(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 586 543 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
01.05.2013 Bulletin 2013/18

(21) Application number: **11797645.6**

(22) Date of filing: **14.02.2011**

(51) Int Cl.:
B21D 45/00 *(2006.01)*

(86) International application number:
PCT/ES2011/070100

(87) International publication number:
WO 2011/161284 (29.12.2011 Gazette 2011/52)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **25.06.2010 ES 201030989**

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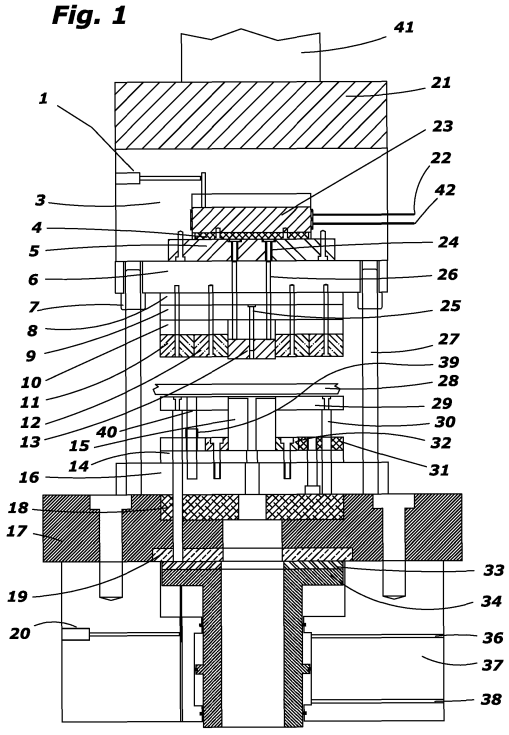
(54) STAMPING PRESS

(57) The invention relates to a stamping press that includes a fixed lower body provided with a bench (17), an upper mobile body or press carriage (21), a lower cushion that constitutes a mobile body with respect to the lower fixed body, an upper cushion that constitutes a mobile body with respect to the upper mobile body, a punch assembly formed by an upper part of the punch assembly rigidly attached to the upper mobile body, and a lower part of the punch assembly rigidly attached to the bench, and a device for guiding(27) the upper part of the punch assembly with respect to the lower part of the punch assembly, in which the lower cushion includes a sole hydraulic cylinder (34) having an annulus located on the central part of the bench, the center part thereof being hollow, said central part constituting an exit area for the pipes or cuttings from the punching carried out during the stamping process.

Fig. 1



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Description

[0001] This invention refers to a high precision press for stamping sheet metal fitted with a set of items representing major advantages in respect of the state of the art, including a single central hollow lower ram which prevents unbalances in the stamping operation, and enables the evacuation of scrap, upper and lower adapter plates, a lower bottoming die on the bed plate or bolster, upper and lower punch holder plates and an attached die on a die shoe plate.

[0002] The devices currently available on the market are used for manufacturing precision items which comply with most of the requirements made by the final user, but are nevertheless not free from certain technical problems during the manufacturing process.

State of the art

[0003] US 4267753 discloses a set of apparatus for producing a stamped item from a strip, which comprises a lower stripper, driven by a set of spiral springs and a central spring for operating the upper stripper. This type of cutting is commercially known as GRIP FLOW®.

[0004] US 4905556 discloses a stamping press comprising upper and lower central hydraulic cylinders for operating the strippers, with the expulsion of the workpieces and the scrap or cuttings taking place together from the lower machine bed upwards. This also comprises a tightening ring for securing the material around the workpiece during the stamping operation. This cutting system is known as "fineblanking".

[0005] WO 01/00396 describes a device for cutting pieces from a sheet of material, which comprises a press and is provided with a set of hydraulic cylinders and at least one additional cylinder for compensation at the bottom.

[0006] US 6370931 describes a press practically identical to the one of US 4267753, but in which the spiral springs have been replaced by hydraulic cylinders.

[0007] In accordance with the "fineblanking" system, the so-called scrap or cuttings are expelled along with the finished part. For this reason there later has to be a second "pumping" or similar operation through a sieve to separate the scrap or cuttings from the finished pieces. This leads to a great risk of "banging" the finished parts in the sieving process that may cause deterioration of the manufactured part. This circumstance requires strict quality control. Furthermore, when a piece of scrap gets stuck in the stamping zone this could damage the die, or even the press. According to this manufacturing method the material for making the part is manipulated in such a way that the most important waste from the strip known as "scrap" is expelled in a single direction, while the workpieces and cuttings are expelled together. There are thus only two channels for expulsion for the waste and finished parts, with finished parts and cuts mingling, at the risk of sending finished parts to the customer along with cuttings, especially in automobile parts.

[0008] The manufacturing processes known as "fineblanking" tend to use a tightening ring known as "V-ring". The purpose of this tightening ring is to stick a V-shaped wedge into the material surrounding what will be the finished part in such a way that this locks the material prior to being "punched". This minimises the deformations in the material surrounding the final part and thus minimises the deformations in the finished part itself. This is not however the case according to the invention, as will be described below. This manufacturing system entails greater consumption of raw material that can in some cases reach a level 35% higher than would be desirable. Taking into account that this increase has a direct effect on the cost of the workpiece, this can be considered a serious problem, even more so if the part to be made has to be made from materials with high value on the market such as copper or stainless steels. It has nevertheless been shown that the use of this tightening ring generates a loss in the planimetry of the finished part, since, when carrying out its "locking" function, this tightening ring also prevents the release of the tensions caused by cutting the part. This means that reason these tensions cannot be passed on to the waste or scrap, which would be more desirable. This problem is solved by the present invention.

[0009] In the stamping processes by the GRIP FLOW® system, the most serious problems are as follows:

[0010] The system is in itself designed for small and medium thicknesses, but is not suitable for manufacturing thicker parts in large production runs due to its own configuration, as will be explained later.

[0011] The upper hydraulic cushion consists of at least two cylinders. This cushion is not steered by any guide element which guarantees its perfectly vertical and synchronic movement. For this reason there is an unbalance problem which affects the position and movement of the upper stripper, either due to a fault in one of these or simply to internal friction or pressure differences. This has a direct effect on the position of stripper pins, both at the time of extension, for which reason this directly affects the cushion bottoming die, the stripper pins and the upper stripper, and can damage this in its guide zone due to the axial strains caused by the unbalancing as well as the punches for internal openings in the part, usually known as "piercing punches".

[0012] The "axial locking" effect may result in the breakage of the cushion bottoming die, as well as the stripper pins, upper stripper, piercing punch or the actual cutting die itself, affecting the tooling or the quality of the part.

[0013] The upper cushion bottoming die is thin and not guided. For this reason there are cases of this being jammed in both the compression and the extension cycle, directly affecting the tool and making this break, as well as affecting the quality of the part.

[0014] The upper hydraulic cushion is inserted in a cavity and opposite this is its bottoming die, and in contact

with this is the upper plate of the die shoe commonly known as "Die-set". The GRIP FLOW® design places the cavity of the upper cushion just above the point where all the cutting pressure, or tonnage necessary for this, is exerted. This means that at the time when the part is cut the upper plate of the die-set is not supported on its uppermost face, that is, on the face where it is in contact with the bottoming die of the upper cushion. This entails that at the time of maximum effort, that is, at the point of cutting, the bottoming die is in a withdrawn position through the action of the upper stripper pins. For this reason the upper plate of the die-set is located just in the area of contact with the bottoming die in the "air", with nothing to overlap the upper plate of the "die-set" or withstand the stress to which this is being subjected at the time of cutting this, and thus preventing its deformation. The result of this lack of support or overlapping is the permanent deformation of this plate in the contact area of the bottoming die. This leads to all the plates forming the upper tool assembly being damaged due to the permanent deformation of the upper plate of the die-set which supports these. This has a direct influence on the quality of the part and life of the tooling, since the effect following this permanent deformation is that the other plates lose their flatness and thus their verticality and alignment. This means that the upper tooling "bites" into the lower tooling, gradually deteriorating the tooling with each new cycle that is run.

[0015] The die-cutter extends along the whole useful surface of the tooling. This is formed of a plate of the same size as the punch holder plate or the bottoming die plate of the tooling. The die consists of a plate which performs the cutting action and a plate that supports this and guides the part after cutting its perimeter.

[0016] This design involves the problem that if there is any breakage of the die or if this is seriously damaged, the whole plate will have to be replaced with a new one, with the consequent costs.

[0017] The lower ejection plate passes on the movement driven by the press carriage and due to the action of the stripper pins not being "guided" by any item guaranteeing the accuracy of its movement or its verticality, resulting in jams and bites in the punch.

[0018] The lower cushion is made up of at least two hydraulic cylinders. This cushion is not steered by any guiding item guaranteeing its perfectly vertical and synchronic movement. For this reason there is an unbalancing problem affecting the position and movement of the lower stripper pins and thus of the lower stripper in respect of the punch, so that the stripper can bite the punch in its upward expulsion movement, damaging this punch.

[0019] The punch is located on a lower plate of the die shoe; this plate is made of soft material, i.e. not hardened or hardened, and the punch will thus "stick into" this plate through the effect of the cutting pressure.

[0020] The punch is secured at the bottom of the tooling to prevent this from being pulled off at the time of ejection. In spite of the punch having a flange facilitating securing this, there is a problem of securing this punch for parts that have little wall between the outside of the part and the inner cutaway, not having sufficient surface area to house any screws of sufficient size to support the traction stress of stripping the scrap or the remains of the outside strip of the punch, for which reason making this without the flange is not feasible, and its manufacturing is thus more expensive.

[0021] The lower part of the tool, according to US 6370931, consists of a punch, a lower stripper, stripper pins and a lower die shoe or " die-set". This assembly rests on a plate which corresponds to the press bed, and this bed has a through-bore of considerable size to allow the scrap or cuttings through. There is thus the deformation problem mentioned above. In this case the plate rests on the die shoe, but there is no support in the cutaway area of the plate and the die shoe thus deforms through the effect of the cutting pressure and the tonnage exerted just in this area stemming from the stress on the punch, this plate being permanently deformed in this area; this affects the support of the punch, which loses alignment and verticality, causing the consequent "bite" on the die in the successive cycles due to the extremely limited tolerances between punch and die, and permanently damaging the tooling.

[0022] Precision stamping requires the balancing of both the upper and lower parts of the die, since when there is any unbalance two unwanted effects are produced: the first effect is the loss of accuracy in stamping the parts and the second effect is the greater wear of the dies, and thus an increase in the production cost and reduction in productivity.

Description of the invention

[0023] This invention refers to a stamping press which solves all the problems mentioned above, enabling high accuracy and durability of the dies, and safety in removing the scrap, ensuring greater stability in making parts.

[0024] The press according to the invention comprises:

- A fixed lower body, which comprises a machine bed;
- A mobile upper body, known as the press carriage;
- A body that is mobile in respect of the fixed lower body (lower cushion);
- A body that is mobile in respect of the mobile upper body (upper cushion);
- A die-cutting set made up of an upper part of the die-cutting set integral with the mobile upper body and a lower part of the die-cutting set fixed to the machine bed; and
- A device for guiding the upper part of the die-cutting set in respect of the lower part of the die-cutting set.

[0025] At the top the machine bed has a housing for a lower adapter plate. At the bottom it also has a support

or housing for a lower bottoming die apart from a set of through-bores for allowing stripper pins through.

[0026] The lower adapter plate also has a set of through-bores for allowing the stripper pins through, as well as holes for allowing the scrap or cuttings out. This lower adapter plate prevents the deformation of the lower die shoe plate. This adapter plate will normally be made of steel.

[0027] The lower bottoming die is located at the bottom of the machine bed and also has through-bores for allowing through the stripper pins and for letting out the scrap or cuttings, the latter being a single large hole. Said lower bottoming die will be made of hardened steel. Said lower bottoming die has the purpose of preventing any permanent deformations on the lower part of the machine bed through impacts on the lower cushion in each expulsion cycle of the stamped parts. If said deformations were to arise through continuing use it is possible to replace said lower bottoming die, without needing to replace the bed.

[0028] The lower cushion is made up of a single central and hollow hydraulic cylinder, with an annular section. The central bore of said lower cushion enables the expulsion of scrap or cuttings down through this without the decompensation or unbalance existing in devices with lower cushions made up of multiple cylinders. The hydraulic cylinder is preferably dual action, meaning that the movements and accelerations can be controlled, this being particularly advantageous for reducing the impact on the lower bottoming die of the bed. The hydraulic cylinder is provided with a position-detecting device, such as an encoder.

[0029] The lower part of the die-cutting set is made up of a lower die-cutting set plate, a lower bottoming die of the die-cutter, a lower punch holder plate and possible a punch press plate, a punch and a lower stripper. The punch holder plate is used for positioning the punch. In some cases the punch simultaneously performs the functions of the die. If the punch is not of the appropriate size to be held at the bottom with screw fittings, then an additional plate known as a punch press can be used. This comprises means for holding the punch by locking this, said holding means being made up of one or more parts. This lower punch holder plate as well as the punch press plate will where applicable be located on a lower bottoming die of the die-cutter. If the punch can be held only by means of screws the lower punch holder plate will be needed for positioning this. The lower part of the die-cutting set comprises a lower stripper. Said lower stripper is provided with stripper pins for driving the expulsion movement, and guide columns which slide along guide bushes, guaranteeing perfect balance and high accuracy in the vertical movement of the lower stripper.

[0030] The upper cushion comprises a base plate on which there is a single dual action hydraulic cylinder which has a hardened bottoming die fitted at the bottom to prevent the deformation of this hydraulic cylinder through the effect of the stress of the transmission pins of the carriage adapter plate. The hydraulic cylinder can be dual action, so that the movements and accelerations can be controlled. The hydraulic cylinder is also provided with a device for position detection, such as an encoder.

[0031] The base plate comprises a housing for a plate for adaptation to the carriage. This plate comprises through-bores for housing transmission pins, which are known as transmission pins for the plate for adaptation to the carriage.

[0032] This plate for adaptation to the carriage can be secured by screws or by a fast-release device.

[0033] Both the base plate and the plate for adaptation to the carriage can be fixed to an upper die-cutter holder plate.

[0034] Fitted to this upper die-cutter plate is an upper bottoming die for the die-cutter, an upper punch holder plate, an upper guide plate and an upper die shoe plate. All these plates are made of hardened steel.

[0035] Secured to the upper die shoe plate there is an upper die. On the interior, in the die and the upper guide plate there is an upper stripper which slides through these parts. On the upper punch holder plate one or more piercing punches are fitted, through which the upper stripper slides. This stripper extends by means of transmission pins of the upper stripper which cross the set of plates forming the upper part of the die set and which rest on the transmission pins of the plate for adaptation to the carriage.

[0036] The expulsion of the die-cut part is performed through the action of the hydraulic cylinder of the upper cushion, through the upper bottoming die and the transmission pins of the plate for adaptation to the carriage and of the transmission pins of the upper stripper, which act directly on the stripper.

[0037] Both the bottom and top part of the die-cutting assembly are fitted on pins to guarantee their respective alignment.

Brief description of the drawings

[0038] In order to illustrate the following explanation, we adjoin to this descriptive report four sheets of drawings in which the essence of this invention is represented in eight figures and in which:

- Figure 1 shows a schematic cross-section view of the stamping press of the invention;
- Figure 2 shows a detail of a first device for securing the punch, as an example;
- Figure 3 shows a detail of a second device for securing the punch, as an example;
- Figure 4 shows a detail of the assembly of the punch, by means of screws.
- Figure 5 shows a view of a stamping press of the earlier GRIP FLOW® system in which one can appreciate the unbalancing of the lower cushion caused by an oil leak, a differential wear of the hydraulic cylinders, a differential

in the internal friction, different load losses in the hydraulic lines or other causes;

Figure 6 shows a detail of the theoretical position of the lower stripper over the lower punch in the machine of Figure 5;

Figure 7 shows a detail of the real effect caused when the lower stripper undergoes a slight unbalancing, according to the preceding state of the art of Figures 5 and 6; and

Figure 8 shows a detail of a "bite" caused in the punch by the lower stripper due to the unbalancing of the lower cushion, according to the system of Figures 5 to 7.

Detailed description of a preferential form of embodiment

[0039] According to a preferential form of embodiment of the invention, a stamping press for a laminated metal material (28), such as a strip, is described, comprising:

- a fixed lower body provided with a machine bed (17);
- a lower cushion which constitutes a mobile body in respect of the fixed lower body;
- a base plate of the lower cushion (37), which will be fixed to the machine bed (17); the lower cushion comprises a single hydraulic cylinder (34) with an annular section placed in the central part of the machine bed; the hydraulic cylinder (34) is hollow in the centre and this hollow area constitutes a zone for removal of any scrap or cuttings produced by the die-cutting performed in the stamping process; through being a single central hydraulic cylinder, the problems stemming from unbalance are ruled out; the lower cushion is driven by means of oil pressure stemming from the pressure line (38) to move the hydraulic cylinder upwards, or the pressure line (36) to move this downward. The hydraulic cylinder (34) also comprises a device for reading the lower position, such as an encoder (20);

- a mobile upper body or press carriage (21); this mobile body is driven by the main hydraulic cylinder of the press (41).
- an upper cushion which constitutes a mobile body in respect of the upper mobile body. This upper cushion is for ejecting the part and/or deforming this prior to cutting when this is required;
- a die-cutter assembly consisting of the top part of the die-cutting assembly fixed to the upper mobile body, and a lower part of the die-cutting assembly integral with the machine bed; and
- A guiding device (27) for the top of the die-cutting assembly in respect of the bottom part of the die-cutting assembly.

[0040] The bottom part of the die-cutting assembly is made up of:

- A lower die-cutter holder plate (16) which houses guide columns (27);
- a lower bottoming die (14);
- a lower punch holder plate (31);
- a punch press plate (32);
- a punch (15);
- a lower stripper (29);
- a set of lower transmission pins (30);
- a set of guide bushes of the lower stripper (39); and
- a set of guide columns of the lower stripper (40).

[0041] The top part of the die-cutting assembly is in turn made up of:

- an upper die-cutter holder plate (6) which houses guide bushes (7);
- an upper bottoming die plate (8);
- an upper punch holder plate (9);
- an upper guide plate (10);
- an upper die shoe plate (11);
- an upper die (12);
- an upper stripper (13);
- transmission pins of the upper stripper (26).

[0042] The press according to the invention comprises a lower adapter plate (18), placed in a housing made in the machine bed (17), said lower adapter plate (18) being provided with through holes for removing the scrap or cuttings, as well as for the lower stripper transmission pins (30) to go through. Said lower adapter plate (18) is used to prevent the temporary or permanent deformation of the lower die-cutter holder plate (16), as well as the set of plates that are fitted on this (lower bottoming die (14), lower punch holder plate (31), punch press plate (32)), also preventing the misalignment or loss of verticality of the punch (15).

[0043] The stamping press of the invention also comprises a machine bed bottoming die (19), set at the bottom part of the machine bed. This machine bed bottoming die (19) prevents the deformation of the bottom part of the machine bed through being pressed by the bottoming die of the lower cushion (33) in each cycle.

[0044] The lower cushion bottoming die (33) is fitted integral to the top part of the hydraulic cylinder (34) with an annular section.

[0045] The press carriage (21) comprises a base plate of the upper cushion (3) provided with an upper cushion. The upper cushion comprises:

- a hydraulic cylinder for the upper cushion (23); a position detection device, such as an encoder (1);
- a plate for adaptation to the carriage (5) set in the base plate of the upper cushion (3); this plate for adaptation to the carriage (5) prevents the deformation of the upper plate of the die-cutter holder (6), and thus also prevents the deformation of the top

part of the die-cutting assembly and the ensuing misalignment;

- transmission pins of the plate for adaptation to the carriage (24) whose base is housed in the plate for adaptation to the carriage (5); and
- an upper cushion bottoming die (4); this bottoming die will normally be made of hardened steel and be secured to the hydraulic cylinder of the upper cushion (23); this bottoming die is for preventing the deformation of the hydraulic cylinder of the upper cushion (23).

[0046] The hydraulic cylinder of the upper cushion (23) has the function of pushing the transmission pins of the plate for adaptation to the carriage (24) and the transmission pins of the upper stripper (26). Said upper cushion hydraulic cylinder (23) is driven by pressure lines (22, 42), which respectively have a pushing and braking effect.

[0047] The upper die shoe plate (11) houses the die plate (12), which means that a more expensive and stronger material can be used for the die, and in the event of breakage only the spoiled part can be replaced; in the case of multiple cavities (for multiple upper dies), only the affected part and not the entire dies can be replaced, significantly reducing the operating and maintenance costs. Similarly, the lower punch holder plate (31) can comprise different cavities in which different punches (15) are housed, in agreement with the upper dies or cavities.

[0048] The top part of the die-cutting assembly normally also incorporates one or more piercing punches (25); it is nevertheless possible for said piercing punches (25) not to be present when their use is not necessary for making the required part.

[0049] It should be pointed out that both the upper cushion hydraulic cylinder (23) and the hollow hydraulic cylinder for the lower cushion (34), comprise internal guides for proper guidance of the movement of the corresponding plungers as well as external scrapers for removing dirt.

[0050] The punch (15) can be secured directly to the lower die-cutter holder plate (16), for example by means of screws crossing the lower bottoming die of the die-cutter(14). This solution can be seen in the diagram in Figure 4. When the geometry or dimensions of the parts to be made mean that this securing system is not feasible it is also possible to use the fixing device, such as a securing part (323) fitted with a variable shaped flange (322) or with a housing for a ring (321), the punch (15) comprising a recess for partly housing said ring (321), with the securing piece (323) being the one that is secured to the lower die-cutter holder plate (16) or to the lower bottoming die of the die-cutter (14) by means of screws.

Claims

1. A stamping press, which comprises:

   - a fixed lower body provided with a machine bed (17);
   - a mobile upper body or press carriage (21);
   - a lower cushion which constitutes a mobile body in respect of the lower fixed body;
   - an upper cushion which constitutes a mobile body in respect of the upper mobile body;
   - a die-cutting assembly formed of a top part of the die-cutting assembly integral to the upper mobile body, and a bottom part of the die-cutting assembly integral to the machine bed;
   - A guiding device (27) of the top part of the die-cutting assembly in respect of the bottom part of the die-cutting assembly

   characterised in that the lower cushion comprises a single hydraulic cylinder (34) with an annular section placed in the central part of the machine bed, hollow in the centre, this central part constituting the zone for removal of the scrap or cuttings produced by the die-cutting operation performed in the stamping process.

2. A stamping press, according to claim 1, **characterised in that** this also comprises a lower adapter plate (18), fitted in the housing made in the machine bed (17), said lower adapter plate (18) being provided with through-bores for removal of the scrap or cuttings, as well as for allowing through the transmission pins of the lower stripper (30) incorporated in said press.

3. A stamping press, according to either of claims 1 and 2, **characterised in that** this also comprises a bottoming die of the machine bed (19), fitted in the bottom part of the machine bed.

4. A stamping press, according to any of claims 1 to 3, **characterised in that** this also comprises a bottoming die of the lower cushion (33) joined to the annular section hydraulic cylinder (34).

5. A stamping press, according to any of claims 1 to 4, **characterised in that** the press carriage (21) is made up of:

   - a base plate of the upper cushion (3) provided with an upper cushion;
   - a bottoming die of the upper cushion (4);

   and because the upper cushion comprises:

   - a hydraulic cylinder for the upper cushion (23);
   - a position detection device, such as an encoder;

- a plate for adaptation to the carriage (5) fitted on the base plate of the upper cushion (3); and
- transmission pins of the plate for adaptation to the carriage (24) whose base is housed in the plate for adaptation to the carriage (5).

6. A stamping press, according to any of claims 1 to 5, **characterised in that** the bottom part of the die-cutting assembly is made up of:

- a lower die-cutter holder plate (16) which houses guide columns (27);
- a lower bottoming die (14);
- a lower punch holder plate (31);
- a punch press plate (32);
- a punch (15);
- a lower stripper (29);
- a set of lower transmission pins (30);
- a set of guide bushes of the lower stripper (39); and
- a set of guide columns of the lower stripper (40).

7. A stamping press, according to claim 6, **characterised in that** the punch press plate (32) comprises a flange for holding the punch (15); and **in that** the punch has a recess for insertion of this flange.

8. A stamping press, according to any of claims 1 to 7, **characterised in that** the top part of the die-cutting assembly is made up of:

- an upper die-cutter holder plate (6) which houses guide bushes (7);
- an upper bottoming die plate (8);
- an upper punch holder plate (9);
- an upper guide plate (10);
- an upper die shoe plate (11);
- an upper die (12);
- an upper stripper (13);
- transmission pins of the upper stripper (26).

9. A stamping press, according to claim 8, **characterised in that** the top part of the die-cutter assembly also comprises one or more piercing punches (25).

10. A stamping press, according to claims 1 to 9, **characterised in that** both the hydraulic cylinder of the upper cushion (23) and the hollow hydraulic cylinder of the lower cushion (34), comprise internal guides for properly guiding the movement of the corresponding plungers and external scrapers for removing dirt.

11. A stamping press, according to claim 6, **characterised in that** the lower punch holder plate (31) comprises a plurality of cavities in which different punches are housed (15).

12. A stamping press, according to claims 8 and 11, **characterised in that** the upper die shoe plate (11) comprises a plurality of cavities in which different upper dies (12) are housed in accordance with the different lower punches (15).

13. A stamping press, according to claim 6, **characterised in that** the punch (15) is anchored to the lower die-cutter holder plate (16) by means of a securing part (323) provided with a flange (322), the securing part (323) being the one that is fixed to the lower die-cutter holder plate (16) or to the lower bottoming die of the die-cutter (14).

14. A stamping press, according to claim 6, **characterised in that** the punch (15) is anchored to the lower die-cutter holder plate (16) by means of the securing part (323) with a housing for a ring (321), the punch comprising a recess for partially housing said ring (321), the securing part (323) being the one that is fixed to the lower die-cutter holder plate (16) or to the lower bottoming die of the die-cutter (14).

Fig. 1

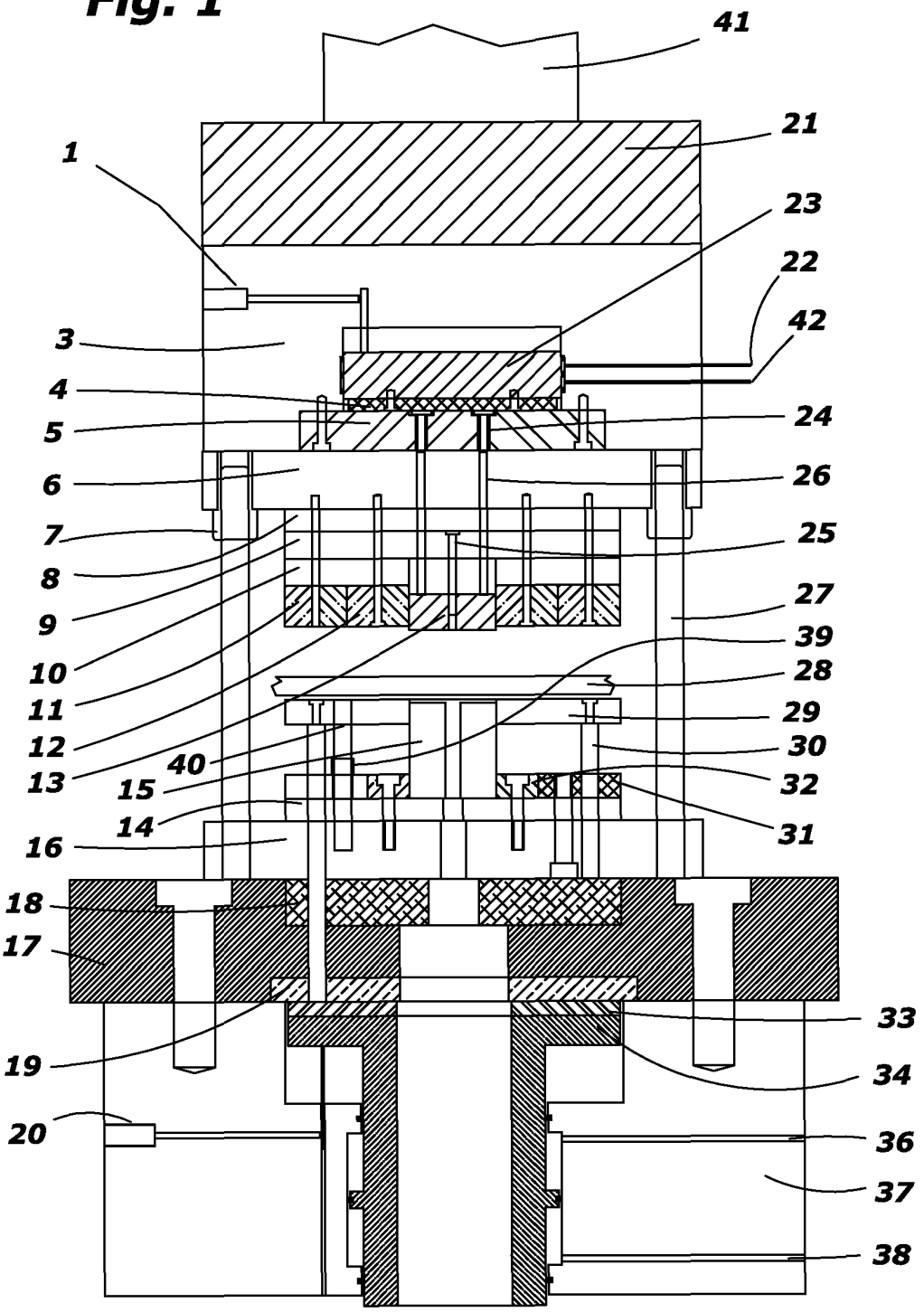
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Fig. 2

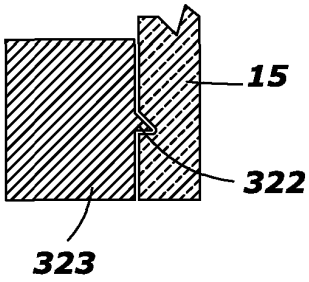
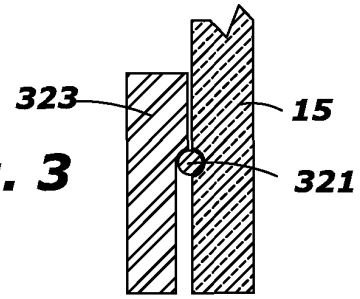


Fig. 3



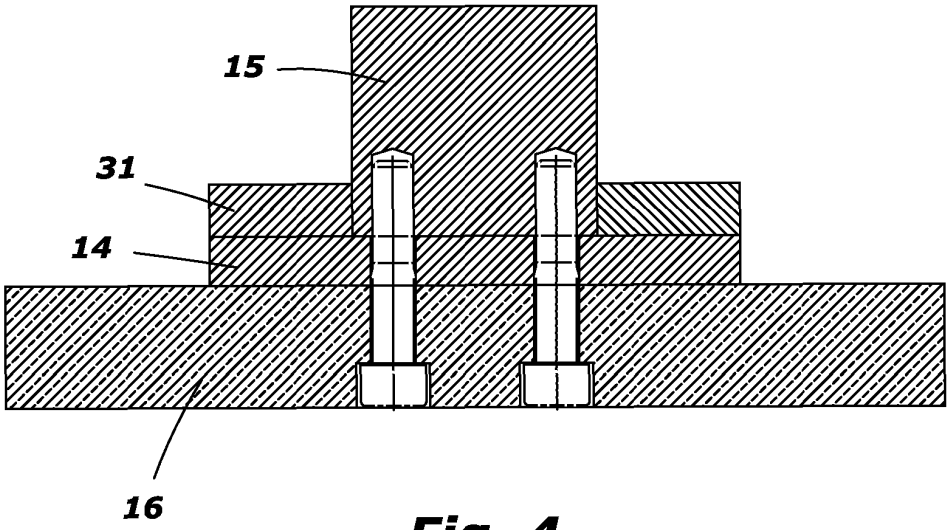


Fig. 4

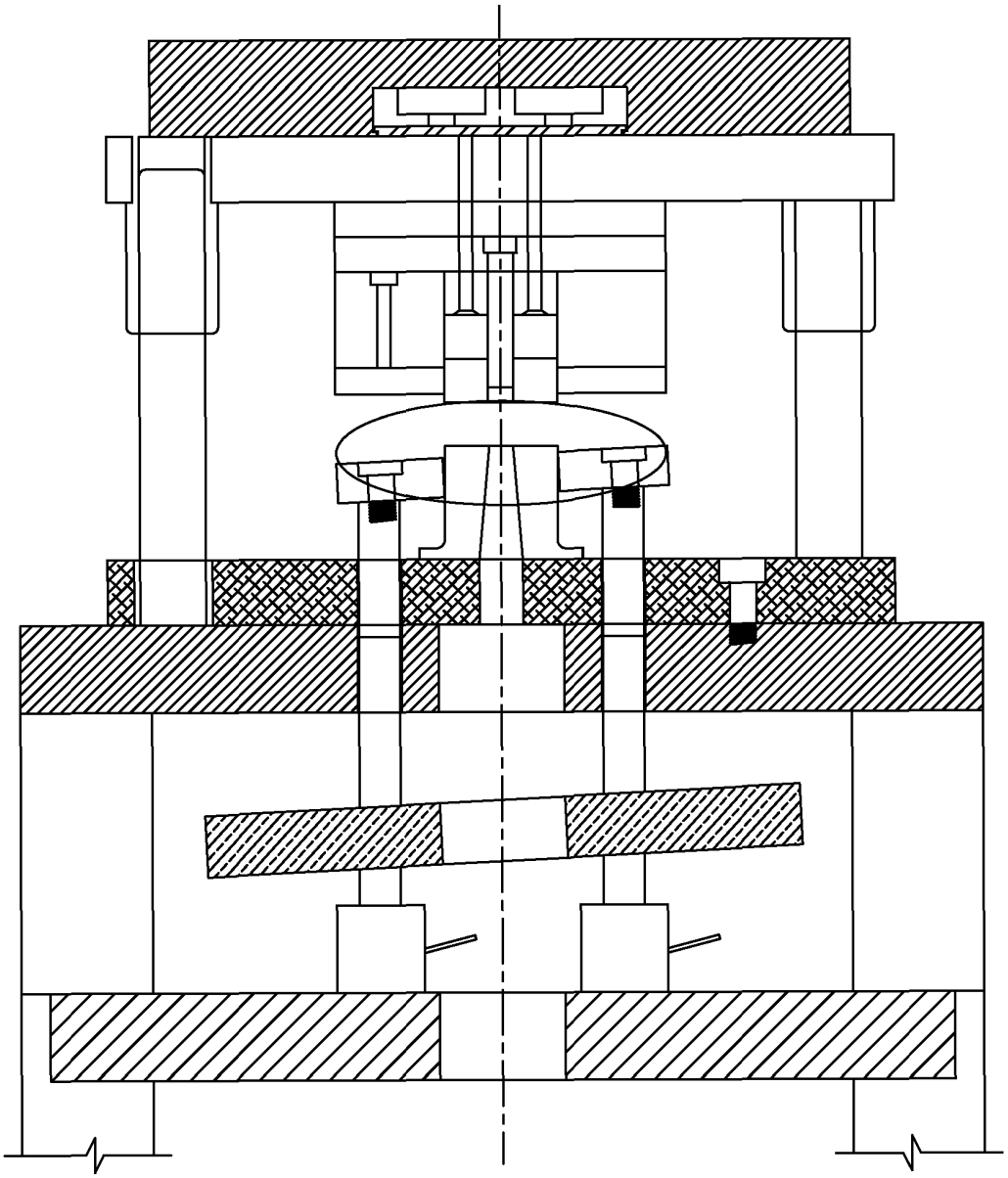
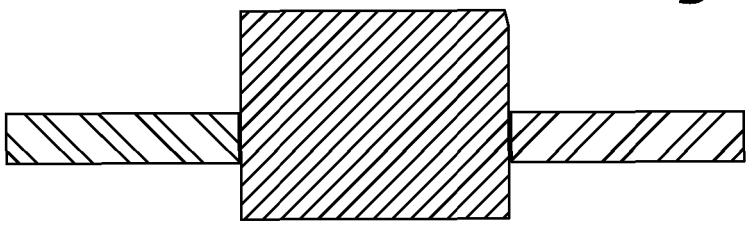


Fig. 5

Fig. 6



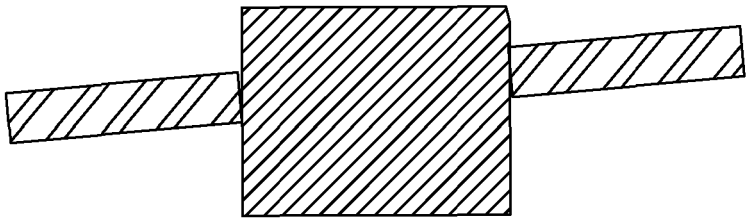


Fig. 7

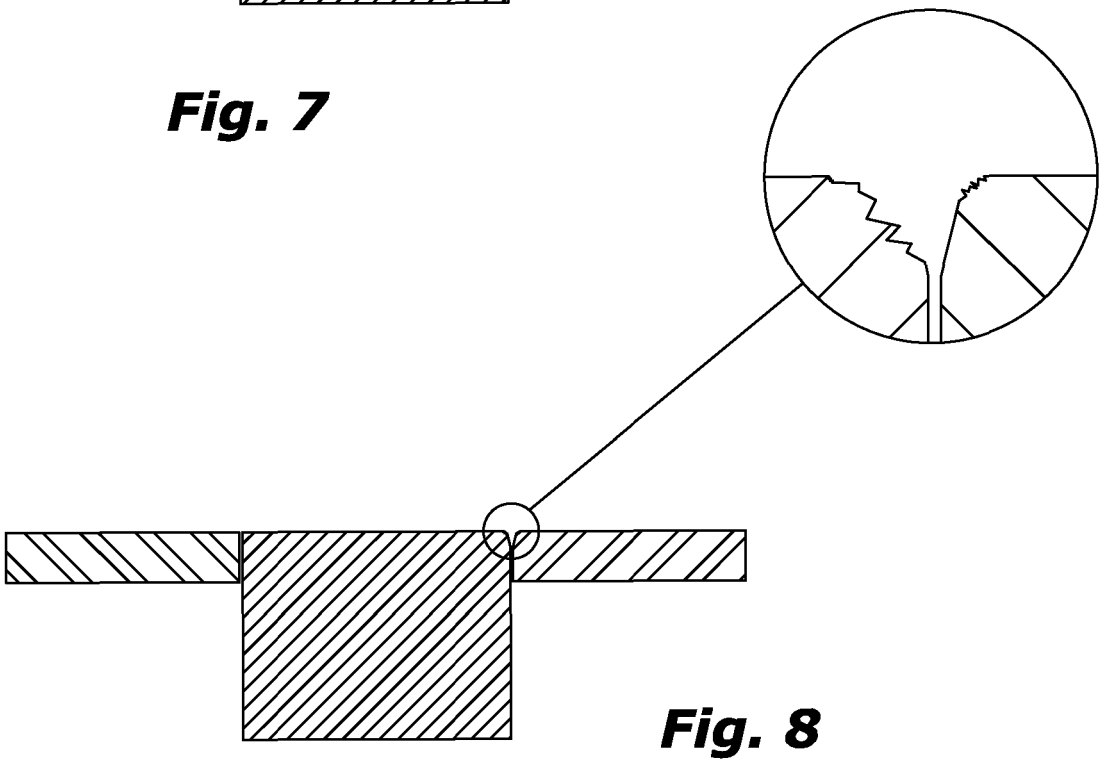


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2011/070100

A. CLASSIFICATION OF SUBJECT MATTER

B21D45/00 (2006.01)

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, B30B

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)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9117005 A1 (ACE TECHNOLOGY CORP) 14/11/1991, pages 9 and 10; figures 6-10	1-14
A	US 4316399 A (WALLIS) 23/02/1982, column 1, line 37 - column 2, line 54; figures 1 and 2.	1-14

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance.
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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
08/07/2011	**(12/07/2011)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer A. Pérez Igualador Telephone No. 91 3498489

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ES2011/070100

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
WO9117005 A	14.11.1991	US4951537 A	28.08.1990
		CA1282647 C	09.04.1991
		EP0526449 AB	10.02.1993
		EP19900911550	27.04.1990
		DE69031173 T	26.02.1998
US4316399 A	23.02.1982	NONE	

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4267753 A **[0003] [0006]**
- US 4905556 A **[0004]**
- WO 0100396 A **[0005]**
- US 6370931 B **[0006] [0021]**