

UNITED STATES PATENT OFFICE

2,430,655

FOUNDRY FACINGS AND METHOD OF MAKING SAME

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No Drawing. Application April 10, 1945,
Serial No. 587,605

9 Claims. (Cl. 22-189)

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This invention relates to the casting of metals in sand molds and has for its particular objects the expeditious and economical production of iron castings and also non-ferrous metal castings from which adhering layers of sand can be readily peeled and which casting when so peeled has a remarkably smooth surface skin, substantially free from the so-called "orange peel" effect, not only on the top and bottom faces thereof, but also throughout a very substantial portion of its vertical walls. Other objects of the invention will hereinafter appear.

Heretofore, as I am well aware, it has been proposed, as set forth in Reissue Patent No. 19,396 of December 11, 1934, to employ as a facing for sand molds, intended for use in the casting of iron, a dry composition composed essentially of carbonaceous base as the major ingredient thereof, a substantial percentage of bentonite and a minor percentage of a gummy substance. Such facing, while in many respects it was quite efficacious for preventing the "burning in" of the sand on the top and bottom faces of castings produced in sand molds on which the facing had been dusted, has certain defects which materially impaired its value as a facing for such molds. Among these defects or short-comings were an "orange peel" effect present in castings produced in sand molds faced therewith and which effect was due to the presence in the surface of the casting of myriads of minute hills and valleys which imparted to such surface an appearance somewhat resembling that of the skin of an orange. Such castings so produced by employing such facing also had a grayish black film on the top and bottom faces thereof which consisted principally of fused bentonite and coke, being attributable to the fact that in such facing the bentonite which is the water-absorbent ingredient of the facing is incorporated with the carbonaceous base thereof as a mechanical mix and therefore particles thereof are directly exposed to contact with the molten metal when the mold is poured.

Such prior facing not only produced an excessive amount of dust when applied to a mold with a shake-bag; due to its extreme fineness of its particle size, about 180 mesh or finer, but also the gummy ingredient, such as dextrine, could not be homogeneously distributed over the coke particles because of the greasy characteristics of

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the latter which prevented them from being thoroughly and evenly wetted by the dextrine solution. Furthermore, when examined microscopically, large isolated agglomerates of dextrine-treated coke particles that are not in close proximity to particles of bentonite are observable, this being largely due to the fact that, as previously explained, the bentonite is mixed mechanically in such facing, thereby resulting in a heterogeneous mix.

My investigations have led to the discovery that substantially all of the above undesirable features which characterized such prior bentonite type of facing, however excellent it was by comparison with prior facings of the non-bentonite type, can be effectively eliminated with the result that it is possible to produce a facing having a vastly improved peeling action as compared with any known facing and which produces a casting having a smooth even skin coating, the same being of a decidedly bluish cast.

In the production of my improved facing I preferably proceed as follows:

2000 lbs. of the carbon base is introduced in the mixer.

200 lbs. of coal tar pitch, (or crude naphthalene rosin pitch, pine pitch, sea coal pitch, or any volatilizable high carbon producing hydrocarbon) is then introduced in finely divided form, or in water suspension or in solution in some dissolving media. The heat is applied slowly until the hydrocarbon is just molten. (The usual range of melting points of these materials is around 160° to 260° or even 400° centigrade.) The mix is allowed to run until some heavy distillate in the form of a white smoke appears. At this point the heat is removed and the mixer allowed to run until cold. During this stage the coke base will become waterproof and will agglomerate into spheroids. It will flow in the mixer like water.

200 lbs. of dextrine in finely divided form is now added and the mixer allowed to distribute this.

225 lbs. of hot water containing 9 lbs. of wetting agent, such as triethanolamine, alkyl aryl sulfonate or diethylene glycol, are added in a steady small stream or sprayed in. After mixing the same for but a few minutes, a violent reaction takes place and the mass will swell very

considerably. (The amount of swelling depends entirely on the amount of hydrocarbon.) Heat is then applied and the moisture driven off. The mass will slowly shrink to less than its original volume. It will again flow like water in the mixer and will have lost its water proof quality entirely. It will, in fact, wet very easily. Moisture is retained at 1% to 2% in this mass.

500 lbs. of bentonite is then introduced thru a rotating sifter or it may be blown in. The residual 1% to 2% moisture gels the bentonite and in this semi-plastic condition it will spread over the coke-hydrocarbon-dextrine spheres. Heat is continued until dry.

The final product is a very flowy material, exceedingly quick to pick up moisture from the mold surface, and, as the particles are round, easily bolted. To maintain the size of the particles the material is bolted thru 115 to 150 mesh. This results in a particle size ideally suited to pass thru an open mesh shake bag and yet small enough to fill up the interstices in any molding sand. The particles are nearly perfect spheres and flow down a sand mold surface to form a very even film.

In order to effect proper distribution of the bentonite over the coke-hydrocarbon-dextrine particle and get an even, fine film of bentonite over the coke the bentonite is desirably distributed as an air floated dust over the surface of the coke-hydrocarbon-dextrine mix which still is allowed to retain a small quantity of the original moisture added, instead of being thoroughly dried out. As the coke-hydrocarbon-dextrine mix is steamy and hot (around 200° F.) the bentonite falling on the surface is gelled by contact with this moisture. The action of the mixer is to carry this fine gelled film down to the bottom of the mixer and rub it around the coke-hydrocarbon-dextrine particle in so doing. There it meets the hot surface of the mixer and is dried out, a complete film of bentonite being around each coke-hydrocarbon-dextrine particle.

Another method of accomplishing the same result is to dry the coke-hydrocarbon-dextrine mixture out and then air float in the bentonite. The mixer is so operated as to distribute this mass as thoroughly as possible. Then the heat is again turned on and the mass raised to 200° F. and a current of wet steam is blown over the surface of the mass. As the coke-dextrine mix is under the temperature of the wet steam, slight condensation takes place and the bentonite is gelled. The action of the mixer distributes this gel over the surface of the coke-hydrocarbon-dextrine spheroids and the heat at the bottom of the mixer dries out the film. A complete even coating of the bentonite thereby is obtained.

Ordinarily, the direct contact of the bentonite with the metal will fuse the bentonite and the result is it burns into the skin of the casting. It is essential, if a clean casting is to be obtained, that steps be taken to prevent the bentonite in the facing composition from becoming fused to the surface of the casting and acting as a bond between such metal and the sand particles in the face of the mold all without interfering with its characteristic function of acting as an agent or as a wick, so to speak, which feeds moisture from the green sand of which the mold is formed to the adhesive gummy ingredient of the facing composition, thus insuring that such composition will be adhesively anchored to the mold surfaces. This is accomplished in my new process by having present a sufficient quantity of a smoke-produc-

ing hydrocarbon such as coal tar pitch, rosin, naphthalene, crude water gas tar or any material which on burning, will produce a large quantity of fine soot or carbon smoke. Then the action is as follows—the metal runs into the mold (already dusted) and strikes the facing dust which has already anchored itself to the surface of the mold—the bentonite has done its work). The heat of the metal sets fire to the pitch or tar or hydrocarbon, which starts to burn in a limited supply of air in the mold. It produces under this condition of a lack of oxygen, a lot of black soot under a slight pressure as the pitch generates a big volume of gas. This carbon or soot is forced against all surfaces of the mold and completely coats the bentonite particles ahead of the metal and all surfaces inside the mold. Thus there is a protective coating of colloidal carbon over the bentonite when the metal strikes it and the bentonite is thus not fused to the casting. In other words, the facing layer itself is self-smoked by the action of the metal starting to run in the mold.

This same action that frees the bentonite from the metal accomplishes another very important reaction and one which to date has never been accomplished by a dust facing. The presence of the carbon-producing hydrocarbon smokes not only the bentonite but smokes the vertical walls of the mold on which no facing was put. As an example, if a flat plate is cast and the mold is only dusted on the drag or bottom side, the smoke produced by the burning hydrocarbon will partially face the cope or upper half and the sand will peel away very much easier. The same thing applies to the vertical walls of the mold. They are coated by the carbon soot and will peel more easily.

The difficulty encountered in the proper distribution of the dextrine over the coke particle, may be compared to the top of a table which is covered with a film of grease. If a water solution of anything is wiped over the table, the water will pull up into small balls and will not spread evenly over the surface. Local concentrations will occur. This condition is overcome in my new process by the use of a "wetting" agent which reduces the surface tension of both the coke and the solution of dextrine so that the film spreads evenly.

One would naturally assume that the finer the particle size of material dusted on a mold surface, the smoother will be the resulting face of the casting. However, these results do not follow, as actually the finer the material dusted on the mold the rougher the surface of the casting becomes. Accordingly the "orange peel" effect is increased by a finer dust. This has been traced down to the fact that the finer dusts will build up on the peaks of the sand particles comprising the mold surface and due to their irregular shape and lightness will not roll down and fill the interstices between the sand particles comprising the mold surface. If a material can be first made to fill the valleys and then reach a level, a smooth, level surface will be obtained on the mold surfaces faced therewith and the resultant casting will be smooth. For this reason it was necessary to make the coke particle impregnated with the soot-evolving hydrocarbon spherical or bead-like or nearly so, in order that it would readily roll off of the peaks of the sand surface of the mold and into the interstices or so-called valleys thereof. Exactly the same phenomenon is involved as in the case of a stone rolling down hill until it reaches the bottom, if the same were round, whereas were the

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same angular or irregular in shape it not only would not travel easily down the slope but would in all probability stop before reaching the bottom.

Other carbonaceous materials, such as graphite, plumbago, gas-retort carbon and the like may be advantageously employed in lieu of finely powdered coke, which latter is the preferred material for use in the carbonaceous base. Also, in lieu of dextrine, other water-soluble adhesives such as gum arabic, gum Tragacanth, soluble starches and the like may be substituted with excellent results.

The percentages of the various ingredients that are incorporated with said finely powdered coke or like carbon base may vary within wide limits, for example within the following ranges, viz.,

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|-------------------------------|----------|
| Bentonite | Per cent |
| Water-soluble adhesive | 5 to 40 |
| Wetting agent | 2 to 15 |
| Heavy, pitch-like hydrocarbon | 1 to 2 |
| | 5 to 30 |

Various modifications within the scope of the appended claims may be made without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. The method of making a carboniferous facing for green sand molds, which comprises incorporating with a carbon base a minor proportion of a pitch-like substance capable of freely evolving sooty fumes upon contact with molten metal thoroughly agitating the mixture, heating the mixture during such agitation until the pitch-like substance is melted and whitish fumes are evolved, cooling the mixture below the melting point of the pitch-like substance, while still so agitating the same, to thereby convert the mixture into a mass of spheroidal particles that are essentially water-repellant, then while the mixture is still at a temperature below the melting point of the pitch-like substance and while still so agitating the mixture adding a minor proportion of a water soluble adhesive, a dilute aqueous solution of a "wetting agent," a substantial quantity of bentonite, but less than the amount of the carbon base and then reducing the resultant mass to a substantially dry powder.

2. The method of making a facing for green sand molds, which comprises mixing together a major proportion of a carbon base and a minor proportion of a heavy normally solid hydrocarbon, having a melting point between about 160° C. and 400° C., which is capable of evolving voluminous sooty fumes upon contact with molten metal thoroughly agitating the mixture, heating the mixture until the hydrocarbon is melted and whitish fumes are evolved, then cooling the mixture below the melting point of such hydrocarbon while still so agitating the same and intimately incorporating in the mixture a water soluble adhesive and a dilute solution of a "wetting agent," reducing the resultant mixture to substantial dryness while still retaining therein a few per cent of water, then gradually introducing into dry mass, while still hot, a substantial percentage, but less than the amount of the carbon base, of powdered bentonite and then heating the mixture to evaporate the moisture therefrom and reducing the resultant product to a powder.

3. The method of making a facing for green sand molds, which comprises heating together a major proportion of a carbon base and a minor proportion of a pitch-like heavy hydrocarbon capable of evolving sooty fumes freely upon contact with molten metal thoroughly agitating the mixture,

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continuing the heating until the hydrocarbon is melted, cooling the mixture below the melting point of the hydrocarbon while continuing such agitation until the particles of the mixture are of generally spheroidal form and become substantially water-repellant, then adding a water soluble adhesive agent and a very small percentage of a "wetting agent" together with some water which latter is relatively hot while continuing such agitation, allowing the mixture to swell, then heating the same to remove all but a few per cent of the moisture therefrom and the mixture is reduced to spheroidal particles that are water-absorbent, then gradually introducing into the mixture, while still slightly moist, finely divided bentonite and then heating the mass until dry and recovering the same as a fine powder.

4. The method of making a facing for green sand molds, which comprises heating a major proportion of a carboniferous base with a heavy normally solid hydrocarbon, having a melting point between about 160° C. and 400° C., which is capable of evolving voluminous sooty fumes upon contact with molten metal thoroughly agitating the mixture, then while still agitating the mixture cooling the same below the melting point of the hydrocarbon and thereby converting said base and said hydrocarbon into water-repellant spheroidal particles, then when the mixture is cool converting such particles into water-absorbent particles coated with an adhesive without destroying the spheroidal form thereof, then while the particles are hot and while containing a small percentage of residual moisture intimately incorporating therewith a very substantial percentage of powdered bentonite and then recovering the resultant product as a dry powder.

5. In the method of making a facing for green sand molds as claimed in claim 4, wherein the powdered bentonite is introduced by air-floating the same into the mass of hot, water-absorbent spheroidal particles while said mass is being agitated.

6. A carbonaceous facing for green sand molds, composed principally of water-absorbent spheroidal particles having kernels composed of particles of a carbon base impregnated and coated with a pitch-like hydrocarbon capable of evolving voluminous sooty fumes upon contact with molten metal during the pouring of a mold faced with such facing and such spheroidal particles having an external coating of bentonite particles adhesively united thereto, said facing being in a dry state.

7. A facing as claimed in claim 6, wherein the carbon base consists of coke.

8. A facing for green sand molds for use in casting metals, which is composed essentially of water-absorbent particles having a pitch-coated carbon kernel in each of them and which particles are essentially spheroidal in form and have an external coating of bentonite particles adhesively united thereto, the said facing being adapted when dusted upon the surfaces of a mold to present a smooth even surface to metal flowing thereover.

9. In the method of casting metal in sand molds, the steps which comprise adhesively uniting to the surface of a green sand mold a dry facing composition comprising principally a dust-like carbon base whose particles are coated with a normally water-repellant pitch-like material, and yet are water absorbent substantially throughout the same and are of spheroidal form and which composition also contains a substantial per

cent of uncoated free particles of bentonite which are adhesively united externally to the pitch-like material with which the base particles are coated, then pouring hot molten metal into such mold and creating therein a sooty gaseous envelope around the free bentonite particles, that are in proximity to the flowing metal, sufficient to heat-insulate such particles of bentonite and substantially prevent the fusion thereof to the surface of the resultant casting.

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