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(54) **DIE**

(57) The present invention relates to a die, said die comprising an upper die that is movable and a lower die that is held stationary, said upper die being provided with a pressure plate (4) for stamping a workpiece, and said lower die being provided with a forming die (11) for sup-

porting said workpiece, characterized in that a cushioning element (6) is arranged at least in a blank pressing region of said pressure plate (4) for tightly pressing the workpiece located on the forming die (11), and said cushioning element is made of polyurethane.

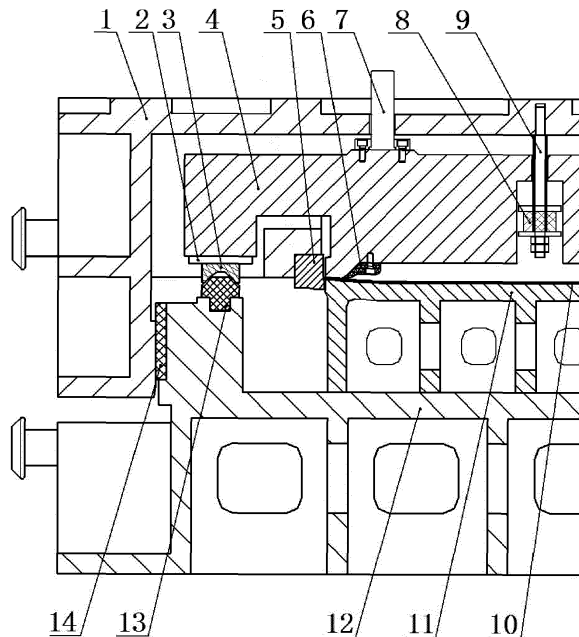


Figure 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a die, in particular a die for flanging. The die according to the present invention is particularly applied for stamping of a vehicle's outer cover element.

BACKGROUND OF THE INVENTION

[0002] In the cold stamping field, the flanging process is a relatively common processing that can be applied for almost all the stamped products. In cold stamping, a flanging die is usually applied to realize flanging.

[0003] The known flanging die generally comprises an upper die and a lower die, the lower die comprising a forming die, the upper die being provided with a pressure plate, a workpiece being arranged on the forming die, and taking the forming die as the basis, the rigid pressure plate is used to make the workpiece be stamped and flanged.

[0004] Such a die has been known from CN202052866U. In flanging dies of existing technologies, the metal pressure plate contacts with a workpiece directly. Due to the fact that the pressure plate itself may be not flat, the deficiency of the pressure plate will be reflected on the manufactured product.

[0005] A generic inward flanging die has been known from CN104353730A, wherein the inward flanging die has an upper template 2 and a lower template 1, and a convex die 14 is connected with a shock absorber 12 and the lower template 1 via blank unloading screws. The shock absorber 12 is arranged between the convex die and the lower template to spring the convex die 14 back when the upper template is lifted after the flanging is finished. In the flanging process, the workpiece is still in direct contact with the metal convex die.

[0006] In existing technologies, manually lapping work for the pressure plate's forming surface is required after the pressure plate's forming surface has been processed by the numerically controlled machine tool, so as to ensure clearance between the pressure plate and the forming die being uniform and consistent and mating with the workpiece's shape. In particular, in manufacturing of the vehicle's outer cover element, high precision of lapping work is required. If the lapping work of the pressure plate is unqualified, blank pressing forces exerted on the workpiece will be non-uniform, resulting in deficiencies on products, which particularly brings about unfavorable effect on quality of the outer plate element's surface. Besides, due to the rigid pressure plate being adopted, scraps generated in production process and dust from external environment will result in impressions on product surface and will lead to the product being scraped when it is serious. Thus it can be seen that current processing has disadvantages such that high requirements of processing precision, heavy lapping workload, resulting

in quality problems of outer plate surfaces easily. Besides, lapping work on the workpiece generally relies on the worker's experience, and insufficient experience leads to generation of waste product.

SUMMARY OF THE INVENTION

[0007] The object of the present invention lies in providing a die in an extremely economical and simple manner to overcome deficiencies of dies in existing technologies.

[0008] The above-mentioned object is realized by a die in the present invention, said die comprising an upper die that is movable and a lower die that is held stationary, said upper die being provided with a pressure plate for stamping a workpiece, and said lower die being provided with a forming die for supporting said workpiece, characterized in that a cushioning element is arranged at least in a blank pressing region of said pressure plate for pressing the workpiece located on the forming die, and said cushioning element is made of polyurethane (PU). Said die is in particular a die used for flanging.

[0009] According to the instant invention, a polyurethane cushioning element is used, and the polyurethane cushioning element can be adapted to the shape of the workpiece due to its flexibility. In the die according to the present invention, the cushioning element transfers the pressure plate's pressure onto the workpiece, which has functions of blank pressing and buffering during blank pressing and simultaneously due to the fact that the cushioning element has deformability to some extent, the cushioning element can remedy the defect caused by non-uniform lapping of the pressure plate, such that the pressure plate's own deficiency will not be reflected on the workpiece to be extruded. Based on the die according to the present invention, the lapping work procedure can be cancelled, so as to realize low production cost, reduction of development period of a whole vehicle, reduction of dependence of the worker's experiment, reduction of amount of labor, reduction of labor cost and reduction of waste product ratio.

[0010] Besides, due to hardness of the cushioning element made of polyurethane plate being lower than hardness of the pressure plate normally made of metal, scraps will fall down into the cushioning element having lower hardness under the action of pressure, such that the problem of impressions caused by scrapes on the workpiece can be overcome, which also further improves product quality, reduces ratio of products to be reprocessed, and simultaneously reduces times required to wipe the die in production, such that production efficiency can be improved.

[0011] Furthermore, based on the fact that the polyurethane cushioning element is adapted to the workpiece's shape, in the development engineering of the die, requirement of the skill level of adjustment staff required by the die according to the present invention is low, which shortens the die adjustment period and reduces die de-

velopment cost.

[0012] Meanwhile, in the die according to the present invention, due to the polyurethane cushioning element being arranged on the pressure plate, in the blank pressing process, the polyurethane cushioning element contacts with the workpiece, and the blank pressing forces from the pressure plate are applied onto the workpiece. Due to the pressure plate being not in direct contact with the workpiece, loss of the pressure plate in stamping forming is also reduced. Due to change of the polyurethane material per se being easy and having low cost, loss of the die is also reduced significantly accordingly.

[0013] In the die according to the present invention, polyurethane is adopted for producing the cushioning element. Polyurethane can be obtained from the market easily and has low price, thus it is favorable from the aspect of cost. Meanwhile, the polyurethane material has extremely good pressure-resistant performance, good insulation property, anti-corrosion characteristic, aging-resistant performance and low noise as far as possible when realizing the buffering, such that safe and reliable operation of the die is realized.

[0014] According to one preferred embodiment of the present invention, the cushioning element has a thickness of 0.3mm to 1.0mm. In particular, the polyurethane material having a thickness of 0.3mm to 1.0mm is suitable for producing the cushioning element in the present application. Such polyurethane can be obtained from the market easily and can realize buffering effect and simultaneously absorbing generated scraps.

[0015] Advantageously, the die according to the present invention, is in particular the die for producing a vehicle's outer cover element appearance quality requirements of which are high, so it can improve production efficiency greatly and reduce percentage of products sent back for repair. Regarding this, the die according to the present invention has a series of advantages such that its structure is simple, the manufacturing is convenient, the pressing process is steady, and its maintenance is convenient.

[0016] According to one preferred embodiment of the present invention, said polyurethane cushioning element is fixed onto the pressure plate through screws or adhesion. In this way, the planar polyurethane cushioning element can be fixed in a simple manner onto the existing die pressure plate. Then, in the case that the existing die is made use of sufficiently, it can be realized to improve production efficiency dramatically and reduce waste product ratio prominently.

[0017] It is required to make the polyurethane material of a cushioning element serving as blank pressing region to have certain deformability, and simultaneously it is required to make it have certain hardness. According to the present invention, hardness of the cushioning element is larger than Shore hardness 80. Based on such a cushioning element material, the cushioning element can possess certain support strength, such that the pressure plate's defect will not be reflected on the workpiece

during pressing process. Meanwhile, deformation can be realized to remedy unevenness of the pressure plate.

[0018] Only a partial region on said pressure plate is provided with a planar cushioning element. Said cushioning element has a blank pressing region in which the cushioning element has a width of 30mm to 40mm to form protection for the pressing region.

[0019] According to one preferred embodiment of the present invention, the upper die comprises an upper shoe plate, and the lower die comprises a lower shoe plate, a backing plate is arranged on a pressure plate, and said backing plate supports an upper balance block that cooperates with a lower balance block on the lower shoe plate, wherein the upper balance block comprises a recessed portion that is preferably conical, and the lower balance block has a preferably conical shape that is adapted to the recessed portion. Based on this, the upper die and the lower die can cooperate precisely, so as to improve precision of the manufactured product.

[0020] According to a further preferred embodiment of the present invention, the lower shoe plate is provided with a guide element that is preferably selected to be guide plate. Said guide element and the upper shoe plate preferably contact in an abutment manner to make the upper shoe plate and the lower shoe plate cooperate precisely. Therefore, in the flanging forming process, it can be assured that the upper die move according to a determined running trajectory relative to the lower die, so as to ensure the pressure plate being positioned on the workpiece precisely to apply suitable pressure to the blank pressing region of the pressure plate.

[0021] In accordance with a further configuration of the present invention, the pressure plate is kept in the upper shoe plate by means of a retaining screw bolt. The retaining screw bolt is provided with a pad made of polyurethane (PU). By means of the polyurethane pad, impact forces will be absorbed in stamping process, so as to reduce generation of noises and make operations of the die be more stable.

[0022] In accordance with a further configuration of the present invention, the pressure plate is provided with an upper beating rod for connection with a loading member located outside the die, said upper beating rod being fixed on the pressure plate via screws and being applied for transferring pressure from the exterior of the die.

[0023] In fact, the cushioning element according to the present invention further can be applied in the processing of trimming and piercing etc.

40 BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The present invention is more specifically described in the following paragraphs by reference to the drawings, wherein,

[0025] Fig. 1 shows a section of a die for flanging according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0026] The present invention is described as follows by reference to the drawings, wherein the figure shows one embodiment of the present invention. However, it should be understood that, the present application can be presented in many different manners and is not limited to the embodiment described in the following text. In fact, the purpose of the embodiment described in the following text is making the disclosure of the present invention be more complete and providing sufficient explanations for the protection scope of the present invention for a person having ordinary skill in the art. It should be further understood that embodiments of the present invention can be combined in various manners, so as to provide more extra embodiments.

[0027] It should be understood that, in the figure, for the sake of clearness, dimensions of some feature can be variant.

[0028] It should be understood that expressions in the description are only applied for describing the specific embodiment and do not aim at limiting the present invention. All the terminologies (including technical terminologies and scientific terminologies) used in the description, except for those being defined additionally, have meanings generally understood by a person having ordinary skill in the art. For the sake of conciseness and clearness, well-known functions or structures may not be explained in details any more.

[0029] Expressions "comprising", "including" and "containing" used in the description indicate existence of alleged features and do not exclude existence of one or more other features.

[0030] In the description, when it is called that one element is located "on" another element or is "connected" to another element etc., this element can be directly located on said another element or connected to said another element, or an intermediate element can be provided.

[0031] A die for flanging is taken as an example as follows to specifically describe the die according to the present invention.

[0032] Fig. 1 shows a die for flanging according to the present invention, said die comprising an upper die and a lower die. In the embodiment as shown in Fig. 1, the upper die and the lower die cooperate with each other and are in the closed state.

[0033] The upper die comprises an upper shoe plate 1 and a pressure plate 4, wherein the upper shoe plate 1 bears other members of the upper die. During stamping, the pressure plate contacts with a workpiece 10 supported on the lower die and exerts pressure on the workpiece. The pressure plate 4 can be kept on said upper shoe plate. The upper shoe plate 1 and the pressure plate 4 can be made of metal. In this embodiment, the pressure plate 4 is kept on the upper shoe plate 1 by means of a retaining screw bolt 9. A region, for instance, a region of 30mm to 40mm on the pressure plate 4 is vacated. In

said region, the pressure plate 4 is connected with the upper shoe plate 1 via the retaining screw bolt 9 for keeping the pressure plate. The pressure plate 4 is provided with an opening, through which the retaining screw bolt 9 passes and is fixed onto the upper shoe plate. The retaining screw bolt 9's end away from the upper shoe plate is provided with a pad 8 for absorbing impact forces generated in the stamping process when the pressure plate contacts with the workpiece. Said pad can be made of a cushion material, e.g. polyurethane. The pressure plate 4 is provided with an upper beating rod 7. Said upper beating rod 7 can be connected with a loading member located outside the die, so as to provide pressure for the pressure plate. In this embodiment, the upper beating rod 7 is fixed onto the pressure plate via screws. A through hole is provided in the upper shoe plate 1. When the die is in the closed state, the upper beating rod 7 passes through the through hole to contact with the equipment's upper air cushion (not shown) to provide pressing force. A flanging insert 5 for flanging the workpiece is fixed to the upper shoe plate. The flanging insert 5 is fixed in the upper shoe plate through a screw. In the stamping process, the flanging insert forces the workpiece to form a flanged portion.

[0034] The lower die comprises a lower shoe plate 12. A forming die 11 is fixed on the lower shoe plate 12. Said forming die is, for instance, fixed onto the lower shoe plate via a screw. When the stamping forming is performed, the workpiece 10 is supported on the forming die 11. The lower shoe plate and the forming die can be made of metal. The lower shoe plate 12 is provided with guide elements, such as guide plates 14, those have the function of making the upper die be guided during die closing. Besides, as shown in Fig. 1, the guide plates are fixed, for instance, are fixed via screws, in the lower shoe plate 12. The number of the guide plates can be one or more. In this embodiment, the lower shoe plate is provided with two guide plates in total. To be positioned precisely, said guide plates contact with the upper shoe plate 1 in the abutment manner, as shown in Fig. 1. The upper shoe plate 1, the lower shoe plate 12 and the guide plates 14 form a die frame of the whole die.

[0035] Besides, as illustrated in Fig. 1, the pressure plate 4 is provided with a backing plate 2. An upper balance block 3 is supported on said backing plate 2. The upper balance block has a recessed portion that is, for instance, conical. The backing plate below the upper balance block has the function of adjusting height. To realize precise positioning between the pressure plate 4 and the forming die 11 in the production process, the upper balance block cooperates with a lower balance block 13 arranged on the lower shoe plate 12. Said lower balance block has a shape, such as a conical shape, adapted to the recessed portion of the upper balance block. In the embodiment according to Fig. 1 of the present invention, the upper balance block 3 and the lower balance block 13 are engaged together to cooperated with each other during die closing, so as to have functions of orientation

and balancing pressure.

[0036] In addition, as can be seen from Fig. 1, according to the present invention, a planar cushioning element 6 is fixed on the pressure plate 4. Said planar cushioning element is at least arranged in the pressure plate's region in contact with the workpiece. In this embodiment, the planar cushioning element is provided in the region of flanging line. The said planar cushioning element transfers pressure of the pressure plate 4 onto the workpiece 10, so as to make the workpiece be pressed tightly, assure that the workpiece does not move any more, and simultaneously buffer impact forces during blank pressing process.

[0037] The cushioning element is a plate made of polyurethane. The experiments prove that the polyurethane material is in particular suitable for manufacturing the cushioning element in the present invention. In particular, the polyurethane having a thickness of 0.3mm-1.0mm is favorable from the aspect of cost, can realize the function of buffering sufficiently and simultaneously is thick enough for absorbing the generated scraps.

[0038] The polyurethane cushioning element 6 has a blank pressing region in which the cushioning element has a width of 30mm-40mm and a thickness of 0.3mm to 1.0mm. To realize fixing the cushioning element by means of a screw, the cushioning element further comprises a remaining region for fixation except for the blank pressing region. Said remaining region starting from the blank pressing region becomes gradually thicker, and a hole for passage of the screw is configured in said remaining region, such that the polyurethane cushioning element 6 can be secured on the pressure plate 4 by the screw. The cushioning element 6 has the function of blank pressing during die closing. Furthermore, to avoid bringing about unfavorable effect on the quality of the workpiece's surface, the screw does not contact with the workpiece 10 supported on the forming die. Certainly, it is possible that the polyurethane cushioning element is also fixed onto the pressure plate by means of adhesion. In the case of adhesion, it is only required to make the blank pressing region be provided with the planar cushioning element.

[0039] A flanging process according to the present invention is described simply in the following paragraphs. In an initial state, the upper die and the lower die are divided. After the flanging process starts, the workpiece 10 is placed on the forming die 11, the lower die is held stationary, and the upper die moves downwards relative to the lower die. Meanwhile, the pressure plate kept on the upper die also moves downwards. Firstly, the polyurethane cushioning element arranged on the pressure plate contacts with the workpiece. After that, the upper shoe plate of the upper die continues to move downwards together with the flanging insert arranged thereon. The upper beating rod 7 is gradually exposed from the upper shoe plate and contacts with the upper air cushion of the press machine, and then starts to transfer a blank pressing force that is transferred onto the polyurethane cush-

ioning element 6 through the pressure plate 4. Simultaneously, due to the pressure plate having been in contact with the workpiece and substantially held stationary, the retaining screw bolt moves downwards along the opening in the pressure plate. On this basis, the pressure applied onto the workpiece becomes larger and larger due to the action of the pressure in the upper air cushion. Therefore, under the action of pressure, the cushioning element is gradually shrunk deformed to balance the blank pressing force of the blank pressing region and press the workpiece 10 tightly, and simultaneously compensate the uneven surface of the pressure plate 4. At the same time, the flanging insert 5 contacts with the workpiece 10 gradually till completion of the flanging at last. After this, the upper die moves upward, the flanging insert 5 and the cushioning element 6 leave the workpiece gradually, such that its initial shapes are recovered.

[0040] In the stamping process, hardness of the cushioning element 6 made of the polyurethane material is softer than the metal material from which the workpiece is made of. In the stamping process, scraps on the workpiece are absorbed by means of the polyurethane cushioning element 6. Therefore, no impression generated by scraps will be left on the workpiece 10.

List of reference signs

[0041]

1. upper shoe plate
2. backing plate
3. upper balance block
4. pressure plate
5. flanging insert
6. cushioning element
7. upper beating rod
8. pad
9. retaining screw bolt
10. workpiece
11. forming die
12. lower shoe plate
13. lower balance block
14. guide plate

Claims

1. A die comprising an upper die that is movable and a lower die that is held stationary, said upper die being provided with a pressure plate (4) for stamping a workpiece, said lower die being provided with a forming die (11) for supporting said workpiece, **characterized in that** a cushioning element (6) is arranged at least in a blank pressing region of said pressure plate (4) for pressing the workpiece located on the forming die (11) tightly, and said cushioning element is made of polyurethane.

2. Said die according to claim 1, **characterized in that** only a partial region of the pressure plate (4) is provided with the planar cushioning element, and said cushioning element comprises a blank pressing region in which the cushioning element has a width of 30mm to 40mm. 5
3. Said die according to claim 1 or 2, **characterized in that** said cushioning element (6) is fixed on the pressure plate (4) by means of a screw or adhesion. 10
4. Said die according to one of claims 1 to 3, **characterized in that** hardness of said cushioning element (6) is larger than Shore hardness 80. 15
5. Said die according to claims 1 to 4, **characterized in that** said cushioning element has a thickness of 0.3mm to 1.0mm.
6. Said die according to claim 1, **characterized in that** said die is a die for flanging. 20
7. Said die according to claim 6, **characterized in that** in the state of flanging, said cushioning element is arranged in a flanging line region. 25
8. Said die according to one of claims 1 to 7, **characterized in that** the upper die has an upper shoe plate (1), and the lower die has a lower shoe plate (12), said pressure plate (4) is provided with a backing plate (2) on which an upper balance block (3) is supported, and said upper balance block cooperates with a lower balance block (13) on the lower shoe plate (12). 30
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9. Said die according to claim 8, **characterized in that** said upper balance block (3) has a preferably conical recessed portion, and said lower balance block (13) has a preferably conical shape adapted to the recessed portion. 40
10. Said die according to claim 8, **characterized in that** the lower shoe plate (12) is provided with guide elements (14) which are preferably guide plates, and said guide elements contact with the upper shoe plate (1) preferably in an abutment manner for precise cooperation of the upper shoe plate (1) and the lower shoe plate (12). 45
11. Said die according to claim 8, **characterized in that** the pressure plate (4) is kept in the upper shoe plate by means of a retaining screw bolt (9), and the retaining screw bolt (9) is provided with a pad (8) made of polyurethane. 50
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12. Said die according to one of claims 1 to 11, **characterized in that** the pressure plate (4) is provided with an upper beating rod (7) for connection with a loading member located outside of the die, and said upper beating rod is fixed on the pressure plate by means of screws.

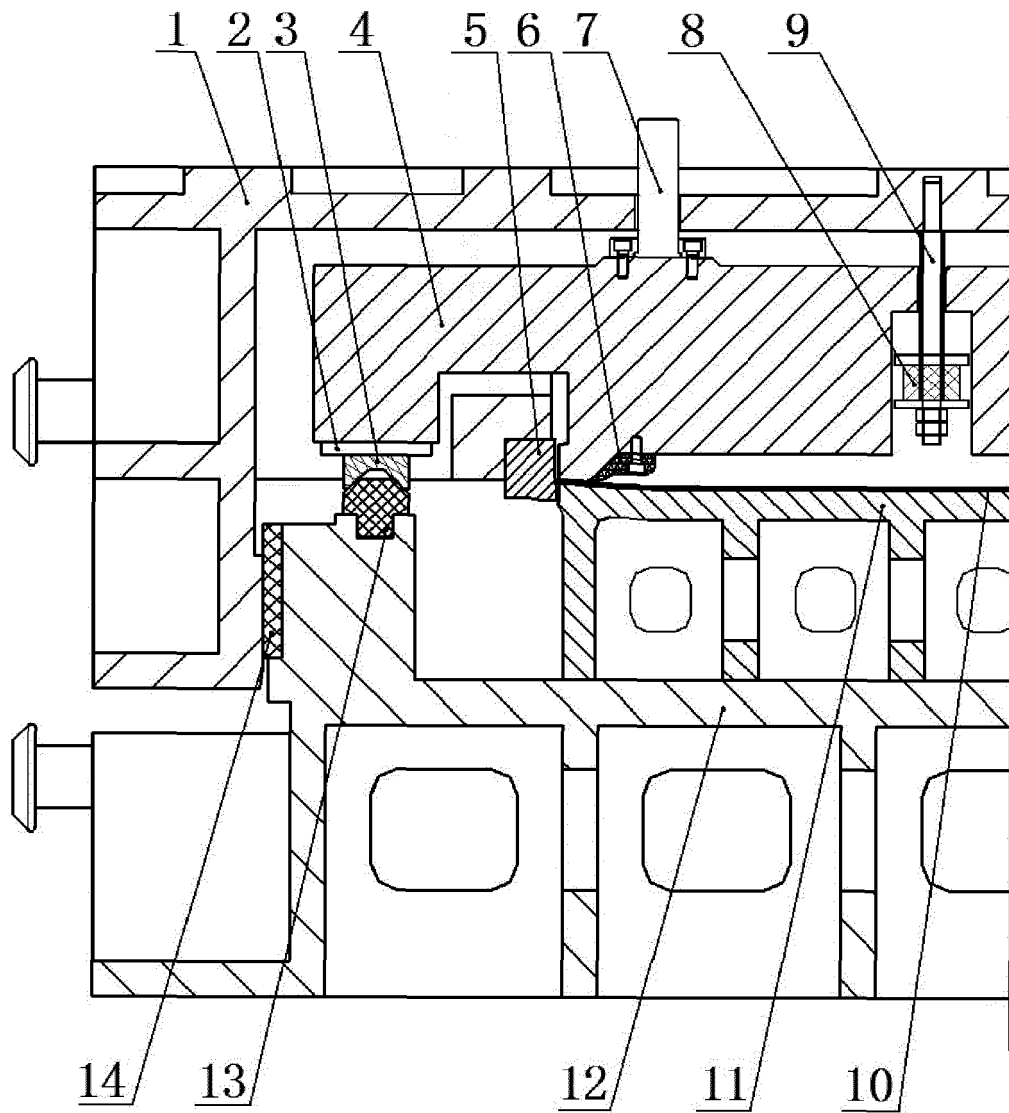


Figure 1



EUROPEAN SEARCH REPORT

Application Number
EP 18 17 1769

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			B21D
Place of search		Date of completion of the search	Examiner
Munich		19 November 2018	Cano Palmero, A
CATEGORY OF CITED DOCUMENTS			
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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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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19-11-2018

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REFERENCES CITED IN THE DESCRIPTION

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