

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
5 February 2009 (05.02.2009)

PCT

(10) International Publication Number
WO 2009/015458 A1

(51) International Patent Classification:

B22D 17/20 (2006.01) **B22D 19/00** (2006.01)
B22C 9/24 (2006.01) **B22D 21/04** (2006.01)
B22D 17/00 (2006.01)

(21) International Application Number:

PCT/CA2008/001135

(22) International Filing Date: 17 June 2008 (17.06.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

11/829,127 27 July 2007 (27.07.2007) US

(71) Applicant (for all designated States except US): **HUSKY INJECTION MOLDING SYSTEMS LTD.** [CA/CA];
500 Queen Street South, Bolton, Ontario L7E 5S5 (CA).

(72) Inventors: **MANDA, Jan Marius**; 132 Anndale Drive,
Toronto, Ontario M2N 2X8 (CA). **GRAETZ, Josef**; 56
Erindale Drive, Erin, Ontario N0B 1T0 (CA).

(74) Agent: **HUSKY INTELLECTUAL PROPERTY SERVICES**; c/o Husky Injection Molding Systems Ltd., 500
Queen Street South, Bolton, Ontario L7E 5S5 (CA).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL,

[Continued on next page]

(54) Title: LIGHT-METAL ALLOY INJECTION-MOLDED ARTICLE HAVING HOLLOW INSERT AND ASSOCIATED PROCESS, MOLD AND SYSTEM

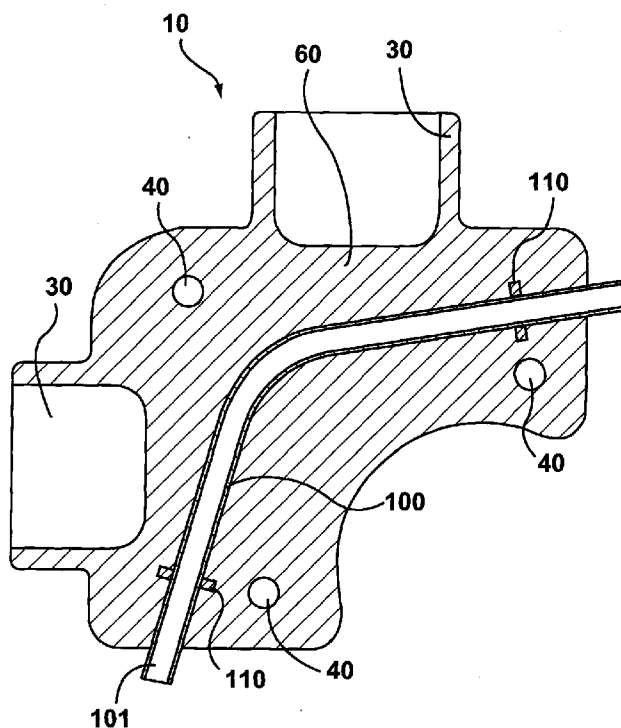


FIG. 3C

(57) Abstract: Disclosed is, according to an aspect, a metal-molded article (10), including: (i) a body (60) molded in association with a mold assembly (20), and (ii) a hollow insert (100) embedded, at least in part, in the body (60). The body (60) has a light-metal alloy that was injected, under pressure, into the mold assembly (20).

WO 2009/015458 A1



NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG,
CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

- *with international search report*

LIGHT-METAL ALLOY INJECTION-MOLDED ARTICLE HAVING HOLLOW INSERT AND ASSOCIATED PROCESS,
MOLD AND SYSTEM**TECHNICAL FIELD**

5 The present invention generally relates to, but is not limited to, molding systems, and more specifically the present invention relates to, but is not limited to, (i) a metal-molded article, (ii) a mold for making a metal-molded article.

BACKGROUND OF THE INVENTION

10

Examples of known molding systems are (amongst others): (i) the HyPET (trademark) Molding System, (ii) the Quadloc (Trademark) Molding System, (iii) the Hylectric (trademark) Molding System, and (iv) the HyMET (trademark) Molding System, all manufactured by Husky Injection Molding Systems (Location: Canada; www.husky.ca).

15

United States Patent Application Number 2005/0001354 (Inventor: Klocke et al.; Published: 2005-01-06) discloses a process for preparing a composite hollow body article by means of injection molding. The process includes the steps of: (a) providing a hollow body having exterior surfaces and interior surfaces, the interior surfaces of the hollow body defining a hollow interior, the hollow body also having at least one opening which provides fluid communication with the hollow interior thereof, (b) introducing a substantially incompressible fluid into the hollow interior of the hollow body, the hollow interior being substantially filled with the substantially incompressible fluid; and (c) injection molding thermoplastic material onto at least a portion of the exterior surfaces of the hollow body. The object of the present invention is to provide a process for the production of a plastics/metal composite component which consists at least of a hollow body made of metal or plastics material, in which process the hollow body does not become deformed when thermoplastic plastics material is injection molded onto and/or around it. Specifically, paragraph 16 indicates that "the incompressible fluid with which the hollow body is filled according to the invention when the thermoplastic plastics material is injection molded onto or around the hollow body prevents plastic deformation of the hollow body by the injection pressure. The incompressible fluid provides the necessary counter-pressure to the injection pressure. In a preferred embodiment of the process according to the invention, a positive pressure of less than or equal to 130 bar is applied to the incompressible fluid (e.g., a pressure of from 1 bar to 130 bar)." Specifically, paragraph 17 indicates that "the incompressible fluid may be, for example, water, a water/oil mixture, especially an oil-in-water emulsion, a water/glycol mixture or a (mineral) oil. Such fluids are known, for example, as hydraulic fluids of category HFA (oil-in-water emulsions or solutions, which contain more than 80% water),

30

35

HFB (water-in-oil emulsions having a water content of about 45%) and HFC (polymer/water or water/glycol mixture having a water content of at least 35%). It is additionally possible to use electro-viscous or magneto-viscous fluids.” Specifically, paragraph 21 indicates that the “preferred metals from which the hollow body may be fabricated include steel, nickel, chromium, iron, copper, zinc, titanium, aluminum and magnesium and also alloys of those metals.”

PCT Patent Application Number WO 2005/002825 (Inventor: KLOCKE; Published: 2005-01-13) discloses a method for producing a plastic/metal composite part consisting of at least one metal or plastic hollow body which is provided with at least one aperture and on which injection molding and/or total or partial over-molding with thermoplastic are carried out. The hollow body is entirely filled with an incompressible liquid during injection molding and/or over-molding.

SUMMARY OF THE INVENTION

The inventors believe they have arrived at an understanding of the problem that is not known and/or understood to persons skilled in the art. In the conventional die-casting processes, a mold core is extracted after a die-casting operation. The mold core is routinely used to form holes or voids in molded parts. Another molding solution uses an expendable core that is disintegrated (or removed) in a post molding operation, and thereby an internal channel may be formed in a molded article. However, to use a high-pressure injection molding process, a necessity to withstand high injection speeds and high pressures (or impacts) creates a series of problems related to the brittle nature of a molded part. A second problem associated with a molded component having a light metal alloy (such as a magnesium alloy) is the increased reaction and resultant corrosion caused by a cooling media in contact with the magnesium alloy. This is a reason for which forced-cooled molded components made out of the magnesium alloy are not seriously considered by designers of molded parts. The nature of the laminar flow associated with a magnesium injection molding process (along with the high level of automation used) may permit opportunities to create more complex parts without significant added cost in the molding operation.

The method proposed by the inventors, includes insertion of a hollow insert (at least one hollow insert) or a collection of hollow inserts (either interconnected or not interconnected) in a mold prior to injection of a metallic alloy (light metal alloy, such as magnesium) into the mold. The hollow insert is permanently over-molded (at least in part). The hollow insert may be made out of a material that is compatible with the light-metal alloy and the cooling media flowing through the hollow insert during the operation. The hollow nature of the hollow insert will allow a broader choice of materials without a negative impact on the weight of the final part.

A technical effect, amongst other technical effects, of the aspects of the present invention is that the hollow insert may be used to perform a function, such as: cooling, heating, weight saving, fluid transfer, improved strength, etc. Also, removal of heat directly from the part being molded during the molding operation may be performed if it is deemed necessary for reducing cycle time of the injection molding system.

According to a first aspect of the present invention, there is provided a metal-molded article, including: a body molded in association with a mold assembly; and a hollow insert embedded, at least in part, in the body, the body having a light-metal alloy that was injected, under pressure, into the mold assembly.

According to a second aspect of the present invention, there is provided a metal-molding process, including: a positioning operation, including positioning a hollow insert in a mold assembly being couplable with an injection metal-molding system; a closing operation, including closing the mold assembly over the hollow insert at least in part; and an injecting operation, including injecting a light-metal alloy into the mold assembly, the light-metal alloy surrounding, at least in part, the hollow insert, and the light-metal alloy forming into a body of a metal-molded article.

According to a third aspect of the present invention, there is provided a mold assembly for molding a metal-molded article, the mold assembly including: a mold portion, having: a molding surface configured to mold, at least in part, a body; and an insert locator configured to locate, at least in part, a hollow insert, the hollow insert to be embedded, at least in part, in the body, the body having a light-metal alloy that was injected, under pressure, into the mold assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the non-limiting embodiments of the present invention (including alternatives and/or variations thereof) may be obtained with reference to the detailed description of the non-limiting embodiments of the present invention along with the following drawings, in which:

FIG. 1A depicts a mold assembly 20 according to a first non-limiting embodiment;

FIG. 1B depicts the mold assembly 20 of FIG. 1A according to a second non-limiting embodiment, and a hollow insert 100 according to a third non-limiting embodiment;

FIG. 2A depicts the mold assembly 20 FIG. 1A according to a fourth non-limiting embodiment, and a molded article according to a fifth non-limiting embodiment;

FIG. 2B depicts a molding system process 500 according to a sixth non-limiting embodiment; FIGS. 3A and 3B depict a molded article according to a seventh non-limiting embodiment; and FIG. 3C depicts a molded article according to an eighth non-limiting embodiment.

The drawings are not necessarily to scale and are sometimes illustrated by phantom lines, diagrammatic representations and fragmentary views. In certain instances, details that are not necessary for an understanding of the embodiments or that render other details difficult to perceive may have been omitted.

Reference Numerals Used in the Drawings

The following is a listing of the elements designated to each reference numeral used in the drawings:

metal-molded article, 10	molding surface, 12
mold assembly, 20	mold portion, 22
bore, 30	bore molding surface, 32
mounting hole, 40	boss molding surface, 42
boss, 44	core locator, 52
body, 60	hollow insert, 100
passageway, 101	standoff, 110
insert locator, 112	metal-molding process, 500
positioning operation, 502	closing operation, 504
injecting operation, 506	

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

FIG. 1A depicts a mold assembly 20 according to the first non-limiting embodiment. The mold assembly 20, used for molding a metal-molded article 10, includes: (i) a mold portion 22, and (ii) an insert locator 112. The mold portion 22 has a molding surface 12 configured to mold, at least in part, a body 60 (depicted in FIG. 2A). The insert locator 112 is configured to locate, at least in part, a hollow insert 100 (depicted in FIG. 1B) to be embedded, at least in part, in the body 60. The body 60 has a light-metal alloy that was injected, under pressure, into the mold assembly 20.

According to variants: the mold portion 22 may include: (i) a boss molding surface 42 configured to locate, at least in part, a boss 44 (depicted in FIG. 3A), (ii) a bore molding surface 32 configured to locate, at least in part, a bore 30 (depicted in FIG. 2A), and/or (iii) a core locator 52 configured to locate, at least in part, a core.

FIG. 1B depicts the mold assembly 20 of FIG. 1A according to the second non-limiting embodiment, and the hollow insert 100 according to the third non-limiting embodiment. Placement of the hollow insert 100 may be done before the mold closes for the injection cycle, preferably by automatic means (robot, etc).

FIG. 2A depicts the mold assembly 20 of FIG. 1A according to the fourth non-limiting embodiment, and a molded article 10 according to the fifth non-limiting embodiment. The metal-molded article 10 includes: (i) a body 60, and (ii) a hollow insert 100. The body 60 is molded in association with a mold assembly 20. The hollow insert 100 is embedded, at least in part, in the body 60. The body 60 has a light-metal alloy (such as magnesium) that was injected, under pressure, into the mold assembly 20.

According to a variant, the hollow insert 100 includes: (i) a tube, (ii) a hollow core, and/or (iii) a network of tubes. According to yet another variant, the light-metal alloy includes a magnesium alloy. Given magnesium's good thermal conductivity, it is in many occasions preferred to plastics in applications where heat removal is a requirement, despite the increased level of complexity posed by magnesium injection molding as compared to plastics. Usually, thermal conduction coupled with natural convection generated at the outside of the part is used to dissipate the heat generated inside casings. Another important feature generated by the magnesium injection process is light-weight components. This is achieved by the low density of the magnesium alloy and a shell design combined with thin wall ribs. The hollow inserts can enhance the light weight requirement in areas where the shell design is not suitable. Providing a liner (that is, a hollow insert) with the desired properties may be an advantage for the parts produced with this method.

FIG. 2B depicts a molding system process 500 according to the sixth non-limiting embodiment. The metal-molding process 500 includes: (i) a positioning operation 502, (ii) a closing operation 504, and (iii) an injecting operation 506. The positioning operation 502 includes positioning the hollow insert 100 of FIG. 1B in the mold assembly 20 of FIG. 1A being couplable with a metal-molding system. The closing operation 504 includes closing the mold assembly 20 over the hollow insert 100 at least in part. The injecting operation 506 includes injecting a light-metal alloy into the mold assembly 20, the light-metal alloy surrounding, at least in part, the hollow insert 100, and the light-metal alloy forms into a body 60 of a metal-molded article 10. According to variants, the hollow insert 100 includes: (i) a tube, (ii) a hollow core, (iii) a network of tubes (either interconnected or not interconnected). According to yet another variant, the light-metal alloy includes a magnesium alloy.

FIGS. 3A and 3B depict the molded article 10 according to the seventh non-limiting embodiment. FIGS. 3A and 3B are different perspective views of the molded article 10.

FIG. 3C depicts the molded article 10 according to the eight non-limiting embodiment. FIG. 3C depicts the molded article in a cross sectional view. In this view, it is seen that the hollow insert 100 defines a passageway 101 configured to convey a fluid. The fluid may be compatible with the hollow insert 100. The choice for the material for the hollow insert 100 may be done such that the compatibility with the injected alloy molding material and the cooling media is ensured. Also, the dimensioning is done such that the injection speeds, pressures and temperatures may be accommodated.

According to a variant, the fluid: (i) includes a coolant, and the coolant is compatible with the hollow insert 100, (ii) is configured to exchange heat, at least in part, with the body 60, and/or (iii) is configured to exchange heat, at least in part, with the body 60. By inserting a cooling/heating circuit into a magnesium component, a larger variety of applications may be accommodated and an increased level of complexity of the molded part may be achieved without significant change in the molding process. Examples of the article 10 include: (i) magnesium seat frames, (ii) automobile steering wheels, (iii) engine blocks, etc. According to other non-limiting variants, the hollow insert 100 permits weight reduction of the body 60, and/or the hollow insert 100 permits conveyance of a vacuum.

It will be appreciated that the fluid may be conveyed to and away from the interior of the hollow insert 100 while the mold is closed and clamped shut; if this arrangement is required, then the hollow insert 100 may be extended so that the insert 100 reaches outside of the mold (this arrangement is not depicted); how the fluid is conveyed to and away from the interior of the hollow insert 100 could be achieved by selecting an appropriate arrangement for connecting the fluid to the insert 100.

It will be appreciated that, under some cases, the insert 100 may be relatively fragile enough to require an internal, counter pressure during injection of the surrounding molten alloy molding material, and the timing of when the counter pressure is applied to and withdrawn from the interior of the insert 100 may be determined with some experimentation because otherwise the insert may rupture under excessive pressure during injection of the molten alloy. However, there may be cases where the insert 100 may be able to withstand the injection pressure associated with the molten alloy, and in these cases therefore the counter pressure during injection may not be required. An example of how pressurization of a part may be achieved is described in PCT Patent Application WO 2005/002825(A1).

The description of the non-limiting embodiments provides non-limiting examples of the present invention; these non-limiting examples do not limit the scope of the claims of the present invention. The non-limiting embodiments described are within the scope of the claims of the present invention. The non-limiting embodiments described above may be: (i) adapted, modified and/or enhanced, as
5 may be expected by persons skilled in the art, for specific conditions and/or functions, without departing from the scope of the claims herein, and/or (ii) further extended to a variety of other applications without departing from the scope of the claims herein. It is to be understood that the non-limiting embodiments illustrate the aspects of the present invention. Reference herein to details and description of the non-limiting embodiments is not intended to limit the scope of the claims of the
10 present invention. Other non-limiting embodiments, which may not have been described above, may be within the scope of the appended claims. It is understood that: (i) the scope of the present invention is limited by the claims, (ii) the claims themselves recite those features regarded as essential to the present invention, and (ii) preferable embodiments of the present invention are the subject of dependent claims. Therefore, what is to be protected by way of letters patent are limited
15 only by the scope of the following claims:

WHAT IS CLAIMED IS:

1. A metal-molded article (10), comprising:
a body (60) molded in association with a mold assembly (20); and
a hollow insert (100) embedded, at least in part, in the body (60), the body (60) having a light-metal alloy that was injected, under pressure, into the mold assembly (20).
2. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) defines a passageway (101) configured to convey a fluid, the fluid being compatible with the hollow insert (100).
3. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) defines a passageway (101) configured to convey a fluid, the fluid including:
a coolant being compatible with the hollow insert (100).
4. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) includes:
a tube.
5. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) includes:
a hollow core.
6. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) includes:
a network of tubes.
7. The metal-molded article (10) of claim 1, wherein:
the light-metal alloy includes:
a magnesium alloy.
8. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) defines a passageway (101) configured to convey a fluid, the fluid being configured to exchange heat, at least in part, with the body (60).

9. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) defines a passageway (101) configured to convey a coolant, the coolant being configured to exchange heat, at least in part, with the body (60).
10. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) permits weight reduction of the body (60).
11. The metal-molded article (10) of claim 1, wherein:
the hollow insert (100) permits conveyance of a vacuum.
12. An injection metal-molding system configured to manufacture the metal-molded article (10) of claim 1.
13. A metal-molding process (500) for making a metal-molded article (10), the metal-molding process (500) comprising:
a positioning operation (502), including positioning a hollow insert (100) in a mold assembly (20) being couplable with an injection metal-molding system;
a closing operation (504), including closing the mold assembly (20) over the hollow insert (100) at least in part; and
an injecting operation (506), including injecting a light-metal alloy into the mold assembly (20), the light-metal alloy surrounding, at least in part, the hollow insert (100), and the light-metal alloy forming into a body (60) of the metal-molded article (10).
14. The metal-molding process (500) of claim 13, wherein:
the hollow insert (100) defines a passageway (101) configured to convey a fluid, the fluid being compatible with the hollow insert (100).
15. The metal-molding process (500) of claim 13, wherein:
the hollow insert (100) defines a passageway (101) configured to convey a fluid, the fluid including a coolant, the coolant being compatible with the hollow insert (100).
16. The metal-molding process (500) of claim 13, wherein:
the hollow insert (100) includes:
a tube.
17. The metal-molding process (500) of claim 13, wherein:

the hollow insert (100) includes:
a hollow core.

18. The metal-molding process (500) of claim 13, wherein:
the hollow insert (100) includes:
a network of tubes.
19. The metal-molding process (500) of claim 13, wherein:
the light-metal alloy includes:
a magnesium alloy.
20. The metal-molding process (500) of claim 13, wherein:
the hollow insert (100) defines a passageway (101) configured to convey a fluid, the fluid being configured to exchange heat, at least in part, with the body (60).
21. The metal-molding process (500) of claim 13, wherein:
the hollow insert (100) defines a passageway (101) configured to convey a coolant, the coolant being configured to exchange heat, at least in part, with the body (60).
22. A mold assembly (20) for molding a metal-molded article (10), the mold assembly (20) comprising:
a mold portion (22), having:
a molding surface (12) configured to mold, at least in part, a body (60); and
an insert locator (112) configured to locate, at least in part, a hollow insert (100), the hollow insert (100) to be embedded, at least in part, in the body (60), the body (60) having a light-metal alloy that was injected, under pressure, into the mold assembly (20), the body (60) and the hollow insert (100) being combined to form the metal-molded article (10).

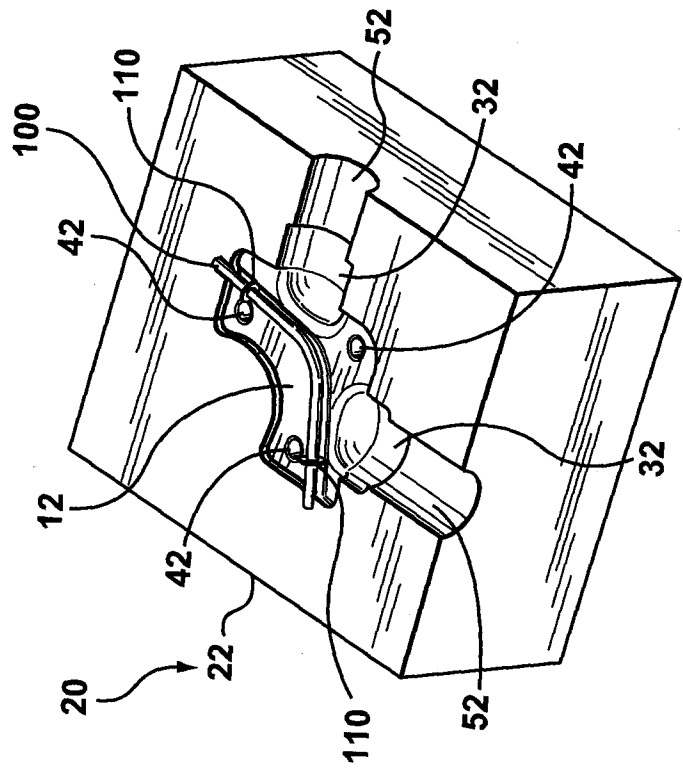


FIG. 1A

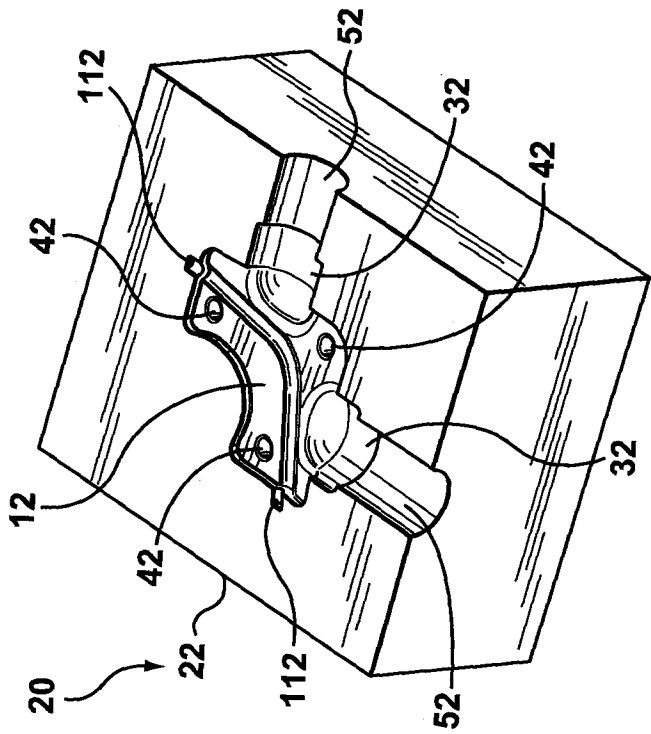


FIG. 1B

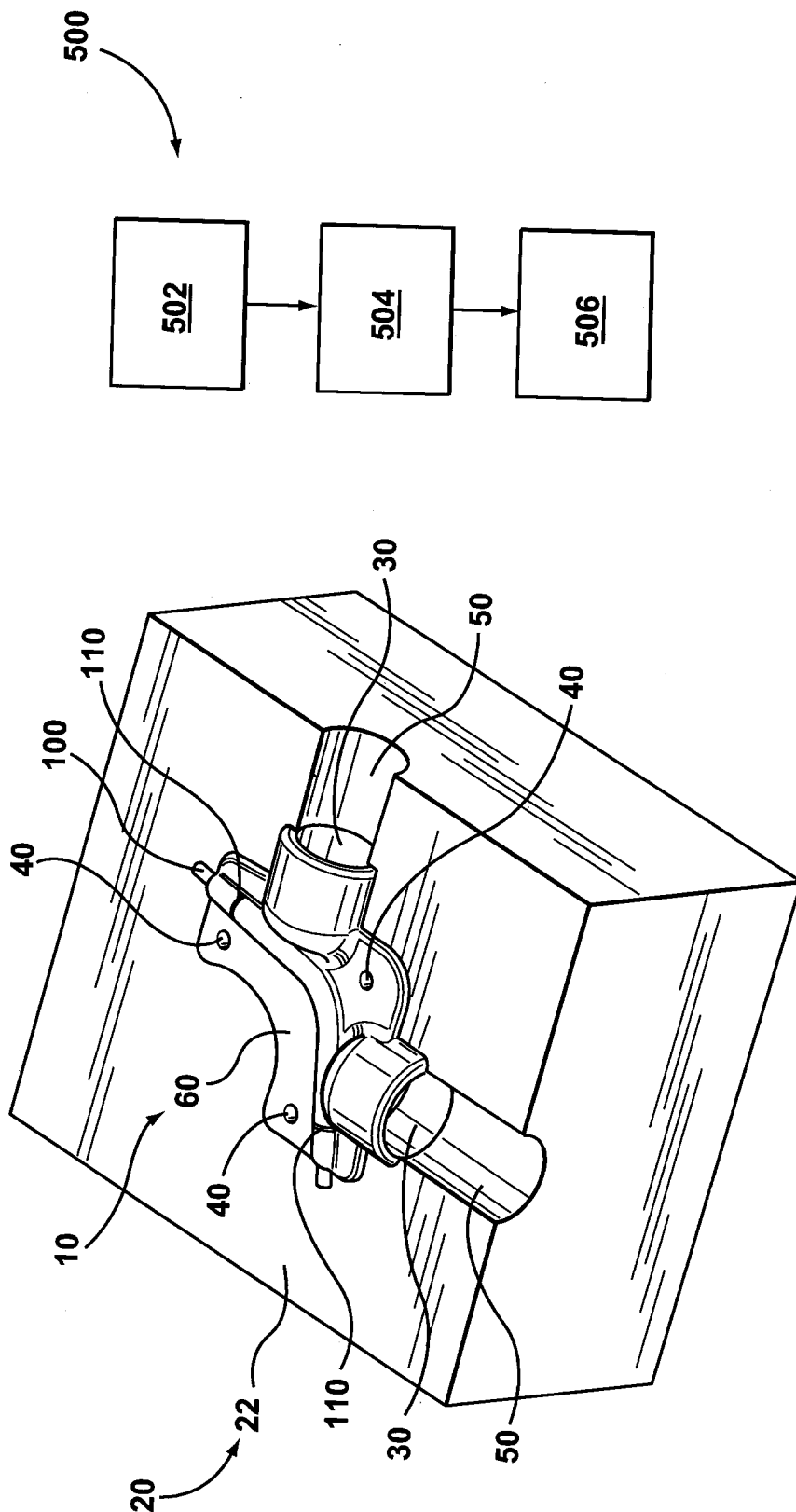


FIG. 2A

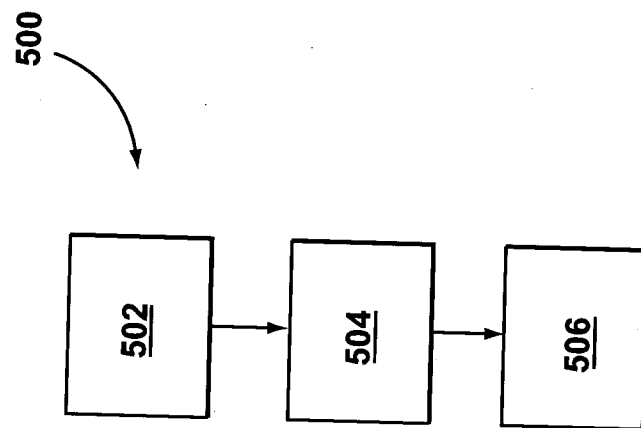


FIG. 2B

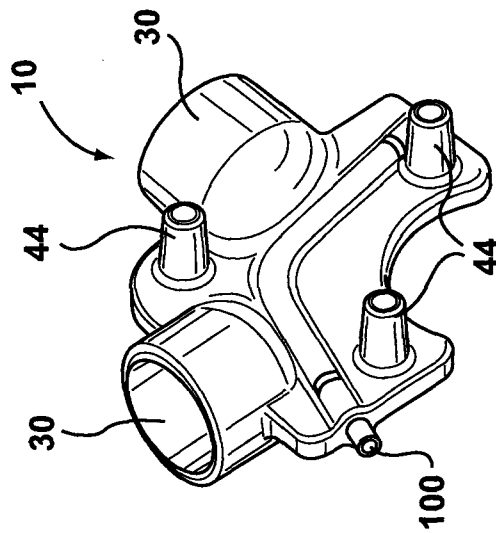


FIG. 3A

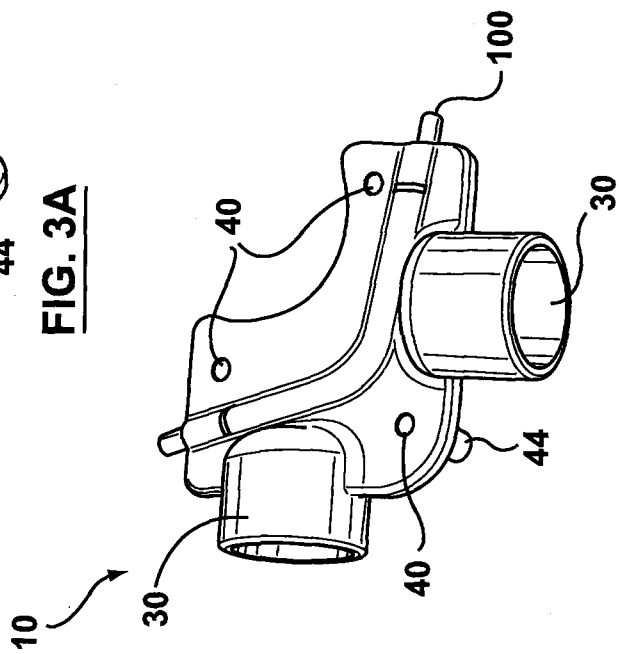


FIG. 3B

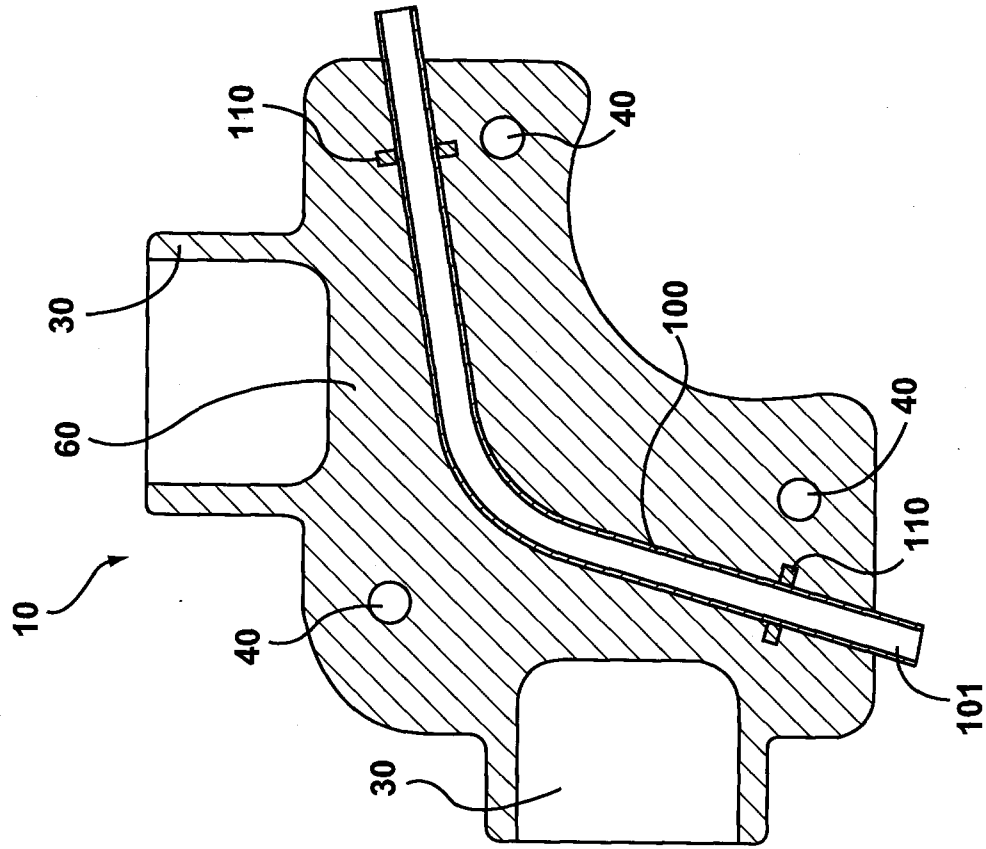


FIG. 3C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2008/001135

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **B22D 17/20** (2006.01) , **B22C 9/24** (2006.01) , **B22D 17/00** (2006.01) , **B22D 19/00** (2006.01) ,
B22D 21/04 (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)

IPC: B22D, B22C, B29C

U.S. Cl.: 264, 428, 301

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Google, QPat (Fampat)

Keywords: mo?ld+, injection, hollow insert OR hollow core, over?mo?ld+ or over?cast+, metal OR aluminum OR magnesium OR steel OR copper OR alloy

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 6,364,425 B1 (MARQUIS, M.) 2 April 2002 (02-04-2002) * cover page, figures 3 and 4 *	1, 4, 5, 7, 10, 11, 13, 16, 17, 19, 22 2, 3, 6, 8, 9, 14, 15, 18, 20, 21
X	JP 2 142 662 A (YUJI, O.) 31 May 1990 (31-05-1990) * abstract, figures 3 and 4 *	1, 5, 13, 17 and 22
X	JP 8 189 414 A (SUZUKI, N. et al.) 23 July 1996 (23-07-1996) * abstract, figures 1-6 *	1, 5, 13, 17 and 22
Y	EP 0 646 447 B1 (TATSUHIKO, M. et al.) 3 March 1999 (03-03-1999) * figure 1a *	6, 18
Y	JP 2 121 746 A (NORIMOTO, M. et al.) 9 May 1990 (09-05-1990) * abstract, figure 3 *	2, 3, 8, 9, 14, 15, 20, 21
A	WO 2005/002825 A1 (KLOCKE, M.) 13 January 2005 (13-01-2005) * Cited by Applicant * * Whole document *	1-22

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

[X] See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"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
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

10 September 2008 (10-09-2008)

Date of mailing of the international search report

17 September 2008 (17-09-2008)

Name and mailing address of the ISA/CA
Canadian Intellectual Property Office
Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 001-819-953-2476

Authorized officer

Maciek Kepka 819- 934-9121

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons :

1. ☐ Claim Nos. :
because they relate to subject matter not required to be searched by this Authority, namely :

2. ☒ Claim Nos. : 12
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically :

Claim 12 does not comply with **Article 6 of the PCT** because it fails to specify characterising features of the injection metal-molding system.

3. ☐ Claim Nos. :
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows :

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos. :
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos. :

- Remark on Protest** ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2008/001135

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005/001354 A1 (CLOCKE, M.) 6 January 2005 (06-01-2005) * Cited by Applicant * * Whole Document *	1-22
A	DE 100 14 332 A1 (SCHNELL, S.) 4 October 2001 (04-10-2001) * Whole document *	1-22
A	US 4,743,481 A (QUINLAN, J. et al.) 10 May 1988 (10-05-1988) * Whole document *	1-22

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2008/001135

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US6364425 B1	02-04-2002	NONE	
JP2142662 A	31-05-1990	NONE	
JP8189414 A	23-07-1996	NONE	
EP0646447 B1	05-04-1995	DE69416763 D1 DE69416763 T2 JP3443140 B2 US5851456 A	08-04-1999 09-09-1999 02-09-2003 22-12-1998
JP2121746 A	09-05-1990	NONE	
WO2005002825 A1	13-01-2005	CN1878648 A DE10329710 A1 EP1644175 A1 KR20060025199 A US2005001354 A1	13-12-2006 10-02-2005 12-04-2006 20-03-2006 06-01-2005
DE10014332 A1	04-10-2001	AU4250301 A EP1274554 A1 US2003077409 A1 WO0172495 A1	08-10-2001 15-01-2003 24-04-2003 04-10-2001
US4743481 A	10-05-1988	NONE	