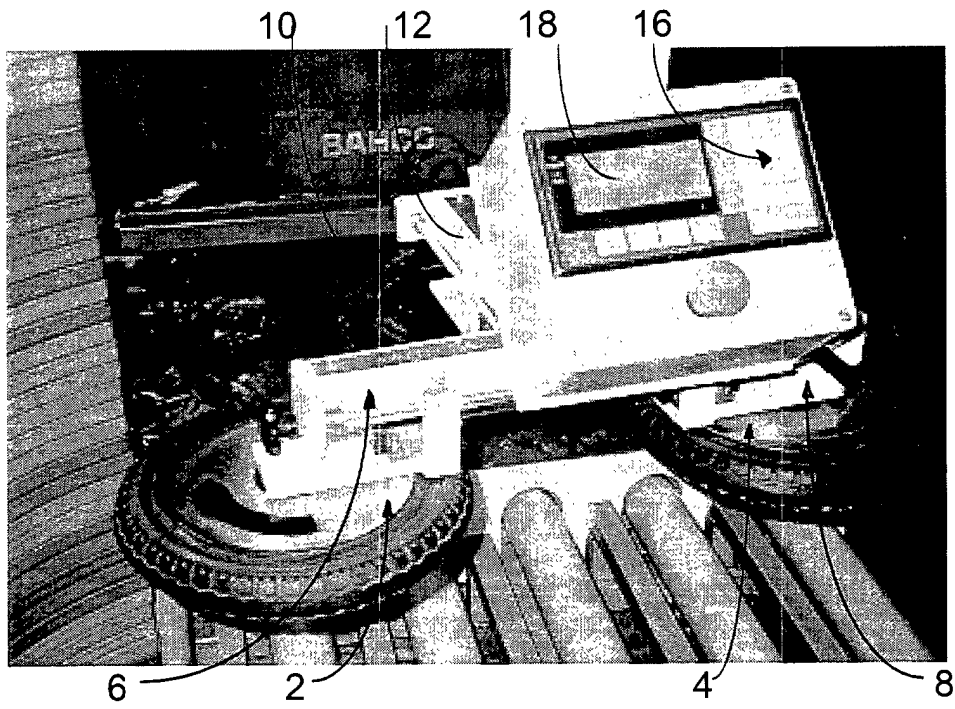


Fig. 3

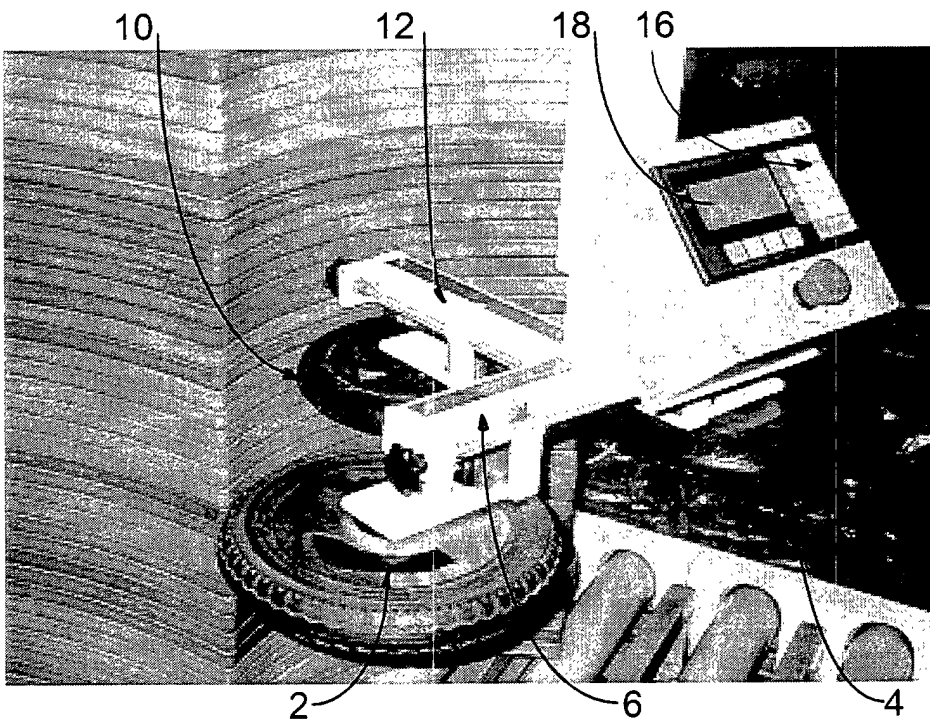


Fig. 4

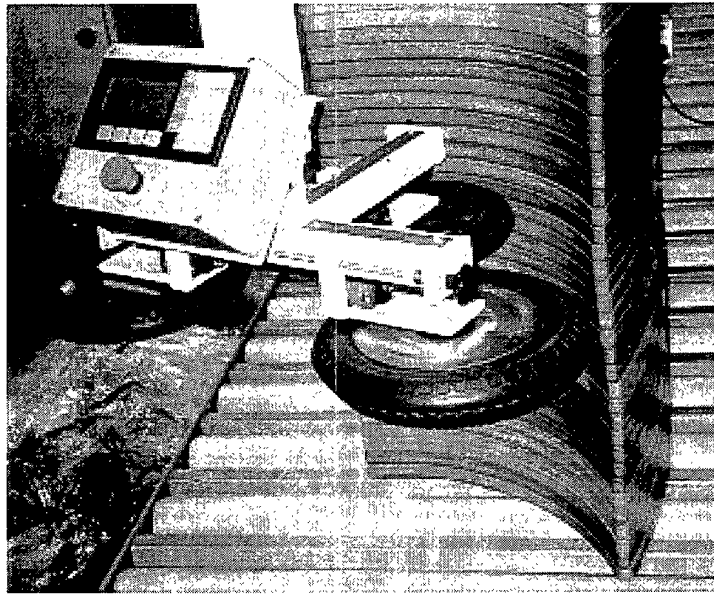


Fig. 5

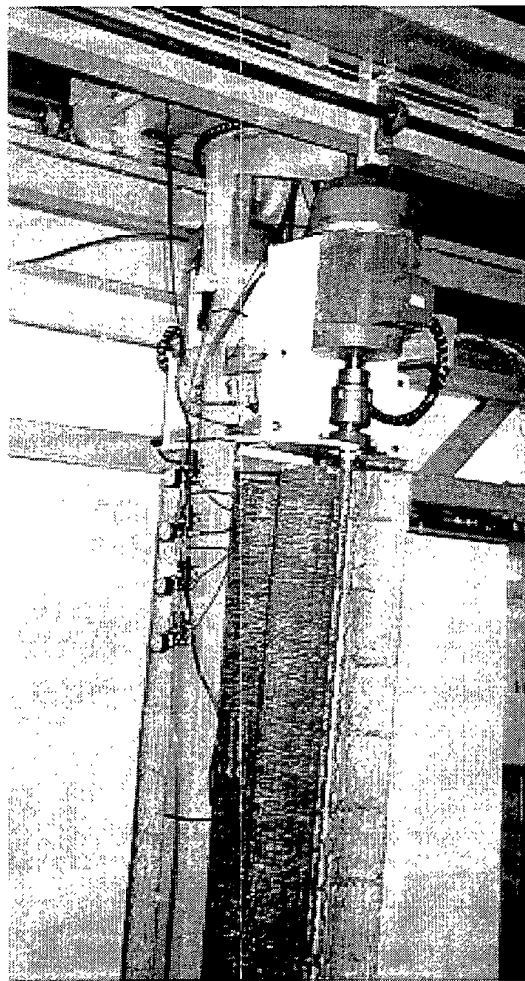


Fig. 6