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(54) **Automatic loader of punch holder cartridges and corresponding dies and method for automatic loading of a punch holder cartridge and a corresponding die in respective housings present in a punch press**

(57) Automatic loader (1; 100; 200) of punch holder cartridges (2) and corresponding dies (3) for a punch press (P) of the type comprising a framework (I) provided with a housing (A1) for the punch holder cartridge (2); a base (B) provided with a housing (A2) for the die (3). The automatic loader (1; 100; 200) comprises: a first supporting structure (5; 105); a die holder unit (5a; 105a) combined with the first supporting structure (5; 105); handling means (7; 107) of the die holder unit (5a; 105a) with re-

spect to the first supporting structure (5; 105); a second supporting structure (9; 109); a punch holder unit (9a; 109a) combined with the second supporting structure (9; 109); handling means (11) of the punch holder unit (9a; 109a); displacement means (6; 10; 106) of the first (5; 105) and second supporting structure (9; 109) according to a substantially horizontal direction; supporting means (4; 8; 104) of the first (5; 105) and second supporting structure (9; 109).

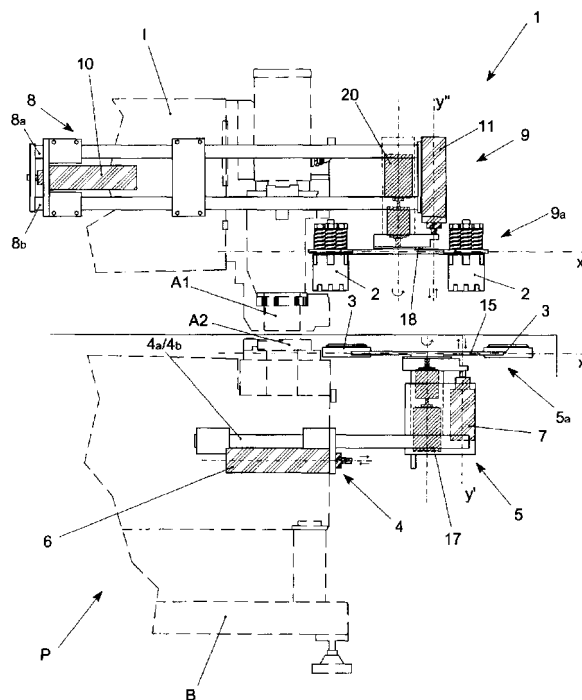


FIG. 1

Description

[0001] The invention concerns an automatic loader of punch holder cartridges and corresponding dies particularly suitable for the loading thereof in respective housings present in a punch press for elements substantially in sheet form.

[0002] The invention furthermore concerns a method for performing said loading.

[0003] It is known that, in the field of machine tools, punch presses are used in particular for machining sheet metal.

[0004] Said punch presses generally comprise a framework, containing a housing for punches, and a base resting on the ground containing a housing for a die corresponding to the punch.

[0005] According to the current state of the art, a first embodiment of said punch presses provides for manual loading of the punches and dies, i.e. of the tools and dies corresponding to said tools, by an operator who takes the tool and the die from a storage space and inserts them in the respective housings in the punch press.

[0006] It is obvious that this type of operation has some acknowledged drawbacks.

[0007] A first of said drawbacks consists in the fact that during machining of the sheet metal, the punch press requires the presence of an operator to replace the punches and dies when necessary.

[0008] A further drawback consists in the fact that the operator's job is tiring due to the effort required for lifting notoriously heavy tools and dies.

[0009] Last but not least, a further drawback consists in the fact that, during said machining, the operator has to be very careful when handling the tools due both to the fact that they can be sharp and because they are heavy and therefore, if they are dropped, they could injure the operator.

[0010] For said purpose different known embodiments of punch presses are known provided with devices for automatic loading of the tools inside the respective housings present on the punch press.

[0011] Said automatic devices are generally able to load punches inside the respective housings in the punch press, taken from a storage space belonging to the automatic loader.

[0012] The loading is performed from the rear side of the punch press or frontally by means of a substantially horizontal movement.

[0013] Said different embodiments, while solving the problem of the necessary presence of an operator beside the machine tool during machining, have a further drawback consisting in the fact that they can be used exclusively for loading punches in machine tools in which the tool housing is accessed horizontally from the front or rear.

[0014] It is known, in fact, that numerous machine tools exist in which the tool must be positioned in a vertical mount locating fixture and, in this case, the known em-

bodiments cannot be used.

[0015] In particular, said machines generally use a type of tool consisting of a tool holder cartridge such as, for example, the one commonly known under the name 'Amada'.

[0016] The object of the present invention is to overcome the above-mentioned drawback.

[0017] In particular, the object of the present invention is to provide an automatic loader for tools and corresponding dies in respective housings which can be used with punch presses in which the tool housing is a vertical mount locating fixture.

[0018] A further object of the present invention is to provide an automatic loader particularly suited to loading punch holder cartridges such as those, for example, commonly known under the name 'Amada'.

[0019] Said objects are achieved by an automatic loader of punch holder cartridges and corresponding dies for a punch press for elements substantially in sheet form of the type comprising:

- a framework having a housing for said punch holder cartridge;
- a base, resting on the ground, having a housing for said die,

which, according to the main claim, is characterised in that it comprises:

- a first supporting structure forming a first substantially vertical axis;
- a die holder unit combined with said first supporting structure and forming a first substantially horizontal axis;
- handling means of said die holder unit with respect to said first supporting structure according to said first vertical axis;
- a second supporting structure forming a second substantially vertical axis;
- a punch holder unit combined with said second supporting structure and forming a second substantially horizontal axis;
- handling means of said punch holder unit with respect to said second supporting structure according to said second vertical axis;
- displacement means for said first and second supporting structures in a substantially horizontal direction;
- means for supporting said first and said second supporting structure.

[0020] Said aims are furthermore achieved by a method for the automatic loading of a punch holder cartridge and a corresponding die in respective housings in a punch press for elements substantially in sheet form of the type comprising a framework, containing said respective housing for said punch holder cartridge, and a base resting on the ground containing said respective housing

for said die, characterised in that it comprises the following insertion operations:

- move said die according to a substantially horizontal direction from the outside of said punch press until it is positioned at the level of said respective housing;
- move said punch holder cartridge according to a substantially horizontal direction from the outside of said punch press until it is positioned coaxial above said respective housing;
- move said cartridge in a substantially vertical direction to insert it inside said respective housing.

[0021] According to the invention, the die holder unit and the punch holder unit each comprise a rotating disc with one or more peripheral housings for the cartridges or for the dies and each comprise driving means which rotate said rotating discs.

[0022] Advantageously, the possibility of loading numerous punch holder cartridges and numerous dies beforehand on the rotating disc of the punch holder and die holder units allows the user to prepare on the loader of the invention all the punches necessary for machining of the sheet elements.

[0023] Again advantageously, said fact allows the operator to be absent during machining of said sheet elements.

[0024] Again advantageously, the operator avoids the personal risks and physical effort involved in the manual operation since throughout the machining, the automatic loader takes from its storage space the punch holder cartridges necessary and positions them inside the housing in the punch press.

[0025] Furthermore, advantageously, since the punch holder cartridge is inserted by means of a first horizontal movement and a subsequent vertical movement, the automatic loader of the invention is particularly suitable for use with machine tools in which the tool housing is a vertical mount locating fixture.

[0026] Said objects and advantages, and others which will be better highlighted below, will be illustrated in detail in the description of preferred embodiments of the invention which are provided by way of non-limiting indication with reference to the accompanying drawings in which:

- fig. 1 shows the automatic loader of the invention in a partially sectioned functional view;
- figures 2 to 5 show some details of the automatic loader of the invention;
- fig. 6 shows an executive variation of the automatic loader of the invention;
- fig. 7 shows a further executive variation of the automatic loader of the invention;
- figures 8 to 11 show a succession of operating phases of the automatic loader of the invention.

[0027] The automatic loader subject of the invention is shown in fig. 1 where it is indicated overall by 1.

[0028] As can be observed, it is combined with a punch press **P** for elements substantially in sheet form of the type comprising a framework **I**, having a housing **A1** for the punch holder cartridge **2** and a base **B** resting on the ground and having a housing **A2** for the die **3**.

[0029] According to the invention, the automatic loader **1** comprises a first supporting structure **5** which forms a first substantially vertical axis **Y'** and is combined with a die holder unit **5a** which forms, in turn, a first substantially horizontal axis **X'**.

[0030] The first supporting structure **5** is combined with first displacement means **6** for moving the entire structure **5** and, consequently, the die holder unit **5a** according to the first horizontal axis **X'**.

[0031] The die holder unit **5a** is also combined with handling means **7** which move it with respect to the first supporting structure **5** according to the first vertical axis **Y'**.

[0032] The automatic loader **1** of the invention also comprises a second supporting structure **9** which defines a second substantially vertical axis **Y''** and is combined with a punch holder unit **9a** which, in turn, defines a second substantially horizontal axis **X''**.

[0033] Also in this case, second displacement means **10** are combined with the second supporting structure **9** to move the latter, and consequently the punch holder unit **9a**, according to the second horizontal axis **X''**, while the punch holder unit **9a** is combined with handling means **11** which move it with respect to the second supporting structure **9** according to the second vertical axis **Y''**.

[0034] The automatic loader **1** also comprises supporting means **4** and **8**, of the first **5** and of the second supporting structure **9**, combined with the punch press **P**.

[0035] According to the preferred embodiment described, the die holder unit **5a** comprises a rotating disc **15** which, as can be observed in the detail of fig. 2, has a plurality of peripheral housings **16** where the dies **3** are housed.

[0036] Said rotating disc **15**, as can be seen in fig. 1, is rotated by driving means **17** combined with the disc **15** and included in the die holder unit **5a**.

[0037] Analogously also the punch holder unit **9a** comprises a rotating disc **18**, shown in fig. 3, which presents a plurality of peripheral housings **19** for housing the punch holder cartridges **2** in a number equal to the number of housings **16** on the rotating disc **15** of the die holder unit **5a**.

[0038] The punch holder unit **9a** also comprises driving means **20** which rotate the above-mentioned rotating disc **18**.

[0039] As regards the punch holder cartridges **2**, as can be seen in fig. 4 and 5, they can contain one or more punches **21** according to the needs of the user and the punching operation which the punch press **P** is required to perform.

[0040] It should be noted that the preferred embodiment described so far provides for the first **5** and the

second supporting structure **8** to be combined respectively with the base **B** and the framework **I** of the punch press by means of distinct first supporting means **4** and second supporting means **8** each consisting of a pair of axial supporting elements **4a**, **4b** and **8a**, **8b**.

[0041] The latter are moved in a horizontal direction by a first **6** and a second displacement means **10** respectively.

[0042] Said embodiment does not constitute a limitation for further different embodiments according to which the supporting means and the displacement means can be at least partly coinciding or different.

[0043] A first example of said executive variations is shown in fig. 6 where it can be seen that the loader **100** presents single supporting means **104** and single displacement means **106** of the supporting structure **105**.

[0044] As regards the handling means **107** of the die holder unit **105a**, they are also combined with the punch holder unit **109a** for a first overall vertical movement, but this does not exclude the presence of the second handling means **111** of the punch holder unit **109a** for a further vertical movement of said punch holder unit **109a** independently of the movement of the die holder unit **105a**.

[0045] More specifically, fig. 6 shows the executive variation in which the loader **100** is combined with the base **B** of the punch press **P**.

[0046] Fig. 7 shows a further executive variation similar to the preceding one, but differing from it due to the arrangement of the loader **200** which rests on a framework **201** external to the punch press **P**.

[0047] This permits positioning of the loader **200** above the work surface of the punch press **P** and performance of all the loading operations from above rather than from below as in the preceding variation.

[0048] The difference between the two executive variations referred to is that according to the first variation the vertical movements of the punch holder unit **109a** and die holder unit **105a** are partly opposed, whereas in the second executive variation all the movements in the vertical direction, in the insertion phase, are in the same direction.

[0049] The advantage of said executive variations lies in their construction simplicity, as they have fewer component parts with respect to the preferred embodiment. The advantage of the preferred embodiment with respect to the two executive variations described lies in the fact that, unlike the variations, the movements never involve the work surface of the punch press so that any change of cartridges and dies during work does not require removal of the sheet element being processed.

[0050] Going back to the description of the preferred embodiment, the supporting means **4** and **8** each comprise a pair of axial supporting elements **4a**, **4b** and **8a**, **8b** each of which generally consists of a metal bar.

[0051] As regards the handling means **7** and **11** and the displacement means **6** and **10**, they comprise a hydraulic actuator which can consist, for example, of a cylinder with piston.

inder with piston.

[0052] According to different executive variations, the handling means can each comprise, as in the case of the second handling means **107** of the first executive variation described, a gearmotor operatively connected to a worm screw which, in turn, is connected to the mechanical parts to be moved.

[0053] Operatively, the operator loads all the housings **16** and **19**, present in the discs **15** and **18** belonging to the punch holder units **9a** and die holder units **5a**, with the dies **3** and the corresponding punch holder cartridges **2** necessary for the work.

[0054] Subsequently, the operator operates the loader **1** and the punch press **P**.

[0055] A first movement consists, as can be seen in fig. 8, of rotation of both the discs **15**, **18**, in a coordinated manner, to set the required punch holder cartridge **2** and corresponding die **3** to the insertion position.

[0056] Subsequently, as can be seen in fig. 9, there is a first vertical movement of the die holder unit **5a** and of the punch holder unit **9a** to set them to the correct horizontal position and prepare them for frontal insertion in the punch press **P**.

[0057] The vertical movement is performed by the handling means **7** and **11**.

[0058] The frontal insertion, as can be seen in fig. 10, is performed by the loader **1** by means of two feed operations performed by the displacement means **6** and **10** so that the cartridge **2** and the die **3** are fed from the outside to the inside of the punch press **P**.

[0059] At the end of the feed, the die **3** is positioned in the housing **A2** on the base **B** of the punch press **P**, while the punch holder cartridge **2** is positioned along the vertical axis **Y'''** of the housing **A1** on the framework **I** of the punch press **P**, but is not yet positioned inside said housing **A1**.

[0060] To reach said position, the loader **1** performs, as can be seen in fig. 11, a further vertical movement of the punch holder unit **9a** via the handling means **11** so as to insert the punch holder cartridge **2** inside the respective housing **A1**.

[0061] Successively, the loader **1** moves the die holder unit **5a** and the punch holder unit **9a** away from the punch press **P** and activates the punch press **P** for the work to be performed on the sheet element.

[0062] At the end of work, the loader **1** takes the cartridge **2** and the die **3** out of the punch press **P** moving the punch holder units **9a** and die holder units **5a** near the punch press **P** so that the cartridge **2** and the die **3** go back into the housings **16**, **19** in the rotating discs **15**, **18**.

[0063] Said movement is performed by using the displacement means **6**, **10** again.

[0064] Subsequently, the cartridge **2** is lifted from the inside of its housing **A1** in the punch press **P** by the second handling means **11**, and the punch holder units **9a** and die holder units **5a** are moved horizontally away from the punch press **P**.

[0065] If the work on the sheet element is finished, the punch holder units **9a** and die holder units **5a** move vertically away from each other to the rest position, otherwise the discs **15** and **18** are rotated to set the new cartridge **2** and the new die **3**, necessary for continuing the work, to the insertion position.

[0066] As regards operation, the executive variations differ in that the cartridges and the dies are moved vertically in the initial phase not by opposed but by concordant movements and, in particular, in one case in a down-up direction and in the other in an up-down direction.

[0067] Furthermore, analogously, the cartridges and dies are moved vertically in the final phase in one case in an up-down direction and in the other in a down-up direction.

[0068] In view of the above, the automatic loader of the invention achieves all the established objects.

[0069] In particular, the invention achieves the object of providing an automatic loader for tools and corresponding dies in respective housings for use with punch presses in which the tool housing is a centering template inserted vertically.

[0070] The object of providing an automatic loader particularly suited to loading punch holder cartridges such as, for example, those commonly known under the name 'Amada', is furthermore achieved.

[0071] In the executive phase, further executive variations can be made to the automatic loader of the invention which, although not described or shown, must all be considered protected by the present patent if they fall within the scope of the following claims.

[0072] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. Automatic loader (1; 100; 200) of punch holder cartridges (2) and corresponding dies (3) for a punch press (P) for elements substantially in sheet form of the type comprising:

- a framework (1) provided with a housing (A1) for said punch holder cartridge (2);
- a base (B), resting on the ground, provided with a housing (A2) for said die (3),

characterised in that it comprises:

- a first supporting structure (5; 105) defining a first substantially vertical axis (Y");
- a die holder unit (5a; 105a) combined with said first supporting structure (5; 105) and defining a

first substantially horizontal axis (X');

- handling means (7; 107) for moving said die holder unit (5a; 105a) with respect to said first supporting structure (5; 105) according to said first vertical axis (Y");
- a second supporting structure (9; 109) defining a second substantially vertical axis (Y");
- a punch holder unit (9a; 109a) combined with said second supporting structure (9; 109) and defining a second substantially horizontal axis (X");
- handling means (11) for moving said punch holder unit (9a; 109a) with respect to said second supporting structure (9; 109) according to said second vertical axis (Y");
- displacement means (6, 10; 106) for moving said first (5; 105) and second supporting structures (9; 109) in a substantially horizontal direction;
- supporting means (4, 8; 104) for supporting said first (5; 105) and said second supporting structure (9; 109).

2. Automatic loader (1; 100; 200) according to claim 1) **characterised in that** said die holder unit (5a; 105a) comprises a rotating disc (15) provided with one or more peripheral housings (16) for said dies (3).
3. Automatic loader (1; 100; 200) according to claim 2) **characterised in that** said die holder unit (5a; 105a) comprises driving means (17) suitable for rotating said rotating disc (15).
4. Automatic loader (1; 100; 200) according to claim 1) **characterised in that** said punch holder unit (9a; 109a) comprises a rotating disc (18) provided with one or more peripheral housings (19) for said punch holder cartridges (2).
5. Automatic loader (1; 100; 200) according to claim 1) **characterised in that** said punch holder unit (9a; 109a) comprises driving means (20) suitable for rotating said rotating disc (18).
6. Automatic loader (1; 100; 200) according to claim 1) or 4) **characterised in that** said punch holder cartridges (2) contain one or more punches (21).
7. Automatic loader (1) according to claim 1) **characterised in that** said supporting means (4, 8) comprise at least one first axial supporting element (4a, 4b) of said first supporting structure (5) and at least one second axial supporting element (8a, 8b) of said second supporting structure (9).
8. Automatic loader (1) according to claim 7) **characterised in that** said first axial supporting element

(4a, 4b) is combined with said base (B) of said punch press (P) by means of a first (6) of said displacement means (6, 10) and said second axial supporting element (8a, 8b) is combined with said framework (I) of said punch press (P) by means of a second (10) of said displacement means (6, 10).

9. Automatic loader (100; 200) according to claim 1) **characterised in that** said supporting means (104) comprise at least one axial supporting element of said first supporting structure (105) and of said second supporting structure (109). 10
10. Automatic loader (100) according to claim 9) **characterised in that** said supporting means (104) are combined with said base (B) of said punch press (P) by means of said displacement means (106). 15
11. Automatic loader (200) according to claim 9) **characterised in that** said supporting means are combined with a framework (201) arranged frontally to said punch press (P) via the interposition of said displacement means. 20
12. Automatic loader (1; 100; 200) according to any one of the preceding claims, **characterised in that** said handling means (7, 11; 111) and said displacement means (6, 10; 106) comprise at least one hydraulic actuator. 25
13. Automatic loader (1; 100; 200) according to any one of the preceding claims, **characterised in that** said handling means (107) and said displacement means comprise at least one gearmotor operatively connected to a worm screw. 30
14. Method for automatic loading of a punch holder cartridge (2) and a corresponding die (3) in respective housings (A1, A2) in a punch press (P) for elements substantially in sheet form of the type comprising a framework (I), provided with said respective housing (A1) for said punch holder cartridge (2), and a base (B) resting on the ground and in which said respective housing (A2) for said die (3) is present, **characterised in that** it comprises the following insertion operations: 35
 - feed said die (3) according to a substantially horizontal direction (X') from the outside of said punch press (P) until it is positioned at the level of said respective housing (A2); 40
 - feed said punch holder cartridge (2) according to a substantially horizontal direction (X'') from the outside of said punch press (P) until it is positioned coaxial above said respective housing (A1); 45
 - move said punch holder cartridge (2) in a substantially vertical direction (Y'') to insert it inside 50

said respective housing (A1).

15. Method according to claim 14) **characterised in that** said horizontal feed operations of said die (3) and said punch holder cartridge (2) are performed simultaneously. 5
16. Method according to claim 14) **characterised in that** it comprises a first operation for moving in a substantially vertical direction (Y') said die (3) and said punch holder cartridge (2) prior to said horizontal feed operations. 10
17. Method according to claim 16) **characterised in that** said first substantially vertical movement is performed in an up-down direction. 15
18. Method according to claim 17) **characterised in that** said first substantially vertical movement is performed in a down-up direction. 20
19. Method according to claim 16) **characterised in that** in said first substantially vertical movement said die (3) and said punch holder cartridge (2) move in opposite directions towards each other. 25
20. Method according to claim 14) **characterised in that** it comprises an operation for extraction of said die (3) and of said punch holder cartridge (2) from said respective housings (A2, A1). 30
21. Method according to claim 20) **characterised in that** said operation for extraction of said die (3) and said punch holder cartridge (2) from said respective housings (A2, A1) comprises the following phases: 35
 - move said punch-holder cartridge (2) according to a substantially vertical direction (Y'') to extract it from the inside of said respective housing (A1);
 - feed said die (3) according to a substantially horizontal direction (X') to move it away from said punch press (P);
 - feed said punch holder cartridge (2) according to a substantially horizontal direction (X'') to move it away from said punch press (P).
22. Method according to claim 21) **characterised in that** said horizontal movement phases of said die (3) and of said punch holder cartridge (2) are performed simultaneously. 40
23. Method according to claim 21) **characterised in that** said extraction operation comprises a phase of substantially vertical movement of said die (3) and said punch holder cartridge (2) after said horizontal feed. 45

24. Method according to claim 23) **characterised in that** said phase of substantially vertical movement is performed in an up-down direction.
25. Method according to claim 23) **characterised in that** said phase of substantially vertical movement is performed in a down-up direction. 5
26. Method according to claim 23) **characterised in that** in said substantially vertical movement phase said die (3) and said punch holder cartridge (2) move in opposite directions away from each other. 10

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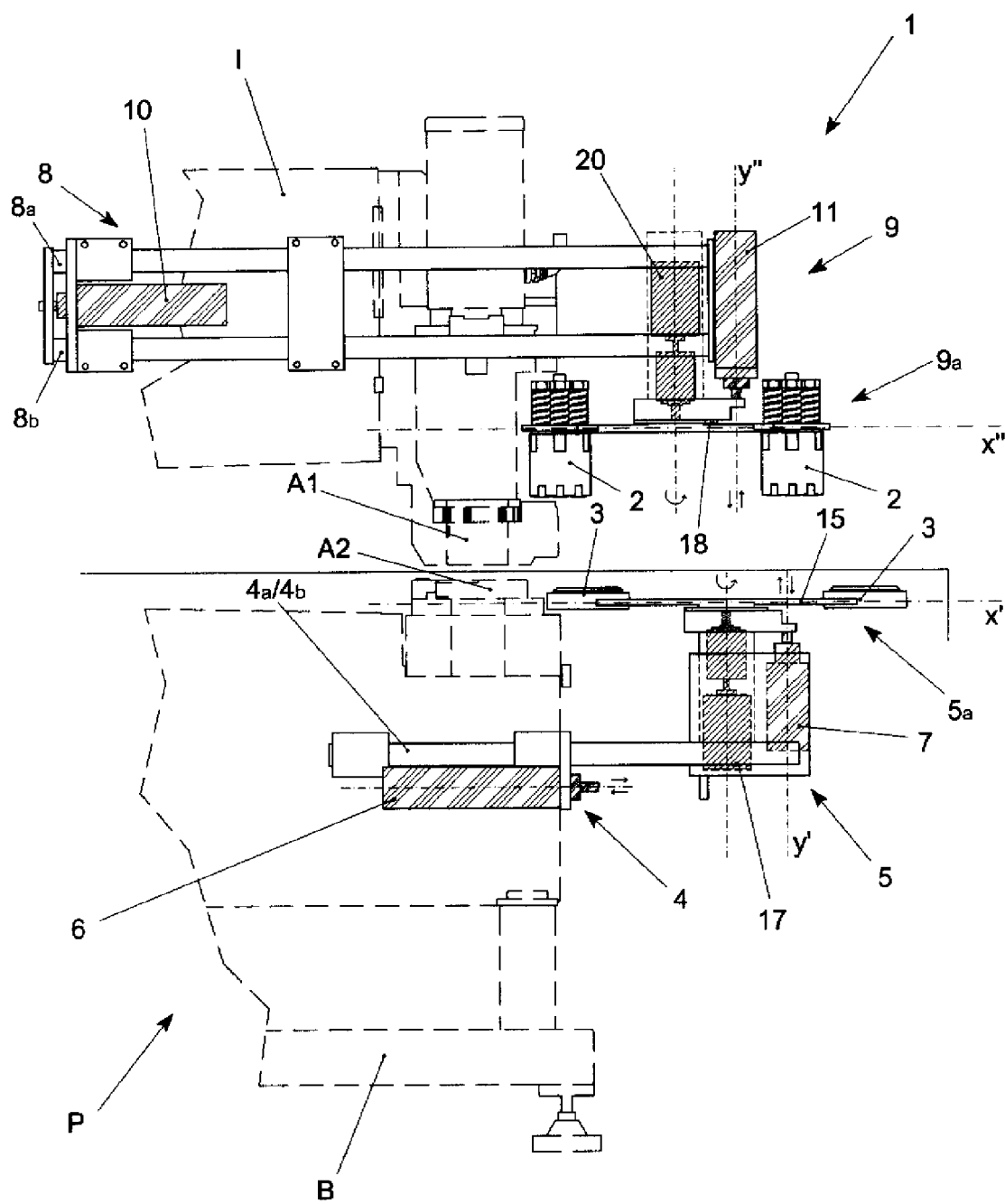
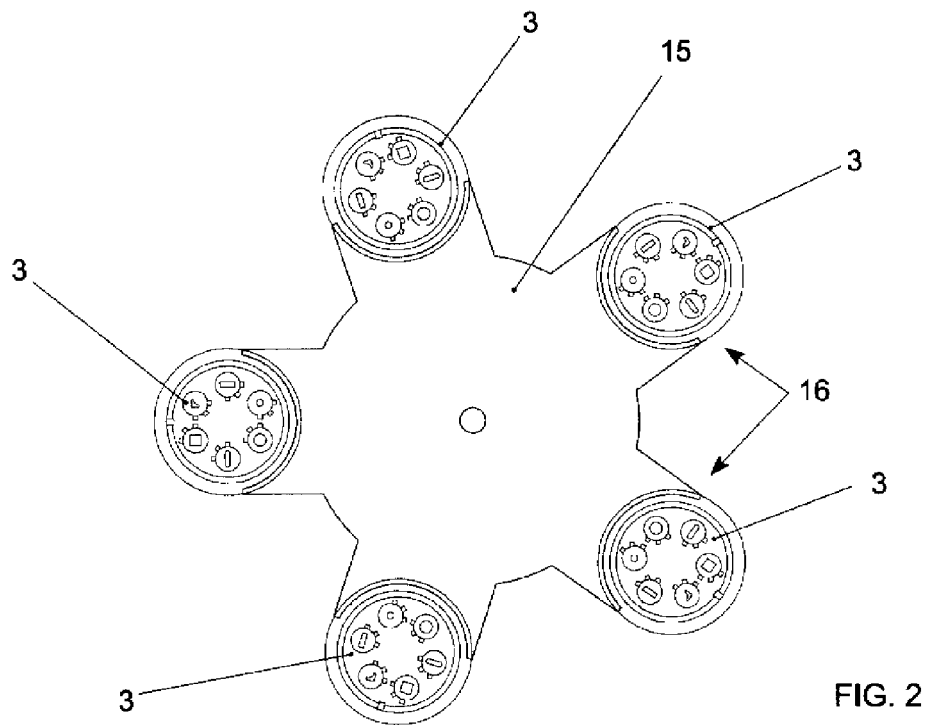
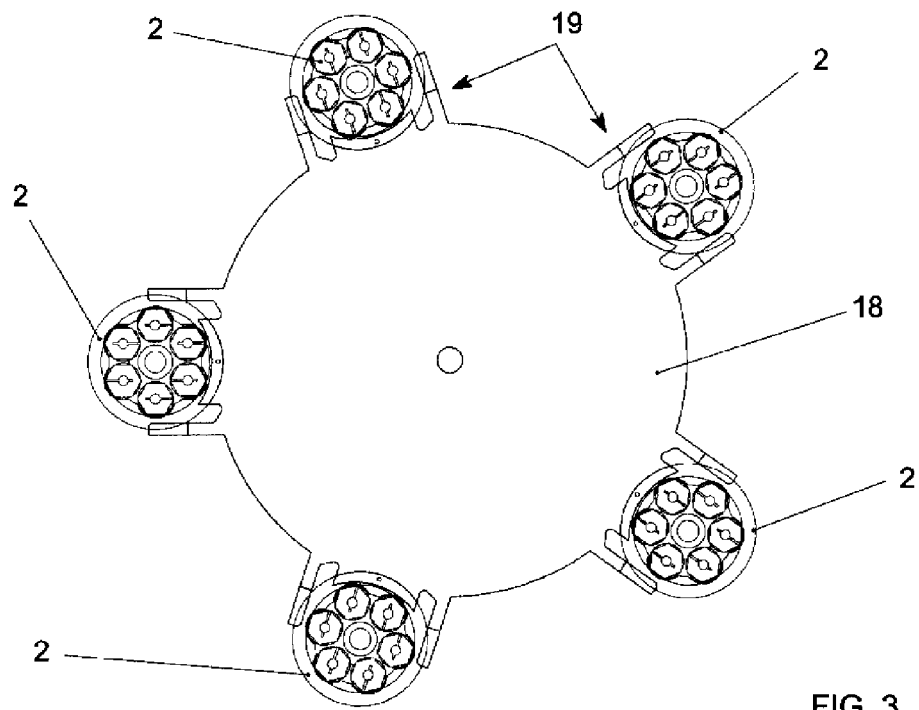


FIG. 1



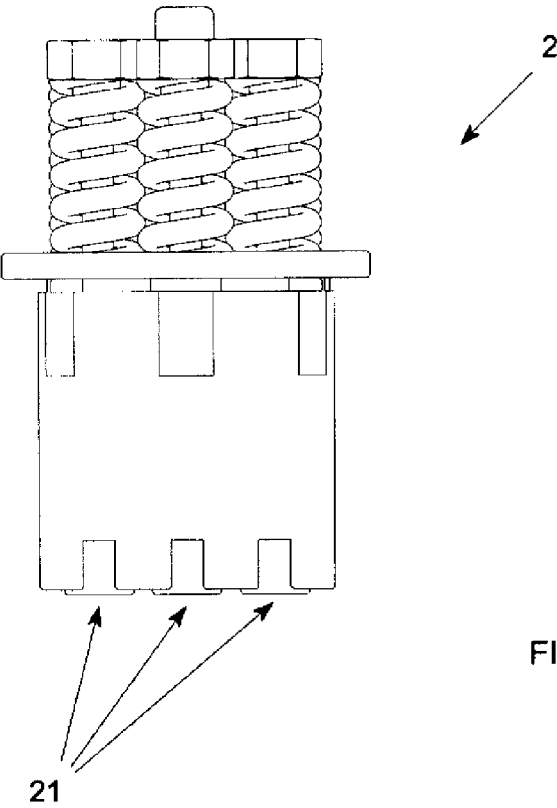


FIG. 4

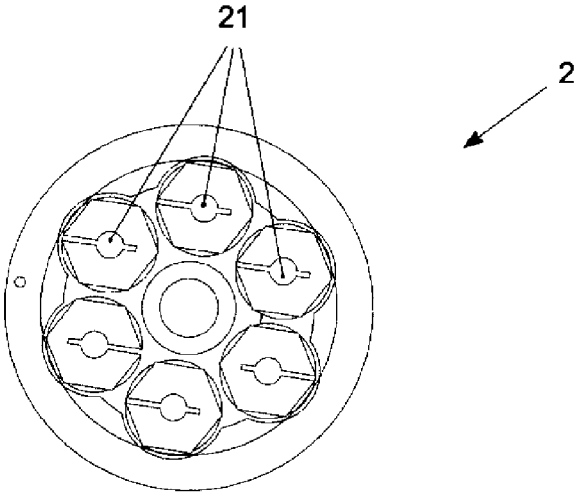


FIG. 5

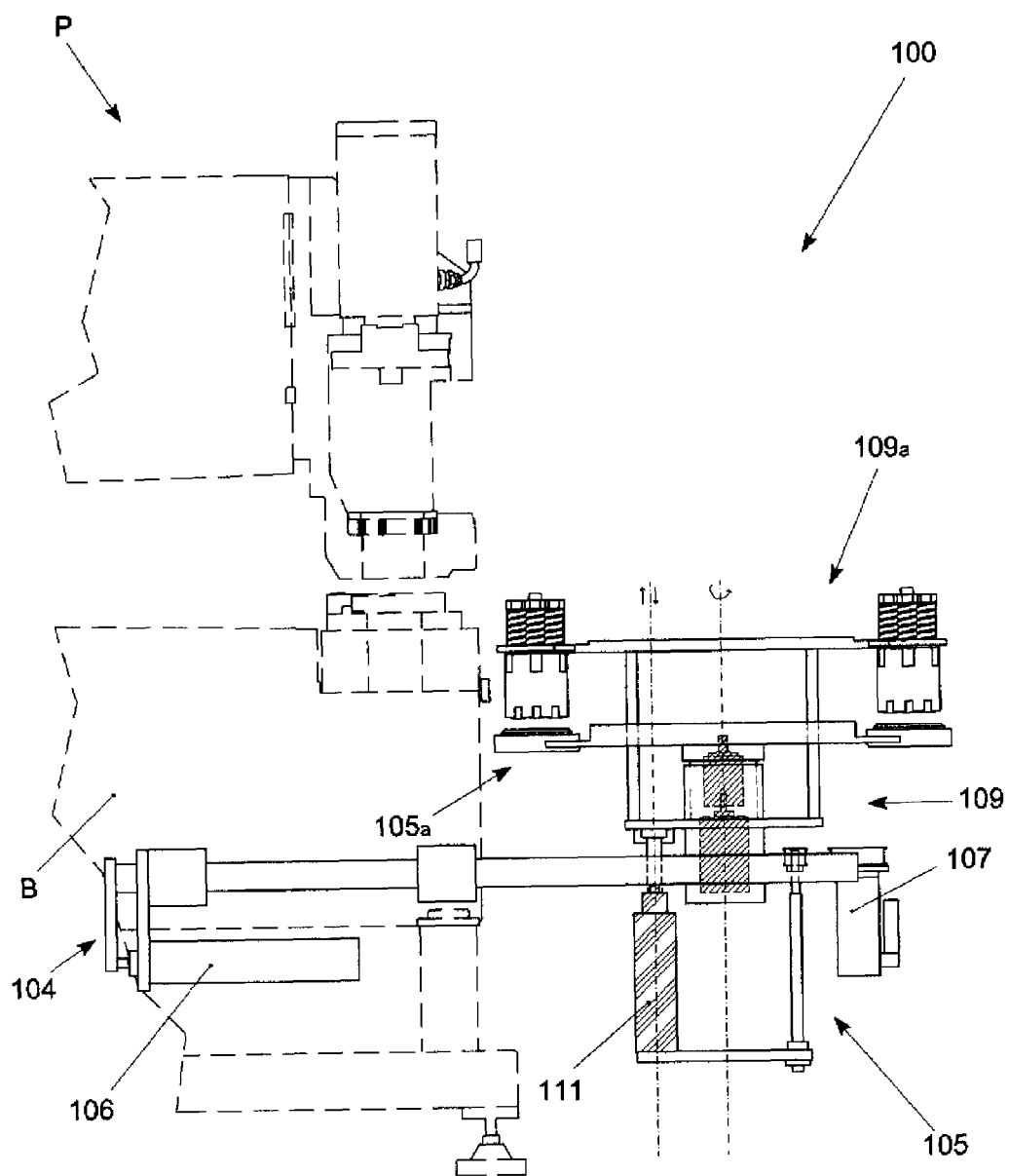


FIG. 6

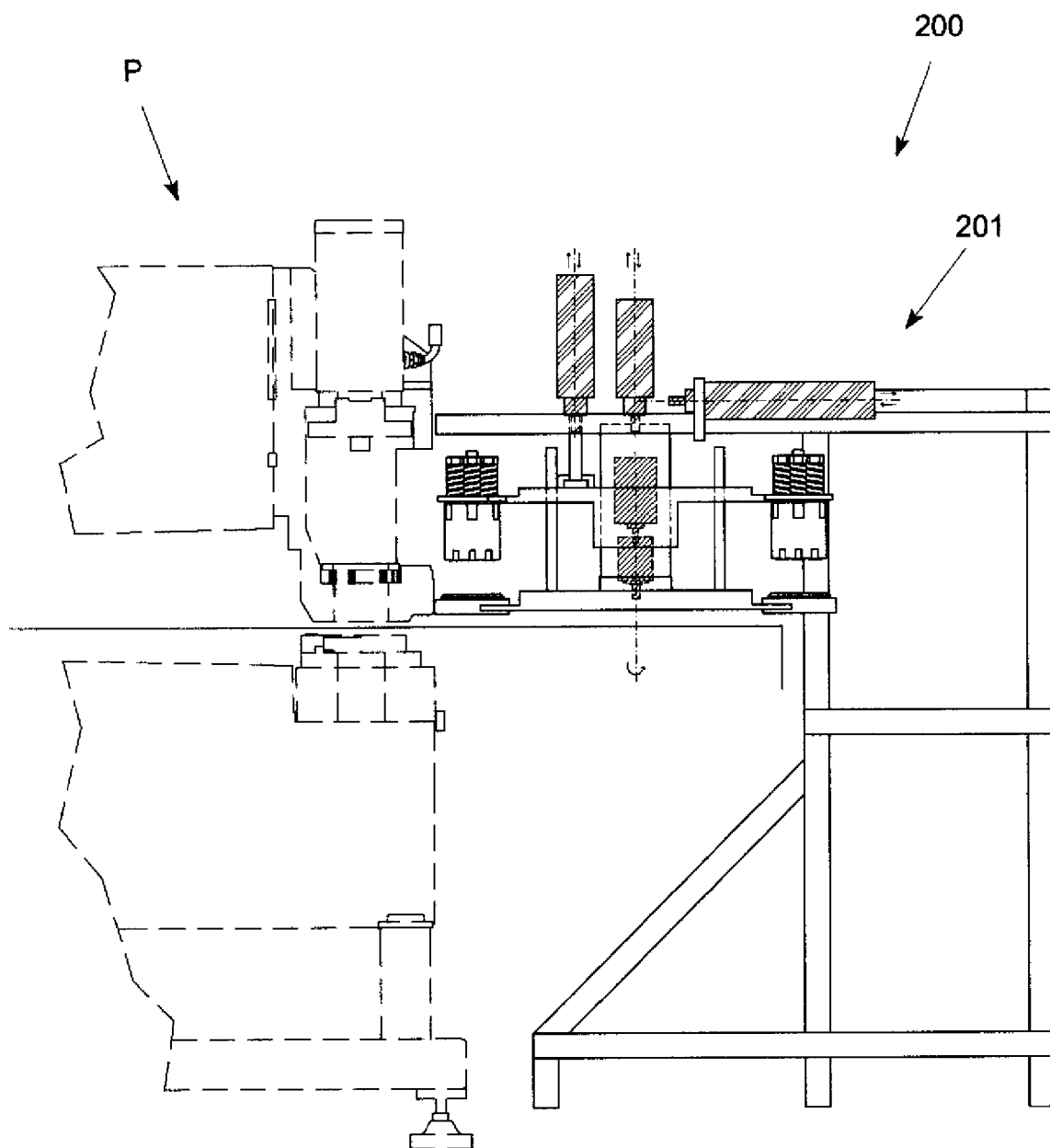


FIG. 7

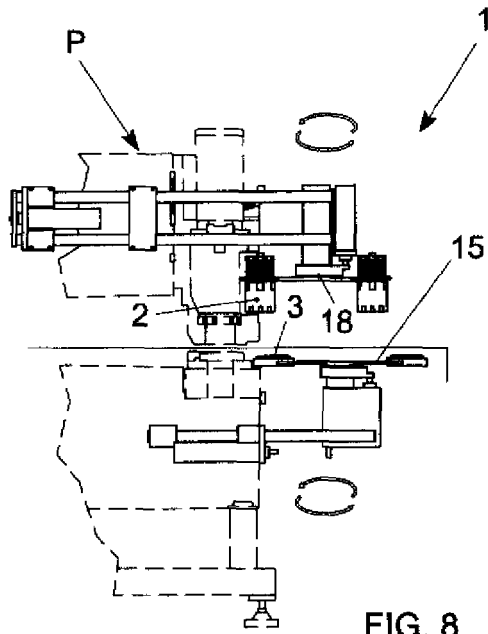


FIG. 8

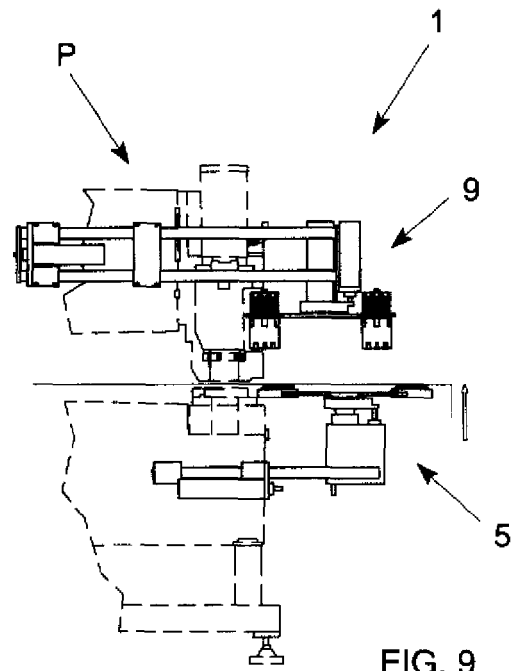


FIG. 9

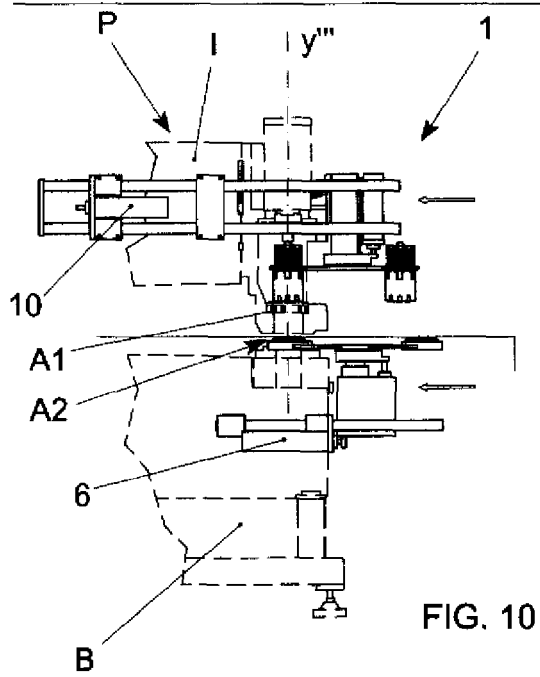


FIG. 10

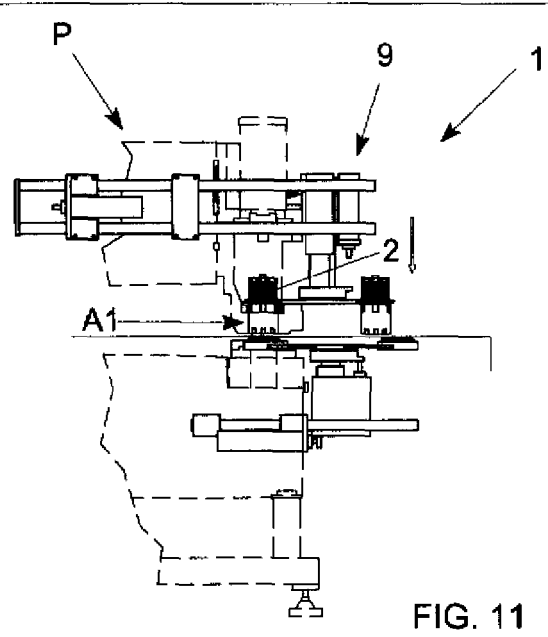


FIG. 11



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	JP 2005 161356 A (MURATA MACHINERY LTD) 23 June 2005 (2005-06-23) * figures 6,9 *	1-21	INV. B21D37/14 B21D37/04 B23Q3/155
Y	US 4 860 428 A (BROLUND THEODORE F [US] ET AL) 29 August 1989 (1989-08-29) * column 5, line 7 - column 6, line 54; figures 1-3 *	1-21	
A	EP 0 893 173 A (RAINER SRL [IT]) 27 January 1999 (1999-01-27) * figure 1 *	1-21	
A	US 6 109 159 A (SETO YOSHIHARU [US]) 29 August 2000 (2000-08-29) * figure 1 *	1-21	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B21D B23Q
3	Place of search Munich	Date of completion of the search 20 April 2007	Examiner Vinci, Vincenzo
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 12 6334

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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