Jan. 28, 1958 H. NOUVEAU 2,821,000

EXOTHERMIC LINED FEED-HEAD FRAME

Filed May 16, 1955 2 Sheets-Sheet 1

Fig. 1

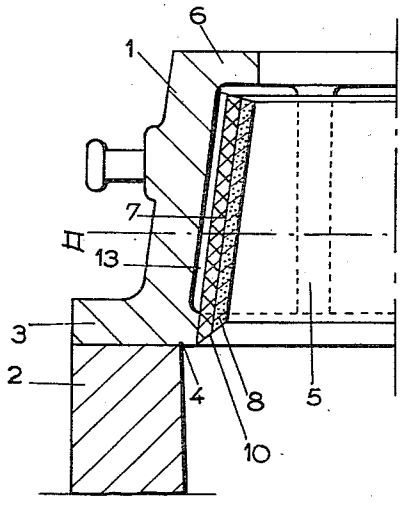

Fig. 1a

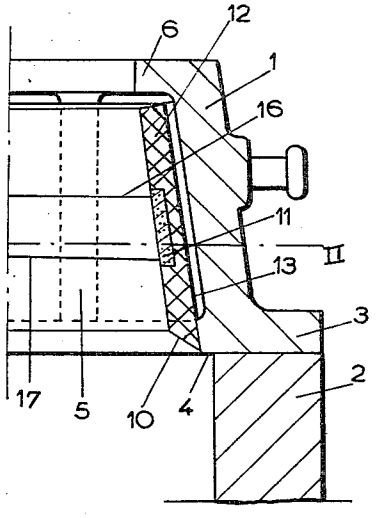

Fig. 2

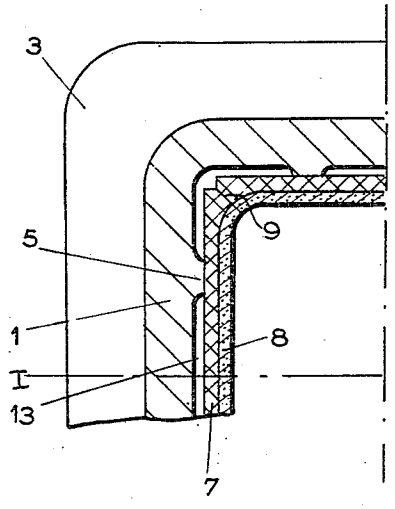

Fig. 2a

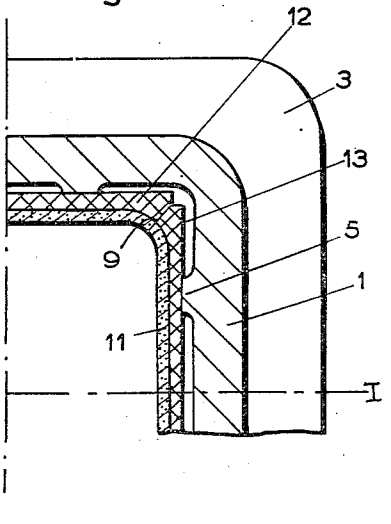

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Fig. 3

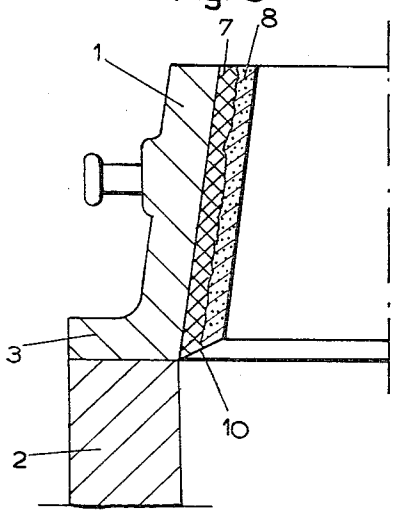


Fig. 5

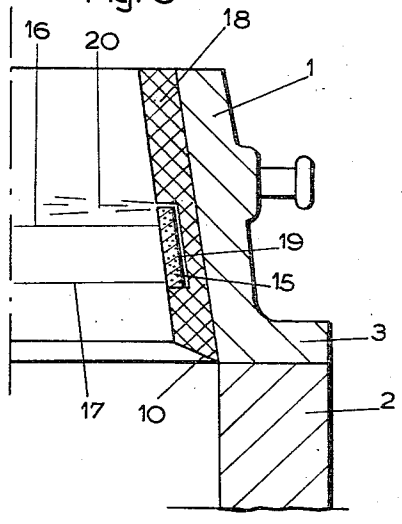


Fig. 4

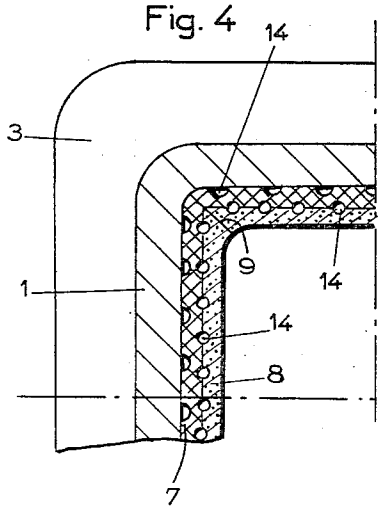
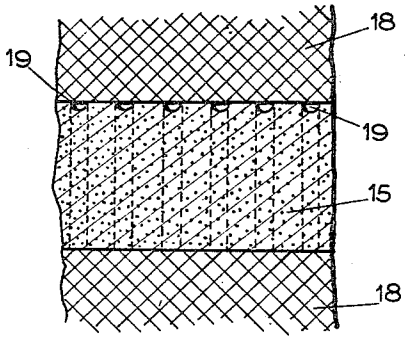


Fig. 6



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EXOTHERMIC LINED FEED-HEAD FRAME

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Application May 16, 1955, Serial No. 508,658
Claims priority, application France October 11, 1954
2 Claims. (Cl. 22—147)

This invention relates to the casting of cast parts.

It is known that in the casting of cast parts and more particularly to metal ingots, it is necessary to maintain the head of the ingot or feed-head in a molten condition so that the molten metal will feed the body of the part or ingot as the latter shrinks during solidification.

In order to effect this prolongation of the liquid state in the head of the ingot or feed-head, use is made either of insulating and refractory linings or of exothermic linings.

The first prevent loss of heat and the second, by their combustion, constitute a source of heat which is supplied to the metal.

My U. S. co-pending specification No. 404,928 of January 19, 1954 describes a method which is concerned essentially with agglomerable exothermic materials and consists in using the exothermic material in the form of a lining of the wall of the feed-head frame or of the upper portion of the ingot mold, leaving an air gap between at least one part of the exothermic lining and the wall.

This air gap acts as a heat insulation and prevents the considerable losses of heat which would otherwise be produced by conductibility between the contacting parts of the exothermic product and the ingot mold.

It has now been found according to this invention that the exothermic lining used in this manner often burns only over a part of its thickness. Moreover, the burned layer in contact with the metal has a strong insulating effect so that the heat tends to be diffused towards the outside. These two factors result in the thickness of the lining being increased beyond what would be strictly necessary for supplying the feed-head with the heat required to maintain the metal in the molten condition during a given time. The result is a considerable loss of expensive exothermic products.

The present invention has as its object to overcome these disadvantages and provides a method of using exothermic materials of the type consisting in using the exothermic material in the form of a lining for the wall of the feed-head frame or of the ingot mold in such an manner as to bring the lining into contact with the molten metal constituting the feed-head, the method being characterized in that between the exothermic lining and the said wall there is interposed a layer of a solid insulating material.

With this method the inner part of the lining of exothermic material burns upon contact with the molten metal and passes its heat into the metal. The outer part prevents the heat from being diffused towards the outside.

The insulating layer is preferably constructed of an insulating and refractory material which is either naturally or artificially porous so as to allow the diffusion of the combustion gases or occluded gases.

It has further been found that with the aforesaid method, the metal passes downwards in a very uniform manner, with the upper surface remaining plane, and that it was possible to reduce the height of the exothermic lining substantially to the zone in which the surface of the

metal is situated as the latter moves downwards. According to a preferred embodiment of the invention the lining is constituted by an insulating lining extending between the maximum high point and the maximum low point of the surface of the metal in the ingot mould, and an inner lining of exothermic material.

This improvement has several advantages. Not only does it allow the quantity of exothermic material used to be reduced, but also the state of the surface of the part of the feed-head situated below the exothermic lining is very much improved since it is similar to that of an ingot cast in a sand mould. It therefore provides a better yield of marketable products.

The method according to the present invention is preferably combined with the method which is the subject of my said co-pending specification Ser. No. 404,928, i. e. an air gap is provided between at least one part of the rear face of the insulating layer and the wall of the ingot mould, which not only has the result of improving the heat insulation of the feed-head but also ensures the circulation of the combustion gases and of the occluded gases which have passed through the insulating wall. However, since the insulating function of this air gap is thus made secondary, it is possible to reduce its size. If desired, collecting channels can be formed in the mass of the insulating layer itself at the junction of the exothermic and insulating layers or in the exothermic layer.

Finally, it may be advantageous for certain applications to combine channels situated on the outer face of the insulating layer and on the inner face thereof and/or in the mass of the exothermic materials. These channels collect the combustion gases. Now it has been found that this combustion is incomplete and these gases have a considerable latent heat energy which is liberated when they arrive in an oxygenated zone, i. e. when they issue from the channels. In accordance with the invention and more especially when the lining of exothermic materials is limited to the zone comprised substantially between the upper level of the molten metal and the lower level reached after shrinkage and solidification, collecting channels are provided between the rear face of the exothermic lining and the insulating lining, the said channels opening at the upper part of the exothermic lining towards the interior of the ingot mold. The heat give off by the combustion of these gases within the feed-head frame limits the surface heat loss and makes it possible to reduce the facing of exothermic materials, it being possible to enrich the said facing with oxygen-generating products in order to ensure the combustion of the said gases. In this case, it is advantageous to choose an insulating layer impermeable to gases or to render it impermeable by a coating such as the adhesive connecting the exothermic slab and the insulating lining.

The relative thicknesses of the two layers can vary. They are preferably chosen so as to substitute, for the part of the layer of exothermic material whose heat resulting from combustion is not entirely used in carrying into effect the method according to my said co-pending specification Ser. No. 404,928, a layer of insulating material of at least equal thickness. This thickness varies in practice between the thickness and half of the thickness of the exothermic layer necessary for ensuring the supply of heat necessary for maintaining the ingot head in a molten condition.

The insulating layer can be constructed of any insulating material, and more especially of agglomerated siliceous sand, of refractory material such as agglomerated silica, chamotte, and kieselguhr. When the insulating layer is not naturally porous, for example a layer of chamotte, perforations can be formed therein if necessary.

The lining can be formed in one piece and constructed directly in the feed-head frame or the top of the ingot

mold by applying a layer of insulating material and then a layer of exothermic mixture but it is preferably formed of a plurality of prefabricated elements assembled in the feed-head frame. The insulating part and the exothermic part can be molded and baked independently and later connected, more especially by gluing, before or during positioning in the feed-head frame. However, it is preferable to construct the two parts in the form of a cast element in one piece, in which case the refractory product is placed first of all in the bottom of the mold and then the assembly is conveyed to a drying or baking furnace.

If the cross-section of the feed-head is angular, the faces of the lining are preferably connected by a wide curve, since a sharp angle encourages the solidification of the edges and prevents the metal from moving downwards over the entire periphery. The curve is preferably formed of the insulating material, which makes it possible to give the layer of exothermic material a uniform thickness.

The present invention also includes as novel industrial products, the prefabricated slabs which are to form the linings, the slabs comprising a layer of insulating material lined with a layer of exothermic material and more especially such slabs wherein the lining of exothermic material is limited to a part of the height of the slab.

One constructional example of the equipment for carrying into effect the method according to the invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view taken on the line I—I of Fig. 2 of the feed-head frame with its lining according to a first embodiment;

Fig. 1*a* is a corresponding sectional view of the feed-head frame with partial lining according to a second embodiment;

Fig. 2 is a half-section taken on the line II—II of Fig. 1;

Fig. 2*a* is a half-section taken on the line II—II of Fig. 1*a*;

Fig. 3 is a vertical sectional view of the feed-head frame with its lining according to a third embodiment;

Fig. 4 is a half-section corresponding to Fig. 2 of a constructional variant;

Fig. 5 is a sectional view of the feed-head frame with partial lining according to a fourth embodiment, and

Fig. 6 is a partial front elevation of the exothermic lining as constructed according to Fig. 5.

Referring to the drawings, the feed-head frame **1** is mounted on an ingot mold **2**. The feed-head frame is of square section and constitutes a truncated pyramid.

The feed-head frame **1** bears against the upper edge of the ingot mold **2** with a base portion **3** which, in Figs. 1 and 1*a* projects inwards five to ten millimetres so as to form a continuous projecting band **4** over the entire periphery of the base portion. Bands **5** which, relatively to the internal surface of the feed-head frame, have the same extra thickness as the band **4** and are arranged perpendicularly to the latter, are formed on the inner faces of the feed-head frame. The upper edge of the said frame is formed with an inwardly projecting portion **6** which limits the useful aperture of the feed-head frame.

The method according to the invention is carried into effect by the use of a lining constituted by four trapezoidal slabs. In Fig. 1 the slabs are formed of a layer of insulating, refractory and porous material **7** and a layer of exothermic material **8** in contact with the molten metal. The lateral edges **9** of the slabs thus constructed are bevelled at 45° so as to allow them to be assembled in the frame and they are so fashioned as to form a pronounced curve at the point of junction between two slabs. The lower edge **10** is likewise bevelled.

In Fig. 1*a* the exothermic lining **11** is substantially limited to the zone comprised between the maximum high point **16** and the maximum low point **17** of the metal in the ingot mold. These two types of slab can be formed by molding in the form of an element made in one piece, or can be formed of two separate molded elements joined together by an adhesive.

In Figs. 1, 1*a*, 2 and 2*a*, the slabs are fitted inside the feed-head frame with interposition, between their external faces and the bearing surfaces of the bands **4** and **5**, of a layer of refractory adhesive. After positioning, the slabs constituting the lining leave between themselves, the internal wall of the feed-head frame **1** and the bands **4** or **5** forming ribs, an air gap **13** which is from five to ten millimetres thick, depending upon the amount of projection of the ribs, and the said air gap constitutes a supplementary heat-insulating means. Formed between the upper edge of the slabs and the inwardly projecting rim **6** is a gap through which occluded gases diffused through the slabs can be evacuated.

In Fig. 3 the slabs are constructed in the mold by the application of a layer of insulating material **7** and a layer of exothermic material **8**. This form of embodiment is similar, apart from the method of manufacture, to that described with reference to Figs. 1 and 2. In the form of embodiment which is the subject of Fig. 4, collecting channels **14** are formed in the insulating material and at the junction of the exothermic and insulating layers for the evacuation of occluded gases at the upper part of the ingot mold. These channels **14** make it possible to dispense with the air gap **13** of Figs. 1 and 1*a*, whose insulating function was secondary.

In Figs. 5 and 6 the exothermic lining **15** is, as in Figs. 1*a* and 2*a*, limited to the zone comprised substantially between the upper level **16** of the molten metal and the lower level **17** reached after shrinkage and solidification, and is fitted into and connected by adhesive to the insulating lining **18** to form the lining slab.

The combustion gases of the exothermic lining **15**, issue chiefly towards the rear face by reason of the properties of the already burned mass of the lining; the said gases are evacuated through channels **19** formed between the rear face of the exothermic lining **15** and the insulating lining **18**. These channels **19** open at the upper portion of the exothermic lining **15** towards the interior of the ingot mold and the gases are burned at **20** within the feed-head frame.

It will be understood that if the forms of embodiment hereinbefore described relate more especially to the casting of ingots, the invention is also applicable, under the same conditions, to the production of cast parts.

What I claim is:

1. In a feed head metal casing for an ingot mold which casing is provided with an inner lining comprising a layer of insulating material and a layer of exothermic material that is exposed to molten metal of a feed head, the said metallic feed head casing being imperforate and having an inwardly projecting lower rim and inwardly projecting, spaced narrow ribs extending upwardly from said rim, said rim and ribs having cemented on the inwardly directed surface thereof, the external face of preformed blocks comprising a layer of agglomerated material forming a gas-pervious insulating layer and an internal layer of exothermic material, so as to allow the gases to freely escape during a casting operation through the insulating layer and upwardly extending passages between said blocks, ribs and feed head casing.

2. In a feed head metal casing for an ingot mold which casing is provided with an inner lining comprising a layer of insulating material and a layer of exothermic material that is exposed to molten metal of a feed head, the said metallic feed head casing being imperforate and having an inwardly projecting lower rim and inwardly projecting, spaced narrow ribs extending upwardly from said rim, said rim and ribs having cemented on the inwardly directed surface thereof, the external face of preformed blocks comprising a layer of agglomerated material forming a gas pervious insulating layer and in recesses provided in the internal face of said blocks on a part of their

height a layer of exothermic material, so as to allow the gases to freely escape during a casting operation through the insulating layer and upwardly extending passages between said blocks, ribs and feed head casing.

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