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DATE: 1967 Oct 17

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U.S. DEPARTMENT OF COMMERCE
PATENT OFFICE
WASHINGTON

Paper No. 3/a

All communications respecting this application should give the serial number, date of filing, and name of the applicant.

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Mailed: JAN 8 1969

Ser. No.: 282713
Filed: Oct. 17, 1967
Applicant: Oglebay Norton Company
Mark: FERROBOARD

The changes hereinafter specified have been made in the above identified application in accordance with the provisions of Order Number 5316 of November 24, 1964, which reads in part as follows:

> Obvious informalities in the application, including the classification of goods or services, may be corrected but said correction must be in the form of an amendment in writing, approved by the examiner, entered in the file and made a part of the record.

If the changes set forth below are not satisfactory to the applicant, appropriate amendment may be submitted under the provisions of Rule 2.74, provided the printing of the registration has not been commenced at the time such amendment is approved.

The application has been amended as follows:

Since applicant's goods are properly classified in Class 23, the class number in this application has been changed accordingly.

RMB
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E. Levy
EXAMINER, DIV. I

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IN THE UNITED STATES PATENT OFFICE

Application of OGLEBAY NORTON COMPANY
For Trademark FERROBOARD
Serial No. 282,713
Filed October 17, 1967

Div. I

Cleveland, Ohio
October 10, 1968

Hon. Commissioner of Patents
Washington, D. C. 20231

Sir:

In response to the Office Action of July 17, 1968, applicant encloses a copy of United States Patent No. 3,373,047 which relates to the insulating panels made and sold by applicant under the mark FERROBOARD. This patent explains the commercial use of the panels. With respect to the identification of the goods, they are identified in accordance with terminology which is utilized in the trade. As will be apparent from the patent, applicant's panels are used to insulate molten steel at the top of an ingot mold from a container therefor or from the ingot mold.

"Ferro Engineering" at the bottom of the specimens submitted with the application indicates the Ferro Engineering Division of Oglebay Norton Company. Oglebay Norton Company, applicant herein, operates its hot topping division under the trade name Ferro Engineering. The phrase "Ferro Engineering" constitutes not only the trade name of applicant but a house trademark.

Respectfully submitted,

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By J. Herman Yount, Jr.

JHY:lk

(216) 621-2234

March 12, 1968 H. D. SHEETS ET AL 3,373,047

MATERIAL FOR HOT TOP

Filed Oct. 6, 1964

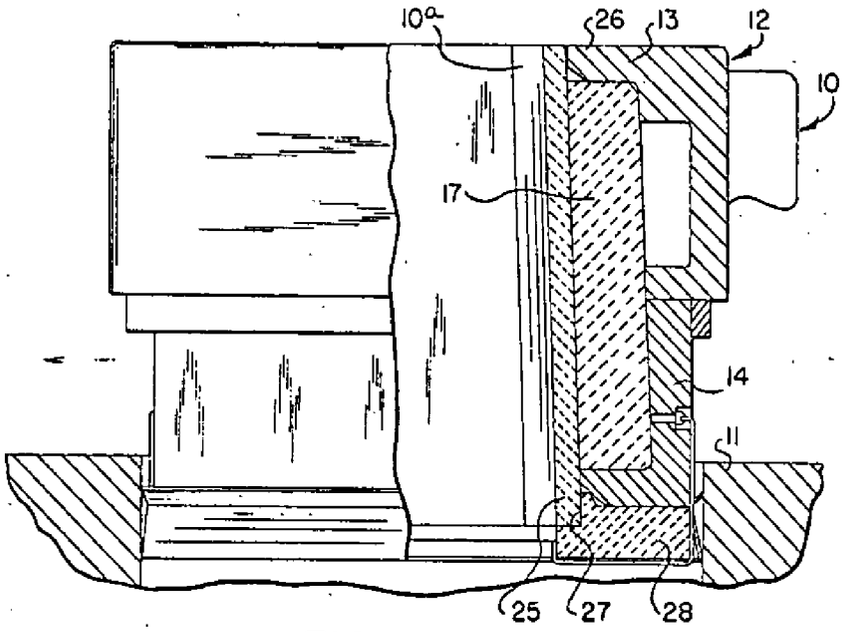


FIG. 1

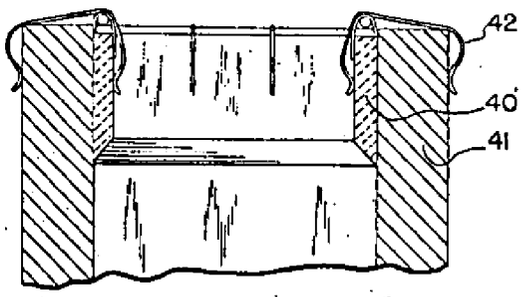


FIG. 3

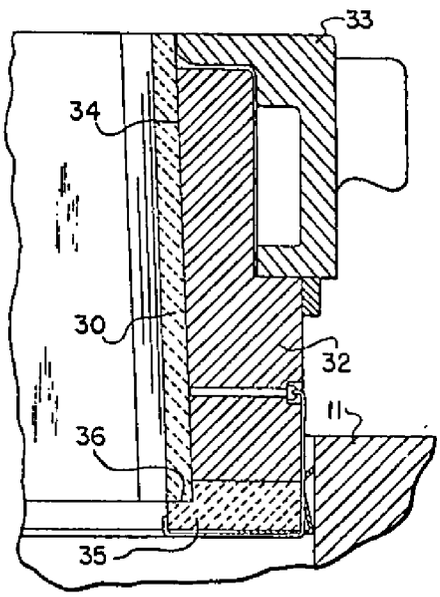


FIG. 2

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United States Patent Office 3,373,047 Patented Mar. 12, 1968

3,373,047

MATERIAL FOR HOT TOP

Herbert D. Sheets and John W. Lennon, Columbus, Ohio, assignors, by mesne assignments, to Ogiebay Norton Company, Cleveland, Ohio, a corporation of Delaware

Filed Oct. 6, 1964, Ser. No. 401,944
5 Claims. (Cl. 106—38.2)

The present invention relates to a refractory material for use in hot topping and, more particularly, to a hot top refractory panel or board which contacts the molten metal being poured into the mold with which the hot top is associated.

Known hot top structures and specifically hot top insulating panels or boards have been constructed of a material including organic and inorganic fibrous materials in combination with a granular refractory material and binder. These known insulating panels or boards when contacted by molten metal generate gases which, at least in part, bubble through the molten metal and cause, what has been termed, "boiling" of the metal. This boiling may cause splashing of the metal and sparks which create a hazard to the pouring crew. Moreover, hydrogen and oxygen may be picked up by the sinkhead metal causing harmful metallurgical effects therein.

The present invention is directed to the solution of this boiling problem. It has been found that by eliminating or drastically reducing the amount of organic fibrous material in the insulating panel and utilizing an asbestos fiber having a low water content in the material constituting the panel, boiling of the molten metal is greatly reduced. Furthermore, the use of an asbestos material having a low water content permits the use of a relatively fine granular filler material which provides a panel having good insulating properties.

Accordingly, the principal object of the present invention is the provision of a new and improved hot top structure constructed of a material which generates a minimum amount of gases when contacted by molten metal and, thus, greatly minimizes the amount of boiling of the molten metal and which has good insulating properties, strength, and flexibility.

Another object of the present invention is the provision of a new and improved hot top insulating panel or board wherein the panel is made of a material containing an asbestos having a low water content and which generates a relatively small amount of gas when contacted by molten metal and wherein the material contains little, if any, organic fibrous material.

A further object of the present invention is the provision of a new and improved hot top insulating panel or board made of a material containing amosite asbestos, a relatively fine granular refractory filler, and a suitable binder which provides an insulating panel or board having good heat-insulating properties, sufficient strength and flexibility, and from which a minimum amount of gas is generated when the board is contacted by molten metal.

A still further object of the present invention is the provision of a new and improved hot top insulating board comprised of 79–90 parts by weight of a granular refractory filler, 5–10 parts by weight of an organic binder, and 5–10 parts by weight of an asbestos having a water content of less than 6%.

Still another object of the present invention is the provision of a new and improved hot top insulating board comprised of 79–90 parts by weight of 200 mesh silica sand, 5–10 parts by weight of an organic binder, 5–10 parts by weight of amosite asbestos, and about 1 part by weight of an organic fibrous material.

Further objects and advantages of the present invention will be apparent to those skilled in the art to which the invention relates from the following detailed description of the preferred embodiment thereof made with reference to the accompanying drawings forming a part of this specification and in which:

FIG. 1 is a side elevational view of a hot top, partly in section, and embodying the present invention;

FIG. 2 is a sectional view of a modified hot top embodying the present invention; and

FIG. 3 is a sectional view of still another hot top embodying the present invention.

The present invention provides an improved hot top structure and, particularly, an improved hot top panel or board for use in a hot top. As is well known, hot tops are utilized in association with ingot molds for maintaining a mass of molten metal above the ingot mold so as to feed the shrinkage cavity as the metal in the mold cools. Hot tops are supported on the upper end of the ingot mold and have a central opening through which molten metal is poured into the mold. The molten metal also is poured so as to fill or substantially fill the hot top. The hot top is constructed of suitable insulating structure so as to maintain some of the metal in the hot top in a molten state, so as to feed the shrinkage cavity as the metal in the mold solidifies.

Hot tops are formed of different constructions and, by way of example, a preferred embodiment of the present invention is illustrated in FIG. 1 which shows a hot top 10 supported in the upper end of an ingot mold 11. The hot top 10 has a central opening therethrough through which molten metal is poured into the ingot mold, and the hot top, as noted above, maintains a mass of molten metal above the ingot mold 11 to feed the shrinkage cavity as the metal in the mold solidifies. The hot top 10 includes a metal casing 12 which is conventional in construction and includes an upper section 13 and a lower section 14, which are suitably secured together. In the illustrated hot top, the metal casing 12 has a lining 17. The lining 17 comprises a hard, dense high temperature firebrick or equivalent castable refractory whose purpose is to form a lining or backup support for the insulating refractory panels. The lining is thus a semi-permanent lining capable of being reused for a number of pouring operations.

An insulating panel means overlies the lining 17 in the embodiment shown in FIG. 1 and comprises a plurality of individual insulating panels or boards 25 suitably positioned in the hot top overlying the lining 17 which backs up the panels 25 and provides support for the panels. The upper end of the panels 25 are substantially flush with the upper side of the upper canopy 26 of the metal casing 12, while the lower ends of the panels 25 are supported in a recessed portion 27 of a bottom ring 28.

When the molten metal is poured through the central opening in the hot top, the molten metal contacts the insulating panels 25. When the insulating panels containing considerable quantities of organic fibrous materials of the known prior art are contacted by the molten metal, the materials in the panels generate gases which bubble through the molten metal causing "boiling" of the molten metal. According to the present invention, the insulating refractory panels are constructed of a material which minimizes the generation of gases when contacted by molten metal and which, thus, minimizes the boiling of the molten metal.

The material of which the panels are made includes a granular refractory filler, a binder, and an inorganic, fibrous asbestos form material having a relatively low combined water content. The granular refractory filler preferably comprises a relatively fine sand such as 200 mesh silica sand, that is, a silica sand substantially all of which passes through a 200 mesh screen. Other granular refractory fillers may also be used, such as diatomaceous earth, magnesia, alumina, or forsterite. The binder may

be of any conventional form and may be a phenolic resin such as the resin marketed under the tradename Durez Phenolic 12335, an organic resin, or any other suitable and known type of binder. A small amount of organic fibrous material may also be included in the mixture. The organic fibrous material may be either ground wood fiber, cardboard shavings, or paper pulp, or combinations thereof.

The asbestos form material utilized has a combined water content of less than 6%. Crocidolite asbestos, anthrophyllite asbestos, tremolite asbestos, or amosite asbestos may be usde, all of which have a combined water content of less than 6%. These materials also have a low loss of weight on ignition. Of the above-noted materials, amosite asbestos is preferably used due to its fiber strength and availability. Amosite asbestos contains a small amount of water, approximately under 6% by weight, and has an extremely low loss of weight on ignition, as compared with other asbestos having a high water content and a higher loss on ignition. The amosite asbestos used has a bundlelike fiber form with voids or spaces therein and an orthorhombic crystal structure. The amosite asbestos also has sufficient fiber length and tensile strength characteristics which provide the hot top panel or board with the desired strength and flexibility.

The table below indicates the various ingredients which comprise the material forming a completed panel or board, with the range of parts by weight of the ingredients in the panels, as well as the preferred parts by weight within the range:

Ingredient	Range (Parts by Weight)	Preferred (Parts by Weight)
Granular Refractory Filler	79-90	86-87
Binder	5-10	6
Asbestos having less than 6% water	5-10	8
Organic Fibrous Material	<2	0-1

As noted above, the use of the above materials in the construction of a hot top panel provides a good lightweight insulating panel and one which minimizes the generation of gases when contacted by the molten metal, and one which has a relatively low loss of weight when contacted by molten metal as compared to known panels containing considerable quantities of organic fibrous materials. The weight loss for panels of the above-noted material in tests has been found to be 5-6% as compared to 11% for such known panels. Moreover, panels constructed in accordance with the present invention have none or very little organic fibrous material in the mix, and thus greatly reduce or eliminate gases generated by the organic fibrous materials. The insulating ability of the refractory panel made of the material noted above is quite good because it includes a relatively fine refractory filler. The use of a relatively fine refractory filler provides a multitude of small air pockets in the panel and provides for better insulation as compared with the use of a coarser filler material. While the air pockets are relatively small, they are adequate to provide a sufficient porosity so that any gases generated when the board is contacted by molten metal flow through the board and not through the molten metal. Moreover, the bundlelike fiber construction of the amosite asbestos provides air pockets in the panel which also assist in permitting the gases to escape through the panels.

In preparing the material of which the panels are preferably made, the granular refractory filler, amosite asbestos, and binder are mixed together in a suitable manner in a conventional vessel with a suitable amount of water. The amount of water may vary; however, 135 to 300 parts by weight has been found satisfactory. The amosite asbestos is added to the water first. Thereafter, the binder is added to the mixture and, finally, after the amosite asbestos and binder have been dispersed in the mixture, the granular refractory filler is added. The mixing time is sufficient to provide a suitable homogeneous mixture, generally one-half hour was found to be satisfactory.

After mixing, the mixture is formed into panels or boards by a suitable molding method. The panels are molded into the desired shape and thickness for the particular use to which they are to be put and are then dried into self-sustaining panels having substantially parallel sides. One suitable method of molding is by pouring the mixture onto a screen and pulling a vacuum on the screen to remove the major portion of the water. After the molding of the boards, the boards are dried. The drying temperatures and time may vary and must be such so as not to exceed the temperature at which the binder material will decompose. Drying by placing the boards in an oven at 400° F. for two hours, then reducing the temperature to 300° F. for one hour has been found to be satisfactory.

In the preparation of the mixture, the amosite asbestos absorbs an amount of water, filling the voids or spaces in the bundlelike fibers of the amosite. When the water is removed in the molding and drying of the boards, the water is removed from these spaces and the spaces or voids remain providing air pockets throughout the boards. These pockets, it is believed, aid in rendering the board a good insulator and provide for removal of gases through the panel.

Insulating panels or boards made of the material and by the method disclosed above may be used in any type of hot top, and the hot top of FIG. 1 is an illustration of one form of hot top for which the panels may be used. FIG. 2 illustrates a modified form of hot top structure in which panels made of the material disclosed above may be embodied. The panels **30**, made of the material described hereinabove, are utilized in the hot top shown in FIG. 2 in the same manner as the panels described hereinabove with respect to FIG. 1. The panels **30** in the hot top of FIG. 2, however, are backed up, that is, supported by a metal portion **32** of the hot top illustrated. The metal portion **32** is suitably secured with and interfitted within the upper hot top casing **33** and has a surface **34** against which the panels **30** engage. A bottom ring **35** is suitably supported at the bottom end of the portion **32** of the hot top and has a recess **36** in which the bottom end of the panel **30** is supported.

Another form of the hot top in which panels made of the material described hereinabove may be embodied is illustrated in FIG. 3. The hot top shown in FIG. 3 comprises a plurality of panels **40** which are located in the upper end of an ingot mold **41** with the upper ends of the panels substantially flush with the upper end of the mold **41**. The panels, thus, extend down into the ingot mold **41**. The plurality of the panels **40** form the hot top and are positioned in the upper end of the ingot mold so as to form a lining at the upper end of the ingot mold **41**. The panels **40** may be held in the upper end of the ingot mold by suitable clamp members, designated **42**, which engage the mold **41** and the panels **40** and hold the panels in position in the upper end of the mold. The panels **40** may also be held in the upper end of the ingot mold by suitable wedgelike tapered corner panel pieces, not shown, which may be driven downwardly at the ingot mold corners between adjacent side panel pieces and wedge the panels **40** into tight contact with the inner walls of the ingot mold **41** so as to hold the panels securely in the upper end of the mold **41**.

It should be apparent that the preferred embodiment of the present invention has been described in considerable detail and it is to be understood that certain changes, modifications, and adaptations may be made therein and it is intended to cover all such changes, modifications, and adaptations as are covered by the appended claims.

Having described our invention, we claim:

1. An insulating structure for use in hot topping and adapted to be supported at the upper end of an ingot mold comprising a body to be supported at the upper end of the ingot mold, said body having one surface for defining at

least a portion of an opening through which molten metal is poured into the mold, said one surface being contacted by molten metal poured into the mold, and said body at least in part constructed of a mixture consisting essentially of 79–90 parts by weight of granular refractory filler, 5–10 parts by weight of inorganic fibrous asbestos form material having a water content between 0 to 6%, 0 to 2 parts by weight of organic fibrous material, and 5–10 parts by weight of a binder therefor.

2. An insulating structure as claimed in claim 1 wherein said granular refractory filler comprises 200 mesh silica sand and said mixture contains about 1 part by weight of organic fibrous material.

3. An insulating structure for use in hot topping and adapted to be supported at the upper end of an ingot mold comprising a hot top insulating board to be supported at the upper end of the ingot mold, said board having a surface for defining at least a part of an opening through which molten metal is poured into the mold, said surface being contacted by molten metal poured into the mold, and said board at least in part constructed of a material consisting essentially of 79–90 parts by weight of sand,

5–10 parts by weight of an inorganic fibrous asbestos material having a water content between 0 to 6%, 0 to 2 parts by weight of organic fibrous material and 5–10 parts by weight of an organic binder.

4. An insulating structure as defined in claim 3 wherein said sand comprises 200 mesh silica sand.

5. An insulating structure as defined in claim 3 wherein said asbestos material comprises amosite asbestos.

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