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(54) **Finishing machine and method for sections made of wood or wood substitute material**

(57) Finishing machine (10) and method for sections (11) comprising a work station (13, 33) that carries out a surface finishing on the section (11), and a guide unit (16) disposed upstream and in cooperation with the work station (13, 33), to determine and guide the positioning of the section (11) with respect to the work station (13, 33) and keep it in a determinate operating position. The guide unit (16) comprises one or more actuator members (20, 21, 22) disposed transversely with respect to a direction of feed of the section (11), to assume a first presetting configuration, in which they are at a determinate distance from the section (11), according to a predetermined range or family of sizes to which the section (11) being worked belongs, and a second specific setting configuration, subsequent to the first configuration, in which they contact the lateral surfaces of each section (11), to keep it in the determinate operating position.

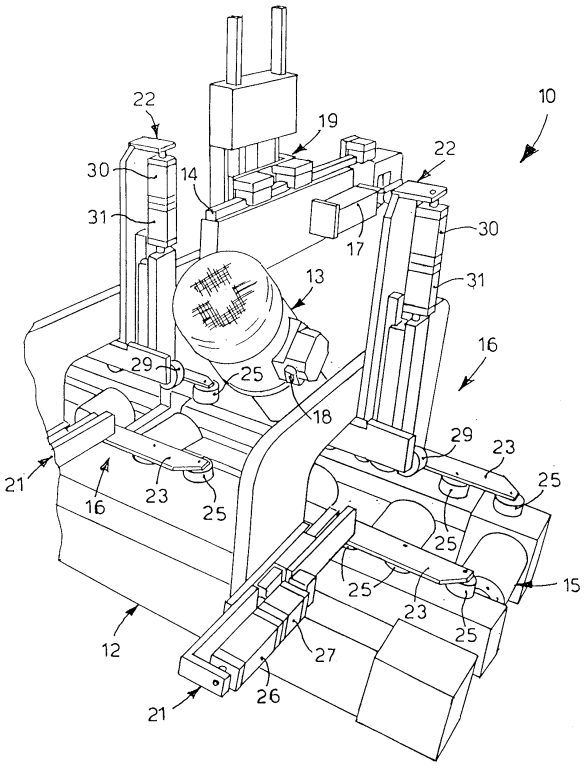

fig. 3

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a finishing machine, such as a sanding machine or a brushing machine, or similar automatic machine, able to perform finishing operations on an object, such as a section or suchlike, made of wood material, or wood substitute material, for example plywood or chipboard, MDF or other. In particular, the machine according to the invention comprises a plurality of work stations disposed in line, which can be for example sanding, brushing painting stations or other.

BACKGROUND OF THE INVENTION

[0002] A machine is known, for finishing sections made of wood material, or wood substitute material, which comprises feed means, to feed forward the section to be finished along a reference plane.

[0003] The machine also comprises one or more work stations mounted in line on the base, along the reference plane, at a determinate distance from each other, in order to finish longitudinally the external surfaces of the section.

[0004] Generally speaking, some of the work stations are able to sand or brush the external surfaces of the section, while others are able to paint or, more in general, to coat the sanded sections.

[0005] Upstream and in cooperation with each work station, this type of known machine also comprises one or more guides and/or one or more positioning pressure elements, of the adjustable type.

[0006] The guides and the positioning pressure elements act externally on the section to be finished, to determine a desired operating orientation and axial positioning of the section with respect to the work station.

[0007] Finishing machines are known, in which the adjustment of the position of the guides and the pressure elements is carried out manually, and on each occasion in a specific manner, depending on the sizes and shape of the sections to be finished.

[0008] This type of known machine provides long and complex steps of preliminary set-up.

[0009] Therefore, in order to reduce the downtimes between the working of different sections, production is normally organized in predefined series of sections according to size.

[0010] The known machines require that each series is worked completely and that it comprises sections having substantially standardized and repetitive sizes and shapes.

[0011] There is a growing need on the market to work a large number of sections which have different sizes and shapes on each occasion, so as to allow a subsequent personalized and specific application of the finished sections.

[0012] To this end finishing machines with a numerical control are known, in which a processor is programmed to specifically prepare the positioning of the guides, the pressure elements and/or the work stations, depending on the sizes of the section to be worked.

[0013] This type of known machine needs numerous high-precision electromechanical control and movement systems, such as ball screws, brushless motors, position transducers, photocells, microprocessors and other.

[0014] The use of this electromechanical equipment in known machines entails very high costs, both of production and of management, and requires highly specialized personnel for the programming and maintenance interventions.

[0015] Therefore, said numerical control machines are used exclusively for productions which provide working in series for several thousands of sections per day.

[0016] One purpose of the present invention is to achieve a finishing machine for a section or suchlike, which has lower production and management costs than known machines with numerical control and which, at the same time, allows to work in sequence a large number of sections having different sizes and shape on each occasion.

[0017] Another purpose of the present invention is to achieve a finishing machine that does not require long set-up times for its components, depending on the sizes of the section to be worked.

[0018] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0019] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0020] In accordance with said purpose, a finishing machine for sections according to the present invention comprises at least a work station able to perform surface finishing on the section. The machine also comprises a guide and pressing unit disposed upstream and in cooperation with the work station, to determine and guide the positioning of the section with respect to the work station and to keep it in a determinate operating position.

[0021] According to a characteristic feature of the present invention, at least the guide and pressing unit comprises one or more actuator members disposed transverse and lateral with respect to a direction of feed of the section. The actuator members are able to assume at least a first pre-setting configuration, in which they are at a determinate distance from the section, according to a predetermined range or family of sizes, to which the section being worked belongs.

[0022] Furthermore, the actuator members of the guide and pressing unit are able to assume at least a second specific setting configuration, after the first con-

figuration. In the second configuration, the actuator members contact the lateral surfaces of each section, to keep it in the determinate operating position.

[0023] In this way, by establishing in advance determinate ranges of size which include different types of sections, the machine according to the present invention can be quickly and easily set so that the actuator members assume for every range a predetermined first presetting configuration.

[0024] In the first configuration, the guide unit is suitable to manipulate and guide all the sections that come within the chosen range of sizes, even if individually the sections have different sizes from each other.

[0025] Indeed, starting from the first configuration, as each individual section passes, the actuator members move to the second specific setting configuration, contacting the section laterally.

[0026] The actuator members thus adapt to the size and shape of the section being worked, without interrupting production.

[0027] In this way, with the machine according to the present invention, it is possible to work in sequence sections with different shapes and sizes, without requiring specific set ups on each occasion.

[0028] With the present invention it is possible to use actuator members of a pneumatic or electro-pneumatic type. The use of actuator members of this type allows to further bring down the costs of production and of management, of intervention and of maintenance

[0029] According to a variant, the work station also comprises actuator members, which allow to move at least the operating part of the work station, according to the specific size and shape of the section to be finished.

[0030] To this purpose, sensor means are advantageously provided, able to detect the position of the actuator members of the guide unit in the second setting configuration, and to command the consequent actuation of the actuator members of the work station, to align the latter with the position assumed by the guide unit.

[0031] According to another variant, the actuator members of the guide unit comprise two lateral thrusters able to guide the section laterally, and at least a pressure element able to keep the section pressed from above.

[0032] Both the lateral thrusters and the pressure element are disposed in directions substantially transverse to the direction of feed of the section.

[0033] According to another variant, at least a first lateral thruster assumes, in said first configuration, a reference position, while a second lateral thruster moves near the section until it contacts it laterally in the second configuration.

[0034] In this solution, the second lateral thruster substantially functions as a feeler and, on each occasion, adapts its positioning according to the sizes of the section.

[0035] According to another variant, at least one of either the first lateral thruster or the second lateral thruster comprises two thrust cylinders, commanded individually, so as to actuate respectively the pre-setting movement and the specific setting movement.

[0036] In this way, the entity of the travel for each movement is reduced, since the positioning times are reduced, and therefore the machine according to the invention has greater productivity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 shows schematically a lay-out of a finishing machine for sections according to the present invention;
- fig. 2 shows schematically an example of how the machine in fig. 1 functions;
- fig. 3 shows schematically an enlarged detail of the finishing machine in fig. 1;
- fig. 4 shows schematically a front view of the machine in fig. 1, in a first operating condition;
- fig. 5 shows schematically a front view of the machine in fig. 1, in a second operating condition;
- fig. 6 shows schematically a front view of the machine in fig. 1, in a third operating condition.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0038] With reference to the attached drawings, a machine 10 according to the present invention is applied for finishing sections 11 made of wood, destined for the production of uprights and crosspieces for frames and casings of doors or windows, skirting boards, sections for furnishing elements or other.

[0039] For the sake of simplicity, in the attached drawings the section 11 is always shown with a quadrangular cross section, but it cannot be excluded that the machine 10 and the method according to the present invention can equally be applied for working sections 11 with a cross section of a different shape.

[0040] In particular, the machine 10 according to the present invention comprises a support frame 12 on which a plurality of work stations 13 are mounted, in this case brushing stations.

[0041] The support frame 12 also provides a transport member 15, in this case rollers, and a plurality of guide stations 16, disposed upstream of and in cooperation with each work station 13.

[0042] The cooperation between the guide stations 16 combined with a relative work station 13 determines a substantial modularity of the machine 10, with all the advantages that such a modularity normally entails.

[0043] The transport member 15 allows to transport the sections 11 from one to the other of the work stations

13, passing through the relative guide stations 16 in a determinate direction of feed.

[0044] The rollers which, in this case, make up the transport member 15, are rotatably mounted on the support frame 12, basically on the opposite side with respect to the corresponding work station 13, so as to contrast better the brushing action on the section 11.

[0045] Each work station 13 is of the substantially traditional type, and can be selectively oriented and positioned with respect to the transport member 15, to define different brushing conditions on the sections 11.

[0046] In particular, each work station 13 is mounted on the support frame 12 and is selectively movable with respect to the latter by means of two linear thrusters, respectively a first horizontal 17 and a second vertical 19.

[0047] Advantageously, to better distribute and support the weight of the components of the work station 13, to increase the functionality of its movement and to limit vibrations to a minimum, each work station 13 is mounted sliding on the support frame 12 by means of respectively linear guides 14.

[0048] Both the first horizontal thruster 17 and the second vertical thruster 19 are of the pneumatic type and are commanded, in a substantially traditional manner, by means of electro-valves.

[0049] The first horizontal thruster 17 is conformed to move the corresponding work station 13 transversely with respect to the transport member 15, on a substantially horizontal plane.

[0050] The second vertical thruster 19 is conformed to move the corresponding work station 13 nearer to or away from the transport member 15, on a substantially vertical plane.

[0051] The possibility is not excluded of actuating a possible combination of movements between the first horizontal thruster 17 and the second vertical thruster 19, to determine a diagonal movement from or toward the transport member 15.

[0052] Each work station 13 also comprises a sensor member 18, electronically connected to the first horizontal thruster 17 and/or the second vertical thruster 19, and able to detect the actual position of the relative guide station 16, to command a consequent movement of the work station 13.

[0053] Each guide station 16 comprises two lateral thrusters, respectively a first 20 and a second 21, and a vertical pressure element 22.

[0054] The sensor member 18 of the work station 13 is able in this case to detect the actual position both of the first thruster 20 or the second thruster 21, and also of the vertical pressure element 22.

[0055] Both the first thruster 20, the second thruster 21, and also the vertical pressure element 22 are able to act in corresponding directions substantially transverse to the direction of feed of the section 11, to keep the latter in a desired condition of operating alignment with the relative work station 13.

[0056] The first thruster 20 and the second thruster 21 are opposite each other with respect to the direction of feed of the section 11.

[0057] The first thruster 20 and the second thruster 21 are substantially identical to each other. Therefore, for the sake of simplicity, hereafter we shall describe only the first thruster 20, with the description also referring to the second thruster 21.

[0058] The first thruster 20 comprises a thrust bar 23 facing toward the transport member 15 and provided with a plurality of rubber wheels 25 able to contact the lateral surfaces of the section 11.

[0059] The first thruster 20 also comprises two pneumatic cylinders, respectively first 26 and second 27, operatively connected to the thrust bar 23, to define two independent movement travels.

[0060] The vertical pressure element 22 comprises a pair of rubber wheels 29 normally disposed above the section 11 and able to contact the upper surface thereof, to keep it adherent to the transport member 15.

[0061] The vertical pressure element 22 also comprises two pneumatic cylinders, respectively first 30 and second 31, operatively connected to the rubber wheels 29, to define two independent movement travels.

[0062] Furthermore, the vertical pressure element 22 is mounted sliding with respect to the support frame 12, by means of an eyelet 39. In this way, as shown in fig. 6, the vertical pressure element 22 can be moved laterally to be positioned in correspondence with the section 11 to be finished.

[0063] The machine 10 according to the invention also comprises a suction pipe 32, disposed below the transport member 15 and able to suck in from below the wood dust generated by brushing the sections 11.

[0064] Between the work stations 13 provided in the machine 10, in this case, a painting station is also provided, indicated in its entirety by the reference number 33, and provided with two tanks of paint 35, selectively interchangeable with other tanks of other paints, and with a plurality of paint guns 36.

[0065] The paint guns 36 can be connected with specific horizontal and vertical thrusters, not shown in detail and of the type described above for the other work stations 13, so as to move the guns 36 according to the position of the lateral thrusters 20, 21 and the vertical pressure element 22 of the relative guide station 16.

[0066] In this way, the painting of the sections 11 is also managed according to the characteristics of the present invention.

[0067] Advantageously, the machine 10 according to the present invention also comprises a command and control unit 37, such as for example a PLC or suchlike, able to control and coordinate the functioning of the various electric, electronic and pneumatic components of the machine 10.

[0068] The command and control unit 37 comprises electronic memorization means on which different presetting configurations are memorized, which the user can select even in sequence.

[0069] With reference to figs. 1 and 2, the machine 10 as described heretofore functions as follows.

[0070] The sections 11 are grouped together and divided into determinate ranges of size, indicated with the Roman numerals I, II, III, IV, V, VI and VII.

[0071] For each range of size an equal number of pre-setting configurations of the lateral thrusters 20 and 21 and of the vertical pressure element 22 is prepared, which configurations are programmed in the command and control unit 37.

[0072] In each pre-setting configuration memorized in the command and control unit 37, the lateral thrusters 2 and 21 and the vertical pressure element 22 assume determinate reciprocal positions, such as to allow the passage of any one of the sections 11 coming within the relative range of size.

[0073] For example, as shown in fig. 2, by setting for each lateral thruster 20 and 21 and for the vertical pressure element 22 determinate positioning travels, indicated by the letters A, B, C and D, it can be seen how for working sections in range I, the lateral thrusters 20 and 21 and the vertical pressure element 22 are initially all taken to the respective positions A.

[0074] For working sections in range II, the lateral thrusters 20 and 21 and the vertical pressure element 22 are initially taken respectively to the positions A, A and B.

[0075] For working sections in range III, the lateral thrusters 20 and 21 and the vertical pressure element 22 are initially taken respectively to the positions B, A and D.

[0076] For working sections in range IV, the lateral thrusters 20 and 21 and the vertical pressure element 22 are initially taken respectively to the positions A, B and A.

[0077] For working sections in range V, the lateral thrusters 20 and 21 and the vertical pressure element 22 are initially taken respectively to the positions A, B and B.

[0078] For working sections in range VI, the lateral thrusters 20 and 21 and the vertical pressure element 22 are initially taken respectively to the positions B, B and C.

[0079] For working sections in range VII, the lateral thrusters 20 and 21 and the vertical pressure element 22 are initially taken respectively to the positions D, B and B.

[0080] It is clear that, depending on the specific shapes and sizes of the sections 11 to be finished, different combinations can be provided of the position of the lateral thrusters 20 and 21 and the vertical pressure element 22.

[0081] All the above examples of the movement of the lateral thrusters 20 and 21 and the vertical pressure element 22 are actuated by the relative first pneumatic cylinders 26 and 30.

[0082] From this first pre-setting configuration, the sections 11 belonging to the corresponding size range are loaded in sequence onto the transport member 15.

[0083] Once the presence of the section 11 has been detected, the lateral thrusters 20 and 21 and the vertical pressure element 22 are commanded by the command and control unit 37 to assume a second specific setting configuration.

[0084] In this configuration, the lateral thrusters 20 and 21 and the vertical pressure element 22 take the relative rubber wheels 25 and 29 into contact with corresponding external surfaces of the section 11.

[0085] In this case, the lateral thruster 20 stays still and functions as an abutment, while the lateral thruster 21 and the vertical pressure element 22 move transversely and in the direction of the section 11 until they come into contact.

[0086] This specific setting movement is actuated by the respective second pneumatic cylinders 27 and 31.

[0087] The rubber wheels 25 and 29 can be stopped in the ideal position of contact against the relative external surfaces of the section 11 by means of various known methods.

[0088] For example, the pneumatic pressure of the relative second cylinder 27, 31 is limited so that the contact under pressure of the rubber wheels 25 and 29 against the section 11 is sufficient to stop the movement, and prevent the accidental movement of the section 11.

[0089] According to a variant, upstream of the relative second pneumatic cylinder there is a pressure switch provided, or other instrument to measure the pressure, which according to the difference in pressure detected, commands the movement to stop.

[0090] The use of first and second pneumatic cylinders 26, 27 and 30, 31, to actuate movement between the pre-setting position and the specific setting position allows, on the one hand, to reduce the losses of load of the pneumatic cylinders 26, 27 and 30, 31 and, on the other hand, to have more reactive actuation times, reducing to a minimum the positioning times.

[0091] Once the setting position has been reached, the sensor member 18 detects the position of the nearest lateral thruster 20 and 21, and/or the vertical pressure element 22, so as to command a correlated actuation of the horizontal thruster 17 and/or the vertical thruster 19, to suitably move the work station 13.

[0092] In this way, the work station 13 is also moved, on each occasion, in a specific manner, depending on the actual sizes of the section 11, without requiring prior set-ups and/or interruptions to the work.

[0093] When working is completed, the lateral thrusters 20, 21 and the vertical pressure element 22 are repositioned in the first pre-setting configuration, to wait for a new section 11 of the same size range.

[0094] In this way, even if the new section has sizes different from the first, the lateral thrusters 20, 21 and the vertical pressure element 22 adapt to the sizes of the latter, without requiring interruptions to the operating of the machine 10.

[0095] An example of what has been described heretofore is shown in sequence in figs. 4, 5 and 6.

[0096] It is clear, however, that modifications and/or additions of parts or steps may be made to the machine 10 and method as described heretofore, without departing from the field and scope of the present invention.

[0097] It is also clear that, although the present invention has been described with reference to specific exam-

ples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of finishing machine and method for sections made of wood material, or wood substitute material, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Finishing machine for sections (11) comprising at least a work station (13, 33) able to carry out a surface finishing on the section (11), and a guide unit (16) disposed upstream and in cooperation with said work station (13, 33), to determine and guide the positioning of the section (11) with respect to said work station (13, 33) and keep it in a determinate operating position, **characterized in that** at least said guide unit (16) comprises one or more actuator members (20, 21, 22) disposed transversely with respect to a direction of feed of the section (11), and able to assume at least a first pre-setting configuration, in which they are at a determinate distance from the section (11), according to a predetermined range or family of sizes to which the section (11) being worked belongs, and at least a second specific setting configuration, subsequent to the first configuration, in which they contact the lateral surfaces of each section (11), to keep it in the determinate operating position.

2. Machine as in claim 1, **characterized in that** said work station (13) comprises relative actuator members (17, 19), which allow to move at least part of said work station (13), depending on the size and specific shape of the section (11) to be finished.

3. Machine as in claim 2, **characterized in that** said work station (13) comprises sensor means (18), able to detect the position of the actuator members (20, 21, 22) of said guide unit (16) in the second setting configuration, and to command the consequent actuation of said actuator members (17, 19) of the work station (13), to align the latter with the position assumed by the guide unit (16).

4. Machine as in any claim hereinbefore, **characterized in that** said actuator members (20, 21, 22, 17, 19) are of the pneumatic type.

5. Machine as in any claim hereinbefore, **characterized in that** said actuator members (20, 21, 22) of the guide unit (16) comprise at least two lateral thrusters (20, 21) able to guide the section (11) laterally, and at least a pressure element (22) able to keep the section (11) pressed from above.

6. Machine as in claim 5, **characterized in that** at least a first lateral thruster (20) is able to assume, in said first configuration, a reference position for the section (11), while a second lateral thruster (21) and said pressure element (22) are able to move nearer to said section (11) until they contact it laterally in said second configuration.

7. Machine as in claim 5 or 6, **characterized in that** at least one of said lateral thrusters (20, 21) comprises two thrust cylinders (26, 27), commanded individually, in order to actuate, respectively, the pre-setting and specific setting movement.

8. Machine as in claim 5, 6 or 7, **characterized in that** said pressure element (22) comprises two thrust cylinders (30, 31), commanded individually, in order to actuate, respectively, the pre-setting and specific setting movement.

9. Machine as in any claim hereinbefore, **characterized in that** it also comprises a command and control unit (37) of the programmable type and able to control and coordinate the functioning of the various electric, electronic and pneumatic components of said machine (10).

10. Machine as in claim 9, **characterized in that** said command and control unit (37) comprises electronic memorization means on which one or more pre-setting configurations are memorized, usable depending on the different size ranges of the sections (11).

11. Finishing method for sections (11), wherein at least a work station (13, 33) carries out a surface finishing on the section (11), and a guide unit (16) disposed upstream and in cooperation with said work station (13, 33) determines and guides the positioning of the section (11) with respect to said work station (13, 33) and keeps the section (11) in a determinate operating position, **characterized in that** it comprises at least a first pre-setting step, in which one or more actuator members (20, 21, 22) of said guide unit (16) are disposed transversely with respect to a direction of feed of the section (11), and assume a first pre-setting configuration, in which they are at a determinate distance from the section (11), according to a predetermined range or family of sizes to which the section (11) being worked belongs, and a second specific setting step, subsequent to the first step, in which the actuator members (20, 21, 22) contact the lateral surfaces of each section (11), to keep it in the determinate operating position.

12. Method as in claim 11, **characterized in that** it comprises a third step of alignment, in which at least part of said work station (13) is moved by relative actuator members (17, 19) depending on the sizes and specific shape of the section (11) to be finished.

13. Method as in claim 12, **characterized in that** in said third step of alignment the actuation of said actuator members (17, 19) is effected to align the work station (13) with the position assumed by the guide unit (16) in the second step, said position being detected by sensor means (18) of the work station (13).

14. Method as in any claim from 11 to 13, **characterized in that** in said first step at least a first lateral thruster (20) of said actuator members of the guide unit (16) assumes a reference position for the section (11).

15. Method as in any claim from 11 to 14, **characterized in that** in said second step a second lateral thruster (21) and a pressure element (22) of said actuator members of the guide unit (16) move nearer to said section (11) until they contact it laterally.

16. Method as in any claim from 11 to 15, **characterized in that** in said first step said actuator members (20, 21, 22) are moved into said first pre-setting configuration by means of first thrust cylinders (26, 30).

17. Method as in any claim from 11 to 16, **characterized in that** in said second step the actuator members (20, 21, 22) are moved into the second specific setting configuration by means of second thrust cylinders (27, 31).

18. Method as in any claim from 11 to 17, **characterized in that,** before said first step, by means of a command and control unit (37) of the programmable type and able to control and coordinate the functioning of the various electric, electronic and pneumatic components of said machine (10), one or more pre-setting configurations are selected, depending on the different ranges of size of the sections (11).

19. Command and control unit of the programmable type and able to control and coordinate the functioning of the various electric, electronic and pneumatic components of a finishing machine as in any claim hereinbefore, **characterized in that** it comprises electronic memorization means on which one or more pre-setting configurations are memorized, usable depending on the different ranges of size of the sections (11).

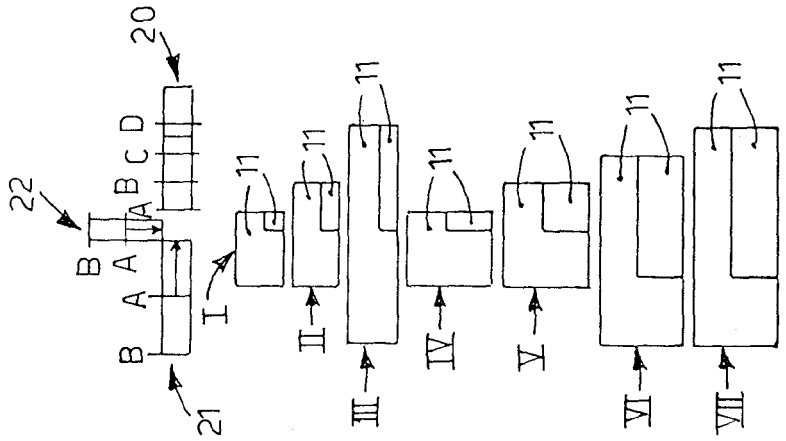
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fig. 2

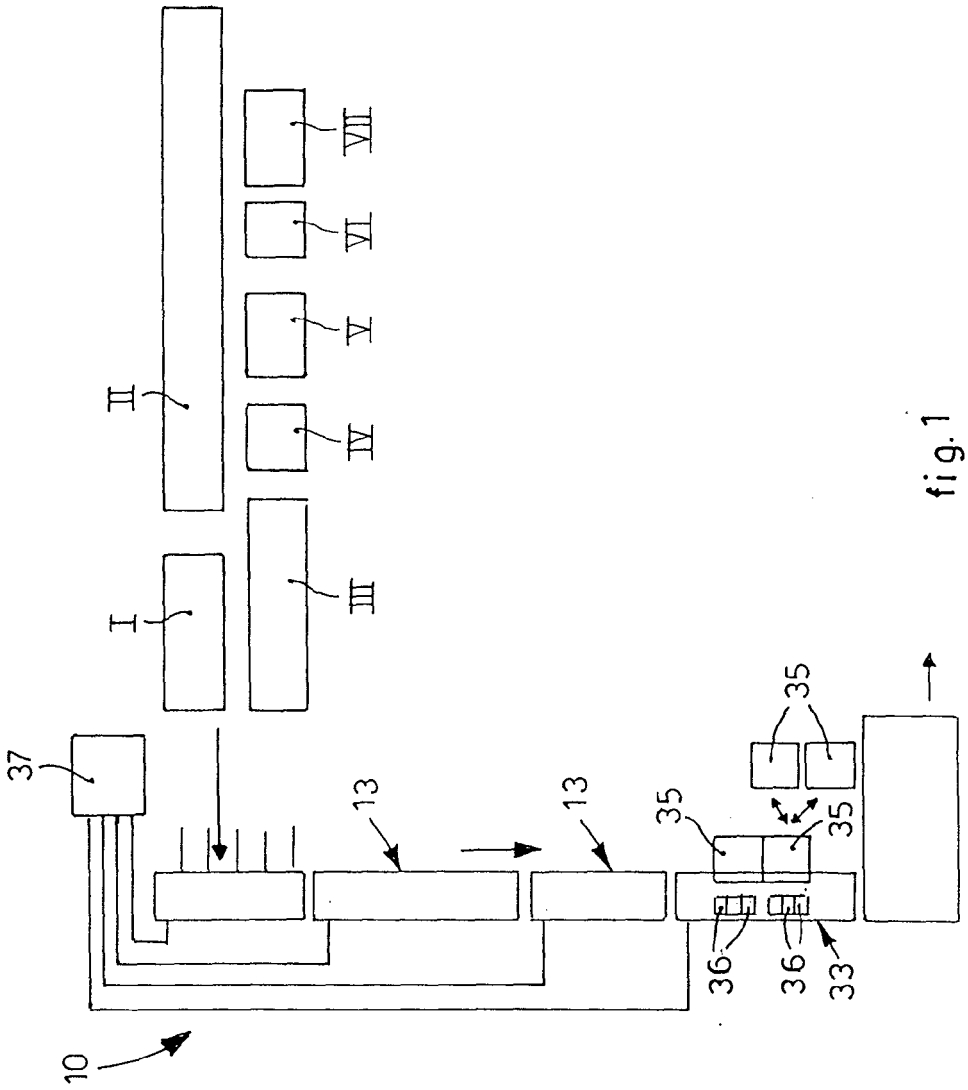
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fig. 1

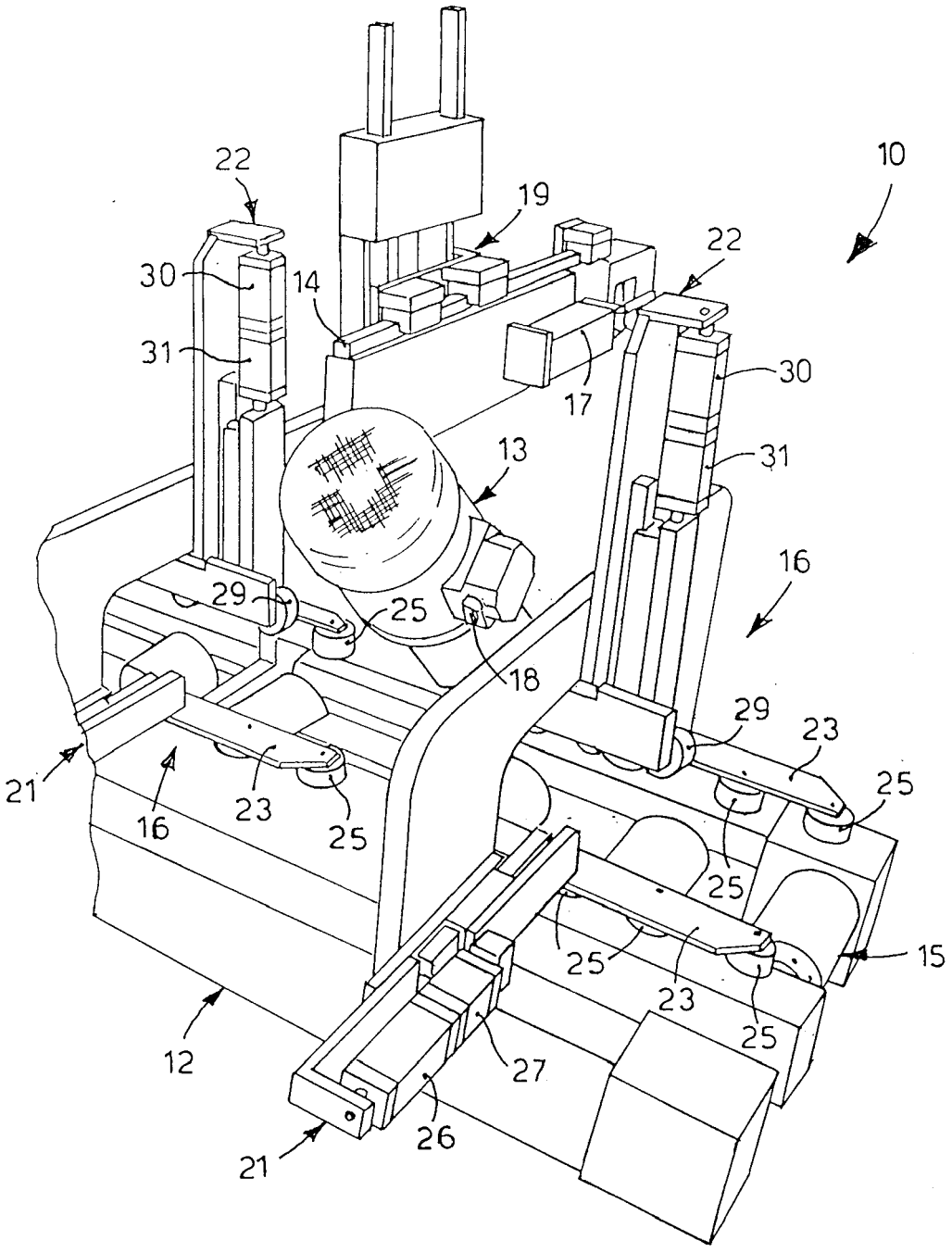
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fig. 3

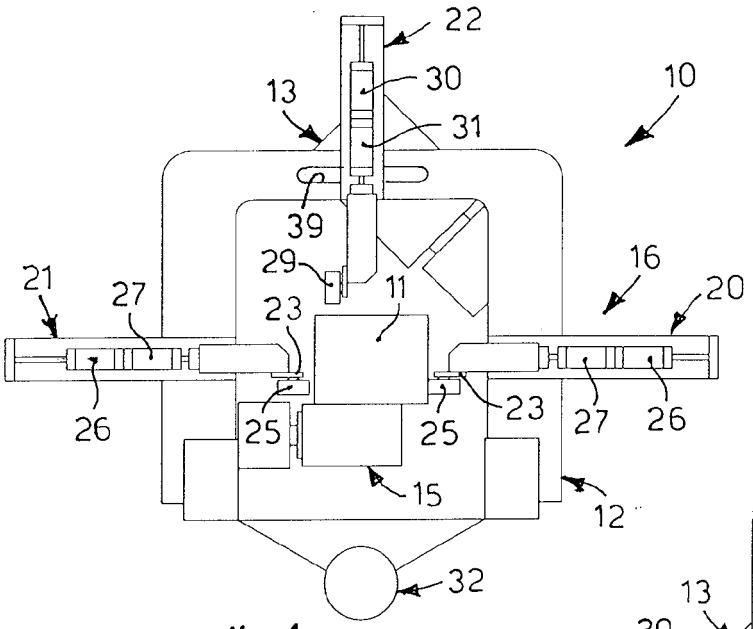

fig.4

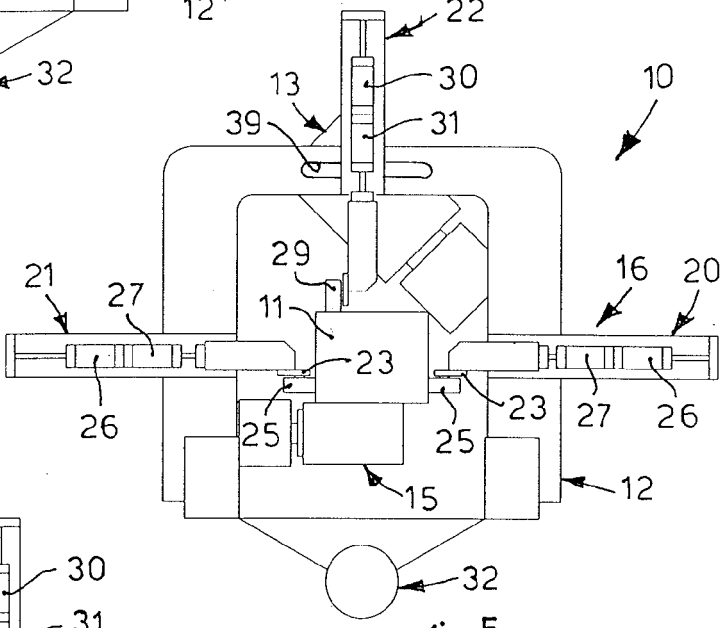

fig.5

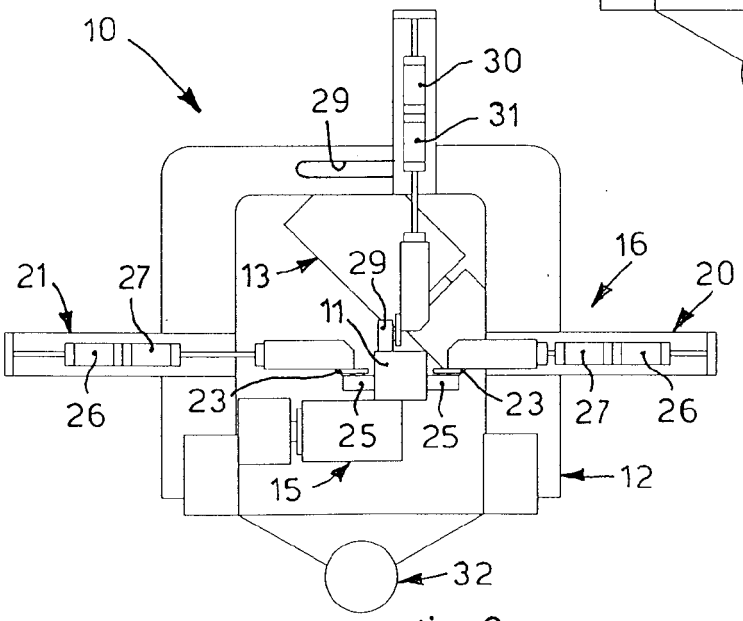

fig. 6