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(54) Title: A MOLD TOOL FOR INJECTION MOLDING

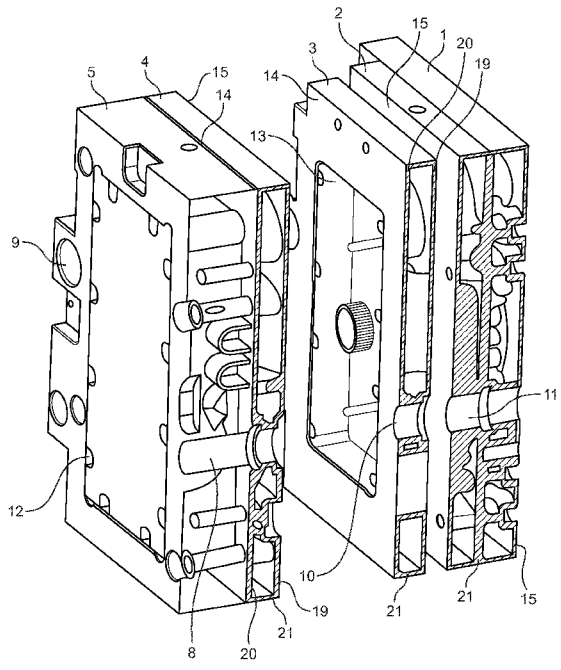

FIG. 2

(57) Abstract: An injection-molding tool comprising at least two separate mold plates each having a mold insert socket with a mold insert attached in the mold insert socket. Each mold plate have mutually opposite and parallel abutting side faces defining the thickness of the mold plate and a number of mutually aligned guide bushings forming through holes adapted for axially sliding one of the mold plates with respect to the other on a common guide pin in a direction perpendicular to the abutting side faces of the mold plates. The guide bushings and the mold insert socket of at least one mold plate are interconnected via one or more connection plates each extending parallel to the abutting side faces and having a thickness of less than half the thickness of the mold plate.

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Title:

A mold tool for injection molding

Prior art:

The present invention relates to an injection-molding tool configured for being mounted in an injection-molding apparatus for automated molding of work pieces in plastics, said injection-molding tool, in its closed position, comprises at least two separate mold plates each having a mold insert socket with a mold insert attached in the mold insert socket and where each mold plate have mutually opposite and parallel abutting side faces defining the thickness of the mold plate, and the mold plates further comprises a number of mutually aligned through holes forming guide bushings adapted for axially sliding one of the mold plates with respect to the other on a common guide pin in a direction perpendicular to the abutting side faces of the mold plates.

Injection-molding tools of this type is known in many different embodiments and they are most often produced by machining various parts such as guide bushings and sockets for mold inserts into a single massive steel plate.

In relation to this type of injection molding tools it is important, in order to reduce wear and tear but also to ensure a high quality of the molded products, to ensure correct alignment of the mold inserts mounted in the mold plates.

In this relation e.g. US patent no. 4372740 discloses a tool for injection molding where the mold inserts are mounted in the mold insert sockets in the mold plates such that they can slide and tilt in the mold insert socket under the influence of hydrostatic pressure of a fluid arranged in a closed space behind each mold insert.

Object of the invention:

Based on this, it is the object of the present invention to provide an injection-molding tool with mold plates allowing correct alignment of the mold inserts in the mold insert sockets and at the same having a more simple construction.

According to the present invention this object is obtained by an injection molding tool as mentioned in the introduction and where the through holes and the mold insert socket of at least one mold plate are interconnected via one or more connection plates each extending parallel to the abutting side faces and having a thickness of less than half the thickness of the mold plate.

Thereby the mold plate is significantly more flexible than e.g. mold plates made from a single and massive steel plate, and therefore the mold plate can compensate e.g. for variations in e.g. the thickness of the mold insert.

In this connection the term mold insert is meant to cover separate parts of the injection molding tool that can be released from the mold plates, and especially those forming the mold cavity or cavities of the injection molding tool or e.g. mold inserts forming e.g. the sprue channel and/or the runners channels arranged in the mold plates.

In a preferred embodiment the through holes and the mold insert socket of at least one mold plate are interconnected via two mutually spaced connection plates.

In this relation each of the two mutually spaced connection plates forms one of the mutually opposite and parallel abutting side faces.

Furthermore the mold insert socket and the guide bushings may preferably extend between the two connection plates.

In an especially advantageous embodiment of the invention the outer periphery of the two mutually spaced connection plates are at least partly interconnected by a peripheral flange and the peripheral flange may preferably extend perpendicular to the mutually opposite and parallel abutting side faces.

In this relation the mold plate preferably forms a closed space extending between the two mutually spaced connection plates and the peripheral flange.

In a preferred embodiment of the invention the mold plate is produced by additive manufacturing as single integral unit, and an especially flexible unit can be achieved by producing the mold plate by additive manufacturing using a polymer material.

In this relation the support material used for additive manufacturing of the mold plate is advantageously left inside the closed space.

Where the mold plate is made from a polymer material at least the mold insert is preferably made from a metal material, such as steel.

In this relation also the guide bushings may advantageously each comprise a metal bushing mounted in a bushing socket formed as an integral part of the additive manufactured mold plate.

The drawing:

Figure 1: Is a perspective drawing showing an injection molding tool.

Figure 2: Is a perspective cross section drawing showing an embodiment of the injection molding tool according to figure 1 and according to the invention.

Figure 3: Is a second perspective cross section drawing showing the embodiment of an injection molding tool shown in figure 1.

Figure 4: Is a perspective drawing showing the embodiment of an injection molding tool according to the invention as shown in figure 1 and 2.

Description of an embodiment:

Figure 1 shows an injection molding tool comprising a set of mold plates. Injection molding tools of this type is known in many different embodiments comprising two or more mold plates and with different functionality depending on e.g. the design of the product that is molded in the injection molding tool. The embodiment shown here is therefore only an example of the construction of such an injection molding tool where the mold plates comprises a clamping plate 1, a

support plate 2, a runner/stripper plate 3, a runner channel plate 4 and a mold plate 5 forming one side of the mold cavity (the other side is not shown) in the drawings. The skilled person would easily recognize that the present invention may also be applied to injection molding tools having more or less mold plates with other functions than the mold plates shown in figure 1.

The mold plates thereby forms a stack, where each mold plate 1, 2, 3, 4 and 5 have mutually opposite and parallel abutting side faces (14, 15, defining the thickness of the mold plate 1, 2, 3, 4, 5.

Each of the mold plates 1, 2, 3, 4 and 5 according to figure 1 further comprises a mold insert 6, 7 which in this context covers any component that can be separated from the mold plate and especially components having a cavity or channel for leading the molten plastic material, such as an insert forming the mold cavity, the runner channels, the sprue or the like.

The injection molding tool shown in figure 1 could be made in the conventional manner where each of the mold plates 1, 2, 3, 4 or 5 are made from a massive plate of steel,

According to the present invention, however, one or more of the injection mold plates may be made from one or more connection plates connecting the guide bushings with the mold insert sockets and where the connection plates are thinner than the thickness of the injection mold plate.

Furthermore according to one embodiment of the present invention, and as shown in figure 2 and 3, the mold plates 1, 2, 3, 4 are each advantageously made by additive manufacturing from especially a plastic

or polymer material. Each mold plate1, 2, 3, 4 and 5 comprises two guide bushings 8, 9, 10, 11 and one guide bushing on one mold plate is aligned with a similar guide bushing on another mold plate, so that the mold plates can slide axially with respect to the other on a common guide pin (not shown).

Each of the mold plates 1, 2, 3, 4 and 5 further comprises a mold insert socket 12, 13 for releasably insertion of a mold insert 6, 7.

According to the embodiment of the invention shown in figure 2 and 3 each of the mold plates 1, 2, 3, 4 and 5 comprises two connection plates 19, 20 interconnecting the guide bushings 8, 9, 10, 11 with the mold insert sockets 12, 13. The two connection plates 19, 20 on each injection mold plate 1, 2, 3, 4, 5 forms the mutually opposite and parallel abutting surfaces 14, 15 on that injection mold plate 1, 2, 3, 4, 5.

The periphery of the connection plates 19, 20 are furthermore connected along their complete periphery by a peripheral flange 21 so that the connection plates 19, 20 forms a closed space together with the peripheral flange 21. Although it is not shown in figure 2 and 3 it is thereby possible to produce the injection mold plates by additive manufacturing and by keeping the support material used during the manufacturing process inside the closed and hollow space in the injection mold plate in order to provide some resistance to unwanted deformations of the connection plates 19, 20 in use.

Figure 4 shows a cross section through an alternative embodiment of a mold plate 5 according to figure 2 and 3 where the periphery of the connection plates are not interconnected by the peripheral flange 21 shown in figure 2 and 3. In this embodiment a number of further reinforcing flanges 22 or rods 23 extends between the two connecting

plates (only one shown in the drawing). Furthermore this cross section shows other elements, such as channels 24 adapted for leading coolant to the mold insert 6 that can be produced by additive manufacturing.

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Claims:

1. An injection-molding tool configured for being mounted in an injection-molding apparatus for automated molding of work pieces in plastics, said injection-molding tool, in its closed position, comprises at least two separate mold plates each having a mold insert socket with a mold insert attached in the mold insert socket and where each mold plate have mutually opposite and parallel abutting side faces defining the thickness of the mold plate, and the mold plates further comprises a number of mutually aligned guide bushings forming through holes adapted for axially sliding one of the mold plates with respect to the other on a common guide pin in a direction perpendicular to the abutting side faces of the mold plates, **characterized in,** that the guide bushings and the mold insert socket of at least one mold plate are interconnected via one or more connection plates each extending parallel to the abutting side faces and having a thickness of less than half the thickness of the mold plate.

2. An injection molding tool according to claim 1, **characterized in,** that the through holes and the mold insert socket of at least one mold plate are interconnected via two mutually spaced connection plates.

3. An injection molding tool according to claim 2, **characterized in,** that each of the two mutually spaced connection plates forms one of the mutually opposite and parallel abutting side faces.

4. An injection molding tool according to claim 2, **characterized in,** that the mold insert socket and the guide bushings extends between the two connection plates.

5. An injection molding tool according to claim 4, **characterized in,** that a number of reinforcing flanges or rods extends between the two connection plates.

6. An injection molding tool according one of the claims 2 to 5, **characterized in,** that the outer periphery of the two mutually spaced connection plates are at least partly interconnected by a peripheral flange.

7. An injection molding tool according to claim 6, **characterized in,** that the peripheral flange extends perpendicular to the mutually opposite and parallel abutting side faces.

8. An injection molding tool according to claim 7, **characterized in,** that the mold plate forms a closed space extending between the two mutually spaced connection plates and the peripheral flange.

9. An injection molding tool according to one or more of the preceding claims, **characterized in,** that the mold plate is produced by additive manufacturing as single integral unit.

10. An injection molding tool according to claim 9, **characterized in,** that it is made from a polymer material.

11. An injection molding tool according to claim 8 and 10, **characterized in,** that the support material used for additive manufacturing of the mold plate is left inside the closed space.

12. An injection molding tool according to claim 10 or 11, **characterized in,** that the mold insert is made from a metal material, such as steel.

13. An injection molding tool according to claim 10 or 11, **characterized in,** that the guide bushings each comprises a metal bushing mounted in a bushing socket formed as an integral part of the additive manufactured mold plate.

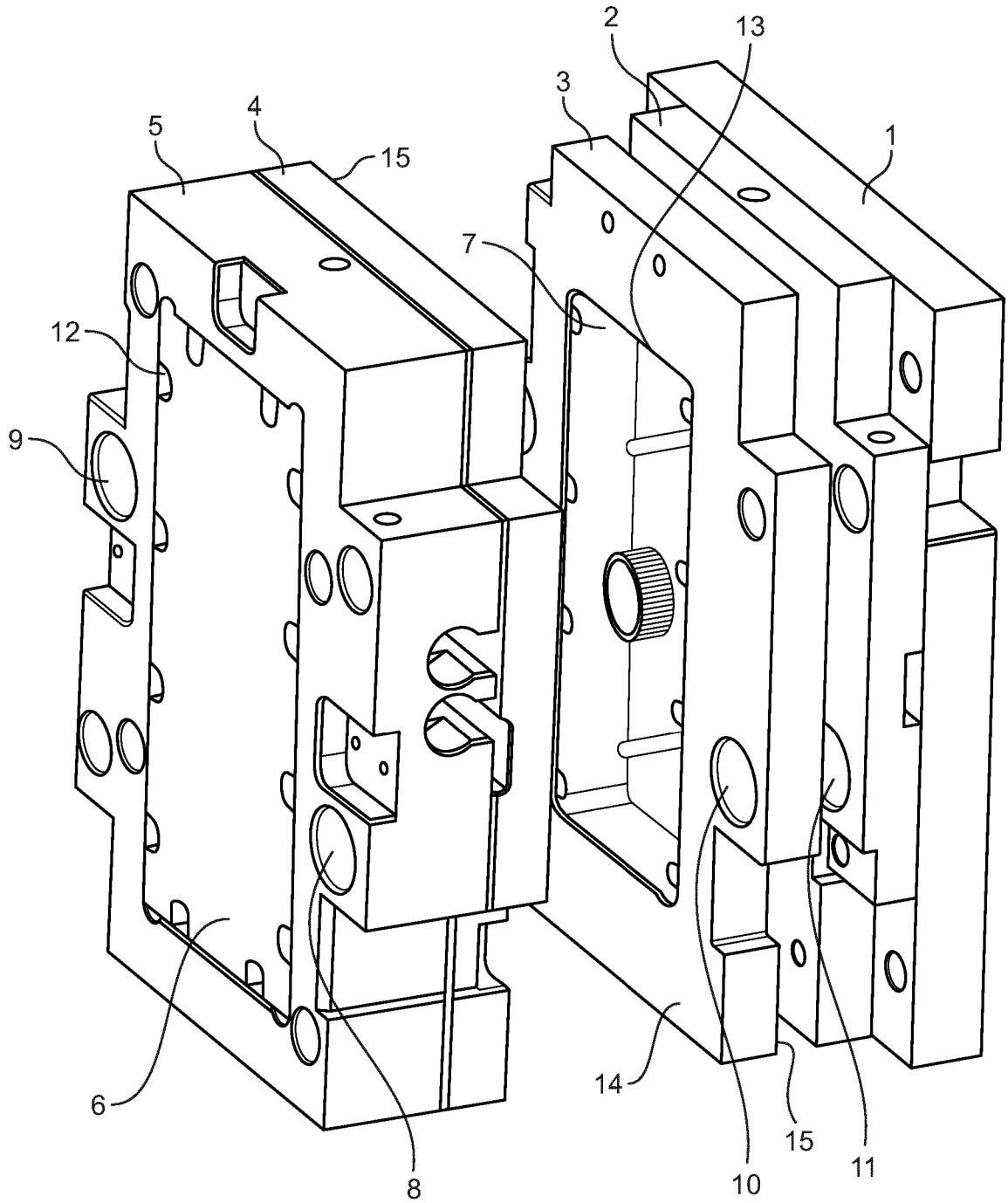

FIG. 1

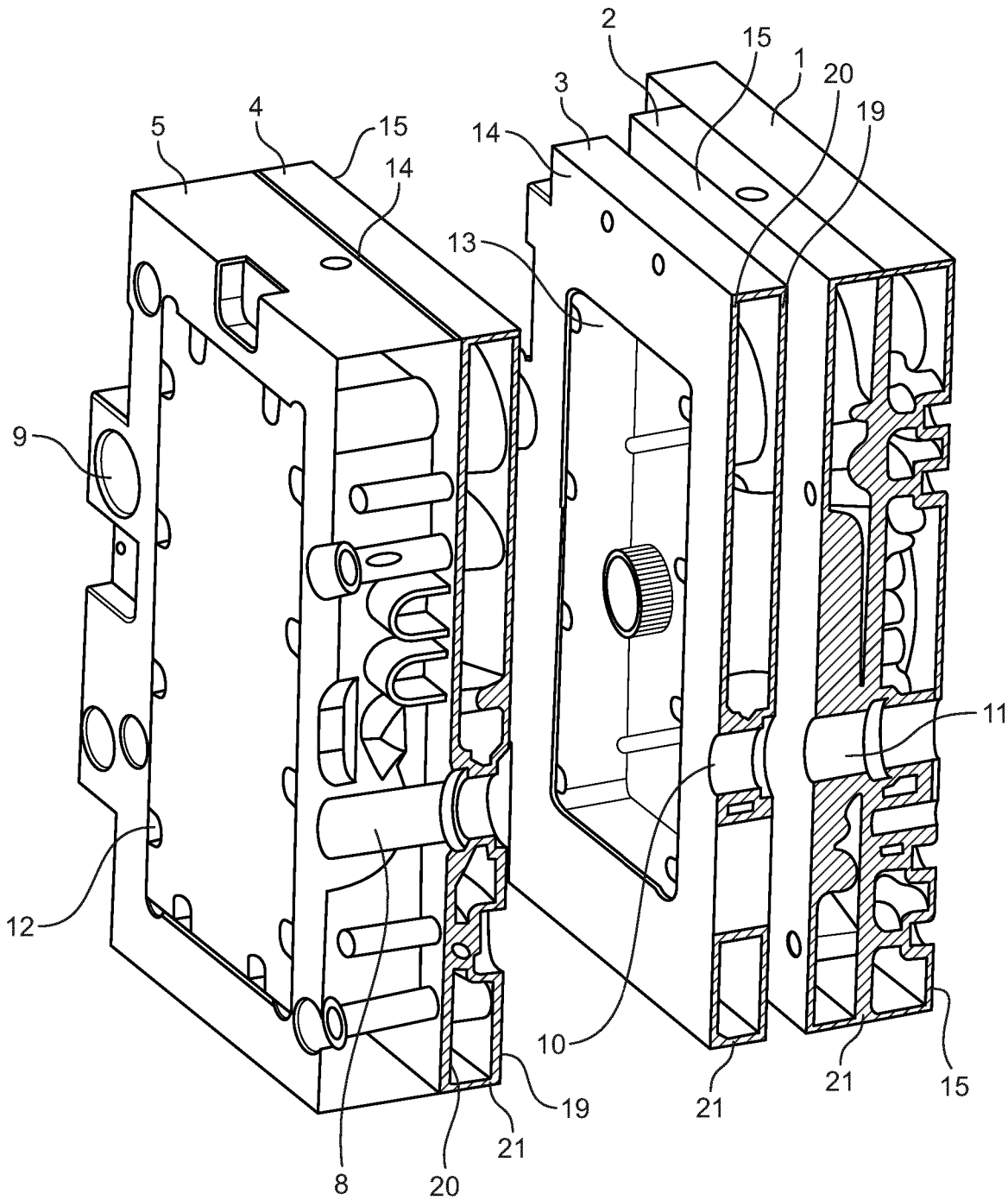

FIG. 2

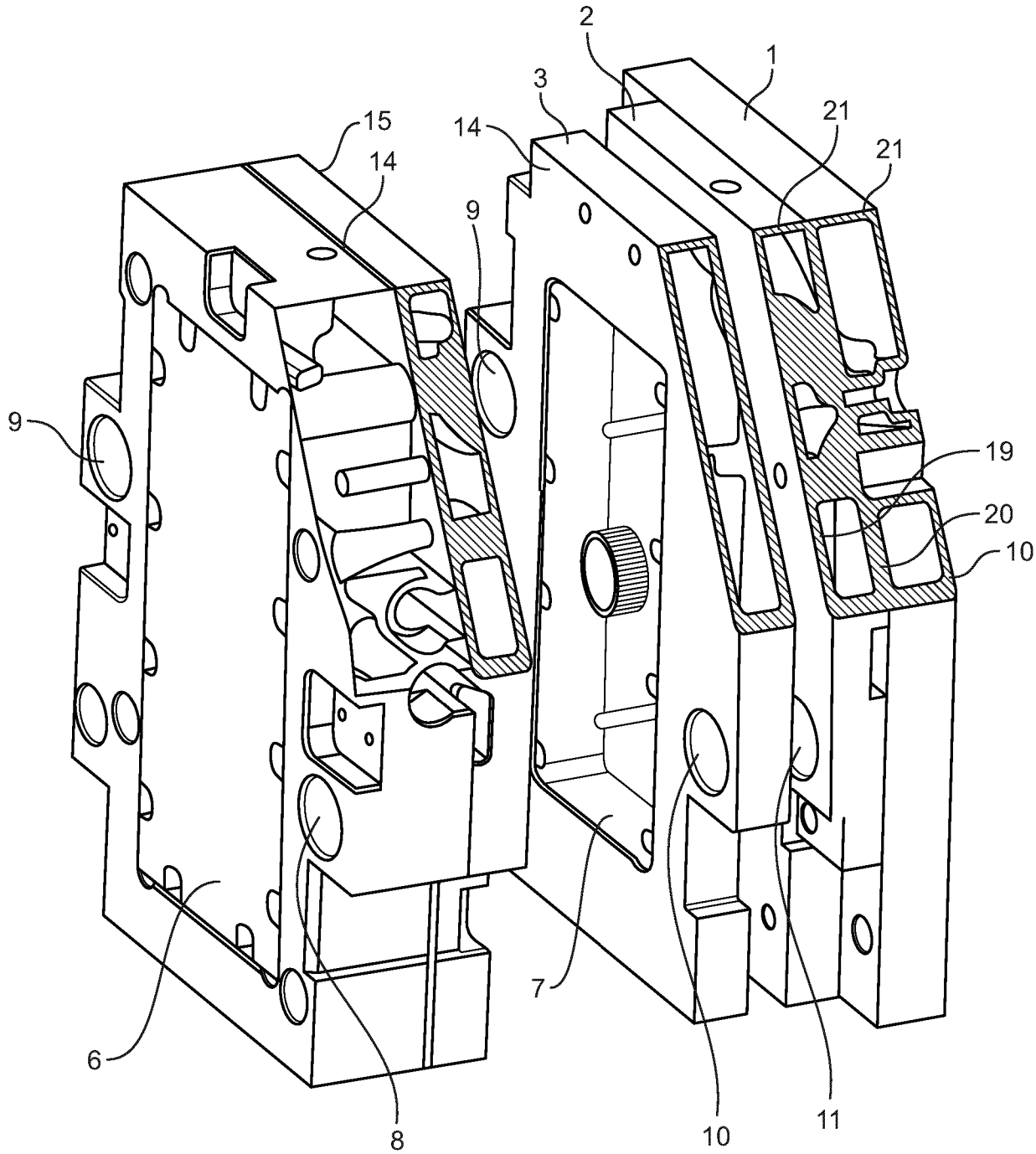

FIG. 3

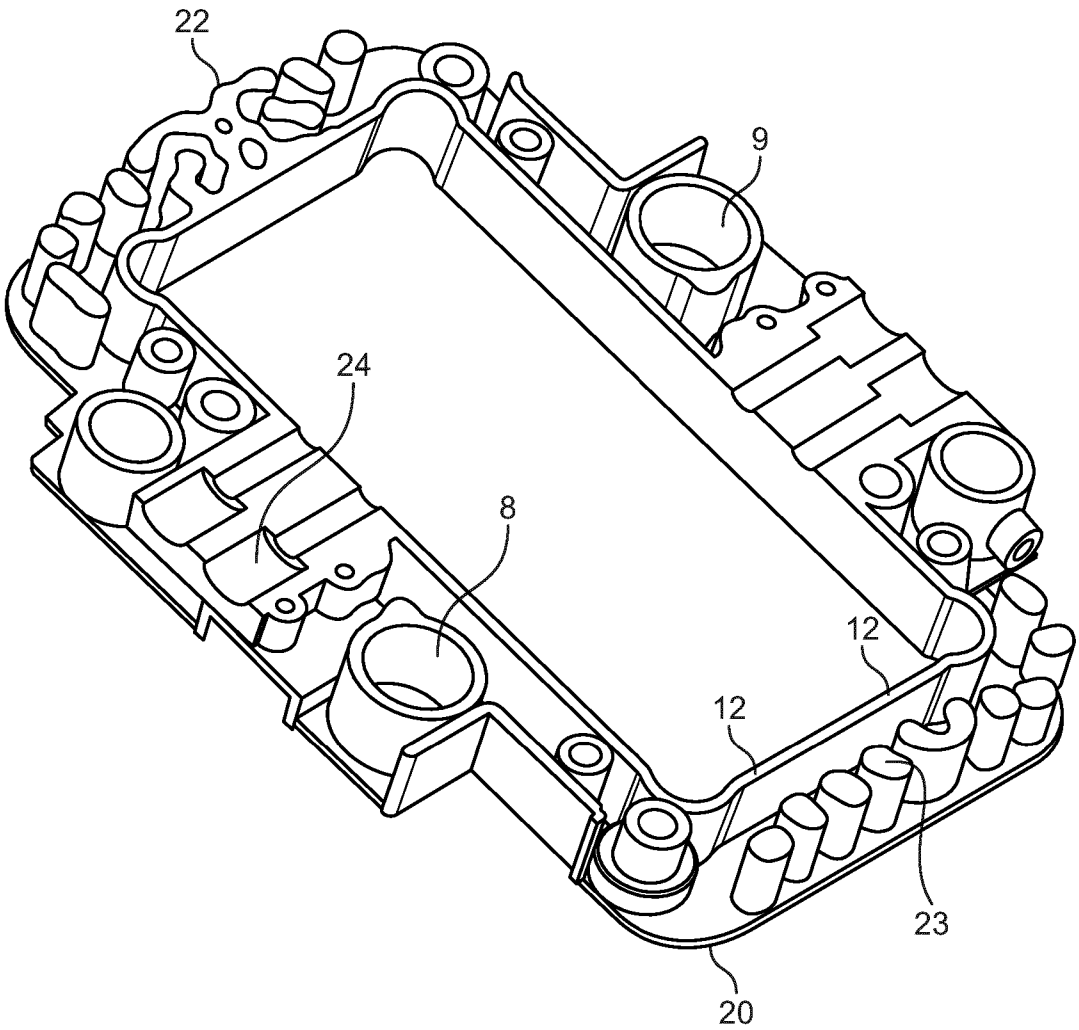

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/055960

A. CLASSIFICATION OF SUBJECT MATTER
INV. B29C45/26 B29C33/30
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)
B29C B33Y

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 90/08022 A1 (MONTONEN MAUNO [FI]) 26 July 1990 (1990-07-26) abstract figure 3	1-13
A	WO 2013/189608 A2 (IFW MANFRED OTTE GMBH [AT]) 27 December 2013 (2013-12-27) abstract figure 4	1-13
A	DE 10 2018 002628 A1 (EMACOS GMBH [DE]) 2 October 2019 (2019-10-02) abstract figures 1,2	1-13

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[x] Further documents are listed in the continuation of Box C.

[x] 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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"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 June 2022	05/07/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Koning, Erik

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/055960

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 570 926 A (SURFACE GENERATION LTD [GB]) 14 August 2019 (2019-08-14) abstract page 12, lines 16-22 figures 6,7	1-13

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2022/055960

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		WO 2019155186 A1	15-08-2019