Feb. 22, 1949. W. M. CHARMAN ET AL 2,462,255

INSULATING COVER

Filed July 28, 1945

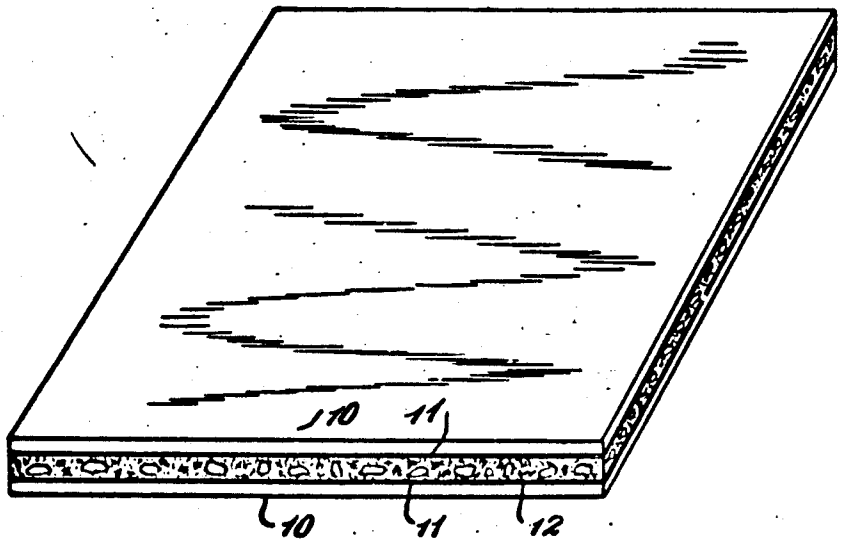


FIG. 1

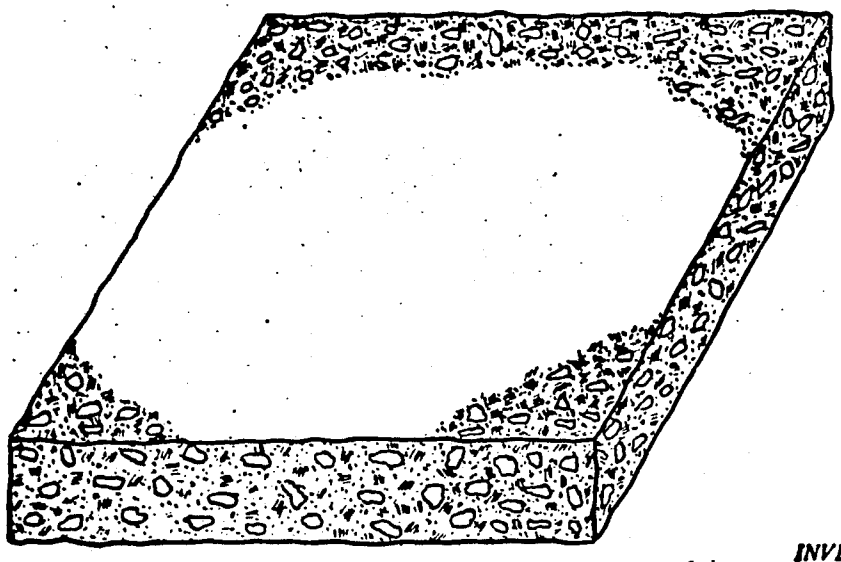


FIG. 2

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INSULATING COVER

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9 Claims. (Cl. 22—147)

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This invention relates to improvements in insulating covers for use upon solidifying metal castings, particularly ingots.

Insulating coverings for ingot sinkheads, feed heads, or risers have been in use to some extent for many years. Various materials, both combustible and incombustible, have been suggested for the purpose. Oftentimes loose or bulk material, has been shoveled upon the surface of the metal to be insulated. Sometimes covers in the form of monolithic or slab-like bodies have been used, and in some cases such slabs have been shaped and dimensioned to approximate the area of hot metal to be covered. In all cases as heretofore practiced in the art the material, whether in bulk or slab form, deposited upon the hot metal in order to cover the same with a blanket of sufficient thickness to constitute satisfactory insulation, must be bulky. Hence it occupies considerable space in shipping and storage. Furthermore, coverings employing many of the materials heretofore used for the purpose suffer contraction or shrinkage when subjected to the intense heat of the metal. This, with its consequent lessening of insulation, must either be accepted or counteracted by additional applications of the material. Where slabs have been used in upwardly tapering hot tops they have necessarily been made small enough to clear the upper end of the hot top opening, which is smaller than the area of metal at the top of the sinkhead. Accordingly the slab in such cases has not completely covered the hot metal.

The present invention overcomes the difficulties above mentioned, and provides insulation at least equal in effectiveness to anything previously known.

One of the objects of the invention is the provision of a covering that is created in situ from material which, when first deposited upon the hot metal, occupies a space of much less volume than that occupied by the covering when completed by the action of the heat.

Another object is the provision of a covering in the form of a slab of a size to readily enter the opening at the top of a hot top, where the material of the slab when subjected to the heat of the molten metal will expand laterally as well as upwardly and fill the cavity in the hot top above the metal to a depth to insure good insulation.

A further object is the provision of means for creating a cover in situ by the expansion under the influence of heat of an exfoliating material, especially an exfoliating material mixed with a combustible material, the latter being distributed

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evenly throughout the cover and its combustion assisting the heat of the molten metal in effecting exfoliation, particularly of the exfoliating material in the upper portions of the cover which, of course, are farthest from the hot metal.

Other objects and features of novelty will appear as we proceed with the description of those embodiments of the invention which, for the purposes of the present application, we have illustrated in the accompanying drawing, in which

Figs. 1 and 2 are diagrammatic perspective views illustrating two somewhat different forms of cover slab embodying the invention.

This invention has to do with the use of insulating coverings for solidifying castings, comprising materials which will expand when subjected to the high temperatures of the castings, either when such materials are used by themselves or in combination with other combustible or incombustible materials.

Expanding materials for the purpose of this invention may be natural or manufactured. Of natural materials perlite, a volcanic glass capable of expanding to six or seven times its original size is an example, but vermiculite, a secondary mineral formed by alteration of biotite and phlogopite mica, found scattered about the world, and capable in some forms of exfoliating up to twenty times its original size, is preferred at the present time. Amongst the manufactured expanding materials may be mentioned pyrotechnics such as Pharaoh's eggs and the well-known Fourth of July serpents, these materials being capable of expanding to ten or fifteen times their original size. We prefer to employ vermiculite.

Micaceous vermiculite ore may be obtained in relatively small particles. In its natural state each vermiculite particle has the appearance of a flake, but when heated sufficiently these flakes expand into a condition in which each one resembles a tiny accordion. A given quantity of the material in its natural state, when expanded by the action of heat, occupies a space many times greater than when unexpanded, the ore of No. 3 quality, which is readily obtainable in sufficient quantities, expanding to the extent of eight to twelve times its original volume. The fact that it may be shipped in its unexpanded low volume state and may be converted in situ to its high volume condition, obviously is of great practical importance from the standpoints of transportation, plant storage facilities and handling.

For the purposes of the present invention, vermiculite ore, the No. 1 grade preferably, may be used as a covering either by itself or combined

with materials of neutral or exothermic properties to form a bulk mixture. In either state the bulk covering material may be shoveled onto the metal surface to be insulated or thrown over its surface from a measuring container. Alternatively, the loose material may be packed in combustible containers, such as cardboard or paper, designed to hold a predetermined quantity, and such container deposited upon the hot ingot, sinkhead or riser surface.

While the use of bulk material is entirely practical and may be preferable in some instances, it is desirable in many cases to prepare the material in slab form, for then it can be handled quickly and easily and the exact amount of vermiculite required for each ingot can be readily incorporated in the slab. The slabs are made preferably to a shape approximately the same as that of the opening in a given hot top, but of slightly smaller dimensions in order that they may be readily inserted through the opening. They may be made as thin as strength for storing and handling will permit, this being dependent partly of course upon the size of the slab. Wire reenforcement may be used if desired.

In Fig. 1 we have illustrated a slab comprising surface layers 10 of paperboard to the inner surfaces of which glue or other adhesive 11 is applied freely. Between these surfaces there is a thin layer 12 of vermiculite in its natural state, the adhesive 11 holding it in place. Alternatively, the adhesive and vermiculite may be mixed together and applied as a paste on an uncoated paperboard layer 10 and the other layer 10 then applied above the pasted layer. More or less pressure and some degree of heat insufficient to cause exfoliation of vermiculite may be used to cause the elements of this sandwich to adhere firmly. Instead of a sandwich like slab, a slab may be made by coating one or both surfaces of paperboard with vermiculite ore and adhesive.

Fig. 2 of the drawing represents a monolithic slab which may be molded to whatever shape is required or may be formed in large sheets and cut to the desired shape and size. The constituents for the mix from which such slabs are made may vary considerably, vermiculite or other heat expansible material constituting one of the ingredients in each case. Sufficient thickness for strength is obtained by the use of a filler and a bonding agent. Any one of many different fillers may be employed, and they may be either neutral or exothermic. As useful inert fillers there may be mentioned slag, rock wool, sand, clay, ashes and crushed brick. Exothermic fillers should be slow burning or charring such as coal, coke, sawdust, hulls, stalks, straws or any combustible wastage. At the present time we prefer sawdust, particularly sawdust containing a large percentage of wood fibers.

As a bonding agent we prefer to employ a material which will be weakened or destroyed when the cover is subjected to the heat of the ingot. Otherwise the expansion of the vermiculite or its equivalent will be hindered. Clay, especially bentonite, is a good bonding agent either alone or in combination with sodium silicate. A sand filler with cement and water as the bonding agent has also been found to be satisfactory. Various other binders and combinations of binders have been found to be usable, as for example dextrin, corn flour, goulac and core oil, and we believe that still others such as gelatins, caseins, gums, resins and waxes would be suitable for the purpose. No binder should be employed which requires heat for setting above that at which exfoliation of vermiculite takes place.

After the molding of the slab is completed, it should be dried quite thoroughly. Temperatures of 200° or 300° F. may be safely employed for drying, as there is no material exfoliation of vermiculite at those temperatures.

Slabs are convenient from the standpoints of shipping, handling and measuring the component constituents. They need not exactly fit the opening to be covered, and the expanding of the swelling agent effectively seals all clearances. Filler shrinkage is more than compensated by the exfoliation, and a complete cover and insulation is thereby obtained. Slabs can be coated for waterproofing and can be packed in quantities to be opened as needed. A limited number of slab sizes for a greater number of sizes of sinkhead areas is sufficient, as lateral expansion during exfoliation compensates for clearance differences. It is also possible to lay slabs across the opening of a mold, hot top or feed head, and allow radiant heat to destroy the bond, exfoliate the vermiculite and permit the covering to sink to the metal metal surface to be insulated.

As a further alternative, the swelling agent may be suspended in a heavy viscous liquid, the proper quantity of which may be poured onto the surface of the casting, the liquid nature of the material causing it to spread evenly over the ingot preparatory to exfoliation. Such a liquid should be combustible but not explosively combustible. Oils and tar compounds which are of such consistency that they may be poured freely are suitable for the purpose. The liquid used must be heavy enough of course that after agitation it will hold the vermiculite in suspension while it is being poured over the ingot.

The use of our method in connection with the casting of metal ingots, for example, will be evident from the foregoing description. The ingot is poured, with a sinkhead in case a hot top is employed on the mold. More or less promptly thereafter a slab of the proper size is dropped upon the molten or crusted surface of the metal, whereupon exfoliation begins immediately accompanied by combustion if combustible filler is present in the slab. Combustion and exfoliation take place gradually but are completed in a relatively short time, about 15 minutes maximum, accompanied by a swelling and expanding of the slab material until a complete blanket of insulation is formed several times thicker than the original slab depending upon the amount of vermiculite present. Where loose or bulk material is employed instead of a preformed slab the proper quantity of such material is shoveled or otherwise deposited upon the metal, exfoliation and swelling with combustion of any combustible material present taking place in much the same manner as when the material is used in slab form.

Having thus described our invention, we claim:

1. The method of creating in situ an insulating blanket for a solidifying casting, which comprises placing over the hot metal a covering comprising noncombustible material of the group consisting of vermiculite and perlite of a character to expand permanently under the influence of heat from the casting to occupy a space at least five times that occupied by the material when deposited.

2. The method of creating in situ an insulating

blanket for a solidifying casting, which comprises placing over the hot metal a covering comprising vermiculite in its unexpanded state to produce a porous blanket under exfoliation due to heat from the casting.

2. The method of creating in situ an insulating blanket for a solidifying casting, which comprises placing over the hot metal a covering of vermiculite in its unexpanded state combined with combustible particles, exfoliation of the vermiculite under the influence of heat from the casting and from the combustion of the combustible particles causing said covering to expand.

4. The method of creating in situ an insulating blanket for a solidifying casting, which comprises placing over the hot metal a covering of vermiculite in its unexpanded state and combustible particles intimately commingled, exfoliation of the vermiculite under the influence of heat from the casting and from the combustion of the said combustible particles causing said covering to expand gradually.

5. The method of creating in situ an insulating blanket for a solidifying casting, which comprises placing over the hot metal a formed body through which vemiculite in its unexpanded state is distributed, the said body being of smaller horizontal dimensions than the area of exposed hot metal, exfoliation of the vermiculite due to heat from the casting swelling the said body and causing its material to expand laterally as well as vertically and thus to completely cover the hot metal.

6. An insulating body for a solidifying casting, which comprises vermiculite in its unexpanded state, a combustible filler, and a bonding agent formed, and dried.

7. An insulating body for a solidifying casting which comprises vermiculite in its unexpanded state, a combustible filler and a bonding agent all intimately commingled, formed and dried.

8. An insulating body for a solidifying casting, which comprises vermiculite in its unexpanded state, sawdust, and a bonding agent formed, and dried.

9. An insulating body for a solidifying casting which comprises vermiculite in its unexpanded state, sawdust, and a bonding agent all intimately commingled, compacted and dried.

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BENJAMIN F. ANTHONY.

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Certificate of Correction

Patent No. 2,462,255. February 22, 1949.

WALTER M. CHARMAN ET AL.

It is hereby certified that the above numbered patent was erroneously issued to Ferro Engineering Company, as assignee of the entire interest, whereas said patent should have issued to Walter M. Charman, and Benjamin F. Anthony, said Anthony assignor to Ferro Engineering Company, as shown by the record of assignments in this office.

In the grant, line 14, for "Ferro Engineering Company, its successors" read *Walter M. Charman, his heirs or assigns, and Ferro Engineering Company, its successors*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of May, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.