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HOT TOP

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9 Claims. (Cl. 106—38.35)

The present invention relates to hot tops for ingot casting molds for the casting of steel and other metals. The function of the hot top is to insulate the upper part of the metal melt from the walls of the casting mold in order to delay the freezing of said upper part so that the formation of cavities therein is prevented e.g. the so-called pipe formation.

It has been found suitable to manufacture hot tops from a fine grained refractory material mixed with some fibrous material and bonded together by a binder, see U.S. Patent No. 3,072,981. In doing so it is essential that said refractory material has a grain size within certain limits. It has been found that a too fine material, as for instance clay with grain sizes below 2μ gives unsatisfactroy results, as the hot top tends to crack. A too large grain size gives a weak coherence and low strength of the hot top.

The fine grained refractory material can comprise for instance quartz, metal silicates, olivine, slag, for instance furnace slag, and/or basic material such a oxide of magnesium. These materials can be used either mixed with each other or one single material can be used.

As organic fibrous material can be used finely divided waste paper, paper pulp or other organic fibers preferably plant fibers. The quantity of this material should not be too large due to the risk of gas formation as this causes damage to the upper part of the ingot. An upper limit of 15 or at the most 20 percent, but preferably 10% has been found suitable. Together with the organic fibrous material can also be used a refractory fibrous material such as asbestos, rock wool or the like. A quantity of up to 10% and preferably up to 8% of asbestos has been found suitable, e.g. between 1 and 5%. It may be possible to wholly omit the organic fibrous material when such refractory fibrous material is included in the mixture in a sufficient quantity to obtain a good cohesion of the hot top.

In the foregoing and following descriptions and claims all parts and percentages are dry weight unless otherwise indicated.

As a binder in the hot top an organic glue is suitable, for instance a synthetic resin glue, up to a quantity of 12%, preferably up to 10% based upon the dry substance Other binders as for instance water glass are possible together with or instead of such glue. A possible embodiment is to wholly omit a separate binder, especially when organic fibers are contained in the hot top composition and instead to press the hot top together to a firm cohesion.

As an example of a suitable composition can be mentioned a mixture consisting of 3–9% of organic fibrous material, preferably paper or paper pulp, 1–8% of binder, preferably a natural or synthetic resin glue, 0–5% of refractory fibrous material as asbestos or the like and 82–94% of fined grained refractory material as quartz, silicate, olivine, slag and/or basic materials as oxide of magnesium. The limits mentioned can often advantageously be chosen still narrower so that the mixture contains 4–8% of organic fibrous material, 2–5% of binder, 1–4% of refractory fibrous material and 85–91% of fine grained refractory material.

As above mentioned it is of a vital importance for

the usefulness of the hot top that the fined grained refractory material, which comprises the main part of the composition of the hot top, comprises grains of a suitable size and with a suitable particle size distribution. The manufacture of the hot top is performed by stirring the materials up with water and forming a cake from the resulting slurry under pressure on a filter cloth of the desired shape. The cake is thereafter removed from the filter cloth and dried. If the fine grained refractory material contains too high a proportion of coarser grains the liquid and finer constituents of the slurry will be forced by the pressure through the openings between the grains, causing an uneven sedimentation of the material. The strength in a hot top having large spaces between the grains will be deficient. If on the other hand the refractory material is too fine grained, the flow in the sedimentation procedure will be too slow, and the hot top will also crack during the drying. It has thus been found unsuitable to use only clay, which has a grain size smaller than 0.005 or even 0.002 mm. Only sand has been found to be not usable for the above mentioned reasons. Furthermore it has not been found suitable to use a material having a grain size between these two extreme limits, if the sizes of the particles are confined to only a small grain size range.

It is thus of great importance that the distribution of the material within the actual size range is relatively scattered. The grain sizes should in the main be within the range 0–1 mm., so that at least 50% of the total quantity of fine grained refractory material passes a screen with 0.84 mm. mesh openings (20 mesh according to ASTM standard), at least 20% being sufficiently fine grained to pass also a screen having 0.105 mm. mesh openings (140 mesh) while at least 40% of the material should have such a coarse grain size that at the most 60% passes a screen of 0.053 mm. mesh opening (270 mesh) and at the most 90% passes a screen with the mesh opening of 0.105 mm. (140 mesh). In general at least 80%, preferably 90% and often 100% should pass a screen with 0.84 mm. mesh openings.

In order to obtain a still more even distribution of the grain sizes it is suitable to use a material of which at least 40% comprises sizes which pass a screen having 0.297 mm. mesh openings (50 mesh) but remains on a screen having 0.053 mm. mesh openings (270 mesh), and of which at least 30% will pass a screen with 0.149 mm. mesh openings (100 mesh) and at least 20% will pass a screen with 0.105 mm. mesh openings (140 mesh).

In certain cases the fine grained refractory material can contain relatively a large proportion of the finest fractions, so that at least 20% and at the most 70% will pass a screen with mesh openings of 0.074 mm. (200 mesh), and in which the distribution further can be such that at least 20% will pass a screen with 0.053 mm. openings (270 mesh). The quantity of material passing this screen should, as mentioned, be below 60% and should in general be below 50%.

In order to obtain a good distribution of the sizes it is suitable that the material contains fractions each comprising at least 5% of the total quantity of fine grained refractory material of such grain sizes that the coarsest fraction passes a screen of 0.210 mm. mesh but remains on a screen of 0.149 mm. mesh, the next fraction passes a screen of 0.149 mm. mesh but remains on a screen of 0.105 mm. mesh while the finest fraction passes a 0.105 mm. mesh screen and remains on a 0.074 mm. mesh screen.

As an example of a hot top according to the invention can be mentioned one having a composition of 3% of binder in the form of synthetic resin glue, 6% of organic fibrous material in the form of finely ground waste paper,

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2% of refractory fibrous material in the form of asbestos and the remainder consisting of fine grained refractory material in the form of quartzite powder. The quartzite had a distribution of the grain sizes according to the following.

Screen with mesh, width in mm.:	Quantity remaining on the screen in percent
0.84	0
0.59	0
0.42	0
0.297	7
0.210	21
0.149	22
0.105	15
0.074	18
Screening remainder	15

As another example can be mentioned a hot top containing 4% of synthetic resin glue, 7% of ground paper, 3% of asbestos and the balance being a powder of olivine with the following grain size distribution.

Screen with mesh, width in mm.:	Quantity remaining on the screen in percent
0.84	0
0.59	1
0.42	2
0.297	3
0.210	6
0.149	11
0.105	9
0.074	12
0.053	9
Screening remainder	47

As a further example of a usable distribution of the grain sizes can be mentioned the following sample of quartzite.

Screen with mesh, width in mm.:	Quantity remaining on the screen in percent
0.84	0
0.59	0
0.42	0
0.297	0
0.210	1
0.149	6
0.105	6
0.074	22
0.053	22
Screening remainder	43

The hot top according to the invention can for instance have the shape of a lining positioned around the opening of the mold at the inside thereof, said lining being supported by the walls of the mold. It is then suitable to make said lining in the form of a number of slabs which hang around the edge of the ingot mold by aid of suitable suspension means, for instance flanges on the slabs protruding above the upper edge of the ingot mold. The thickness of such slabs should be 6–20 mm., preferably 8–16 mm. depending on the size of the ingot mold and the ingot. The invention is usable also for hood-shaped hot tops which in use are surrounded by a special supporting hood on top of the ingot mold. The use of the invention is, however, of course not limited to any particular geometric shape of the hot top.

The different types of hot tops referred to above are well known.

The invention has been described in connection with material for hot tops but can of course also be used in connection with materials for casting molds in casting steel or other metals.

I claim:

1. Hot top for ingot and similar casting molds for casting steel and other metals consisting of from 3 to 15% of an organic fibrous material, up to 10% of a refractory fibrous material, up to 12% of an organic glue and from 82 to 94% of a fine grained refractory material substantially all of which will pass a screen with mesh openings of 1.0 mm., at least 50% of which will pass a screen with mesh openings of 0.84 mm., at least 20% and at most 90% of which will pass a screen with mesh openings of 0.105 mm. and at most 60% of which will pass a screen with mesh openings of 0.053 mm.

2. Hot top according to claim 1, characterized in that at least 80% of the fine grained refractory material will pass a screen with mesh openings of 0.84 mm.

3. Hot top according to claim 1 characterized in that at least 40% of the total quantity of fine grained refractory material will pass a screen with mesh openings of 0.297 mm. but will not pass a screen with mesh openings of 0.053 mm., and at least 30% of said total quantity will pass a screen with mesh openings of 0.149 mm. and at least 20% will pass a screen with mesh openings of 0.105 mm.

4. Hot top according to claim 1 characterized in that at least 20% and at the most 70% of the fine grained refractory material will pass through a screen with mesh openings of 0.074 mm.

5. Hot top according to claim 4 characterized in that at least 20% of the fine grained refractory material will pass through a screen with mesh openings of 0.053 mm.

6. Hot top according to claim 1 characterized in that the fine grained refractory material consists of a portion which will pass a screen with mesh openings of 0.210 mm. but will not pass a screen with mesh openings of 0.149 mm., a portion which will pass a screen with mesh openings of 0.149 mm., but will not pass a screen with mesh openings of 0.105 and a portion which will pass a screen with mesh openings of 0.105 mm. and will not pass a screen with mesh openings of 0.074 mm., each of said portions constituting at least 5% of the total quantity of fine grained refractory material.

7. Hot top according to claim 1 characterized in that at least 10% of said fine grained refractory material will not pass a screen with mesh openings of 0.074 mm.

8. Hot top according to claim 1 characterized in that it contains 3–9% organic fibrous material, 1–8% of organic glue, 0–5% of refractory fibrous material and 82–94% of fine grained refractory material.

9. Hot top according to claim 8 characterized in that it contains 4–8% of organic fibrous material, 2–5% of glue, 1–4% of refractory fibrous material and 85–91% of fine grained refractory material.

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