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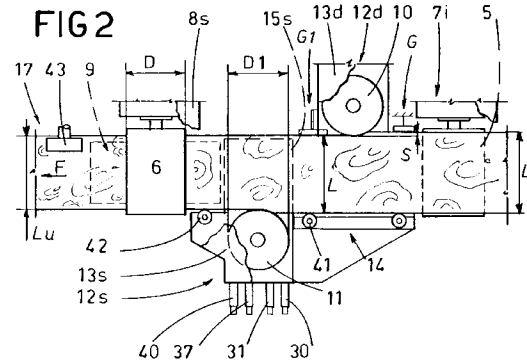
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**A molding machine for woodwork.**

The machine has a first and a fourth tool (5, 6) for working respectively the lower horizontal and the upper horizontal surfaces of a workpiece (3) and a second and a third tool (10, 11) destined to work right and left vertical surfaces of the same workpiece (3); each of the tools is supported by corresponding slides (7, 12) aimed at varying the operative distance of the tool in an orthogonal direction to the plane to be worked on; each tool is equipped with a covering casing (8, 13) equipped with guides (6, 61) and pressing organs (9, 14) aimed at permitting of guiding and stabilising the workpieces (3); the vertical tools are equipped with a mobile meeting plane (15) for the workpiece (3) and regulating means (16) acting on the casing (13), on the tool (11) and on the plane (15) in such a way as to permit of varying, in consequential series on the workpieces and with independent actions, the distanced from the work plane according to a second reference diameter (D1) of the tools and the breadth (L) of the workpiece (3).



The invention relates to a molding machine used in the working of wood.

In the field of design and production of machines for the working of wood, and in particular molding machines, there is continual research for ways of improving the work quality of the machines, their precision and the speed with which the non-machine operative positioning operations can be carried out.

In the case of the abovementioned machines, that is in machines predisposed for the working of all four faces of a plank of wood arriving from a feeding line, it has been noted that the tool-change times (or for a change of wood-shape) are very long and the work is laborious: the tools used, which are in the elementary and classic conformation of one for each side of the plank (with some variants for the types of work to be done), are arranged along a horizontal work plane. Drawing wheels (rubber or steel) are interpositioned between the tools and have their rotation axes parallel to the work plane and are connected in motion one to another by a posterior cross-piece: these wheels have the function of drawing the workpiece along the operative advancement direction, feeding it continuously to the tools.

The tools (which, along the feeding line are respectively defined as the lower horizontal, the right vertical, the left vertical and the upper horizontal) are covered by a protection casing also functioning as an aspirator of the sawings, and are equipped, each bilaterally and outside the casing, with pressing elements to maintain the workpiece in a guided position before, during and after its working; more precisely, the front presser is arranged in an inclined position to invite the workpiece towards the tool, while the posterior presser is positioned parallel to the plane and is at a distance from the plane depending on the thickness the finished workpiece is to have.

Recently it has been noted that the substitution of one or more of these tools, for a change of shape or profile, is lengthy and laborious: the operator must substitute the tools after removal of the protection casing, disengaging it with respect to the posterior cross-piece which supports it; then the operator must set the new tool on the same work plane (according to its new diameter), by means of special handwheels and using graduated scales situated on the machine itself, with which scales it is possible to control, by varying, the distance and/or the height of the rotation axis of the tool from the work plane. Once this phase has been carried it is then necessary to reposition the casing according to the new size and dimensions of the new workpiece.

Thus it can be seen from the preceding summary description, that the substitution of each single tool brings about a work time which is rather long on the part of the operator, apart from the fact that the precision of the repositioning of the new tool and the pressers (casings) depends, in a great number of cas-

es, on the operator's experience.

To this end the present Applicant made an improvement in a molding machine (see Patent Application IT-3518A/90) in which it was envisaged that each of the tools is supported by a relative positioning slide, mobile in an orthogonal direction to the work plane for the positioning of the tool, and is equipped with a casing to which the pressing organs are solidly and laterally connected, which casing is equipped with regulation means acting between the casing and the slide, which regulation means can vary the distance with respect to the work plane according to the reference diameter of the tool with a reading device associated to slide able to indicate, on a digital reading scale, the values of the relevant distances.

Thanks to this improvement, the molding machine is more rapid and precise in the positioning of the tools, in in the change of shape, and works with a considerable precision. As often happens, however, the improvement influences the design of the machine it derives from, giving rise to "hybrid" machines with costs that are relatively high.

The aim of the present invention is thus to eliminate the above-mentioned drawbacks by providing a molding machine for wood workpieces which is precise, rationalised with regard to all of the tool- and shape-change operations, so as to enable an improvement in the relative work operations.

The technical characteristics of the invention, according to the above-mentioned aims, emerge clearly from the contents of the following claims, and the advantages of the invention will become more evident during the detailed description that follows, made with reference to the enclosed drawings, which represent an embodiment which is purely in the form of a non-limiting example, and in which:

- figure 1 shows, in a schematic side-view with some parts removed better to evidence others, the molding machine object of the invention;
- figure 2 shows, in a schematic plan view from above, with some parts removed in order better to evidence others, the machine of figure 1;
- figure 3 shows, in a side view with some parts in section and other removed in section, a detail of a tool of the machine of the preceding figures;
- figures 4 and 5 show respectively in a plan view from above and lateral with some parts removed in order better to evidence others, and other parts in section, a further tool of the machine of the previous figures;
- figure 6 shows a kinematic design of the movement groups of the tools of figures 5 and 6.

With reference to the figures, the molding machine in question is of the type which works on four sides of a plank of wood and comprises (see in particular figures 1 and 2) a station 1 disposed close to a horizontal reference and transport plane 2 for the

four-sided working of the workpieces 3 supported on a relative base 4; naturally some parts of the machine have not been fully illustrated since they are bearing structures, and some devices used are already very well known.

The station 1 essentially comprises four working tools for the workpieces 3 (see figures 1 and 2) which tools, following the advancement direction of the workpieces 3, (indicated by F in figures 1 and 2), are known as lower horizontal 5, right vertical 10, left vertical 11 and upper horizontal 6; the denomination indicates the side of the workpieces 3 that each single tool works on (or the plane to be worked on itself). Each of these tools is supported by corresponding slides 7i, 7s and 12d, 12s, which are positioned according to the tool supported and which enable the variation of the operative distance in an orthogonal direction to the work plane; apart from the guides 7 and 12, each of these four tools is equipped with a relative casing 8i, 8s and 13d, 13s to cover it.

Pressing organs 9 and 14 are solid bilaterally to the casings 8s and 13s of the relative tools (left vertical 11 and upper horizontal 6), which pressing organs 9 and 14 permit the guiding and stabilising of the workpieces 3 for the relative work operations. The said pressing organs 9 and 14 can be constituted by strip couples 41, 42 for each tool, of which the front strip 41 is inclined with respect to the transport plane 2, while the back strip 42 is parallel with respect to the said transport plane 2 so as to permit the guiding or the invitation or the stabilising of the workpieces 3; while the right vertical tool 10 is equipped with a guide pair, of which one G stops the workpieces 3 and one G1 functions as a mobile reference in such a way as to enable relative variation in the distances according to the thickness of the shaving to be planed off.

In figures 1 and 2 17 denotes roller means arranged over all of the horizontal plane and constrained to a cross-bar T posteriorly disposed with respect to the transport plane 2 and aimed at permitting the drawing of the workpieces 3 from one tool to another. These roller means are constituted by wheels 43, made of steel or rubber, regularly distributed over all of the transport plane 2 so as to permit the workpieces 3 to be drawn.

As can be seen in figure 3, the upper horizontal tool 6 is regulatably mobile on the corresponding slide 7s and is equipped with a casing 8s solid to it to enable a variation to be made in the distance with respect to the plane to be worked on according to a reference diameter D of the tool and a height H of the workpiece 3.

More in detail, the horizontal tool 6 is supported by a vertical column 18, which is arranged posteriorly with respect to the transport plane 2 and is constrained, by means of vertical guides 19 defining the slide 7s, to the base 18; the casing 8s is solidly constrained to the guides 19 and is also superiorly equipped

with a sawdust and shaving aspirator and collector 8t. As can be seen, again in figure 3, the horizontal support shaft 6a of the tool 6 is constrained, through the relative slide supports 20, to the guides 19 so as to permit a relative regulation between the upper horizontal tool 6 and the vertical column 18.

In figures 4 and 5, only the left vertical tool 11 is visible, which is equipped, like the right vertical tool 10, with a mobile arrest plane 15s for the workpiece 3, which is interplaced between the slides 12d and 12s and the tools; the tools 10 and 11 are further equipped with regulation means 16, which act, as regards the left vertical tool 11, on the casing 13s, on the tool 11 and on the said arrest plane 15s, while with regard to the right vertical tool 10 they only act on the tool itself and on the relative plane 15d to enable a variation to be made to both, in consecutive series or independently between successive and preceding, of the distance of the plane to be worked on according to a second reference diameter D1 of the tool 11 and the breadth L (for the upper left) or the breadth S (for the right vertical) of the workpiece 3.

More precisely, the left vertical tool 11, illustrated purely by way of example since the two vertical tools are identical and equipped with the slide 12s having a horizontally-developing base on which the corresponding casing 13s is slidably constrained with relative pressing organs 14: the casing 13s is constrained inferiorly on a parallel relief couple 21 equipping the slide 12s to which a support cylinder 23 of a tool-bearing shaft 11a is slidably constrained, at the end closest to the work plane 2 and in a corresponding seating 22. Obviously the plane 15s interplaced between the casing 13s and the slide 12s, the plane 15s has a greater mass than the slide 12s itself and exhibits a pair of slots 24 for the passage of the relief couple 21 constraining the casing 13s and a circular seating 25 for the passage of the tool-bearing shaft 11a.

The left vertical tool 11 as it is structured equips the above-mentioned regulation means 16, which are constituted (see figures 4 and 5) by a first casing 28 defining a part of the slide 12s; the casing 28 is inferiorly arranged with respect to the transport plane 2 and exhibits a plate 29 equipped with two constraint reliefs 21 of the casing 13s and a first and second horizontal regulation screw 30 and 31: the first of the screws 30 is screwably connected to a corresponding first nut seating 32 exhibited by the said base 4, arranged on the opposite side of the machine with respect to the slide 12s, so as to enable the movement from the outside of the protection casing of all of the casing group 13s and pressing organs 14 - tool 11 - plane 15s; the second screw 31, parallel to the first, is screwably constrained at its internal end to a second nut seating 33 made on a support plate 34 defining the shaft-tool bearing group 11a and is aimed at permitting the movement, independently of the pre-

ceding setting, of the tool 11 - plane 15s group with respect to the casing 13s.

Parallel to the first casing 28 is a second casing 35, arranged by the side of the first casing and rigidly fixed to it and also to the tool-bearing group by means of a rigid central bar 36 which exhibits a third horizontal screw 37 screwably inserted in a relative third nut seating 38 made on a bridge 39 which is rigidly connected to the plane 15s in such a way as to permit a single and independent transversal movement, independent with respect to the tool 11 and to the casing 13s, and transversal with respect to the plane 2. This type of regulating structure is also made in the right vertical tool 10, apart from the first regulating screw 30 of the casing 13d since it is fixed to the slide 12d.

The second casing 35 can also exhibit a fourth regulating screw 40 (illustrated by a broken line in figure 4) parallel to the previous ones and connected to the tool-bearing group 10a and 11a in such a way as to enable an axial height regulation with respect to the work plane 2; such regulation is effected thanks to a kinematic connection between the screw 40 and the tool-bearing shaft 10a and 11a (not illustrated herein since of known type).

The molding machine as it is structured herein functions in the following way: the operator, when he must newly set the machine tools, when a new work operation is about to begin or when a worn tool is to be substituted, merely has to substitute and reposition the lower horizontal 5 and right vertical 10 tools and according to the new dimensions of the workpiece 3, which are functions of the diameters D and D1 of the relative new tools and height H and breadth L of the workpiece 3. The setting is thus effected, after having opened the relative casings 8i, 13d and having substituted the tool 5, 10, the casing is repositioned with respect to the tools (so that the lower strike plane of the mobile guide G1 coincides with the line of the smallest diameter of the tool). Obviously with regard to the right vertical tool there is a plane 15d regulating operation which will be explained together with that for the left vertical. Following this operation, the work plane and the mobile guide G1 are at a distance from the transport plane 2 which, concerning the horizontal tool 5, is equal to the entry height of the workpiece 3 minus the predetermined thickness t to be removed (or  $H_e - t$  of figure 1); regarding the vertical tool 10, the distances are equal to the entry breadth minus the thickness S to be removed, which is also predetermined (or  $L_e - S$  of figure 2). Once this first regulation has been effected, the operator goes on to define the settings of the left vertical tool 11 and those of the upper horizontal tool 6 which define the exit breadth and the exit height of the workpiece 3 from the station 1 (respectively final  $L_u$  and  $H_u$  of the workpiece 3), or the thickness not removed by the preceding tools. Regarding the upper horizontal 6, the phases are the same as the preceding except for the fact

that it is possible subsequently also to regulate the height of the tool-bearing shaft 8sa with respect to the casing 8s.

As for the left vertical tool 11, the regulation happens in three distinct phases, and for greater clarity these movements can be seen in figure 6, wherein the kinematic connection of the various elements is shown schematically: as soon as the tool 11 has been substituted with the new one, and the casing 13s has been reapplied, the operator proceeds to the first regulation of the casing 13s with the relative pressing organs 14 through the first screw 30 which causes the advancing or the retracting (see arrow F1) of all of the casing-tool-plane groups at distance  $L_u$ ; once this operation has been done the operator brings the tool 11 to the edge of the casing (see arrow 2) thanks to the second screw 31 being behind it also the plane 15s, but no longer the casing 13s. Finally the operator proceeds to the definitive setting of the plane 15s by using the third screw 37 (a function of the tool 11 diameter and indicated by F3) so as to arrange the edge of the seating at the edge of the tool 11 so as to permit a better lie of the workpiece 3 in arrival.

Summarising, there occurs a regulation of the elements in series starting from the casing which time by time however distances the just-regulated element so as to enable a faster positioning of the successive elements.

Naturally the operator can further regulate the tools 10 and 11 by acting on the relative fourth regulating screw 40 at the height of the tool 10 and 11 with respect to the work plane 2.

## Claims

1. A molding machine for working wood workpieces on four sides comprising a station (1) disposed near to a horizontal reference and transport plane (2) of the said workpieces (3), supported by a relative base (4), characterised in that said station (1) comprises:
  - a first tool (5) destined to work on a lower horizontal surface of the said workpiece (3) and supported by a corresponding slide (7i) aimed at varying the operative distance of the said tool (5) in an orthogonal direction to a plane to be worked on; the said tool (5) being equipped with a casing (8i) for covering and being regulatably mobile on the corresponding slide (7i) so as to permit of varying the tool (5) with respect to the said plane to be worked on according to a diameter (D);
  - a second tool (10) destined to work on a right vertical surface of the said workpiece (3), supported by a corresponding slide (12d) destined to vary the operative dis-

- tance in an orthogonal direction to the plane to be worked on and equipped with a covering case (13d) bilaterally to which case (13d) are respectively positioned a fixed reference guide (G) for the workpiece (3) and a mobile reference guide (G1) so as to permit of relative variation of the distance according to a thickness (S) of wood to be removed; the second tool (10) being equipped with a mobile meeting plane (15d) for the said workpiece (3) supported by the said slide (12d); regulating means (16) being provided on said slide (12d) and acting on said tool (10) and said meeting plane (15d) so as to permit of varying, in consequential series on the tool (10) and plane (15d) and independently of successive and preceding operations, the distance from the said plane to be worked on according to a second reference diameter (D1) of said tool (10) and said thickness (S) of said workpiece (3);
- a third tool (11) designed to work on a left vertical surface of the said workpiece (3), supported by a corresponding slide (12s) aimed at varying the operative distance in an orthogonal direction to the plane to be worked on and equipped with a covering casing (13s) to which corresponding pressing organs (14) are bilaterally solid; said third tool (11) being equipped with a mobile meeting plane (15s) for said workpiece (3) supported by said slide (12s); regulation means (16) being provided on said third tool (11) and acting on said casing (13s), on said tool (11) and on said plane (15s) in such a way as to permit of varying, in consequential series on the tool (11) and casing (13s) and independently of successive and preceding operations, the distance from the said plane to be worked on according to a second reference diameter (D1) of said tool (11) and a breadth (L) of said workpiece (3);
  - a fourth tool (6) destined to work on an upper horizontal surface of said workpiece (3) and supported by a corresponding slide (7s) aimed at varying the operative distance of the said tool (6) in an orthogonal direction to the plane to be worked on; said tool (6) being equipped with a casing (8s) bilaterally to which pressing organs are solid, which pressing organs (9) are aimed at permitting guiding and stabilising of said workpiece (3) during said working; said tool (6) being regulatably mobile on the corresponding slide (7s) and equipped with said casing (8s) solid to said slide (7s) so as to permit of varying the distances with respect to said plane to be worked on according to a reference diameter (D) of said tool (6) and a height (H) of said workpiece (3);
  - roller means (17) being provided for all said horizontal plane, constrained to a cross-piece (T) which is posteriorly arranged with respect to said plane (2), said roller means (17) being aimed at permitting a drawing of said workpiece (3) from a said tool to another.
2. A molding machine as in claim 1, characterised in that said fourth tool (6) is supported by a vertical column (18) arranged posteriorly with respect to said plane (2) and constrained, by means of vertical guides (19) defining the said slide (7s), to said base (18) and to which tool (6) said casing (8s) is solidly constrained; the horizontal support shaft (6a) of said tool (6) being constrained through relative slide supports (20) to said guides (19) so as to permit of relative regulation between said tool (6) and said column (18).
  3. A molding machine as in claim 1, characterised in that said third vertical tool (11) is equipped with said horizontal-base slide (12s) on which the corresponding casing (13s) is slidably constrained with relative said pressing organs (14); said casing (13s) being inferiorly constrained on a couple of parallel reliefs (21) with which said slide (12s) is equipped; also slidably constrained to said slide (12s), at an end close to said work plane (2) and in a corresponding seating (22), is a support cylinder (23) of a tool-bearing shaft (11a) and, interplated between said casing (13s) and said slide (12s) is said plane (15s), which has a greater mass than that of the slide (12s) and exhibits a pair of slots (24) for the passage of said constraining reliefs (21) of said casing (13s) and a seating (25) for a passage of said tool-bearing shaft (11a).
  4. A molding machine as in claim 1, characterised in that the said regulating means (16) of said second and third tools (10, 11) are constituted respectively for each tool (10, 11) by:
    - a first protection casing (28) defining part of said slide (12d, 12s), arranged inferiorly with respect to said plane (2) and exhibiting a second horizontal regulating screw (31) screwably constrained at an internal end to a second nut seating (339) made on a support plate (34) defining the tool-bearing shaft group (11a) and aimed at permitting of independent movement of the said tool (10, 11) - plane (15d, 15s) group with respect to said casing (13d, 13s);
    - a second protection casing (35) parallel to

the first casing (28) arranged by a side of said first casing (28) and fixed rigidly to it and to said tool-bearing group (10a, 11a) by means of a rigid central bar (36) and exhibiting at least one third horizontal screw (37) screwably inserted in a relative third nut seating (38) made on a bridge (39) rigidly connected to said plane (15d, 15s) so as to permit of a single and independent transversal movement, being independent to said tool (10, 11) and said casing (13d, 13s) and transversal with respect to said plane (2).

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5. A molding machine as in claim 4, characterised in that said first protection casing (28) for regulation of said third tool (11) exhibits a plate (29) equipped with two reliefs (21) for constraining said casing (13s) and a first screw (30) screwably connected to a corresponding first nut seating (32) presented by said base (4), which first screw (30) is arranged on an opposite side with respect to said slide (12s), so as to permit of moving, from outside said protection casing (28), all of the casing (13s) and the pressing organs (14) - tool (11) - plane (15s) group.

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6. A molding machine as in claim 4, characterised in that said second protection casing (35) exhibits a fourth regulation screw (40) which is parallel to the preceding regulation screws and is connected to said tool-bearing group (11a) so as to permit of axial height regulation with respect to said plane (2).

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FIG 1

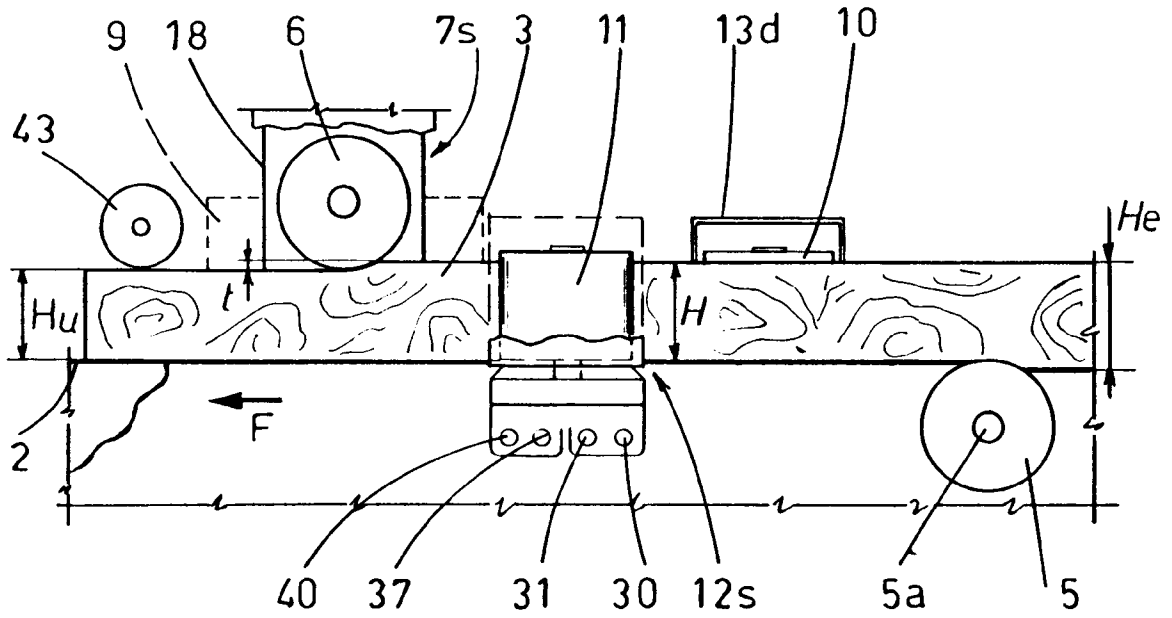


FIG 2

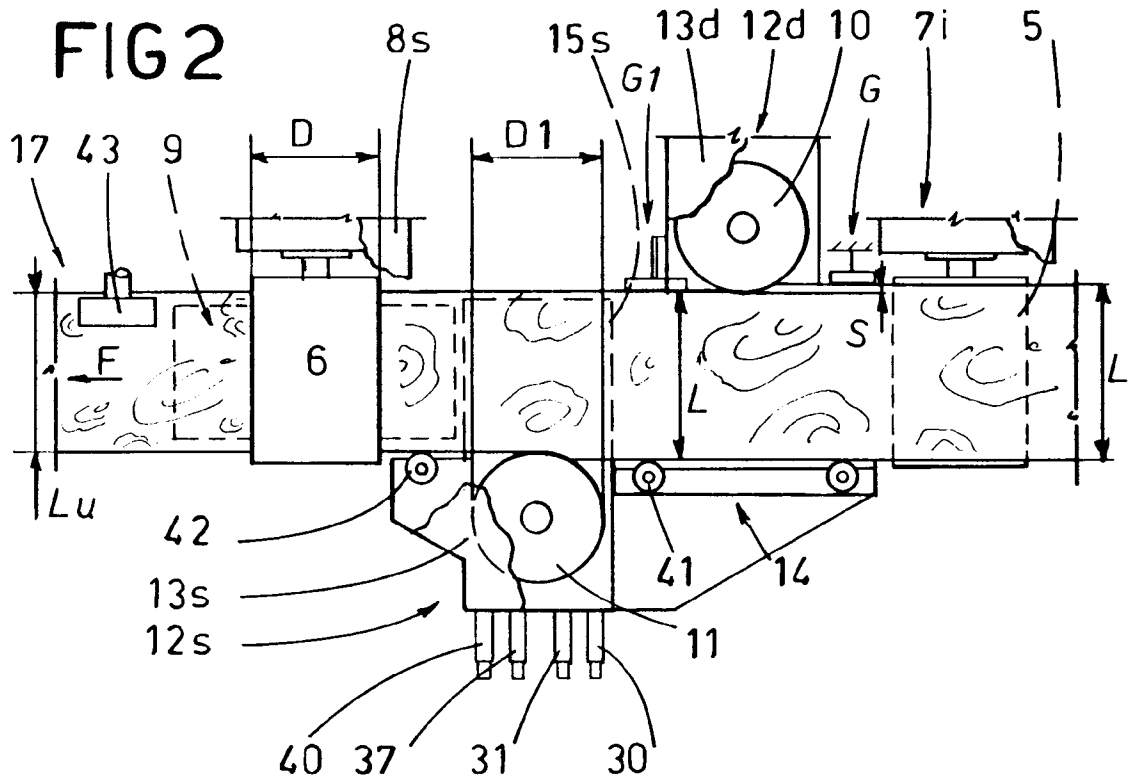


FIG 3

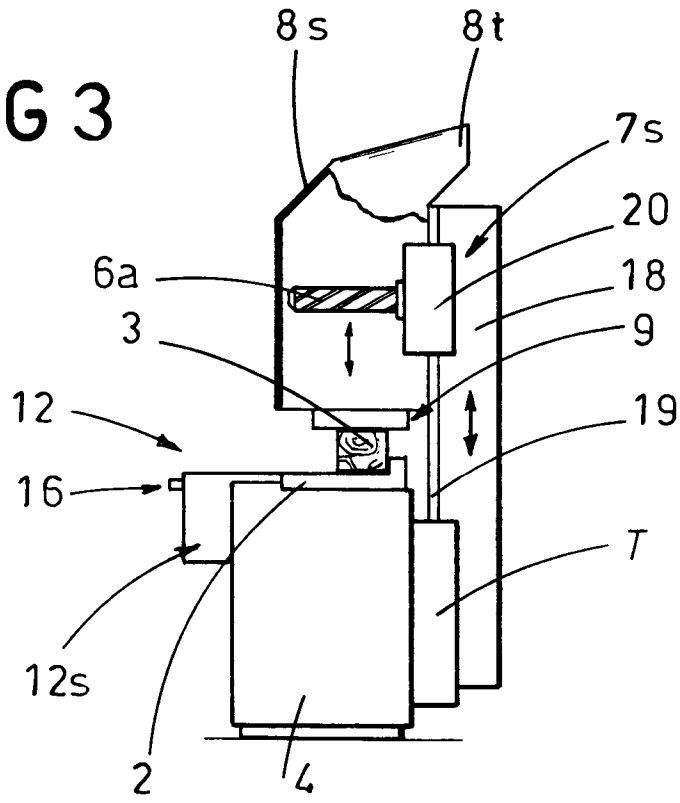
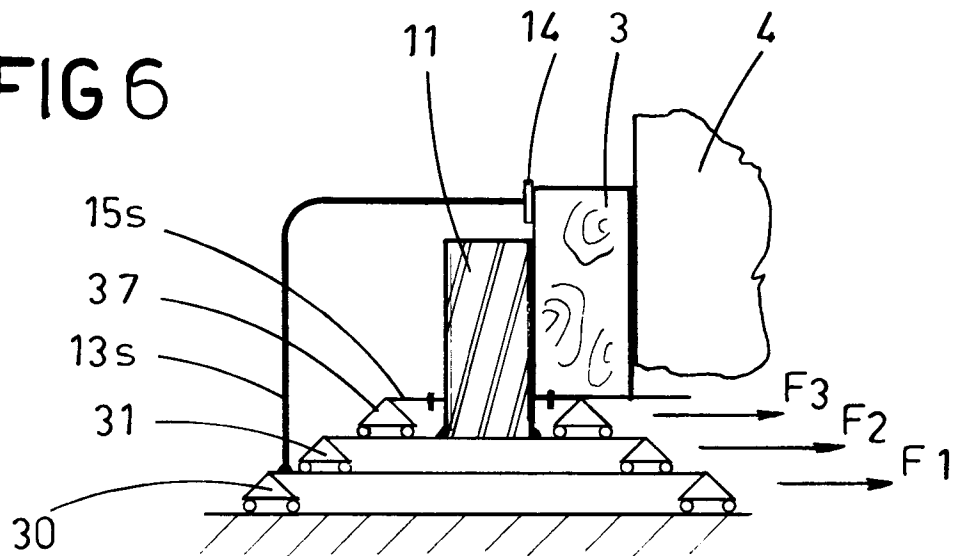


FIG 6



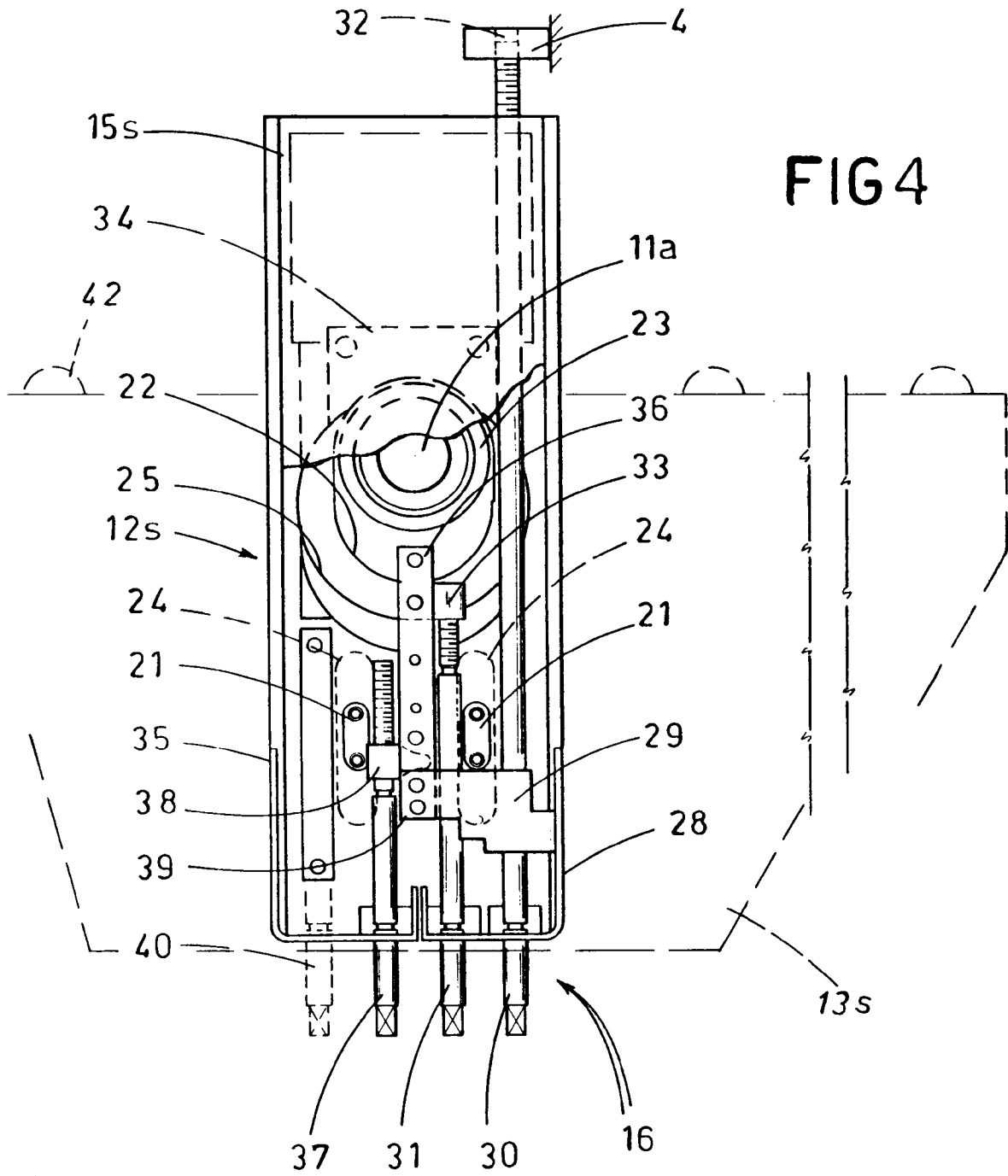
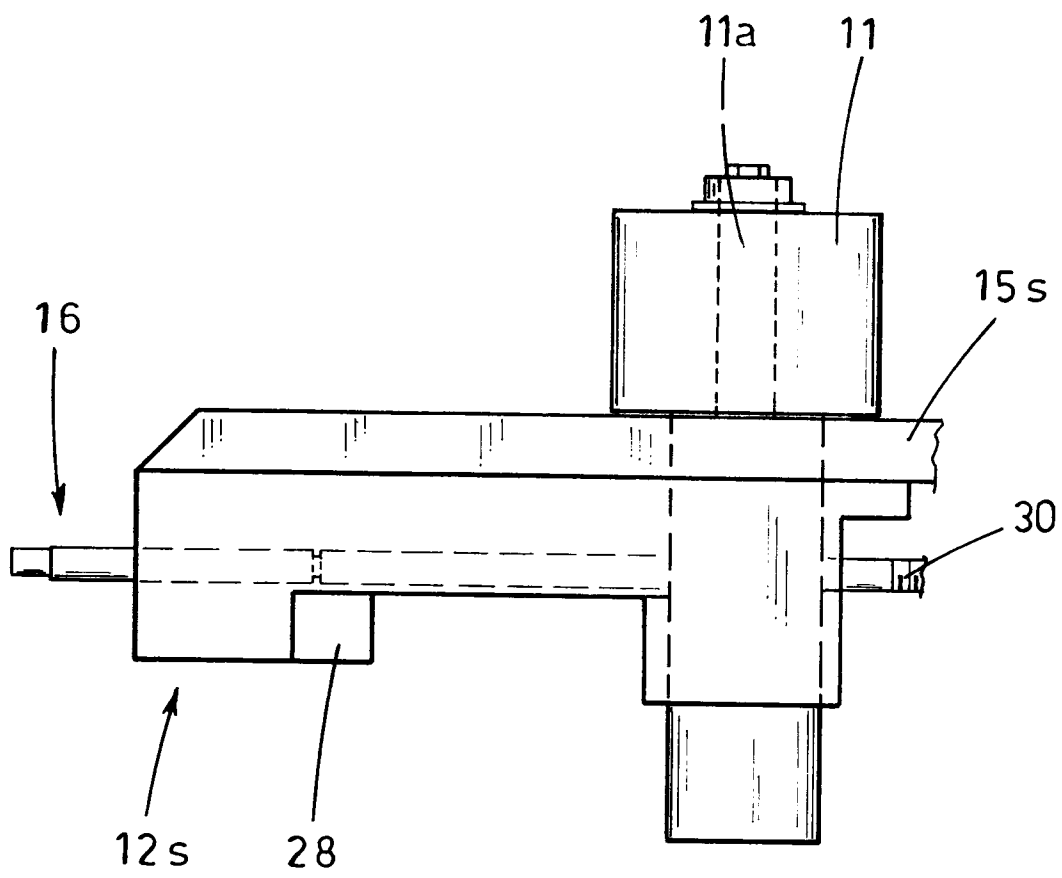


FIG 5





European Patent  
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EUROPEAN SEARCH REPORT

Application Number

EP 93 83 0211

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	EP-A-0 458 002 (SCM) * the whole document * ---	1	B27C1/08 B27F1/06
A	EP-A-0 458 001 (SCM) * the whole document * ---	1	
A	DE-A-3 903 906 (OTTO) ---		
A	DE-A-3 443 398 (REICHENBACHER) ---		
A	EP-A-0 385 056 (HIRSCH) ---		
A	US-A-1 456 864 (BLOOD) ---		
A	US-A-4 457 350 (FINNILA) ---		
A	PATENT ABSTRACTS OF JAPAN vol. 12, no. 478 (M-775)(3325) 14 December 1988 & JP-A-63 200 902 ( PURIMA ) 19 August 1988 * abstract *  -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B27C B27F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 AUGUST 1993	Examiner HUGGINS J.D.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

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