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

(11) EP 1 749 593 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.02.2007 Bulletin 2007/06

(51) Int Cl.:
B21D 37/16 *(2006.01)*

(21) Application number: **06380199.7**

(22) Date of filing: **13.07.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **06.08.2005 ES 200501991**

(71) Applicant: **Agrupacion de Conformado y Ensamble, S. Coop.**
48170 Zamudio (Bizkaia) (ES)

(72) Inventors:
- **Ugartemendia Arregui, Jose Cruz**
  48100 Mungia (Bizkaia) (ES)
- **Sanz Gil, Agustin**
  48990 Getxo (Bizkaia) (ES)
- **Baranano Cenicacelaya, Luis**
  48200 Durango (Bizkaia) (ES)
- **Erdocia Gallastegui, Andoni**
  20560 Onati (Gipuzkoa) (ES)

(74) Representative: **Igartua, Ismael**
Apartado 213
(Dpto. Propiedad Industrial)
20500 Mondragon (Gipuzkoa) (ES)

(54) Die with cooling circuit

(57) Die that comprises an exterior surface (12) with the form of the piece (4) to be deformed, at least one cooling circuit (31), and at least one casing (10), said casing (10) comprising said exterior surface (12) and an interior surface (13) that delimits at least one housing (11). The die (1) also comprises a body (20) housed in said housing (11) so that the cooling circuit (31) is formed between said casing (10) and said body (20).

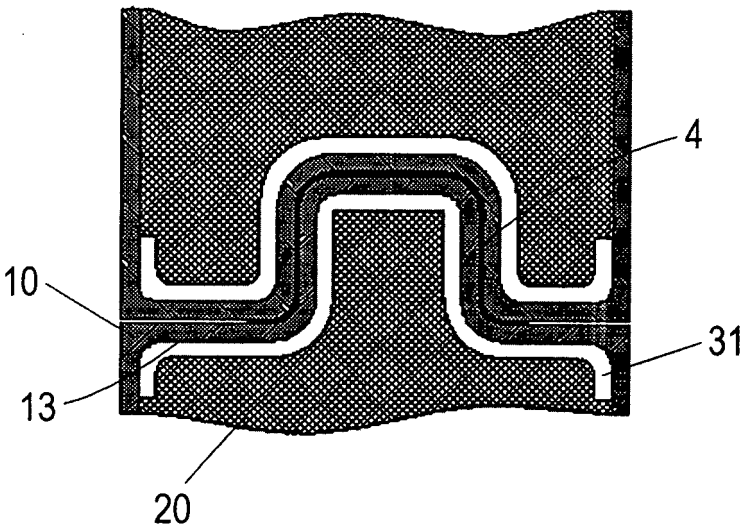

Fig. 2

EP 1 749 593 A2

Description

TECHNICAL FIELD

[0001] The present invention relates to a die that incorporates at least one cooling circuit.

PRIOR ART

[0002] Dies that incorporate cooling circuits are known, said die comprising a male and a female element. Said male and female elements comprise an external surface with a form substantially equal to the form of the piece to be deformed, a piece that can be, for example, metallic. In order to deform the required piece, a metallic plate is disposed between the male and the female elements. Said female element presses said metallic plate against the male element, the required piece being obtained.

[0003] US20040103709 discloses a die with the characteristics described, so that by making a coolant circulate through said cooling circuit the temperature of said die and the deformed piece are reduced. To achieve this, the male element of said die is formed by profiles connected to each other, forming a single solid body with a plurality of holes or channels that make up the cooling system.

DISCLOSURE OF THE INVENTION

[0004] It is an object of the invention to provide a die with a cooling circuit.

[0005] The die for the deformation of pieces of the invention comprises at least one casing that has an exterior surface with the form of the piece to be deformed. Said casing also comprises an interior surface that delimits at least one housing, the die of the invention comprising at least one body housed in the housing. The form of the body is such that when it is housed in the interior of the casing, said body and said casing delimit a cooling circuit. The casing and the body form the male element of the die and the female element can also be equally formed by a second casing and a second body.

[0006] In the die of the invention, instead of using a solid male element or a male element formed by different contiguous modules connected to each other, "a hollow male element" (the casing) is used, into which is introduced a core (the body). Said casing must be of a hard material, for example steel, but the body must be made up of other types of more economical and/or more malleable materials. The use of a material that is easier to machine or work would allow said body to be given the necessary external form in order to form the cooling circuit in a simple manner. Thus, the external form of the body is adapted to the interior surface of the casing to form said cooling circuit, as a consequence of which it is not necessary to perform additional machinings on said interior surface in order to form said cooling circuit, nor is it necessary to machine said interior surface with precision.

[0007] Another advantage of the die of the invention is the accessibility of the zones that have to be machined in order to form the cooling circuit, as said machining is conducted on the surface of the body before said body is introduced in the casing.

[0008] These and other advantages and characteristics of the invention will be made evident in the light of the drawings and the detailed description thereof.

DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a front view in section of a first embodiment of the invention.

Fig. 2 is a front view in section of the embodiment of Fig. 1, with the deformed piece.

Fig. 3 is a front view in section of the male element of the embodiment of Fig. 1, which shows the housing delimited by the casing.

Fig. 4 is a first exploded view of a second embodiment of the invention.

Fig. 5 is a second exploded view of the embodiment of Fig. 4.

DETAILED DISCLOSURE OF THE INVENTION

[0010] Figures 1 and 2 show a first embodiment of the die 1 of the invention. The die 1 comprises a male element 5 and a female element 3, said male element 5 comprising an exterior surface 12 with the form of the piece 4 to be deformed, and a refrigeration circuit 31. Said piece 4 is preferably metallic, being deformed in said case by a metallic plate 2. Said metallic plate 2 is positioned on said exterior surface 12, and the female member 3 presses said metallic plate 2 against said exterior surface 12, thereby deforming the piece 4.

[0011] In the first embodiment, the male element 5 comprises a casing 10, said casing 10 comprising the exterior surface 12 and an interior surface 13 that delimits a housing 11, shown in figure 3. Said male element 5 also comprises a body 20 housed in said housing 11, the cooling circuit 31 being formed between said casing 10 and said body 20. In the cooling circuit 31 is introduced a coolant that may be, for example, water, so that said coolant absorbs part of the heat of the male element 5 and the piece 4.

[0012] In this embodiment, the interior surface 13 of the casing 10 has a form substantially equal to the form of the exterior surface 12 of said casing 10. Between said interior surface 13 and the body 20 there is at least one zone of separation, said zone of separation belonging to

the cooling circuit 31. In this first embodiment, the body 20 is fixed to the sides 14 of the casing 10, the interior surface 13 of said casing 10 being separated from the body 20. In the embodiment of figures 1 and 2 the female element 3 has a similar configuration to that of the male element 5, but it may have a different configuration.

[0013] Figures 4 and 5 show a second embodiment of the invention. In this second embodiment, the body 20 has an exterior surface 21 that is in contact with the interior surface 13 of the casing 10, said exterior surface 21 comprising a plurality of cooling circuits 31. Said exterior surface 21 is divided into a plurality of areas 23, each of the areas 23 comprising a cooling circuit 31.

[0014] As shown in figure 5, a cooling circuit 31 may be made up of longitudinal sections 32 connected to each other, or only by a channel 33, although it can also be formed by transverse sections (not shown in the figure) or any other type of configuration, the sections of the cooling circuit 31 being capable of having the form, position and section considered most suitable for the die 1. The number of cooling circuits 31 on the exterior surface 21 of the body 20 depends on the form of the piece 4 to be deformed, said exterior surface 21 being capable of comprising a single cooling circuit 31. In this second embodiment, as in the first, the female element (not shown in the figures) may have a configuration similar to that of the male element 5 or a different configuration.

[0015] The body 20 may be composed of a different material to the material of the casing 10. Said casing 10 must be of a material with characteristics such that it is able to bear the stresses exerted in order to deform the piece 4, said material possibly being, for example, steel. The body 20, in view of the fact that said casing 10 bears the stresses of deformation, may consist of softer and more malleable materials than steel, possibly being composed of, for example, a resin or a polymer. For this reason, the form of the cooling circuits 31 of said body 20 can be manufactured in a more simple way. This enables the cooling circuit 31 to be easily adapted to the most suitable form in each case taking into account, for example, the points of the male element 5 that require more cooling.

[0016] As the cooling circuit 31 is configured by giving the body 20 the necessary external form, which is adapted to the interior surface 13 of the casing 10, it is not necessary to carry out precise machinings of said interior surface 13. Thus, in the first embodiment, it is the body 20 that has the cavity that delimits the zone of separation, and in the second embodiment it is said body 20 that comprises said cooling circuit 31.

[0017] The body 20 may be formed by a single module, as in the examples of embodiment described above, or by a plurality of modules connected to each other.

Claims

1. Die for the deformation of pieces (4) that comprises an exterior surface (12) with the form of the piece (4) to be deformed, and at least one cooling circuit (31), **characterised in that** it comprises at least one casing (10), said casing (10) comprising said exterior surface (12) and an interior surface (13) that delimits at least one housing (11), the die (1) also comprising at least one body (20) housed in said housing (11) so that the cooling circuit (31) is formed between said casing (10) and said body (20).

2. Die according to claim 1, wherein the interior surface (13) of the casing (10) has a substantially equal form to the form of the exterior surface (12) of said casing (10).

3. Die according to any of the preceding claims, wherein there is at least one zone of separation between the interior surface (13) of the casing (10) and the body (20), said zone of separation belonging to the cooling circuit (31).

4. Die according to any of the preceding claims, wherein the body (20) comprises an exterior surface (21) in contact with the interior surface (13) of the casing (10), said exterior surface (21) comprising the cooling circuit (31).

5. Die according to the preceding claim, wherein the cooling circuit (31) is formed by longitudinal sections (32), the longitudinal sections (32) being connected to each other.

6. Die according to claim 4, wherein the cooling circuit (31) is formed by transverse sections, the transverse sections being connected to each other.

7. Die according to claims 5 or 6, wherein the exterior surface (21) is divided into a plurality of areas (23), each one of said areas (23) comprising a cooling circuit (31).

8. Die according to any of the preceding claims, wherein the body (20) is of a different material to the material of the casing (10).

9. Die according to the preceding claim, wherein the body (20) is of a non-metallic material.

10. Die according to any of the preceding claims, wherein the body (20) is formed by a plurality of modules.

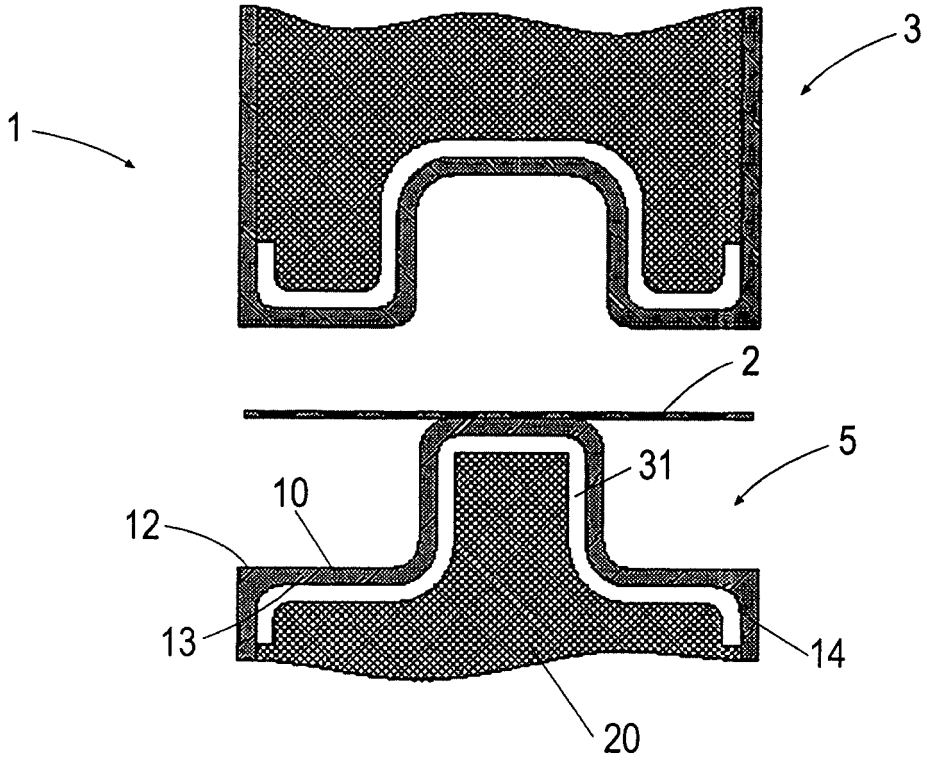

Fig. 1

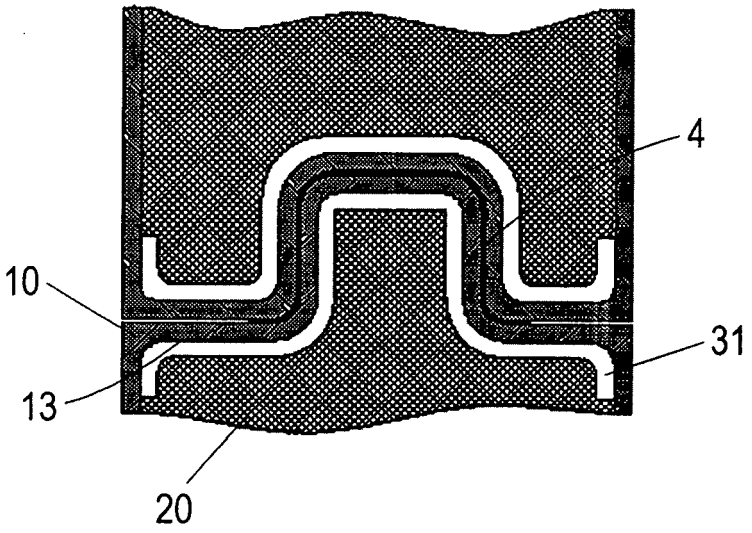

Fig. 2

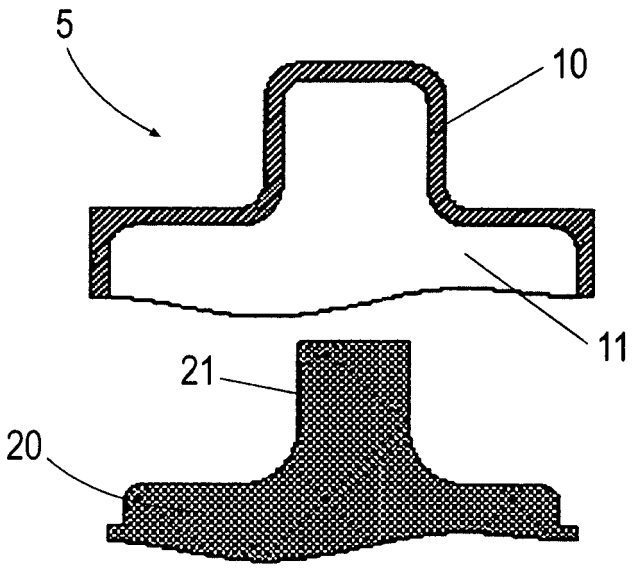

Fig. 3

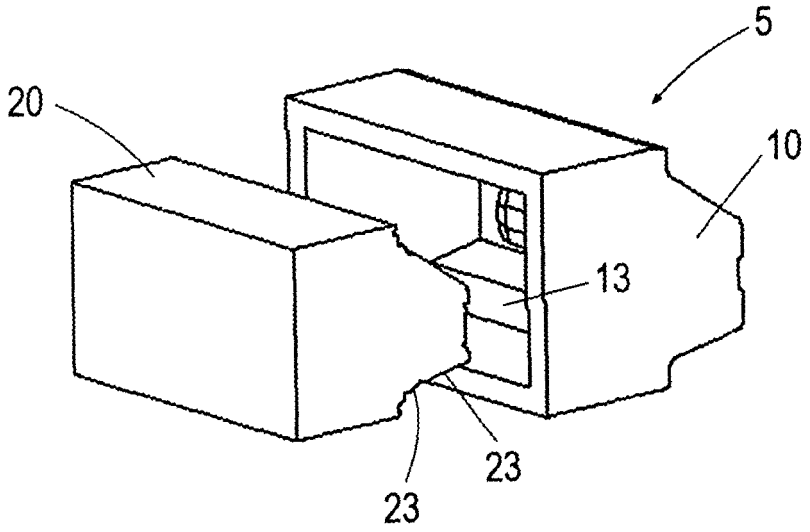

Fig. 4

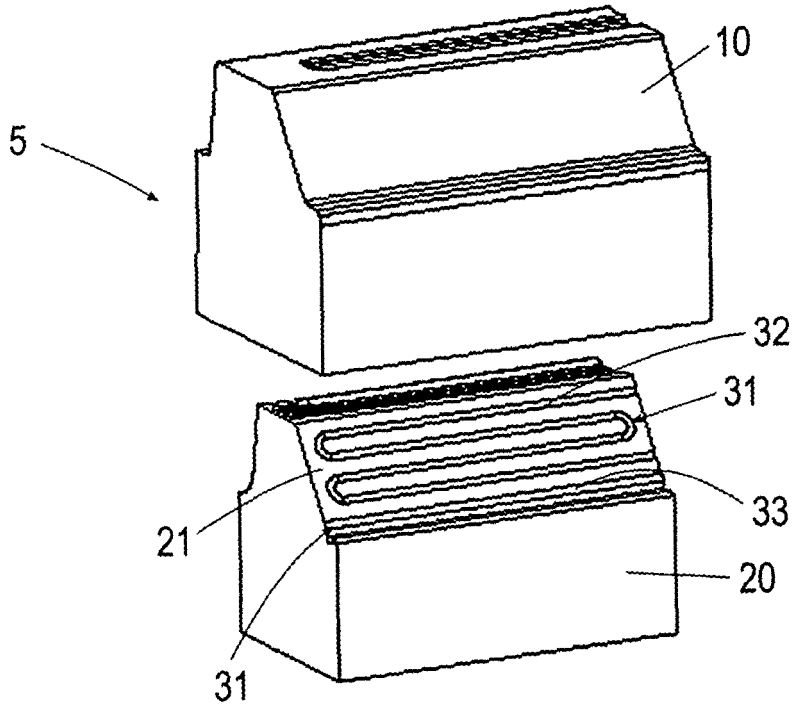

Fig. 5

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20040103709 A **[0003]**