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3,558,591

HEAT INSULATORS FOR USE IN THE CASTING OF MOLTEN METAL

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No Drawing. Filed July 3, 1969, Ser. No. 839,041
Claims priority, application Great Britain, July 4, 1968,
32,019/68

Int. Cl. B28b 7/36; C08g 37/03, 37/18, 51/04, 51/18
U.S. Cl. 260—17.2 4 Claims

ABSTRACT OF THE DISCLOSURE

Compositions of matter suitable for use in the production of hot top linings and the like comprise 15 to 50% by weight of fibrous material, 40 to 80% of refractory filler and 0.5 to 10% of a binder material. The fibrous material is wholly inorganic fibrous material or contains up to 40% of its weight of organic fibrous material, and the refractory filler consists in whole or in part of diatomaceous earth, bubble alumina, hollow silica microspheres, calcined rice husks or pozzolana (bubbled aluminosilicate).

This invention relates to the art of casting molten metal and more particularly to heat insulators for use in the production of metal castings in foundry practice in which connection it will be more specifically described. However the heat-insulators may be used in connection with the production of steel ingots.

In the casting of molten metal into a mould to form a metal casting it is important to ensure that the head metal, i.e. the metal in the feeder heads, risers and like parts of the mould, does not solidify too quickly since if it does the feed and molten metal, to compensate for the contraction of the main body of the cast metal on cooling and solidification, will be hampered and the resulting casting may contain imperfections such as fissures and cavities. It is accordingly the practice to line the feeder heads, risers and the like of casting moulds with a composition which acts as a barrier to the loss of heat from the head metal, e.g. a heat insulating composition or a composition which contains ingredients which react exothermically when fired by the heat of the molten metal thereby positively to supply heat to the head metal.

In recent years increasing use has been made for the purpose of lining compositions which comprise a granular or powdered refractory heat insulating material, organic fibrous material and a binder material. Whilst various organic fibrous materials have been employed it has been found very convenient, on basis of economy, to use either an intrinsically cheap organic fibrous material such as paper pulp or a waste synthetic fibrous material. It has also been proposed to include in such compositions a small proportion of refractory fibrous material, e.g. asbestos, slag wool or mineral wool.

The compositions in question must, in order to be most effective, be of substantially homogeneous character and the procedure which has commonly been adopted, therefore, is to make an aqueous slurry containing the granular or powdered refractory, the organic fibrous material, refractory fibrous material if required, end binder, and then by expressing the liquid from the slurry to make suitable shapes, e.g. sleeves of the solid ingredients which, when dried and preferably stoved, are rigid structures, the binder serving to bind together the other ingredients. Thus the slurry may be brought against a wire mesh and the liquid expressed through the mesh so that a body of the solid ingredients which do not pass the mesh is built up on the mesh surface.

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The binder may be any material known per se for use in the production of shaped bodies of refractory material for the purpose indicated herein, e.g. an inorganic binder such as sodium silicate or an organic binder such as a natural gum, e.g. dextrin, or a cereal flour, e.g. wheat flour, or a synthetic resinous material, preferably a thermosetting resin such as a urea-formaldehyde, phenol formaldehyde or furane resin.

Whilst compositions formulated as described above are in widespread use and have many advantages, they do not always have a sufficiently high degree of refractoriness for use when handling high melting metals. Moreover their heat insulating characteristics are not always as good as is desired.

It is an object of the present invention to provide new compositions which may be used for lining feeder heads, risers and the like of metal casting moulds and which have improved characteristics.

According to the present invention there are provided compositions of matter, suitable for use in the production of linings as aforesaid which comprise 15 to 50% by weight of fibrous material, 40 to 80% of refractory filler and 0.5 to 10% of a binder material, the said fibrous material being wholly inorganic fibrous material or containing up to 40% of its weight of organic fibrous material and the said refractory filler consisting in whole or in part of lightweight filler selected from diatomaceous earth, bubble alumina, hollow silica microspheres, calcined rice husks and pozzolana (bubbled aluminosilicate).

Preferably according to the invention the content of fibrous material is 20 to 30% by weight of the composition.

The invention further provides a method for the production of shaped elements suitable for use as aforesaid which comprises forming an aqueous slurry of the ingredients of a composition as just defined, and expressing the liquid therefrom to deposit a body of the solid ingredients in the required shape.

The invention further provides a method for lining a feeder head, riser or the like of a metal casting mould which comprises forming a said lining of one or more shaped elements formed of a composition as hereinbefore set forth, and preferably one made by the method hereinbefore set forth.

Within the field of compositions of this invention there may be provided compositions which are refractory enough to be used with molten steel, which are economic to manufacture (due to their light weight and the fact that a substantial proportion of the relatively expensive organic fibre materials may be replaced by the relatively inexpensive organic fibrous materials), and which has a high heat insulating capacity.

Referring now to the individual ingredients of the composition, the refractory filler consists of one or more of the lightweight fillers noted above, alone or in association with other granular or powdered non carbonaceous refractory fillers, for example, silica flour, olivine, chamotte, alumina, or any refractory silicate. The grain size of the refractory filler may vary widely but a material which will pass a 325 BSS mesh has been found particularly satisfactory.

The fibrous material included in the compositions of the present invention consists, to the extent of at least 60% of its weight, of inorganic fibres such as calcium silicate, aluminum silicate or (more preferably) aluminosilicate fibres, asbestos, slag wool, rock wool, mineral wool or metal fibres.

Organic fibrous material when present may be, for example, wood pulp (paper pulp) or wood flour but larger fibered material may be employed if desired, e.g. cotton waste, rag stock or waste synthetic staple fibre, for exam-

ple of nylon, polyester or acrylonitrile fibre. It will be appreciated that the longer-fibred materials tend to be more effective in increasing the strength of the final composition.

The binder material may be any of those shown per se for use in the production of shaped elements for the purposes indicated, e.g. sodium silicate, gums, cereal flours, or thermosetting resin. It is preferred to employ thermosetting resins and generally a combination of phenol-formaldehyde and urea-formaldehyde resins has been found most suitable.

If desired, shaped elements made of the compositions of this invention may be given a surface coating of a compact ceramic refractory material, e.g. deposited from a dressing comprising zircon flour, to increase the resistance of the elements to metal penetration.

The following examples will serve to illustrate the invention:

EXAMPLE 1

An aqueous slurry is formed of 90 parts by weight and 10 parts by weight of a composition consisting of:

	Percent by weight
Diatomaceous earth (—325 BSS mesh)-----	50
Paper fibre-----	10
Mineral wool-----	30
Phenol-formaldehyde resin-----	8
Urea-formaldehyde resin-----	2

The slurry was dewatered against a wire screen to deposit its solid ingredients as a compact slab, the slab was dried and stoved at 180° C. for 3–4 hours. Slabs so made were found to have a permeability of 13.0 AFS units, a transverse strength of 65 p.s.i. and a density of 0.31 g./cc.

Slabs so made, used for lining the feeder head of a sand mould for casting steel at 1575° C. were found to afford excellent heat insulation with no blowing of the molten metal.

EXAMPLE 2

Example 1 was repeated except that in place of the diatomaceous earth, the same weight of calcined rice husks was used. Permeability of the slab was very high, transverse strength 75 p.s.i. and density 0.37 gm./cc.

Feeder head performance was similar to that of the material of Example 1.

EXAMPLE 3

Example 1 was repeated except that in place of the diatomaceous earth, the same weight of calcined rice zolana was used. Permeability of the slab was very high, transverse strength 70 p.s.i. and density 0.35 gm./cc.

Feeder head performance was similar to that of the material of Example 1.

Whilst the invention has been described with particular reference to use with metal casting moulds it is to be understood that the compositions may also be used for lining the head of an ingot mould or for lining a head box fitted to such mould.

It is observed that the presence in riser sleeves and like shapes of carbon or carbonaceous filler (e.g. coke dust), is not desirable when casting steel; the presence of carbon tends to affect the final composition and properties of the cast metal.

We claim as our invention:

1. A heat-insulating composition of matter suitable for use in the production of hot top linings and the like which consists essentially of 15 to 50% by weight of an inorganic fibrous material selected from the group consisting of calcium silicate, aluminium silicate, aluminosilicate, asbestos, slag wool, rock wool, mineral wool and metal fibers, with the proviso that an organic fibrous material selected from the group consisting of wood pulp, wood flour, cotton waste, rag stock, and waste synthetic staple fiber may be substituted for up to 40% of the inorganic fibrous material, 40 to 80% of a light weight refractory filler selected from the group consisting of diatomaceous earth, bubble alumina, hollow silica microspheres, calcined rice husks and pozzolana and 0.5 to 10% by weight of a binder material selected from the group consisting of sodium silicate, natural gums, cereal flour and thermosetting resins.

2. A composition according to claim 1 wherein the fibrous material constitutes 20–30% by weight of the composition.

3. A composition according to claim 1 wherein part of the refractory filler consists of a particulate refractory filler selected from the group consisting of silica flour, olivine, chamotte, alumina and refractory silicates.

4. A composition according to claim 1 wherein the binding agent is a mixture of phenol- and urea-formaldehyde resins.

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U.S. Cl. X.R.

106—38.3, 38.35, 38.5, 38.6; 260—17.3, 38, 39, 840