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(54) Title: PRESS BRAKES

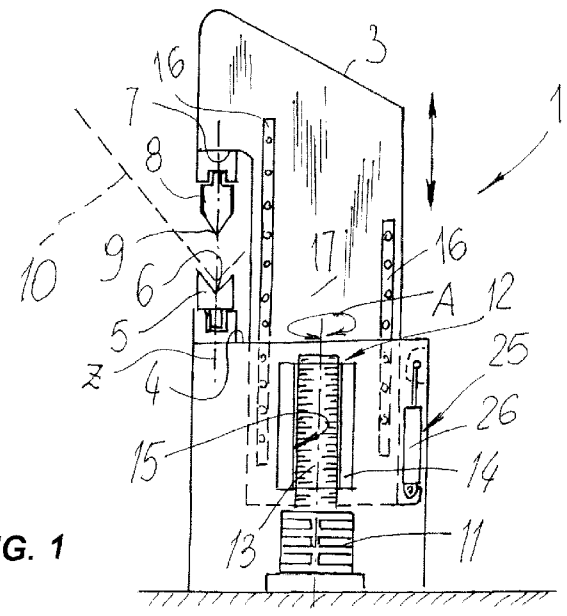

FIG. 1

(57) Abstract: The press brake comprises: a base frame (2); an upper frame (3) overhanging the base frame (2) and vertically reciprocating with an active brake-forming stroke and an inactive return stroke, and being guided by guide means (16) and actuated by actuation means; a die (5) attached to a support surface (4) of the base frame (2) and having a first brake-forming profile (6) for the workpiece (10) to be brake-formed; a punch (8) attached to a second surface (7) of the upper frame (3) facing said support surface (4) and having a second brake-forming profile (9) for the workpiece (10) to be brake-formed and being aligned with said first brake-forming profile (6) and designed to be matingly coupled to the first profile (6); the actuation means comprise a moving unit (11); a vertical motion transmission unit (13, 14) which connects the drive unit (11) and the upper frame (3) to each other and has a pulling action on the upper frame (3) in the active brake-forming stroke and a pushing action in the inactive return stroke.

PRESS BRAKES

Field of the invention

The invention relates to a press brake, which is generally intended to be used for forming bends or successions of bends in sections, plates and workpieces to be bent.

Background art

Press brakes, hereinafter briefly referred to as brakes, are known in the art to allow bends to be formed in sections and sheets, according to desired profiles, particularly U-sections.

Typically, a known press brake comprises a frame that forms a base defining a horizontal bottom bed with a concave die attached thereto.

The brake also comprises a head which overhangs the bottom bed and has moving members housed therein for moving a crossbeam supported by the frame in a vertically displaceable manner.

A convex punch is mounted to the crossbeam, namely to a horizontal surface thereof facing above the bottom bed of the base, and its profile mates the concave profile of the die, such that by interposing a workpiece to be bent between the die and the punch, and by actuating the crossbeam to cause it to slide toward the base, the punch fits into the die and forms a bend in the workpiece according to the mating profiles.

The crossbeam slides along guides attached to the frame by the action of one or more hydraulic cylinders mounted in the upper area and acting on the crossbeam by pushing it toward the bottom bed or retracting it therefrom.

A known brake is particularly taught by the Italian patent IT 1,309,645, which relates to a press brake particularly adapted to form U-section products or the like ("Pressa piegatrice particolarmente adatta alla realizzazione di manufatti a forma di profilati con sezione ad "U" o simili").

In this patent, the brake usually comprises the base that forms the bottom bed with the concave die attached thereto, and a crossbeam that is slidably mounted to the base and is guided by appropriate vertical guides.

Here again the crossbeam supports a convex punch, which is aligned

to the concave die supported by the bottom bed and the concave and convex profiles are adapted to mate with each other to form a bend in a workpiece to be bent.

Typically, both the punches and the dies are interchangeable with others depending on the bending profiles to be followed.

In addition to being adapted to be displaced up and down relative to the base, to form successive U-shaped bends in one workpiece, the crossbeam has the front upper face, i.e. the one facing the standing place of an operator which, unlike prior art brakes, is inclined toward the rear portion of the brake and its inclination starts at an area slightly above the working face of the punch.

Thus, once a first bend has been formed in a workpiece, such as a section, the operator may form a second bend parallel to the previous one according to a U profile, because the portion of the workpiece in which the first bend was formed rests on the inclined upper face, and the latter does not interfere with the position of the workpiece to form the second bend.

The crossbeam is movably actuated by a hydraulic unit which is held within the base of the brake and which, during the active brake forming step, presses upon a flange rigidly joined to the crossbeam, thereby moving the latter downwards and causing the die and the punch to be coupled together and which, during the crossbeam lifting step, exerts a pulling action on the flange, thereby releasing the punch from the die.

In a further type of brake, the crossbeam that supports the punch is moved by means of a worm screw and nut assembly, with the worm screw being rotatably actuated by a motor unit which is held within the upper area of the head of the brake.

The nut is rigidly joined to the movable crossbeam and, during the active brake forming step, the worm screw is rotatably actuated by the motor unit and the stress generated thereby is a buckling stress that axially acts upon the worm screw.

This prior art suffers from certain drawbacks.

A first drawback is that, in prior art brakes, if the crossbeam moving

members suddenly break, the crossbeam, that has a considerable weight, falls on the base by gravity, thereby creating an immediate hazard for the operators, whose hands may be interposed between the die and the punch at that time.

Furthermore, the fall will also cause serious damage to the structure of the brake.

A second drawback is that in prior art brakes actuated by the worm screw and nut assembly, the screw is acted upon, as mentioned above, by a buckling stress which will tend to deform it with time, i.e. curve it and, as a result, by considerably alter the screw pitch; this will hinder, or even prevent rotation of the screw in the nut, thereby completely stopping the operation of the brake.

A third drawback is that prior art brakes have an upper crossbeam with a considerable height dimension, which will limit the workpiece processing potential, when successive and parallel bends are required to be formed.

Disclosure of the invention

One object of the invention is to improve the prior art.

Another object of the present invention is to provide a press brake that can prevent deformation of the actuation members and, as a result, processing cycle breaks.

A further object of the invention is to provide a press brake that can prevent accidents caused by the failure of the crossbeam actuating members, using a very simple and hence more cost-effective structure.

A further object of the invention is to provide a press brake that can reduce the height dimensions of the upper crossbeam and hence, can form successive bends without causing the bent workpieces to interfere with the crossbeam itself.

In one aspect the invention relates to a press brake as defined in the features of claim 1.

Further aspects of the invention are defined in the dependent claims.

The invention affords the following advantages:

- avoiding buckling stresses on the worm screw that actuates the

upper punch-carrying crossbeam and hence eliminating any risk of deformation of the worm screw;

- preventing the upper crossbeam from falling in case of malfunctioning of the upper frame actuating members;

- forming successive bends without causing the bent workpieces to interfere with the upper frame.

Brief description of the drawings

Further characteristics and advantages of the invention will be more apparent from the detailed description of a preferred, non-exclusive embodiment of a press brake, which is shown as non-limiting example in the annexed drawings, in which:

FIG. 1 is a highly schematic side view of a press brake of the invention;

FIG. 2 is a front perspective view of a possible embodiment of the press brake of the invention;

FIG. 3 is a front perspective view of a second possible embodiment of the press brake of the invention;

FIG. 4 is a perspective, smaller-scale view of a press brake of the invention, during a working step.

Detailed description of a preferred embodiment

Referring to Figure 1, numeral 1 generally designates a press brake having a base frame 2 and an upper frame 3, the latter being vertically movable relative to the base frame 2.

The base frame 2 comprises a support surface 4 with a die 5 having a concave profile 6 attached thereto.

A punch 8 having a convex profile 9 designed to be coupled with the concave profile of the die 5 is attached to a second surface 7 of the upper frame 3.

A workpiece 10 to be bent is designed to be interposed between the punch 8 and the die 6 as schematically shown in Figure 1 by a broken line.

Referring to Figures 2 and 3, it shall be noted that two front recesses 21 and 22 are defined in the base frame 2, and are designed to receive the

legs of an operator "P" during use of the press brake 1, as best shown in Figure 4.

A moving unit, namely a motor unit 11, is held within the base frame, and is connected to the upper frame 3 via a transmission unit 12.

Such transmission unit 12 comprises, in a first embodiment of the press brake 1 as shown in Figure 2, a worm screw element 13 which is vertically supported by the motor unit 11 and is actuated thereby with a bidirectional rotary motion, as defined by arrows "A".

A sleeve body 14 is fixed to the upper frame 3 and the worm screw element 13 is engaged in its axial cavity 15.

Parallel vertical guides 16 are arranged between the upper frame 3 and the base frame 2, for guiding the vertical strokes of the upper frame 3, namely an active downward brake forming stroke and an inactive upward return stroke.

As shown in the figures, the upper frame 3 is composed of a pair of uprights 17, with a transverse element 18 supported therebetween for forming the second surface 7 facing the first support surface 4.

The concave profile 6 and the convex profile 9 are vertically aligned along a common alignment axis "Z".

Referring to Figure 3, a second embodiment of the press brake 1 is shown, which differs from the first embodiment in that the movement of the upper frame 3 relative to the base frame 2 is obtained by means of two motor units 11 located at both sides of the base frame 2, and rotatably actuating respective worm screw elements 13 in synchronized fashion.

Once again, in this second embodiment of the press brake 1, two respective sleeve bodies 14 are fixed to the upper frame 3, here at both sides thereof, with the worm screw elements 13 rotatably engaged in their axial cavities.

Once again, in this second embodiment of the press brake, the base frame 2 defines the two front recesses 21 and 22 and the bottom bed 4 having a support 23 for the concave die 5 attached thereto.

The upper frame 3 is composed, also in this second embodiment of

the press brake 1, of a pair of uprights 17, typically in the form of flat gibs, which are vertically displaced and guided relative to the base frame 2 and support therebetween the transverse element 18 that forms the second surface 7 with a support 24 attached thereto for supporting a convex punch 8.

Braking means 25 are also interposed between the upper frame 3 and the base frame 3, for stopping the downward stroke of the upper frame 3 when required.

The operation of the press brake is as follows; when a bend has to be formed in a workpiece 10, e.g. a metal sheet, the upper frame 3 is lifted upwards, such that the space between the punch 8 and the die 6 is cleared.

The upper frame 3 is moved upwards by actuation of the motor unit 11 to rotate the worm screw 13, which pushes the sleeve 14 and hence the upper frame 3 upwards.

When the operator has properly positioned the metal sheet between the punch 8 and the die 6, he/she actuates the motor unit 11 again, and the latter rotates the worm screw 13 in a direction opposite to the previous direction of rotation.

The worm screw 13 carries the sleeve 14 and hence the upper frame 3 attached thereto downwards.

When the punch 8 and the die 6 start to couple, the worm screw 13 is submitted to the processing load, i.e. the stress required for brake forming.

This stress is a pulling stress, and involves no risk of deformation of the worm screw 13.

Once brake forming has been carried out, the operator reverses the direction of rotation of the motor unit 11 and hence of the worm screw 13, which pushes back upwards the sleeve 14 and the entire upper frame 3.

It shall be noted that, even in case of accidental failure of the worm screw 13, the upper frame 3 is automatically locked and prevented from falling onto the base frame 2.

This is because the stumps generated when the worm screw 13 is broken still lean against each other in substantially coaxial relationship, as

they are retained in this position by the sleeve 14 that prevents any offset thereof.

Nevertheless, for enhanced safety, the upper frame 3 and the base frame 2 have braking means 25 therebetween, which are known to the skilled person and are synthetically formed with a small hydraulic circuit for shunted supply, through a distribution valve, to a cylinder 26 whose jacket has one end connected to the upper frame 3 and the opposite piston shaft end connected to the base frame, as schematically shown in Figure 1.

All the displacements of the upper frame 3 relative to the base frame 2 are guided by the guides 16.

The invention has been found to fulfill the intended objects.

The invention so conceived is susceptible to changes and variants within the inventive concept.

Also, all the details may be replaced by other technical equivalent elements.

In its practical implementation, any material, shape and size may be used as needed, without departure from the scope as defined by the following claims.

CLAIMS

1. A press brakes comprising:

- A base frame (2);

- An upper frame (3) overhanging the base frame (2) and which is movable vertically, reciprocating between an active brake-forming stroke toward the base frame (2) and an inactive return stroke away from the latter, being guided by guiding means (16) and actuated by actuating means;

- A die (5) which is associated with a resting surface (4) of the base frame (2) and having a first brake-forming profile (6) of a piece (10) to be brake-formed;

- A punch (8) associated with a second surface (7) of the upper frame (3) facing said resting surface (4) and having a second brake-forming profile (9) of the piece (10) to be brake-formed and being aligned with said first brake-forming profile (6) and designed to be conjugately mated with said first profile (6);

characterized in that said actuating means comprise:

- A moving group (11);

- A vertical motion transmission group (13, 14) which connects reciprocally the motion group (11) and the upper frame (3) and acting under traction on said upper frame 83) in the active brake-forming stroke and under push in said inactive return stroke.

2. A press brakes as claimed in claim 1, wherein said moving group comprises at least one motor (11) associated with said base frame (2).

3. A press brakes as claimed in claim 1, wherein said transmission group comprises:

- At one screw element (13) rotationally bi-directionally actuated by said moving group (11);

- At least one corresponding sleeve body (14) fixingly associated with said upper frame (3) and having an axial threated cavity (15) wherein said screw element (13) is engaged.

4. A press brakes as claimed in claim 1, wherein said moving group comprises a fluid-dynamic actuator (26) fitted between said upper frame (3)

and said base frame (2).

5. A press brakes as claimed in claim 1, wherein braking means (25) of said active and inactive strokes are interposed between said base frame (2) and upper frame (3).

6. A press brakes as claimed in claim 1, wherein said upper frame comprises a transversal element (18) supported by at least one up-right element (17).

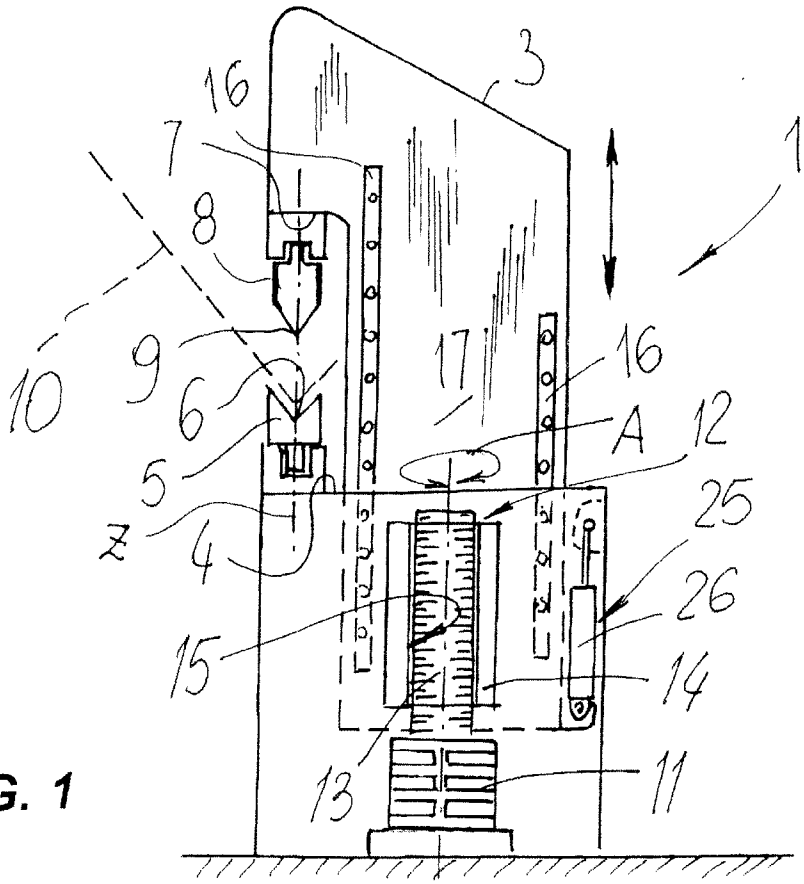

FIG. 1

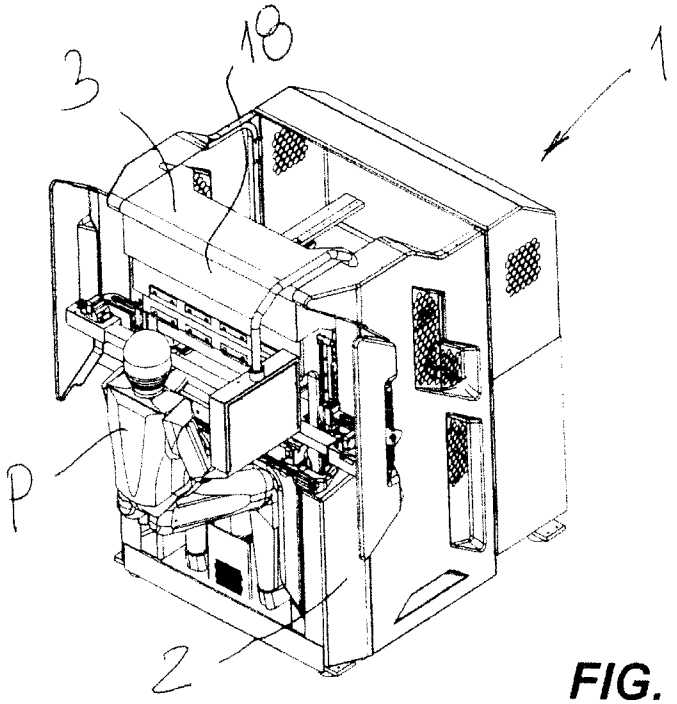

FIG. 4

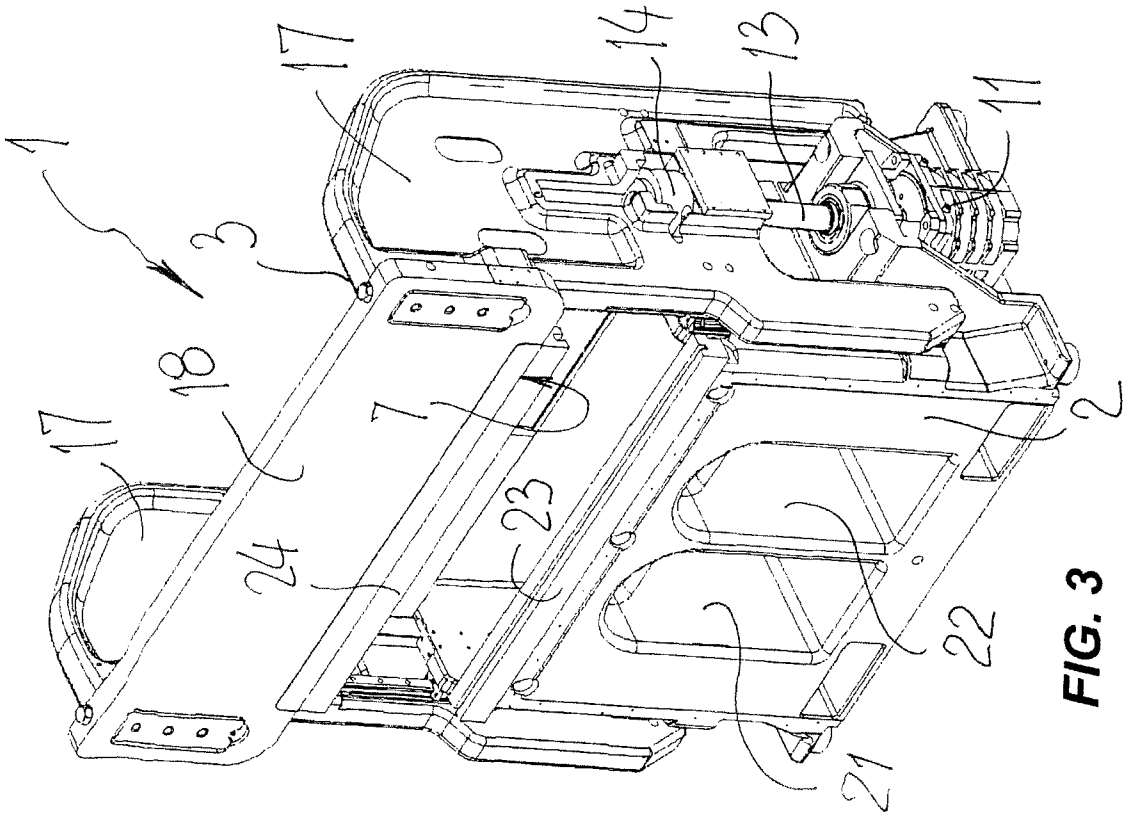
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FIG. 3

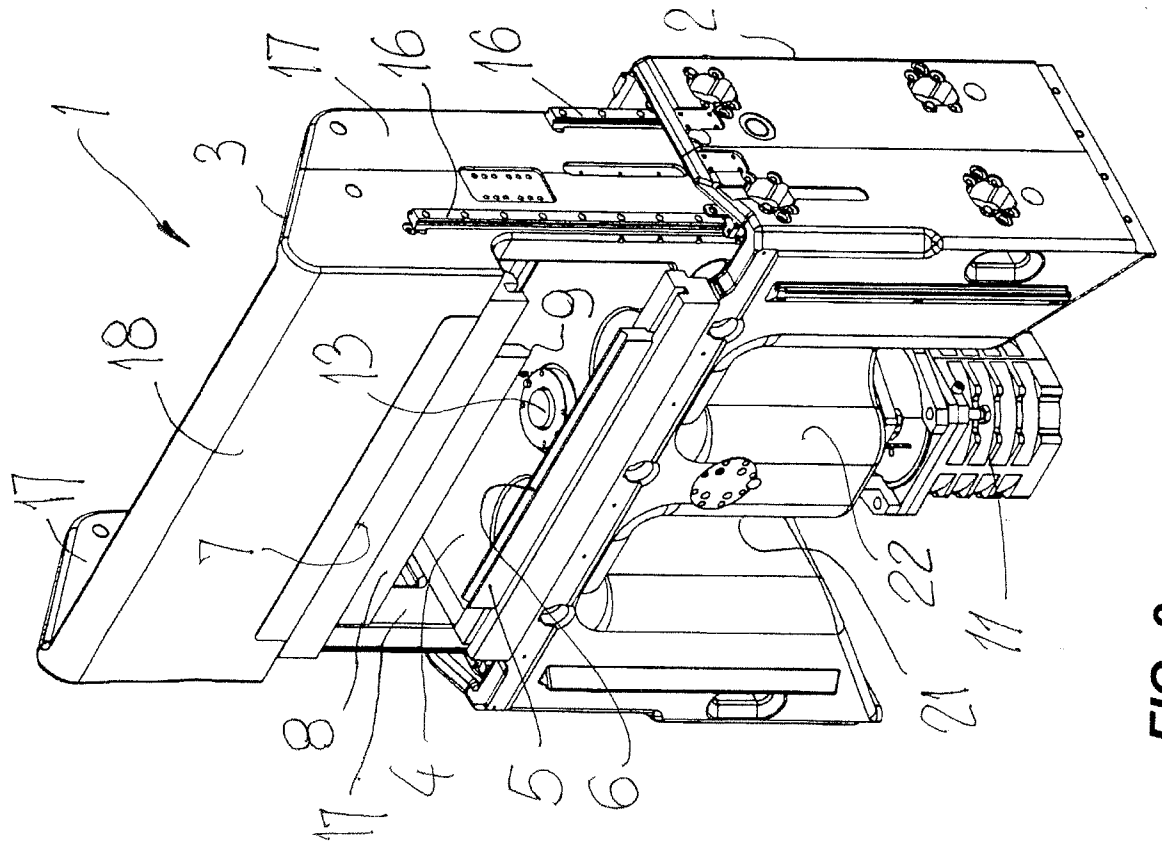
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FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/055753

A. CLASSIFICATION OF SUBJECT MATTER
INV. B21D5/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 006 079 A1 (TRUMPF MASCHINEN AUSTRIA GMBH [AT]) 24 December 2008 (2008-12-24) paragraph [0041]; figures 1,6	1-6
X	JP H04 75798 A (AMADA CO LTD) 10 March 1992 (1992-03-10) abstract; figure 1	1-6
X	JP 2005 238280 A (AMADA CO LTD) 8 September 2005 (2005-09-08) abstract; figures 1-3	1-6
X	US 3 198 108 A (FRITZ INGOLD) 3 August 1965 (1965-08-03) column 2, line 14 - line 21; figure 1	1-6

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 November 2015	18/11/2015

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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