May 19, 1970 D. F. EDNELL 3,512,572

FORMING A HOT TOP ELEMENT BY FORCING SLURRY THROUGH PENETRABLE MOLD WALLS

Filed Feb. 17, 1966

3 Sheets-Sheet 1

FIG. 1

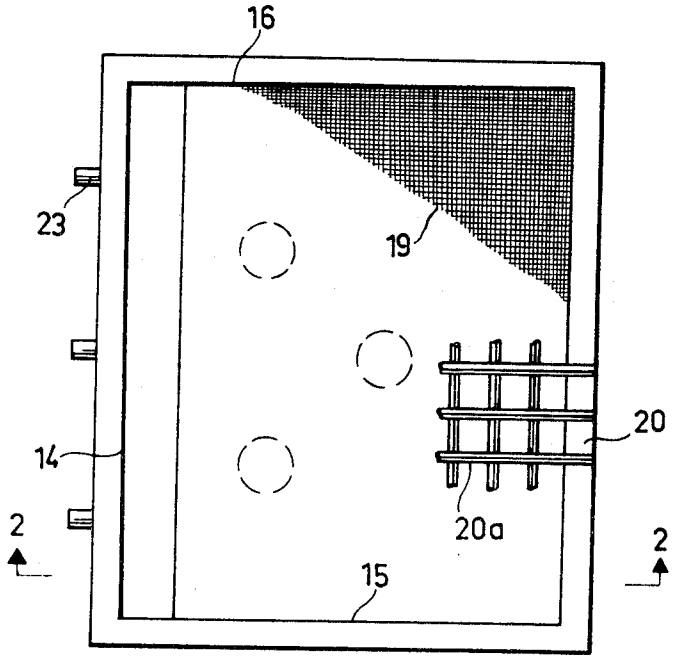

FIG. 2

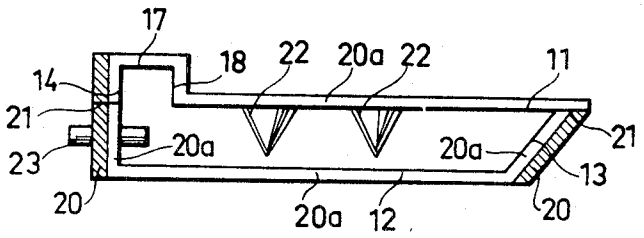

FIG. 3

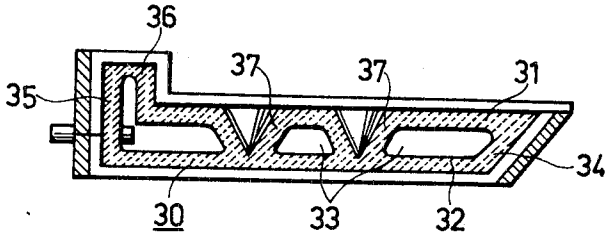

FIG. 4

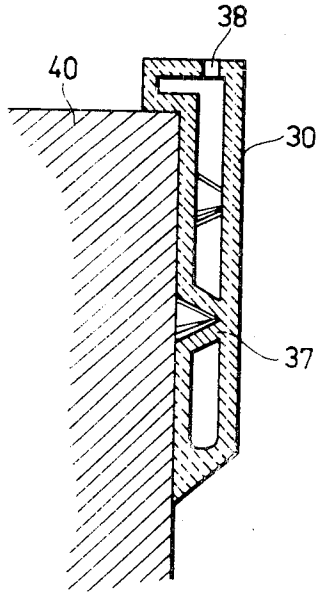

FIG. 5

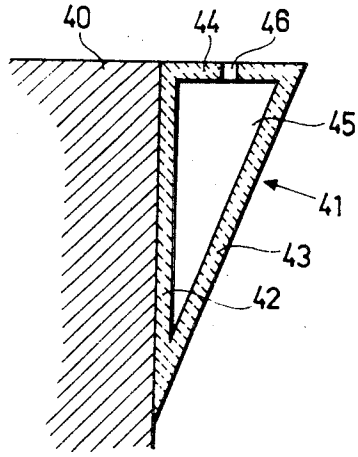

FIG. 6

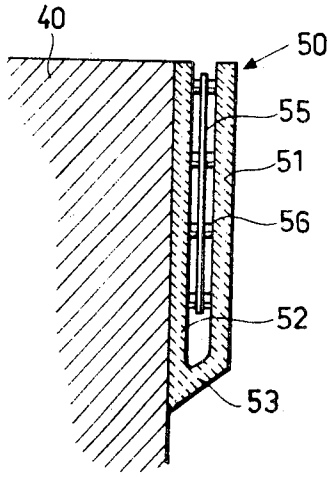

FIG. 7

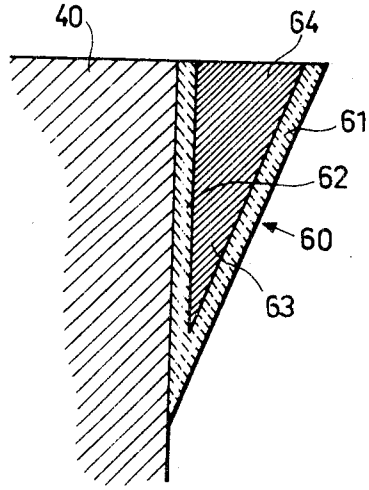

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FIG. 8

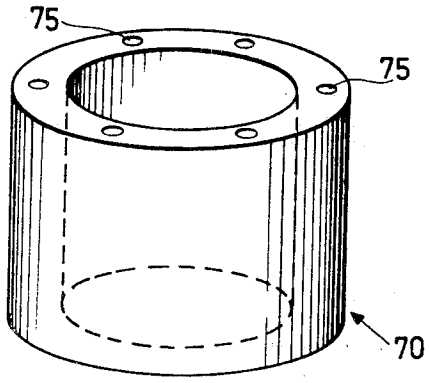
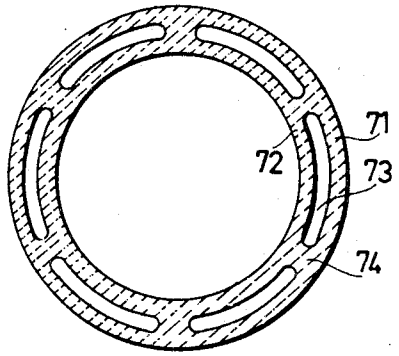


FIG. 9



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FORMING A HOT TOP ELEMENT BY FORCING SLURRY THROUGH PENETRABLE MOLD WALLS

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Int. Cl. B22c 1/00
U.S. Cl. 164—41 5 Claims

ABSTRACT OF THE DISCLOSURE

A hot top for a casting mold is prepared by filling the interior space of a special mold form, having spaced apart walls penetrable by liquid, with a flowable slurry of fine-grained refractory material including a minor amount of an organic binder material in a liquid. Two opposed mold form walls are permeable to the liquid and such liquid is drawn through the permeable walls either by suction or pressure in order to manufacture a hollow hot top wall.

The present invention pertains to hot tops and to a method for manufacture of hot tops or similar for casting molds, for example ingot molds, from a composition of materials comprising in the main a refractory fine grained material and a minor quantity of a binder. Additionally the composition contains suitably a minor quantity of an organic finely divided material of for instance fibrous structure and possibly also a minor quantity of refractory fibrous material.

It is previously known to manufacture hot tops of this kind by mixing the composition with a liquid and then causing it to sedimentate on a penetrable model mold, after which it is dried. The finished hot top attains a firm consistency when the binder hardens and binds the particles of the composition together. The hot top made in this way has a high heat insulation, low bulk weight and low heat capacity.

For obtaining the said sedimentation on the model mold it is possible either to subject the slurry to pressure and/or to apply a suction at the opposite side of the model mold. The invention is based on the fact that the sedimentation may occur independently of the influence of the gravity force on the particles in the slurry and can be effected in an arbitrary direction, including laterally or upwardly. It is thus possible to achieve a sedimentation on a model mold having two opposed penetrable mold walls, thereby obtaining a hot top slab with a double wall. The sides of the double wall can be interconnected by transverse connections, which can be obtained by means of penetrable mold elements connecting the said opposed mold walls.

The invention appears more in detail from the following description with drawing figures, showing:

FIG. 1, an elevational view of a model mold for making a hot top slab according to the invention.

FIG. 2, a cross section on the line 2—2 in FIG. 1.

FIG. 3, the same cross section as in FIG. 2 including a hot top slab manufactured with the model mold.

FIG. 4, a cross section of an ingot mold with a hot top slab of the type illustrated in FIG. 3.

FIGS. 5–7, cross sections of an ingot mold wall with different embodiments of a hot top slab according to the invention.

FIG. 8, a perspective view of a feeder according to the invention for use with casting molds.

FIG. 9, a cross section of the feeder in FIG. 8.

The model mold shown in FIGS. 1 and 2 is adapted for manufacture of hot top slabs. The model mold comprises two opposed parallel sides **11** and **12** and intermediate sides **13**, **14**, **15** and **16**. For forming a projection on the hot top slab a recess is formed in the side **11**, limited by the side **14** and two small sides **17** and **18**. All of the said sides are made of a penetrable material, for instance a net, as indicated in FIG. 1 by reference **19**. Said net is supported at its outside by a frame construction **20**, for instance a grid **20***a* or a net having greater openings than the net forming the side surfaces. The mold is divided by a joint **21**, in order that the two parts can be separated from each other.

For producing supporting connections between the side walls of the slab which is cast in the mold there are conical mold elements attached to the mold wall **11** and extending toward the wall **12**, said elements also being penetrable.

For supplying the slurry which is intended to sedimentate on the mold walls there are a number of short tubes **23** through the wall of the model mold. The slurry is supplied through the tubes **23** to the inside of the mold and is subjected to pressure from the inside and/or suction from the outside. This results in that the suspending liquid is squeezed out through the mold walls, the material suspended in the liquid sedimentating on the walls. In this way a slab **30** is formed which is illustrated in FIG. 3. The slab has a double wall section comprising two sides **31** and **32** separated by an intermediate space **33**. The model mold is suitably made with penetrable edge sides **13–16** around the edges of the sides **11** and **12**, so that the cavity **33** is closed except at the holes in the slab left by the tubes **23**. Said tubes can possibly have an oblong section in the longitudinal direction of the mold in order to obtain a more even distribution of the composition. At the mold wall **13** is thus formed an edge side **34** and at the mold wall **14** an edge side **35** and a projection **36** at the mold sides **17** and **18**. At the conical mold elements **22** there are formed conical connections **37** between the sides **31** and **32**, which give the slab a higher internal strength against the pressure of cast metal when the slab is used.

In FIG. 4 is illustrated how the hot top slab **30**, shown in FIG. 3, is hung on the wall of an ingot mold **40**. It is assumed in this case that the hot top consists of a number of separate slabs which are hung up at the inside of the ingot mold around the upper part thereof.

In FIG. 5 is shown another embodiment of a hot top **41** hung on an ingot mold **40** by means of suspension means not illustrated as for example hooks of steel wire. The hot top has in this case a triangular cross section with a vertical wall **42** and an inclined wall **43** which at their lower edges are joined to wedge shape and at their upper ends are joined by a horizontal wall **44**. The slab **41** is shown without the conical transverse connections **37**, which are illustrated in the slab **30** in FIG. 3, but of course it is possible to have such connections also in the slab **41** if necessary. In the cavity **33** in the slab **30** as well as in the cavity **45** in the slab **41** can be filled an insulating, possibly exothermic material, through the holes **38** and **46** respectively.

FIG. 6 shows a hot top slab **50** applied to an ingot mold **40**. The two wall portions **51** and **52** are integrally interconnected only at their lower edges by a wall portion **53**. The space **54** between the wall portions is open at the upper end and a separate support body is inserted into the space, consisting of a frame **55** holding a number of support pieces **56** abutting against the inside of the wall portions **51** and **52**. The support body has the same function as the conical portions **37** in FIG. 3, i.e.

to prevent the side **51** of the slab facing the cast metal from being broken.

FIG. 7 shows a hot slab **60** with a V-shaped cross section. The slab comprises an outer side **61** and an inner side **62**, which are joined at their lower edges and diverge upwardly with a space **63** between them. The space **63** is open at the upper end, which can be obtained by providing a solid wall and omitting the penetrable mold wall at this part. A support body **64** can be inserted into the space **63**, said body being solid or having a powder consistency and possibly consisting of an exothermic material.

The use of the invention has been described above for hot tops comprising a number of separate slabs, but it can also be used for making hot tops in one piece for instnce as a hood which is placed on top of an ingot mold with a supporting collar around it. A use of the invention similar to the last mentioned is for feeders in casting molds in foundries, and FIGS. 8 and 9 show a feeder **70** made according to the invention. It is cylindrical with an annular cross section, the wall comprising an outer wall **71** and an inner wall **72**, between which there are spaces **73**. In the illustrated embodiment the spaces **73** are separated by intermediate walls **74**, but the latter can possibly be omitted, leaving an uninterrupted annular space. In this case the walls **71** and **72** are held together by the transverse connections at the lower and upper ends of the feeder. The upper end has holes **75** which are formed by the tubes for supply of slurry when manufacturing the feeder.

As appears from the above the mold element formed according to the invention consists of a body with a double wall comprising two opposed wall portions. These wall portions are interconnected integrally and in one piece by one or more connections situated between them. The two opposed wall portions can be in the main equally thick, but it may often be advantageous to make the wall portion situated adjacent the cast metal somewhat thicker in order to increase the ability of the wall to resist the pressure from the cast metal. This can be achieved for instance by turning the side of the model mold downwardly at which the thicker wall portion is wanted, as illustrated in FIGS. 2 and 3. In this way the gravity force causes a more rapid sedimentation at the lower side of the mold, the layer sedimentating thereon becoming thicker. It is also possible to use mold sides with different degrees of penetrability in order to regulate the thicknesses of the sedimentated layers. The thickness of the layer adjacent the cast metal can be 1.25–2.0, preferably 1.4–1.6 times the thickness of the opposite wall portion. The wall portion adjacent the cast metal can suitably have a thickness of 10–30 mm. in the type of hot top illustrated in FIG. 4. In other embodiments of hot tops the thickness may be greater than the said upper limit.

The hot top according to the invention consists essentially of finely divided particles and a binder connecting said particles. At least a major part of the particles consists of a fine grained refractory material, for instance olivine or quartz. Additionally the composition of in the hot top can suitably contain a minor quantity of organic particles, for instance of a fibrous structure as finely divided paper pulp or wood pulp, or of a cellular structure as cork. The composition can also advantageously contain particles of a fibrous refractory material as asbestos, glass wool or rock wall. The particles in the composition should have such a size that they can be mixed with a suspending liquid to a slurry and then be caused to sedimentate on a model mold according to the above. The binder should be soluble or mixable in the suspending liquid and should be added to such a concentration that the finished hot top contains the desired quantity

of binder. For the actual purpose a resin glue is suitable, and said glue may be synthetic.

After being formed in the model mold by sedimentation of particles of the composition the formed object is removed and dried at a temperature of 120–200° C., usually 140–160° C. There is thus no sintering, but the composition is held together by the dried and/or hardened binder. The fibrous material contributes to the cohesion.

As an example of a composition which is suitable for the present purpose can be mentioned a mixture containing 82–94% by weight fine grained refractory material, 3–9% by weight finely divided organic material of fibrous or cellular structure, 1–8% by weight binder and possibly a minor quantity, preferably up to 5% by weight of a fibrous refractory material.

The invention provides the advantage that the double wall gives the insulating hot top element a very high heat insulation. Also the heat capacity is low. It is possible to add an exothermic material to the hot top element without letting this material come in contact with the cast meal. A further substantial advantage is that all the sides of he hot top element can be exactly shaped with regard to the future use.

I claim:

1. Method for the manufacture of a hot top element which comprises delivering a slurry of a composition consisting essentially of a major portion of a fine grained refractory material and a minor portion of a binder in a liquid to the interior of a mold having spaced apart walls part of which are situated closer to each other than other parts, which walls are penetrable by said liquid, causing sedimentation of solids of said slurry over the interior surfaces of the mold by creating and maintaining such a higher pressure of slurry within the mold than the ambient atmospheric pressure that sedimentation can occur laterally and upwardly as well as downwardly thereby depositing a hollow structure with spaced apart walls, which partially are integrally interconnected, and drying said structure.

2. Method as defined in claim **1** in which one wall of said mold is positioned substantially horizontally and below another wall whereby the thickness of said composition on said one wall is made greater than the thickness on said other wall.

3. Method as defined in claim **1** in which said mold walls are substantially parallel and are connected at an edge of each wall by a penetratable transverse wall.

4. Method as defined in claim **1** in which said mold walls are at an acute angle to each other and are connected to each other at one edge of each wall.

5. Method as defined in claim **1** in which spaced apart, conical, penetratable projections extend from one of said mold walls toward the other of said mold walls.

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U.S. Cl. X.R.

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