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CORE-BINDING COMPOUND.

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To all whom it may concern:

Be it known that I, THEODORE NAGEL, a citizen of the United States, and a resident of the borough of Brooklyn, county of Kings, and city and State of New York, have invented certain new and useful Improvements in Core-Binding Compounds; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a method of producing cores for foundry work, and refers particularly to a liquid binding material that possesses unusual properties and has not previously been employed in this art. One constitutent of the binder is radically different from anything previously suggested, and induces reactions that differ markedly from those taking place in the ordinary core setting processes. The invention also relates to a method of shortening up the time required to carry out the process, and in which less labor is involved.

It has as an object the production of a binder which will be comparatively inexpensive, and more effective than those at present in use, and which in conjunction with molding sand will harden to form a core in an unusually short time. With these and other objects in view the invention consists in the novel binding material, and the novel steps and combination of steps, constituting the process, all as will be more fully hereinafter disclosed and particularly pointed out in the claims.

As an example of my process, I mix with 100 parts of sand from 1 to 7 parts of the new binding material and mold the core in the usual manner. The core is then baked at a temperature not above 400° C. for approximately 30 minutes, the time depending upon the weight of the core. The binding material is a liquid composed of 5 parts by weight of molasses, and from 1 to 3 parts by weight of commercial phosphoric acid of about 60 per cent strength.

It is well known that binders heretofore used, especially of the paste type require drying before baking which operations are unduly slow. As a result, in many cases the output of a foundry is limited to its core oven capacity. Core binding materials, such as those composed of wheat, flour, rye meal, corn starch, residue molasses and syrup, are slow in giving up their moisture and if heated too quickly the cores crack, bulge or become deformed and they also lack what might be called a preliminary setting action, and, therefore, in many cases require an initial drying of the green core previous to baking. When water-free binders, such as rosin, pitch, asphalt, linseed oil, etc., are employed a certain amount of time is usually necessary to elapse before they may safely be placed in the baking oven. This is not due to any dehydrating action, but probably to a complete penetration of the binding material and a settling of all the particles of sand to a fixed position.

When phosphoric acid is employed in conjunction with molasses or other organic material of an adhesive nature, or materials having similar action, the changes that take place in the core are very unusual and are at present but little understood. A preliminary hardening takes place and the green cores can be subjected immediately to baking temperatures without previous preliminary drying. In the case of the usual water soluble binders too speedy drying before baking leads to cracking, swelling or other deformation which prevents immediate introduction of the green cores into a hot oven having the ultimate baking temperatures. In the case of liquid binders containing phosphoric acid a preliminary surface setting begins when the core is formed, which is accelerated when the core is subjected to heat, and this surface hardening prevents the tendency to warp, crack or swell. Usually the entire baking or curing operation requires from 15 to 30 minutes, but the time varies with the size and thickness of the cores.

Reasonable excess in baking temperature and time of treatment does not materially alter the good qualities of the core, and moreover cores made with a binding material containing phosphoric acid when cured become extremely hard. On the other hand the cores become fragile and may be easily removed after the molten metal has chilled and the operation is complete. This is an essential quality, and is caused by the excess heat imparted to the cores from the liquid metal on chilling.

The preliminary hardening or setting that takes place in the cores made with a binding material containing phosphoric acid, is sufficient to overcome the usual risks of breaking attendant upon handling green cores.

The preliminary setting and its rapid acceleration on introduction into the oven, does away with the danger of swelling, softening and deforming in any manner, and the non-hydroscopic nature of the set mass and its freedom from any tendency to effloresce, overcomes the dangers accompanying the use of many of the paste binders. When molding and curing cores made with a binding material containing phosphoric acid, no tendency of the binding material to travel or draw to the surface of the cores is exhibited.

It has been customary in the past to incorporate clay or other earth material with the core sand to increase the binding strength, but this procedure has its limitations. The more clay added the less the porosity of the cores. Due to the remarkable self-setting powers of phosphoric acid binding compounds, coarse sand may be employed without any addition of clay for the purpose of imparting strength. It is thus apparent that a binder of this nature makes possible the use of clean fairly coarse sand alone, this effecting an economy in foundry practice. All the old cores may be crushed and used again as the aggregate for new cores, without waste.

The addition of phosphoric acid to a binder of the molasses type overcomes an objection that has always applied to molasses and other syrups, such as glucose, dextrine, etc. As they are almost invariably thick, viscous liquids, unless diluted, considerable trouble is met with in thoroughly incorporating them with sand, and dilution introduces additional troubles. I have found that the fluidity and wetting power of a liquid binding material is increased by the addition of phosphoric acid.

Considerable difficulty has been experienced with foundry cores since many are hydroscopic and tend to absorb moisture while in storage. This brings about an appreciable surface softening. Cores made with a binding material containing phosphoric acid when cured at 400° C. entirely overcome this trouble. Even the new binder alone, when composed of phosphoric acid and molasses is converted on heating into a hard, dry glassy mass.

Cores made with this new binder can remain in green sand molds for long periods before the molds are poured. This is not the case with cores that absorb moisture as they must be replaced with dry cores after standing for short periods, even in many cases less than a day.

It has been found that the discovery of the very unusual properties of phosphoric acid as an ingredient in core binding materials, makes possible its addition to improve a majority of the pastes and water-soluble binders in common use at the present time. It is thus possible to take some of the cheapest and most inefficient core binders now in use, and with the addition of phosphoric acid, to convert them into high-grade products at an ultimate cost far below such binding materials as linseed oil, etc. Linseed oil is considered to be the highest grade core binder.

It is obvious that those skilled in the art may vary the details of the process as well as the nature of the product without in any way departing from the spirit of the invention, and therefore I do not wish to be limited to the above disclosures except as may be required by the claims.

I claim:

1. The method of producing a core which comprises incorporating with 100 parts by weight of comminuted material not more than 7 parts by weight of a mixture of not more than 3 parts by weight of a phosphorus compound with 5 parts by weight of an organic adhesive material and moulding the same substantially as described.

2. The method of producing a core which comprises incorporating with core sand a mixture containing molasses and commercial phosphoric acid and moulding the same; substantially as described.

3. The method of producing a core which comprises incorporating with one hundred parts by weight of core sand, not more than seven parts by weight of a mixture of not more than three parts by weight of commercial phosphoric acid with five parts by weight of molasses, and moulding the same; substantially as described.

4. The method of producing a core which comprises incorporating with core sand, a mixture of phosphoric acid and molasses; moulding the same; and baking till the core is able to withstand the action of molten metal encountered in casting substantially as described.

5. The method of producing a core which comprises incorporating with core sand, a mixture of phosphoric acid and molasses; moulding the same; and baking at a temperature of not above 400° C. for about 30 minutes; substantially as described.

6. The method of producing a core which comprises incorporating 100 parts of core sand by weight, with not more than seven parts of a mixture of phosphoric acid and molasses in the proportions by weight of not more than three parts of 60% acid to five parts of molasses; moulding the same and baking at a temperature not above 400° C. for about 30 minutes; substantially as described.

7. A new core for foundry purposes which comprises core sand agglomerated with a binding compound comprised of phosphoric acid and molasses; substantially as described.

8. A new non-hydroscopic core for foundry purposes which comprises a cemented mass of core sand, molasses and phosphoric acid, and that is subject to a reduction in strength without change in form on coming in contact with melted metal; substantially as described.

9. A new non-hydroscopic core for foundry purposes which comprises a cemented mass of core sand, molasses and phosphoric acid, capable of remaining intact with molten metal encountered in pouring, after which it may be easily disintegrated by mechanical means; substantially as described.

10. A binding material for foundry cores which comprises phosphoric acid and molasses; substantially as described.

11. A binding material for foundry cores which comprises phosphoric acid and molasses, and when incorporated with core sand and heated, forms a hard water-insoluble material; substantially as described.

12. A binding material for foundry cores which comprises phosphoric acid and molasses and which on heating forms a hard glassy material, substantially as described.

In testimony whereof I affix my signature.

THEODORE NAGEL.