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Lyass et al.

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[54] **METHOD OF MAKING FOUNDRY MOULDS AND CORES**

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[58] **Field of Search** 106/38.3, 38.35, 38.9, 106/89, 97; 164/23

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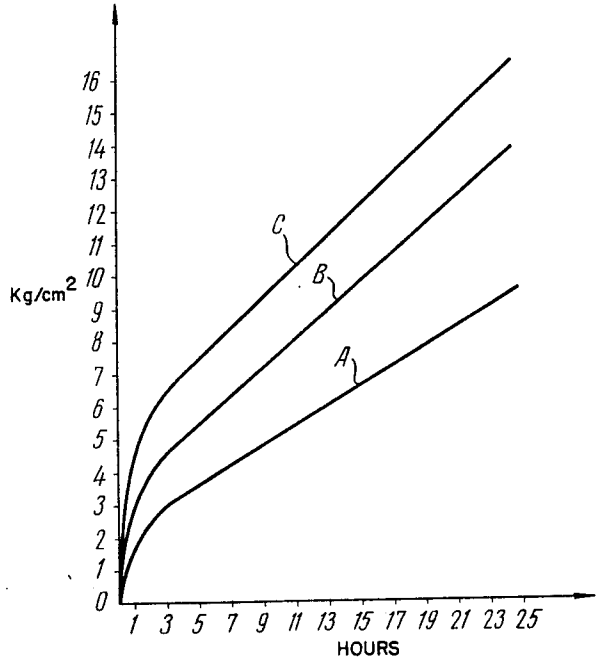
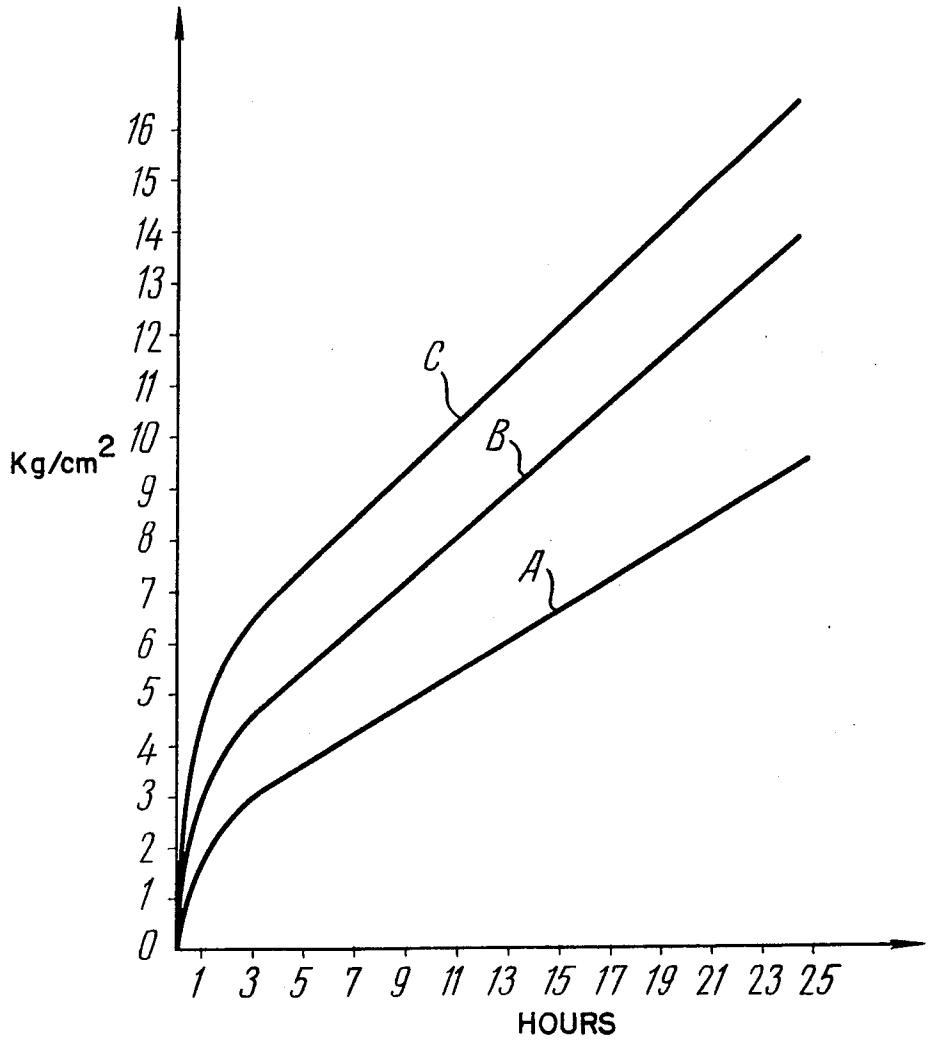
[57] **ABSTRACT**

A process of producing foundry moulds and cores from a moulding sand or sand mixture, containing moulding sand, hydraulic cement as a binder, an alkali-metal aluminate, an alkali-metal carbonate and a surface-active material.

6 Claims, 1 Drawing Figure




Kg/cm2
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1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
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7
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11
13
15
17
19
21
23
25
HOURS
A
B
C

METHOD OF MAKING FOUNDRY MOULDS AND CORES

BACKGROUND OF THE INVENTION

The present invention relates to foundry work and more particularly to a process of making foundry moulds and cores from a fluid self-hardening moulding sand or sand mixture.

By using the above mixtures such operations as the compacting of the moulding sand and drying of the moulds and cores produced thereof can be avoided, dimensional accuracy of castings and efficiency of the process are enhanced.

Well known are the processes of manufacturing foundry moulds and cores based on the use of fluid self-hardening sand mixtures containing a small amount of a surface-active material which ensures the conversion of the mixture to a fluid state.

One of these sand mixtures contains a moulding sand, an alkali-metal silicate as a binding agent, dicalcium silicate as a hardener and a surface-active material (see, for example, French Pat. No. 1,342,529).

The above sand mixture proved successful, though the hardening rate and strength control is rather difficult to predict because the dicalcium-silicate-containing material is a waste product varying in dicalcium silicate content and, hence, perties are unique to this sand mixture. Moreover, the knockout of the cores made from the above sand mixtures presents a serious problem.

Attempts also have been made to provide a fluid self-hardening sand mixture containing cement as a binder (see, for instance, English Pat. No. 1,085,651, French Additional Pat. No. 87,456).

The sand mixture features stable properties, though typical of the moulds and cores manufactured of the above mixture is a low hardening rate and inadequate strength. The compression strength of the sand mixture within 1 hr after manufacture does not exceed, as a rule, 1 kg/cm^2 which precludes the possibility of using the mixture for the production of heavy cores of intricate shape.

It is an object of the present invention to overcome or at least to diminish the above difficulties.

SUMMARY OF THE INVENTION

The present invention has the principal object to provide a process of making foundry moulds and cores from a fluid self-hardening sand or sand mixture with controllable properties, such as: hardening rate and strength.

This is achieved by the fact that in a sand mixture containing moulding sand, hydraulic cement as a binder and a surface-active material, according to the invention, an alkali-metal aluminate and an alkali-metal carbonate are introduced during production.

The alkali-metal aluminate enables more rapid hardening of the fluid sand mixture.

Most advantageous is the addition of the alkali-metal aluminate in an amount ranging between 0.25–1.5 percent of the weight of the moulding sand. Usually sodium aluminate is employed being among the compounds most widespread in the industry. According to the present invention, sodium aluminate is introduced into the fluid sand mixture in a liquid state. It would be expedient to employ sodium aluminate of a specific

gravity of 1.48–1.68 g/cm^3 with a molar ratio of Na_2O: Al_2O_3 of between 1.1:1 and 1.5:1. Sodium aluminate is an active hardening accelerator, therefore its addition even in small amounts substantially reduces the flowability of the sand. As the contents of sodium aluminate in the fluid sand mixture increases, a moment might occur when the mixture completely loses its flowability by hardening during the preparation cycle.

According to the present invention an alkali-metal carbonate is also added to the fluid sand mixture. Most effective is potassium carbonate.

Potassium carbonate assists in increasing the bench life of the sand mixture, decelerates the sand hardening at the initial stage and enhances its strength at the late hardening stage. Fluidizing capacity of potassium carbonate offers a two-fold reduction in the amount of foaming agent, preserving meanwhile high flowability of the sand mixture which enhances its strength. Preferably, the content of the alkali-metal carbonate in the sand mixture shall amount to 0.5–2 percent of the weight of the moulding sand.

According to a preferred embodiment of the present invention a fluid self-hardening sand might contain 100 parts by weight of moulding sand, for example, quartz, 10 parts by weight of Portland cement, 6 parts by weight of water, 0.1 part by weight of a surface-active material. The amounts of sodium aluminate and potassium carbonate are given in Table 1. The sand and Portland cement are mixed for 1–2 min. Then a liquid composition is prepared by dissolving potassium carbonate in water and adding the surface-active material and sodium aluminate to the solution. Next the liquid composition produced thereby is introduced into the sand-Portland cement mixture and stirred until the mixture is converted to a fluid state.

In the accompanying graph the x-axis indicates the hardening time or holding time of the foundry moulds and cores in air in hours and the y-axis — shows compression strength in kg/cm^2.

Variation of compression strengths of the foundry moulds and cores manufactured of sand mixtures of 1, 2 and 3 of Table 1 respectively with their air hardening time is illustrated by curves A, B and C.

As shown by the graph and Table 1, the higher the potassium carbonate content of a sand mixture, the greater amount of sodium aluminate can be introduced into the mixture and the higher will be the hardening rate of the sand mixture (curve C).

According to the present invention the binder is cement, such as Portland cement, alumina cement, their mixtures or neat cements.

Conforming to this invention, a specific surface area of a cement exerts an appreciable influence upon the hardening rate of a fluid sand mixture. The larger the specific surface area of cement, the higher the hardening rate and strength which can be attained for a given fluid sand mixture. By changing the specific surface area of cement it is possible to control the mixture hardening rate. The properties of sand mixture 1, containing Portland cement with a different specific surface area, are compared in Table 2.

Table 2 gives the specific surface area of Portland cement measured by filtration of air through a layer of a

Table 1

Sand mixture ingredients	Parts by weight		
	Sand mixture 1	Sand mixture 2	Sand mixture 3
Quartz sand	100	100	100
Portland cement	10	10	10
Surface-active material	0.1	0.1	0.1
Water	7	7	7
Sodium aluminate, spec. gr. 1.60, molar ratio of $Na_2O:Al_2O_3 = 1.1:1$	0.9	1.2	1.5
Potassium carbonate	1.0	1.5	2.0

Table 2

Specific surface area of Portland cement, cm^2/g	Flowability preservation time, min	Compression strength, kg/cm^2		
		1 hour	3 hours	24 hours
2500	20	2.0	2.5	9.5
4500	7	3.0	4.5	14.0

ground material and calculated by the Causenie-Carmand method.

For the objects specified in the present invention several types of surface-active materials can be advantageously used, such as: anion, cation, nonionogenic materials and/or a mixture of these. Such materials are alkyl aryl sulfonates, alkyl sulfonates, primary and secondary alkyl sulfonates, products of oxyethylation of fatty acids, alcohols, alkyl phenols, fatty amines, alkyl nephtols and mercaptans, quaternary ammonium compounds. The proportion of the surface-active material shall be within 0.05–0.2 percent by weight of the moulding sand.

Any ground refractory material commonly employed in foundry work for the production of moulds and cores, such as quartz sand, olivine, chromo-magnesite, grog or chamotte, etc. can be used as a moulding sand.

What is claimed is:

1. A process of making foundry molds and cores from a fluid self-hardening sand or sand mixture with controllable properties comprising the steps of preparing (1) a mixture consisting essentially of 100 parts by weight of molding sand, from 8 to 15 parts by weight of hydraulic cement as a binder, (2) a mixture of from 0.25 to 1.5 parts by weight of an alkali-metal aluminate and from 0.5 to 2.0 parts by weight of an alkali-metal carbonate as the hardening accelerator, from 0.05 to 0.2 parts by weight of a surface-active material with a foaming action; and water; mixing (1) and (2) to form a fluid mass; forming the foundry mold and cores from said mass and hardening said molds and cores in air.

2. The process as claimed in claim **1,** in which the alkali-metal aluminate is sodium aluminate.

3. The process as claimed in claim **1** in which the alkali-metal carbonate is potassium carbonate.

4. The process as claimed in claim **1** in which the surface-active material is sodium alkyl aryl sulfonate.

5. In a liquid self-hardening mold or core mixture consisting essentially of 100 parts by weight of molding sand, from 8 to 15 parts by weight of hydraulic cement as a binder and from 0.05 to 0.2 part by weight of a surface-active substance with a foaming action and a self-hardening accelerating additive, the improvement consisting of, as said additive 0.5 to 2.0 parts by weight of potassium carbonate and from 0.25 to 1.5 parts by weight of sodium aluminate.

6. The liquid self-hardening mold or core mixture as claimed in claim **5,** wherein sodium alkyl aryl sulfonate is the self-active substance with a foaming action.

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