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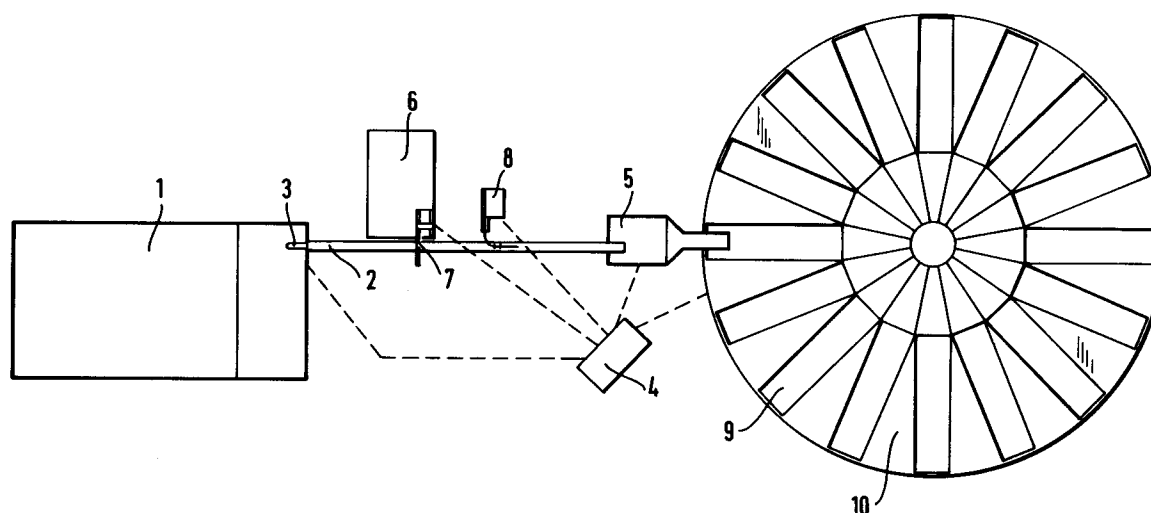
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D-80639 München (DE)(54) **Method and apparatus for producing metal objects.**

(57) The invention relates to a method and apparatus for producing standard-weight metal object, alloyed with at least one alloy ingredient, by means of casting. According to the invention, the main metal and

alloy ingredient flows are conducted so, that the alloy ingredient is fed into the molten main metal flow in between the smelting furnace (1), used for smelting the main metal, and the casting mold (9).

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The present invention relates to a method and apparatus for producing alloy metal objects, advantageously of a standard weight, by means of casting, so that the alloy ingredients are added to the main metal flow after smelting the main metal.

While casting alloy metal objects, the alloy ingredients are usually added, in connection with the smelting of the main metal, to the same smelting furnace in solid state. Prior to the casting, an analysis sample must be taken from the smelting furnace in order to define the right composition, which operation essentially increases the duration of the casting cycle. Moreover, if several alloys containing different alloy ingredients are desired to be cast in the same smelting furnace, the furnace must essentially be completely emptied in order to prevent any mixing of the respective alloys.

The object of the present invention is to eliminate some of the drawbacks of the prior art and to achieve an improved and peratively more secure method and apparatus for producing alloy metal objects, essential of a standard weight, by casting so that the alloy ingredients need not be fed into the smelting furnace used in the smelting of the main metal, but the alloy ingredients are fed later into the molten main metal flow in between the smelting furnace and the casting mould. The essential novel features are apparent from the appended patent claims.

According to the invention, from the smelting furnace of the main metal, there is conducted molten metal, advantageously at a rate allowed by the smelting capacity of the furnace, to at least one connecting channel provided in between the smelting furnace and the molten metal batching member, which connecting channel can be moved essentially in the transversal and vertical directions. The amount of molten metal to be conducted into the connecting channel is adjusted by means of control members, so that an essentially continuous feeding of molten metal from the smelting furnace into the connecting channel is achieved. The metals to be alloyed, which can be one or several, are conducted in desired quantities to the molten flow in between the smelting furnace and the casting mold, so that the control members adjusting the main metal flow also are advantageously used for adjusting the feeding quantities of the alloy metal or metals, according to the desired alloy ratio and the weigh of the metal object to be cast. The alloy metals can be conducted into the main metal flow either in molten or solid state, either into the connecting channel in between the smelting furnace and the molten metal batching member, or directly into the molten metal batching member.

From the connecting channel in between the smelting furnace and the batching member, the molten metal is conducted to the batching member

advantageously so, that the connecting channel is shifted vertically downwards by means of shifting members, and the melt begins to flow from the connecting channel to the batching member of the casting mold. Essentially for the duration of the flowing of the melt from the connecting channel to the batching member, the feeding rate of the melt from the smelting furnace to the connecting channel and respectively the feeding rate of the alloy metals to the connecting channel, or directly to the batching member if so desired, can be increased. The feeding of the melt from the connecting channel to the batching member, and the resulting turbulence of the metal alloy, advantageously intensifies the mixing of the metal alloy in an advantageous fashion.

The batching member receives the molten metal flow fed from the connecting channel, and possibly also at least one alloy metal flow fed directly into the batching member. When the same molten metal alloy as in the previous casting cycle is fed into the batching member, a small amount of the said metal alloy is advantageously left in the batching member from the previous casting cycle, so that there can advantageously be taken into account for instance metal losses caused by splashing of the molten metal, as well as metal losses caused by its sticking to the bottom of the batching member. Now a new charge of molten metal, corresponding to the weight of the metal object to be cast, is fed into the batching member. If the metal alloy to be cast should be changed, to the batching member there is fed alloyed molten metal only as much as is necessary in order to make the melt quantity contained in the batching member to correspond to the weight of the metal object to be cast.

When the desired quantity of melt is fed into the batching member, the melt flow into the batching member is stopped, advantageously for instance by lifting the connecting channel and the alloy metal feeding members to their top position. From the batching member, the alloyed melt corresponding in quantity to the object to be cast is conducted into a casting mold by tilting the batching member. Only if the metal alloy to be cast should be changed, the batching member is emptied altogether, otherwise a small amount of the alloyed molten metal to be cast is advantageously left in the batching member as a base charge.

The feeding of the main metal in the metal object to be cast from the smelting furnace to at least one connecting channel in between the smelting furnace and the batching member is advantageously carried out in two successive stages, so that when the connecting channel is in its lifted position, and thus the melt does not flow into the batching member, only molten main metal is fed

into the connecting channel. Now the connecting channel advantageously serves as an intermediate tank for the molten main metal, in which case a separate intermediate tank is not needed, and thus one slag-forming transfer of the melt from one tank to another is avoided. On the other hand, when the connecting channel is in its low position, so that the melt flows from the connecting channel to the batching member, the feeding rate of the molten main metal from the smelting furnace into the connecting channel is increased. Essentially simultaneously with the increase of the main metal feeding rate, the feeding of the alloy ingredient or ingredients is switched on, and the alloy ingredients are fed either in solid or molten state to the main metal flow contained in the connecting channel, or directly to the batching member. Thus the main metal flow in the smelting furnace remains clear of the alloy ingredients, and the metal alloy to be cast can be changed simply by changing either the quantity of the alloy ingredient, the alloy ratio or the alloy ingredient, and by feeding the alloy ingredient or ingredients from the smelting furnace to the main metal flow that is already removed from the smelting furnace, in between the smelting furnace and the casting mold. Moreover, the feeding of the alloy ingredient or ingredients to the connecting channel advantageously starts the alloying of the main metal flow already prior to the batching member.

While employing the method and apparatus of the invention for producing metal objects, the alloy ingredient quantity, alloy ratio or alloy ingredient of the metal object can be changed essentially without a break in the production. In similar fashion, each metal object accurately contains a desired amount of alloy metals, and the metal object is essentially accurately of the desired weight. Furthermore, when changing the alloy ingredient quantity, alloy ratio or alloy ingredients, there are not created incorrectly alloyed metal objects, and thus the analysis samples become essentially unnecessary. Moreover, when using the method and apparatus of the invention, the need for space and labour is essentially reduced. Owing to its simplicity, the apparatus requires an essentially small amount of building and installation work in the production facilities, and thus the apparatus is installable essentially rapidly, which increases the applicability of the method and apparatus of the invention.

The invention is explained below with reference to the appended drawing, which represents a preferred embodiment of the invention in a top-view schematical illustration.

According to the drawing, the main metal in the metal object to be alloyed is smelted in the smelting furnace 1. From the smelting furnace 1, the

smelted main metal is conducted to the connecting channel 2 advantageously by means of a pump 3, and the molten flow passing therethrough can advantageously be adjusted to be suitable for the capacity of the smelting furnace 1. The quantity of the melt fed into the connecting channel 2 by the pump 3 is adjusted by means of the control member 4. The melt feeding rate is adjusted so that when the connecting channel 2 is in its top position, i.e. during the unloading stage of the batching member 5, the melt feeding rate is advantageously maintained such that only a small amount of melt flows into the chute-like connecting channel 2. On the other hand, when the connecting channel 2 is in its low position, i.e. during the filling stage of the batching members 5, the melt feeding rate is increased, and essentially simultaneously with an increase in the feeding rate, the feeding of alloy ingredients into the connecting channel 2 is begun. One of the alloy ingredients is first smelted in the alloy ingredient smelting furnace 6, and a desired quantity of alloy ingredient per one metal object is conducted via the alloy ingredient batching member 7 to the connecting channel, whereas a desired amount of the second alloy ingredient to be fed in solid state is fed via the alloy ingredient feeder 8 to the molten metal flowing in the connecting channel 2. The feeding of the alloy ingredients to the connecting channel 2 is also advantageously conducted by means of the same control member 4.

From the connecting channel 2, the alloyed molten metal is conducted in batches and in standard charges to the batching member 5. The standard charge essentially corresponds to the weight of the metal object to be cast. In the method of the invention, in the first batching after changing the alloying of the metal object, into the batching member 5 there is, however, fed a batch which corresponds to the weight of the metal object to be cast plus the base charge left in the batching member 5 after unloading the same. This base charge is removed in connection with the last unloading of the batching member 5, which takes place prior to changing the alloying of the metal object.

From the batching member 5, a quantity of the alloyed molten metal corresponding to the weight of the metal object to be cast is discharged into the casting mold 9. There can be several casting molds 9, so that they are located on the same rotating cast line 10. The casting molds 9 can also be located immovably, advantageously in a curved configuration, so that the batching member 5 is located turnably in the center of the circle pertaining to the said curve.

The above specification is a description one preferred embodiment of the invention only, but the invention can be largely modified within the scope

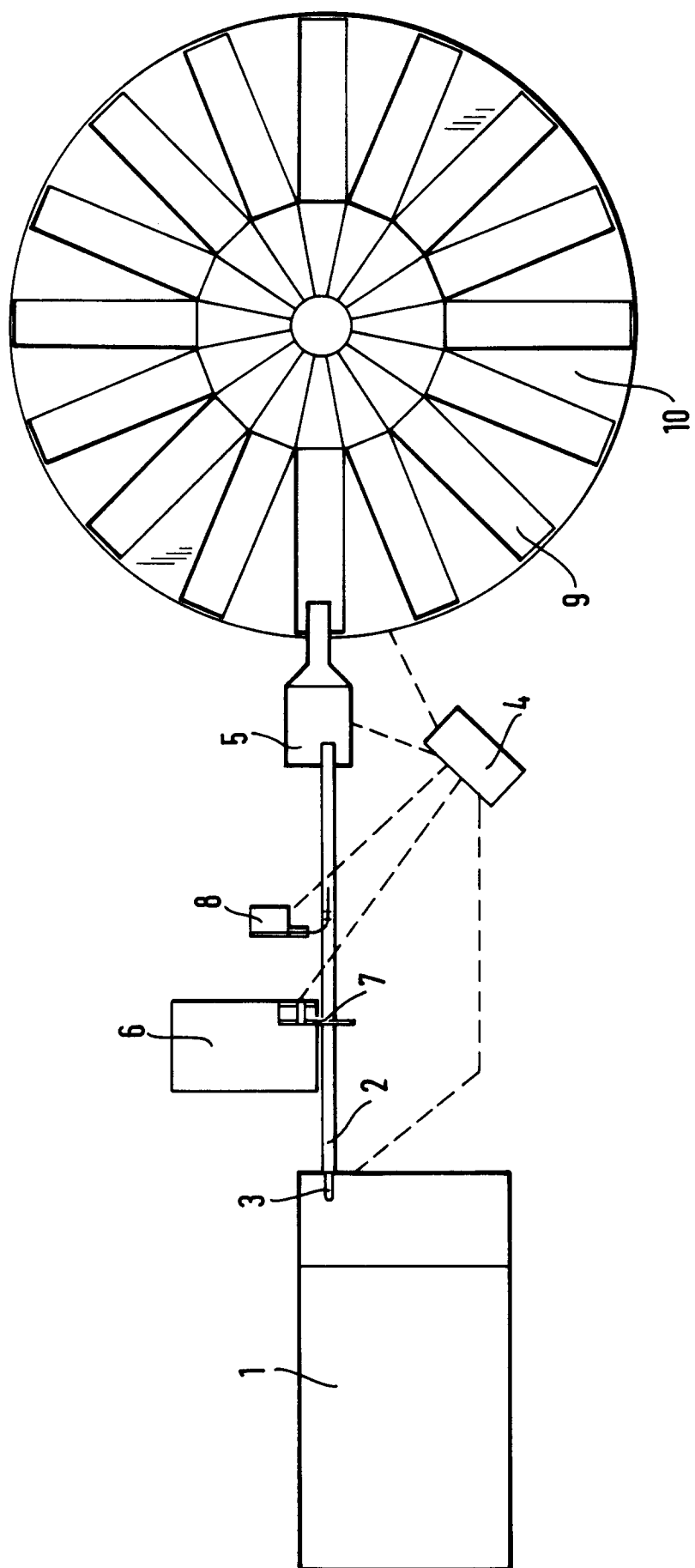
of the appended patent claims. For instance, the batching member 5 can advantageously be common for two or several connecting channels 2. Thus even large metal objects can be alloyed with an essentially high accuracy and speed.

Claims

1. A method for producing a standard-weight metal object, alloyed with at least one alloy ingredient, by means of casting, **characterized** in that the main metal and alloy ingredient flows are controlled so, that the alloy ingredient is fed into the molten main metal flow in between the smelting furnace (1), used for smelting the main metal, and the casting mold (9). 10 15
2. A method according to claim 1, **characterized** in that the alloy ingredient is fed into the molten main metal flow in a connecting channel (2) in between the smelting furnace (1) and the batching member (5). 20
3. A method according to claim 1, **characterized** in that the alloy ingredient is fed into the molten main metal flow in the batching member (5). 25
4. A method according to any of the previous claims, **characterized** in that the feeding of the main metal into the connecting channel (2) takes place in an essentially continuous operation. 30 35
5. A method according to any of the previous claims, **characterized** in that the alloy ingredient is fed into the main metal flow in batches. 40
6. A method according to any of the previous claims, **characterized** in that the alloy ingredient is fed into the main metal flow in molten state. 45
7. A method according to any of the claims 1-5, **characterized** in that the alloy ingredient is fed into the main metal flow in solid state.
8. An apparatus for realizing the method of claim 1, comprising a smelting furnace (1) for smelting the main metal, batching members (7, 8) for the alloy ingredient, a connecting channel (2) for transporting the molten metal to be cast, a control member (4) and batching member (5) of the molten metal and a casting mold (9), **characterized** in that the connecting channel (2) is installed to be essentially movable, at 50 55

least vertically, with respect to the batching member (5).

9. An apparatus according to claim 8, **characterized** in that the connecting channel (2) serves as an intermediate tank for the essentially continuous main metal flow.
10. An apparatus according to claims 8 or 9, **characterized** in that the number of connecting channels (2) is at least one per each metal object to be cast.





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EUROPEAN SEARCH REPORT

Application Number
EP 93 11 4609

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	DE-A-23 16 045 (MITSUI MINING & SMELTING CO. LTD.) 4 October 1973 * claims * * figures *	1,2,4,6	B22D1/00 B22D5/00
X	--- PATENT ABSTRACTS OF JAPAN vol. 6, no. 236 (M-173)(1114) 25 November 1982 & JP-A-57 134 241 (JIDOUSHIYA IMONO K.K.) 19 August 1992 * abstract *	1,2,5,7	
X	--- US-A-4 436 142 (MATHER) 13 March 1984 * figures *	1	
A	--- WO-A-80 02659 (MASCHINENFABRIK & EISENGIESSEREI ED. MEZGER AG) 11 December 1980 * abstract *	1	
A	--- DE-A-122 573 (KOPS) 2 May 1900 * whole document *	8	TECHNICAL FIELDS SEARCHED (Int.Cl.5) B22D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 December 1993	Examiner Riba Vilanova, M
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			