



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.07.2017 Bulletin 2017/28

(51) Int Cl.:
B22D 17/14 (2006.01)

(21) Application number: **16203338.5**

(22) Date of filing: **12.12.2016**

(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
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Kranjc, Andrej**
1380 Cerknica (SI)

(72) Inventor: **Kranjc, Andrej**
1380 Cerknica (SI)

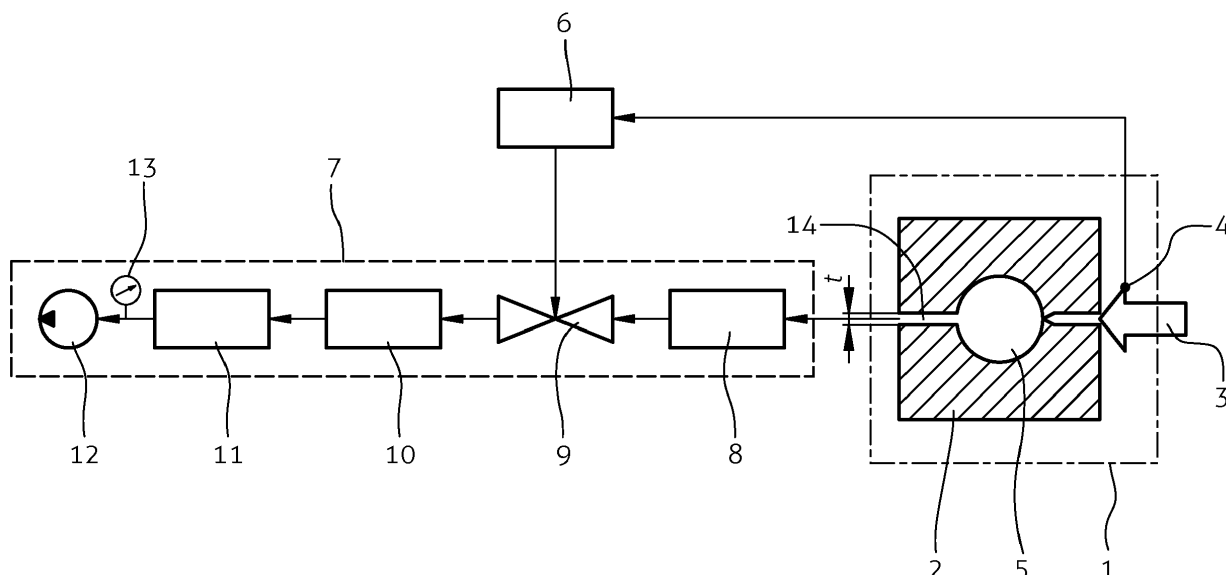
(74) Representative: **Ivancic, Bojan**
Inventio d.o.o.
Dolenjska cesta 11
1000 Ljubljana (SI)

(30) Priority: **23.12.2015 SI 201500308**

(54) **A METHOD OF PRESSURE DIE CASTING AND A DEVICE FOR CARRYING OUT SAID METHOD**

(57) The present invention refers to a method of pressure die casting and to a device for carrying out said method. A device for carrying out a method of pressure die casting comprises elements attached to a mould (2), said elements being mutually connected in series, said elements being in particular a filtering means (8), a block-

ing means (9), a first operating container (10), a second compensating container (11), and a suction means (12), wherein said elements (8, 9, 10, 11, 12) are data-connected with a control unit (6) and indirectly via control unit (6) with a position sensor (4) arranged on an injection nozzle (3).



SL. 1

Description

[0001] The present invention refers to a method of pressure die casting and to a device for carrying out said method.

[0002] A method of pressure die casting such as zinc die casting is generally known and comprises forcing molten metal under high pressure and in short time period directly into a reusable mould in order to obtain required shape of a cast. The casting cycle of the molten metal is relatively high. A problem of such casting lies in a fact that gases are present in the mould that are not forced out of the mould by the molten metal. Therefore, a substantial amount of bubbles and cavities is present in the casts made by such a process rendering such a cast even unusable.

[0003] It is the object of the present invention to create a method of pressure die casting which enables production of a cast having as low porosity as possible, wherein the mechanical features of the cast metal are as close to the theoretical ones as possible.

[0004] Further object of the present invention is to create a device for carrying out said method of pressure die casting.

[0005] The object as set above is solved by a method comprising activating a casting machine and activating by means of a control unit a device for suction air and/or gases through a gap out of a mould. Afterwards, establishing vacuum in said device by means of a suction means, wherein fluid communication between the device and the mould is prevented. Now, pressure casting is triggered in the casting machine. A signal is sent from the casting machine by means of a position sensor about reaching the end position of the injection nozzle to the control unit, which after receiving a signal from the position sensor sends a signal to a blocking means, thus, enabling fluid communication between the mould and said device. Previous step is followed by evacuating air and gases from the mould and, simultaneously, injecting hot melt into the mould. At the moment when injecting the melt into the mould is ended, and the control unit sends a signal to the blocking means, the fluid communication between the mould and the device breaks. The last two steps comprise ejecting a cast out of the mould and supervising the cast.

[0006] A method of die casting will be more readily understood on reading the following description of a non-limiting embodiment and with reference to the accompanying drawing showing a schematic view of a device for carrying out the method according to the invention.

[0007] The drawing shows as an example a schematic representation of a casting machine 1 for pressure die casting of metals such as zinc and zinc alloys, comprising a mould 2 and an injection nozzle 3 having a position sensor 4. Said position sensor 4 can be selected as a limit switch and similar. Said mould 2 comprises a mould cavity 5 and at least one parting line. A control unit 6 being attached to said casting machine 1 controlling dif-

ferent parameters required at die casting such as, for example, cast pressure, injection nozzle movement velocity and similar. Furthermore, a device 7 for suction air and/or gases out of the mould 2 and, respectively, out of the mould cavity 5 is in fluid communication with said casting machine 1. Said device 7 comprises, when viewed in direction away from the casting machine 1, mutual in series interconnected elements, in particular a filtering means 8, a blocking means 9, a first operating container 10, a second compensating container 11, and a suction means 12. With the present embodiment, said filtering means 8 is selected as a solid particles sieve, and said blocking means 9 is selected as an electric-pneumatic valve. Further, said first container 10 and said second container 11 are selected as vacuum containers, and said suction means 12 is selected as a vacuum pump. It is provided for with the method according to the invention that the pressure in the mould 2 and, respectively, in the mould cavity created by said suction means 12 amounts to about 0,8 bar, wherein the pressure level can be controlled by means of the control unit 6. A pressure gauge 13 is provided on said suction means 12 for fast metering the pressure in the system.

[0008] Said device 7 is connected to the casting machine 1 at the point of said parting line of the mould 2. It is provided for according to the present invention that said parting line is formed at the connection point of the device 7 with a relatively narrow gap 14 interconnecting the mould cavity with the connecting section of said device 7. The width t of said gap 14 particularly depends on material to be cast and the casting pressure used. For example, the width t of the gap 14 in case of pressure die casting of zinc and, respectively, of zinc alloys lies in the area of between about 0,03 mm and about 0,05 mm.

[0009] The method of pressure die casting according to the invention starts by activating the casting machine 1 and by activating by means of the control unit 6 the device 7 for suction air and/or gases through the gap 14 out of the mould 2. Afterwards, the suction means 12 creates required vacuum in the system, particularly in the operating container 10 and in the compensating container 11. The fluid communication from the operating container 10 to the mould 2 and, respectively, to the mould cavity 5 prevented. When the pressure gauge 13 shows the required value of the pressure and, respectively, the vacuum, the pressure casting in the casting machine 1 is activated with the required time delay. Said time delay which can be pre-set at the control unit 6 or the casting machine 1 represents a delay between the moment the injection nozzle 3 of the casting machine 1 reached its final position and, respectively, abuts a sprue bushing, and the starting moment of forcing molten metal into the mould 2. Said time delay depends on the casting pressure and the material to be cast and typically lies in the area of between 1 millisecond and 30 milliseconds.

[0010] The casting machine 1 sends by means of the position sensor 4 a signal about reaching the end position of the injection nozzle 3 to the control unit 6 which oper-

ates the blocking means 9. Immediately upon the reception of the signal from the limit switch 4 the control unit 6 sends adequate signal to the blocking means 9 which opens and, thus, enables fluid communication between the mould 2 and the operating container 10. Vacuum in the operating container 10 evacuates air and gases from the mould 2 simultaneously with forcing of hot melt into the mould 2. At the moment the injection of the melt into the mould 2 ends the control unit 6 sends a signal to the blocking means 9 which brakes again the fluid communication of the mould 2 with the operating container 10. This step is followed by ejection of a cast from the mould 2. Supervising the cast is carried out in manners known per se such as by means of a density scale, by means of computer tomography and similar, for instance.

[0011] The method according to the present invention enables production of casts where the scale of the porosity is minimised as much as possible. Simultaneously, surface irregularities of the cast are eliminated resulting in improved quality with the subsequent galvanizing of the casts. In addition, the mechanical properties of the basic material to be moulded are improved in a way that they are entirely close to the values determined by the producer of the materials to be moulded. Also, during method of casting metal the pressure utilised at the casting machine decreases up to 30%. The method and the device according to the invention enable the cast produced by casting machine to be filled for above 99%.

Claims

1. A method of pressure die casting, **characterised in that** it comprises the following steps:

- a) activating a casting machine (1);
- b) activating by means of a control unit (6) a device (7) for suction air and/or gases through a gap (14) out of a mould (2);
- c) establishing vacuum in the device (7) by means of a suction means (12), wherein fluid communication between the device (7) and the mould (2) is prevented;
- d) activating pressure casting in the casting machine (1) triggered with time delay;
- e) sending by means of a position sensor (4) a signal from the casting machine (1) about reaching the end position of the injection nozzle (3) to the control unit (6);
- f) enabling fluid communication between the mould (2) and the device (7) so that the control unit (6), after receiving a signal from the position sensor (4), sends a signal to a blocking means (9);
- g) evacuating air and gases from the mould (2) and, simultaneously, injecting hot melt into the mould (2);
- h) breaking the fluid communication between

the mould (2) and the device (7) at the moment when injecting the melt in the mould (2) is ended, and sending a signal by means of the control unit (6) to the blocking means (9);

- i) ejecting a cast out of the mould (2);
- j) supervising the cast.

2. A method according to claim 1, **characterised in that** said time delay can be pre-set and represents a delay between the moment the injection nozzle (3) of the casting machine (1) contacts the mould (2) and the starting moment of forcing melt into the mould (2).

3. A method according to claim 1, **characterised in that** said time delay lies between 1 millisecond and 30 milliseconds.

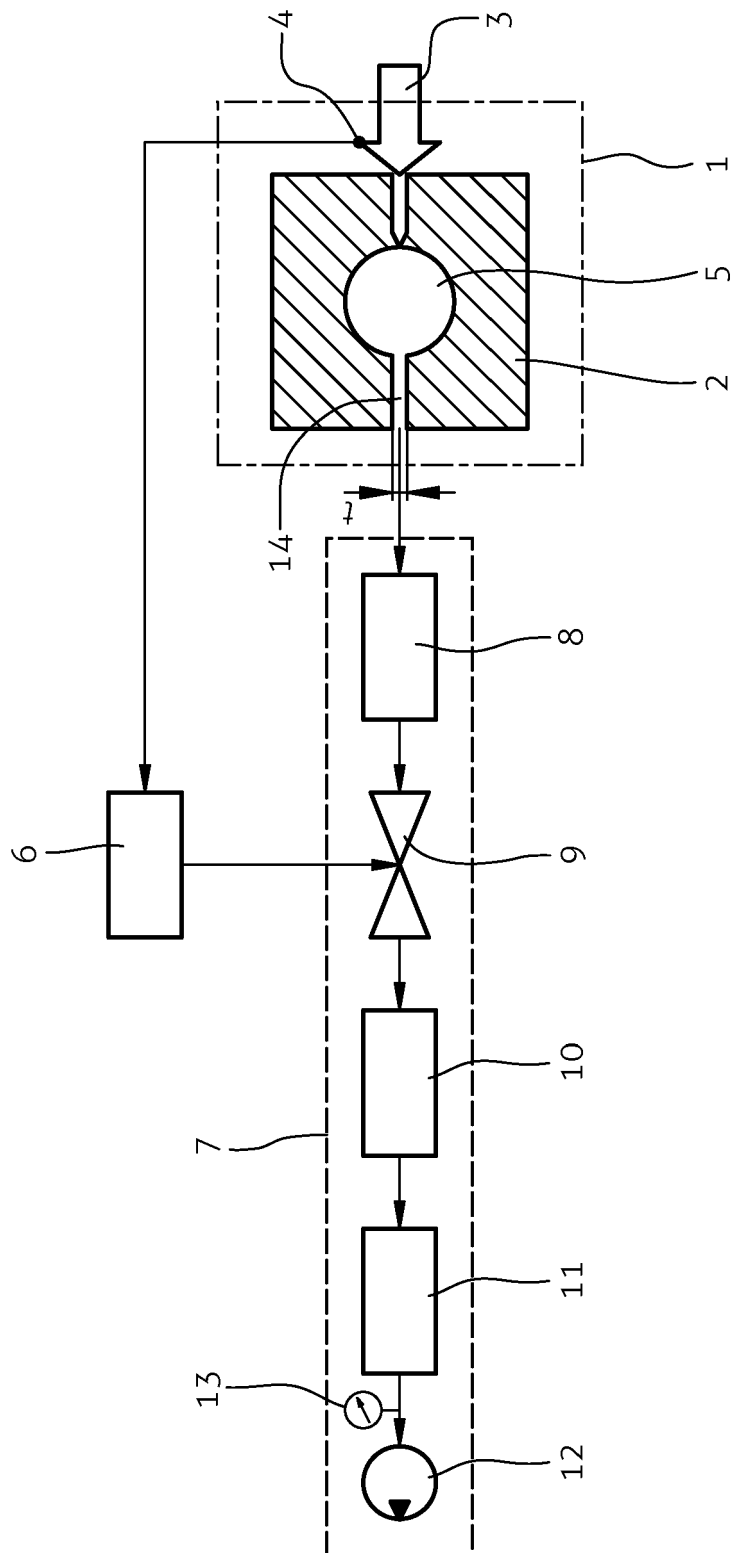
4. A method according to claim 1, **characterised in that** supervising the cast is carried by means of a density scale, by means of computer tomography and similar.

5. A device for carrying out the method of pressure die casting according to claims 1 to 4 on a casting machine comprising a mould and an injection nozzle, **characterised in that** it further comprises elements attached to a mould (2), said elements being mutually connected in series, said elements being in particular a filtering means (8), a blocking means (9), a first operating container (10), a second compensating container (11), and a suction means (12), wherein said elements (8, 9, 10, 11, 12) are data-connected with a control unit (6) and indirectly via control unit (6) with a position sensor (4) arranged on an injection nozzle (3).

6. A device according to claim 5, **characterised in that** said position sensor (4) is selected as a limit switch and similar.

7. A device according to claims 5 and 6, **characterised in that** said elements (8, 9, 10, 11, 12) are fluidly coupled with said mould (2) by means of a gap (14) formed at the point of a parting line of the mould (2).

8. A device according to claims 5 to 7 **characterised in that** said filtering means (8) is selected as a solid particles sieve, and that said blocking means (9) is selected as electric-pneumatic valve, and that said first and second containers (10, 11) are selected as vacuum tanks, and that said suction means (12) is selected as a vacuum pump.





EUROPEAN SEARCH REPORT

Application Number
EP 16 20 3338

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2001 205392 A (HITACHI LTD) 31 July 2001 (2001-07-31)	1-4	INV. B22D17/14
Y	* paragraphs [0038], [0039], [0047]; claims 4,5; figures 1,4,7 *	5-8	
Y	US 5 782 287 A (IWAMOTO NORIHIRO [JP] ET AL) 21 July 1998 (1998-07-21)	5-8	
A	* column 2, lines 33-41; figures 1,6 *	1-4	
A	US 2006/118264 A1 (TAKEYA KENGO [JP] ET AL) 8 June 2006 (2006-06-08)	1-8	
A	* the whole document *	1-8	
A	US 6 460 596 B1 (YAMAGUCHI TAKESHI [JP] ET AL) 8 October 2002 (2002-10-08)	1-8	TECHNICAL FIELDS SEARCHED (IPC) B22D
A	* the whole document *	1-8	
A	JP 2002 086257 A (JAPAN STEEL WORKS LTD; JYO KK) 26 March 2002 (2002-03-26)	1-8	
	* abstract; figures 1-5 *		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 May 2017	Examiner Nikolaou, Ioannis
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p>			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 20 3338

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-05-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2001205392 A	31-07-2001	NONE	
US 5782287 A	21-07-1998	CN 1150921 A JP 3490188 B2 JP H08332558 A TW 375542 B US 5782287 A	04-06-1997 26-01-2004 17-12-1996 01-12-1999 21-07-1998
US 2006118264 A1	08-06-2006	CN 1781627 A JP 4041489 B2 JP 2006159200 A US 2006118264 A1	07-06-2006 30-01-2008 22-06-2006 08-06-2006
US 6460596 B1	08-10-2002	DE 10052130 A1 JP 3477124 B2 JP 2001113352 A US 6460596 B1	31-05-2001 10-12-2003 24-04-2001 08-10-2002
JP 2002086257 A	26-03-2002	JP 3502600 B2 JP 2002086257 A	02-03-2004 26-03-2002