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(12) # EUROPEAN PATENT APPLICATION

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(54) **Continuous production of alloys.**

(57) An apparatus and method are described for the continous production of molten metal alloy. A furnace (1) is used to melt a basic metal of the alloy, and that is transferred to a valve (2). Controlled amounts of at least one alloying metal are fed into the supply of molten metal in valve (2) for combining with the basic metal of the alloy to form a controlled supply of the desired alloy.

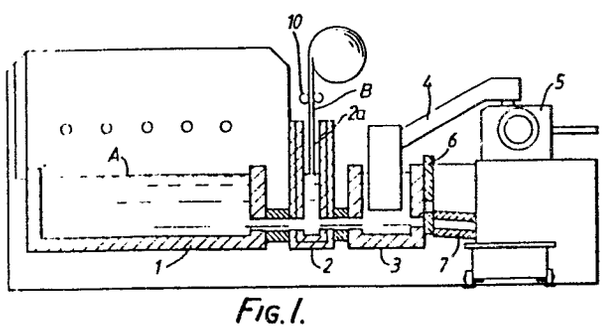

FIG. 1.

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CONTINUOUS PRODUCTION OF ALLOYS.

TECHNICAL FIELD

The present invention relates to the continuous production of alloys and in particular, though not exclusively, to the production of aluminium alloy continuously.

BACKGROUND ART

Molten aluminium alloy is used in a variety of production methods, for example in continuous casting and to supply a "Conform" extruder. Conventionally a furnace full of pure aluminium is melted, and the molten aluminium doped with the necessary quantities of alloying metals to produce a desired alloy formulation. As a method of producing a large quantity of molten aluminium alloy this method is reasonably satisfactory. However, it is quite common to only want to produce a relatively small quantity of a finished product of a particular alloy, for example when using a Conform extruder. The practice in the past has been to produce a furnace full of the desired molten alloy and to use as much as is necessary for a production run and then to discard the rest, with only a limited possibility of recycling. This known technique has resulted in a considerable waste of alloy, and consequently increased the expense of small scale production of products of a particular alloy, to the extent that it may not be worthwhile making only small amounts of a product.

DISCLOSURE OF THE INVENTION

The present invention seeks to provide a method and apparatus for the production of molten alloy metals in controllable quantities.

According to a first aspect the invention provides an apparatus for the continuous production of molten metal alloy, comprising: a furnace for melting a basic metal of the alloy, means for receiving a controlled supply of molten metal from the furnace, and means for providing to the molten metal in the receiving means controlled amounts of at least one alloying metal for combining with the basic metal of the alloy to form a controlled supply of the

desired alloy.

Preferably the apparatus includes a feedback control system which determines the rate of production of the alloy and adjusts the amount of alloying metal being supplied.

In a preferred embodiment a valve controls the flow of the molten basic metal from the furnace and the valve assembly forms part of the receiving means and the alloying metal is introduced into the basic metal flowing through the valve, and together they are supplied to an alloying chamber where the alloy is temporarily contained to allow the alloying elements to diffuse uniformly through the basic molten metal.

The alloying metal(s) can be held in a "master" alloy of the basic metal with high concentration(s) of the alloying metal(s).

According to another aspect of the invention there is provided a method of producing molten metal alloy comprising

(a) melting a basic metal,

(b) supplying a controlled flow of the molten basic metal, and

(c) introducing into the controlled supply of molten basic metal, at least one alloying metal in controlled amounts in order to produce, continuously, an alloy of controlled and desired composition.

A preferred embodiment of the invention will now be described by way of example and with reference to the accompanying drawings:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic section through an apparatus according to the preferred embodiment of the invention; and

Figure 2 is a combination of a part of the diagram of Figure 1 and a block schematic diagram of a control circuit for the apparatus of Figure 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the subsequent description the apparatus of the preferred embodiment will be described being used in conjunction with a "Conform" extruding apparatus. It is to be appreciated that

the invention is not limited to the use of the apparatus in conjunction with any particular apparatus which uses, or method of using, the molten metal alloy produced by the apparatus of the invention. A typical alternative to "Conform" extrusion apparatus would be a continuous casting machine.

Figure 1 shows a preferred embodiment of the invention, wherein a molten aluminium alloy is produced and supplied to a "Conform" extruding apparatus. A furnace 1 is connected through a mixing and flow control valve 2 to an alloying chamber 3, which valve has an upper port 2a. A conveying apparatus 4 is arranged to supply a molten alloy from the alloying chamber 3 into a Conform apparatus 5. A sluice gate 6 controls run-off from the alloying chamber 3 to a run-off 7.

In the preferred embodiment aluminium A is melted in the furnace 1 and run into the mixing control valve 2. A "Master Alloy" B in rod form is also supplied into the mixing control valve 2 through port 2a, to be melted by the molten aluminium A. The molten alloy mixture runs into the alloying chamber 3 where the alloying metals in the "Master Alloy" diffuse throughout the basic aluminium metal to produce a consistent alloy of desired composition. The "Master Alloy" rod B is of known alloy composition and is continuously fed into the mixing control valve 2 to produce the desired output alloy.

As can be better seen in Figure 2 the feeding of the "Master Alloy" B is controlled by a pair of rollers 10. The speed of rotation of the rollers 10 is controlled by a control circuit 20. A sensor 8 detects the area of the extrusion output from the Conform extruder 5 to provide an area input A to control circuit 20 and a speed sensor 9 provides an input V related to the speed of production of the extrusion material. In addition the control circuit 20 is supplied with input data giving the required alloy composition and the composition of the master alloy B which is to be added to the basic molten aluminium A. From the data supplied the control circuit 20 controls the feed rolls 10 to provide the master alloy rod at an appropriate rate to produce the desired output

alloy.

At termination of extrusion with a particular alloy the valve 2 is closed shutting off flow of aluminium from the furnace 1 and the master alloy B is no longer supplied. The remaining, relatively small quantity of alloy in the mixing control valve 2 and alloying chamber 3 is run-off through run-off 7 by opening the sluice gate 6. It will be appreciated that only a relatively small volume of alloy is run-off. Production of an alloy of differing composition can then begin, with the appropriate data being provided to the control circuit 20.

In some circumstances it may be advantageous to agitate the alloy mixture in the alloying chamber 3 to ensure the consistence of the alloy. This may be done by means of a metal mechanical or an electromagnetic stirer.

Although the described embodiment makes use of a master alloy in rod form it would be possible to use pellets or granular master alloy for feeding to the basic aluminium metal. In such alternative cases it would be obviously necessary to replace the feed rolls 10 with some means for regulating the supply of master alloy appropriate to the form of alloy material being used.

An example of production of one alloy will now be described for the purposes of illustration only.

The control circuit 20 is supplied with data such as:-

(1) extrusion speed V,

(2) extrusion cross section area A, which together with the extrusion speed V enables it to calculate the volume or weight per minute flowing through the valve,

(3) alloy composition required, and

(4) composition of alloying rod or pellets.

Typical alloying calculation:

extrusion speed 30 metres per minute,

cross section area 100 sq mm,

weight per minute = $\frac{30 \times 100 \times 2.7}{1000}$ = 8.1 Kg/min,

bath purity 99.8% aluminium,

composition of alloying pellets say
Al 50%, Si 25%, Mg 25% (master alloy),
for 6063 Alloy (Al Mg Si.6)
weight/minute silicon required = 8.1 x .006 = .048 Kg/min
weight/minute Magnesium required = 8.1 x .006 = .048 Kg/min
total weight of alloy elements = .096 Kg/min
weight of master alloy required
$= \frac{.096}{.5} = .192$ Kg/min

Hence wire or pellets would be added at the rate of 192 grams per minute to create 6063 from high purity aluminium.

weight/metre 6mm master alloy = 65 gm.m
master alloy rod speed = $\frac{192}{65}$ = 2.95 m/minute

If, for the sake of example the extrusion speed were suddenly reduced to 10 metres per minute, the control system would reduce the master alloy rod speed to 0.98 m/min to maintain the correct alloy composition.

CLAIMS:

1. An apparatus for the continuous production of molten metal alloy, comprising: a furnace (1) for melting a basic metal of the alloy, means (2) for receiving a controlled supply of molten metal from the furnace, and means (20, 10) for providing to the molten metal in the receiving means (2) controlled amounts of at least one alloying metal for combining with the basic metal of the alloy to form a controlled supply of the desired alloy.

2. An apparatus as claimed in claim 1, wherein there is a feedback control system (29) which determines the rate of production of the alloy and adjusts the amount of alloying metal being supplied by the alloying metal providing means (10).

3. An apparatus as claimed in claim 1 or claim 2, wherein a valve (2) controls the flow of the molten basic metal from the furnace (1) and the valve assembly forms part of the receiving means (2) and the alloying metal is introduced into the basic metal flowing through the valve (2), and the valve (2) is connected to an alloying chamber (3) where the alloy is temporarily contained to allow the alloying elements to diffuse uniformly through the basic molten metal.

4. A method of producing molten metal alloy comprising

(a) melting a basic metal,

(b) supplying a controlled flow of the molten basic metal, and

(c) introducing into the controlled supply of molten basic metal, at least one alloying metal in controlled amounts in order to produce, continuously, an alloy of controlled and desired composition.

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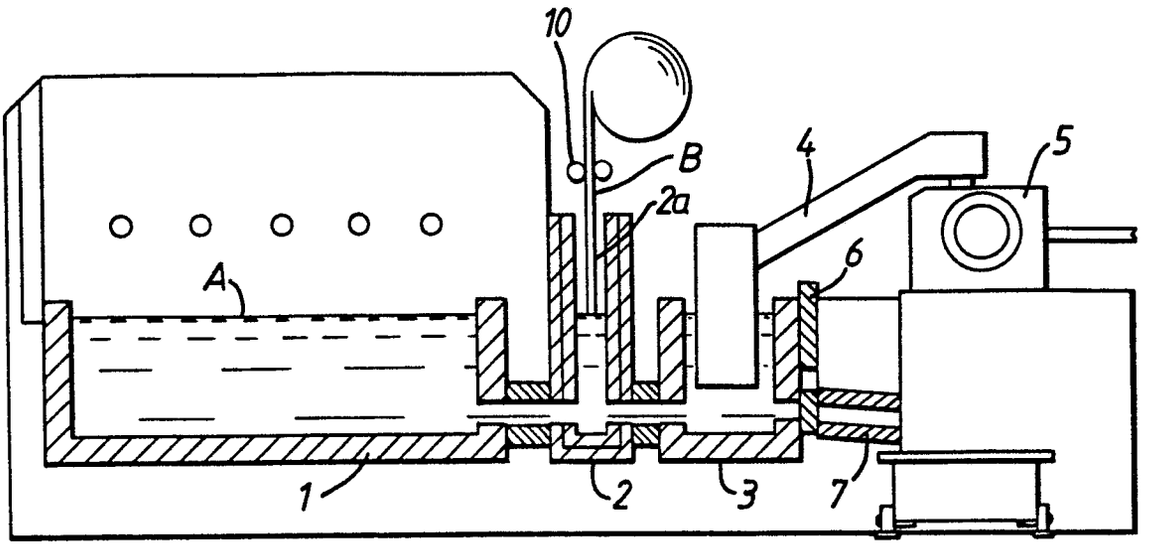

FIG. 1.

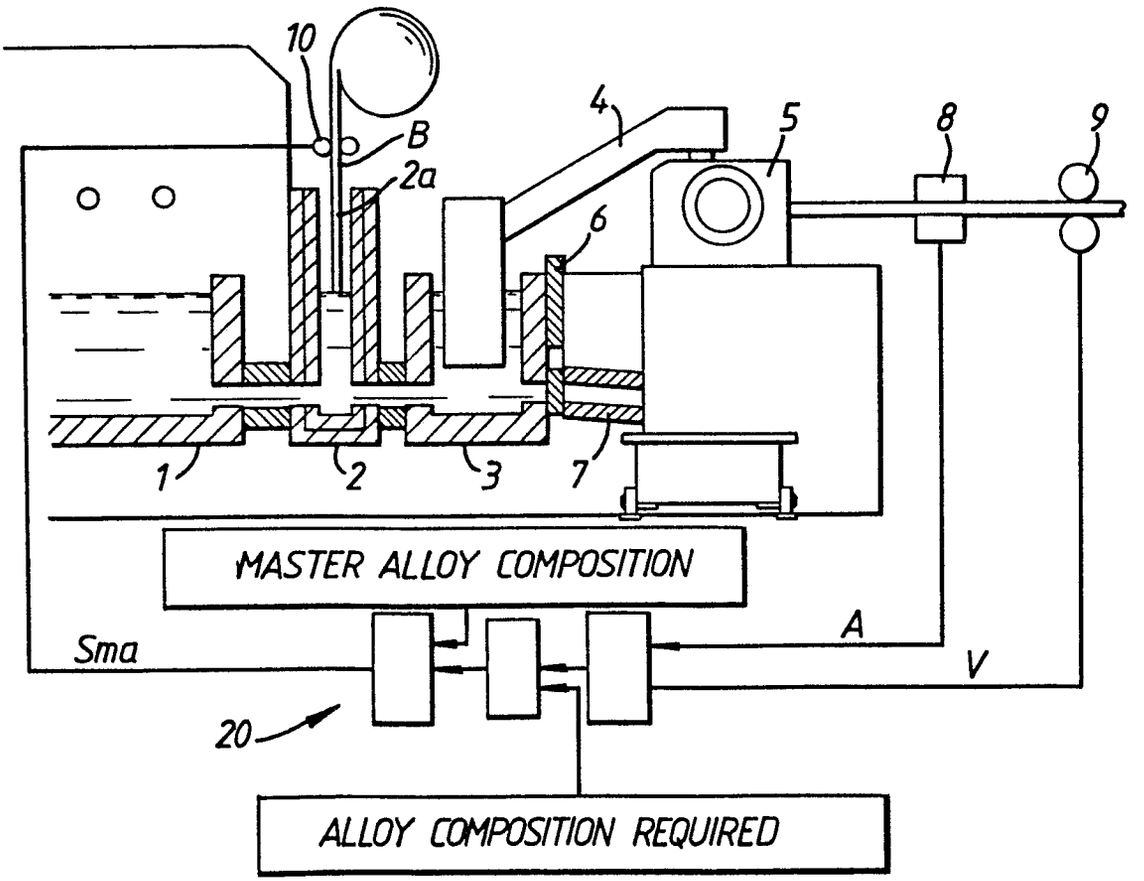

FIG. 2.

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EUROPEAN SEARCH REPORT

Application number

EP 87 30 3902

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 4)
Y	FR-A-2 393 073 (ALUMINIUM SUISSE) * Claims 1,3,4 *	1,2	C 22 C 1/02 F 27 D 3/14 B 22 D 11/10
Y	FR-A-2 194 506 (CONCAST AG) * Claims 1,2,6; figure 5; page 10, line 13 - page 11, line 32 *	1,2	
Y	US-A-4 105 438 (SHERWOOD) * Claims 1-4; column 4, lines 54-63 *	1,2	
A	GB-A-2 069 898 (METAL RESEARCH CORP.) * Claim 1 *	1	

TECHNICAL FIELDS SEARCHED (Int Cl 4)

C 22 C 1/02
F 27 D
B 22 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-08-1987	LIPPENS M.H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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