Machine for forming metal bars.

Machine for forming metal bars, in particular for producing ingots made of precious metal such as gold, silver, precious alloys, as well as other pure metals or different alloys, comprising a solidification station provided with a cooling surface, said cooling surface having passage holes and being cooled with cooling fluid; said cooling surface being made of copper, aluminium or alloys thereof or other materials suitable for the controlled dispersion of heat, said machine being characterized in that said cooling surface comprises a sliding surface on which the ingot moulds are inserted and rested; said cooling fluid passing longitudinally and/or transversely to the direction of insertion of said ingot moulds.

FIG. 2
Description

[0001] The present invention regards a machine for forming metal bars, in particular for producing ingots made of precious metal such as gold, silver, precious alloys, as well as other pure metals or different alloys.

[0002] As known, producing ingots, in particular made of gold, silver, precious alloys, other pure metals and different alloys, is usually obtained by means of two different methods. When producing light ingots, from 5 g up to 50 g, there is used a cold moulding and coining process, starting from semi-finished products, such as cylindrical-shaped preformed pads or billets.

[0003] When producing ingots with weight varying between 50 g and 50 Kg there is instead used the melting method and subsequent solidification of the metal in the special moulds. In practice, the metal to be melted is placed within ladles, in form of powders, granules or loose raw materials of various sizes, wherein it is brought to melting. Then the molten metal is poured in single ingot moulds, generally shaped to form a truncated-trapezoid whose, providing the necessary cooling means, also positioned around the ingot mould and on the cover.

[0004] Such two operations, the melting one and the subsequent one for solidifying the material, must be carried out with special care, given that the obtained end-product must meet strict and specific standard requirements.

[0005] Actually the ingots available in the market, besides having an exact purity if made of pure metal, or an exact percentage of pure metal if made of an alloy (the so-called "count"), must have extremely precise dimensions and weight, an external configuration with regular surfaces, without depressions or cracks, a uniform coloration and, above all, they must have a perfect internal metal-graphic structure, without blowholes, microporosities and structural tensions.

[0006] In order to avoid obtaining faulty ingots not capable of allowing obtaining the "punching", which would thus be considered as waste material, it is necessary that the entire production cycle be carried out with a lot of care, in particular during the steps of melting, solidifying and cooling the metal.

[0007] An object of the present invention is to provide a machine for forming metal bars, in particular for producing ingots, made of precious and non-precious material and, which does not have the drawbacks revealed by the plants of the known type.

[0008] The characteristics of the invention will be made clearer through the description of a possible embodiment thereof, provided by way of non-limiting example, with reference to the attached drawings, wherein:

- fig 1 represents an elevational view of the machine according to the invention;
- figs 2 and 3 represent detailed views of the ingot mould, in the solidification station, with different cooling modes;
- fig 4 represents three different configurations of the sliding plate of the ingot moulds, during the solidification step.

[0009] As observable from the figures, the machine according to the invention, generally indicated with reference 100, comprises a station for solidifying the molten metal, indicated with reference 104.

[0010] In the solidification station 104 the incandescent temperature ingot moulds, containing the molten metal and closed by the cover, slide until they stop on a cooling surface 10, cooled with water by means of passage holes present therewithin and made using copper, aluminium or alloys thereof or other materials suitable for the controlled dispersion of heat, in which they remain for a pre-defined period of time, averagely 1 to 5 minutes, as a function of the amount of material to be solidified, up to the complete solidification of the entire mass.

[0011] Also in the solidification process there should be created an "inert" environment, hence there is introduced a flow of inert gas such as Nitrogen, Argon or Nitrogen-Hydrogen mixture, which prevents the oxidation of the ingot moulds and the covers and protects the metal being solidified against oxygen.

[0012] Specifically, depending on the internal metal structure the ingot is required to obtain, which should have large, medium or small crystals and a more or less marked solidification shrinkage, the solidification station 104 may be provided with further insulating or refractory cooling plates for slowing the thermal dispersion 11; such plates may be possibly provided with notches for defining the localised heat areas, which are placed near or in contact with one or more sides of the ingot mould and of the cover (see fig 2), and/or further heating plates for slowing the cooling 21, made of graphite, metal or refractory or insulating materials, smooth or provided with suitable millings in relief or recessed, which may be placed between the cooling plate 10 and the ingot mould 1 (see fig 3).

[0013] Alternatively, when there is required an accurate control of the thermodynamic solidification gradients, with the aim of obtaining an ingot with the most suitable solidified metal structure the solidification station 104 may be provided with heating panels 12 for example heated using electrical resistors, gas or using any other means, also positioned around the ingot mould and on the cover.

[0014] Furthermore, with the aim of having a further possibility of accurately determining the thermodynamic gradients, depending on the internal metal structure the ingot is required to take, the cooling plate 10 may have the sliding surface - on which the ingot moulds stop in the solidification step - having a flat and smooth surface, or provided with millings in relief or recessed; furthermore the passage of the cooling fluid may be executed longitudinally and/or transversely to the direction of movement of the "trains" of ingot moulds (see fig 4).

[0015] Due to construction reasons, in some cases the solidification station is incorporated in a single station.
which also comprises a station of secondary addition.

The invention thus conceived can be subjected to numerous variants and modifications and the construction details thereof can be replaced by technically equivalent elements, all falling within the inventive concept defined by the following claims.

Claims

1. Machine for forming metal bars, in particular for producing ingots made of precious metal such as gold, silver, precious alloys, as well as other pure metals or different alloys, comprising a solidification station provided with a cooling surface, said cooling surface having passage holes and being cooled with cooling fluid; said cooling surface being made of copper, aluminium or alloys thereof or other materials suitable for the controlled dispersion of heat, said machine being characterized in that said cooling surface comprises a sliding surface on which the ingot moulds are inserted and rested; said cooling fluid passing longitudinally and/or transversely to the direction of insertion of said ingot moulds.

2. The machine, according to claim 1, characterized in that said cooling surface is flat and smooth.

3. The machine, according to one or more of the preceding claims, characterized in that said cooling surface comprises millings in relief or recessed.

4. The machine, according to one or more of the preceding claims, characterized in that said solidification station comprises heating plates for slowing down the cooling process, made of graphite, metal or refractory or insulating materials; said heating plates being interposed between said cooling surface and said ingot mould.

5. The machine, according to one or more of the preceding claims, characterized in that said heating plates comprise smooth surfaces.

6. The machine, according to one or more of the preceding claims, characterized in that said heating plates comprise surfaces provided with suitable millings in relief or recessed.

7. The machine, according to one or more of the preceding claims, characterized in that said solidification station comprises cooling or thermal insulation plates, provided with notches for defining localised heat areas; said cooling or thermal insulation plates being placed near or in contact with one or more sides of the ingot mould and its cover.

8. The machine, according to one or more of the preceding claims, characterized in that said solidification station comprises heating panels of the electrical resistor type, gas-type or heated with other means, positioned around the ingot mould and on the cover.

9. The machine, according to one or more of the preceding claims, characterized in that said solidification station comprises an inert environment which comprises inert gas such as Nitrogen, Argon or Nitrogen-Hydrogen mixture, which prevents the oxidation of said ingot moulds and said covers and protects the metal still in liquid form against oxygen.

10. The machine, according to one or more of the preceding claims, characterized in that said solidification station is incorporated in a single station which also comprises a station of secondary addition.