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CARBONACEOUS ADDITIVE FOR MOLDING SAND

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This invention relates to carbonaceous additives for foundry molding sands, and particularly, to a thermoplastic carbonaceous additive. Molding sands, in general, comprise various mixtures of silica grains and clay particles to which may be added a wide variety of carbonaceous materials, such as seacoal, gilsonite, high melting point coal tar pitch, asphalt, lignin, sawdust, wood flour, dextrine, farinaceous flour and gelatinized starch.

These carbonaceous additives, when utilized in various combinations or proportions in a built or synthetic molding sand, impart molding and packing characteristics to the sand which are different from those which the sand would otherwise have, and also, determines to a substantial extent the physical and chemical, or "thermal" reaction of the mold when the hot metal is poured into it. Although there are innumerable theories as to chemical and physical reactions of the various carbonaceous ingredients of molding sand when the metal is poured, the variety of the molding problems and the variety of the available carbonaceous additives has made it difficult to formulate theories of any substantial scope as to proper blending practices. On this account, the selection of specific molding sand compositions for specific purposes has depended, for the most part, on empirical experiences and preferences which have developed in each particular foundry.

The present invention relates to an improvement in thermoplastic carbonaceous additives such as asphalt and pitch which hereinafter will be termed "bituminous plastic." Materials of this nature may be desirable in a synthetic mold sand either because of their adhesive characteristics which impart desirable molding characteristics to the sand prior to the pouring of the metal or because of chemical characteristics which impart desirable thermal properties to the mold when the metal is poured, or both. In any event, for whatever reason the bituminous plastics are employed, one problem is always present, namely, that of admixing the bituminous plastic with the molding sand.

Customarily, the bituminous plastic is ground up into pulverized condition and then physically mixed with the silica grains and clay particles. The ease with which this operation may be performed depends, of course, upon the discreteness of the grains or particles of the bituminous plastic. In order to avoid the maintenance of the machinery for grinding the bituminous plastic in the foundry, where it would be used only occasionally, it is desirable practice to grind the bituminous plastic at a point of manufacture then ship it in sacks or other containers to the foundry where it may be stored and then used as needed. This practice has the disadvantage that the pul-

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verized bituminous plastic tends to set up in shipment or storage, particularly under pressure or if it gets warm, or both, that is, the grains or particles of bituminous plastic tend to stick together or congeal or coalesce thereby making it difficult to mix the supposedly pulverized plastic with the sand of the composition.

One of the objects of the present invention is to provide a pulverized bituminous plastic additive for foundry molding sand which retains its pulverulent condition both in shipment and in storage despite heat and pressure of the order to which it is apt to be exposed. Another object of the invention is to provide such carbonaceous additives which have generally desirable characteristics both from the point of view of forming the mold and of modifying the thermal reaction of the mold when the metal is poured. In other words, it is the object of this invention to provide a pulverulent bituminous plastic for use in molding sand which has, at least, all of the desirable properties which are characteristic of bituminous plastics, but which retains its pulverulent form during shipment and storage.

I have discovered that if furfural residue is blended with a pulverized bituminous plastic, the tendency of the bituminous plastic to set up during shipment or storage is offset, and further, that both the molding and thermal characteristics of the sand to which the mixture is added are also improved.

Furfural residue is a partially carbonized cellulosic material which is essentially acidic in its chemical reaction. Furfural residue is recovered from the manufacture of furfural and comprises approximately equal portions of soft carbon and cellulose. A typical furfural residue is that resulting from the manufacture of furfural according to the process described in United States Patent No. 1,735,084, issued November 12, 1929. Obviously, other cellulosic materials may be subjected to conditions of temperature and acidity to provide a mixture of soft carbon and cellulose which is the equivalent of the furfural residue which is a by-product of the manufacture of furfural. Thus, the term "furfural residue" as used herein is intended to comprehend the members of a general class of partially carbonized celluloses which are physically and chemically the substantial equivalents of the by-product residue of the process of said Patent No. 1,735,084.

The bituminous plastics which are suitable for use in the present invention comprise, in general, gilsonite, petroleum by-product asphalts having melting points of from 200 to 360° F., coal tar pitches having melting points of from 265 to 325° F., both melting points measured by the ball in ring method. Whenever desired, the bituminous plastics may be constituted by blend-

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ing higher and lower melting point bitumens to provide the desired characteristics.

In manufacturing the carbonaceous additive of this invention, the bituminous plastic and furfural residue are ground together in the desired proportion to such fineness that 60 to 70 per cent of the ground materials pass a 50 mesh United States Standard screen sieve.

I have discovered that if as little as 10 per cent furfural residue is mixed with many bituminous plastics to form an even homogeneous admixture, then the materials may be shipped and stored in sacks or other containers without setting up or without the particles of bituminous plastic adhering one to another sufficiently to interfere with later admixture with a molding sand. However, if more than 70 per cent furfural residue is added to the bituminous adhesive, then the adhesive properties of the mixture is apt to be inadequate after addition of it to the molding sand. Compositions within this general range, 10 to 70 per cent furfural residue, 90 to 30 per cent bituminous adhesive, both by weight, not only provide carbonaceous additives for molding sand which have all of the desired properties of straight bituminous plastics, but also have the added advantage of ready mixability, regardless of adverse conditions of shipment and storage.

The above suggested proportion of bitumen to furfural residue is merely a general statement of the order of proper proportioning. The exact ratio which is suitable for any particular additive will depend upon the nature of the ultimate molding operation and on the characteristics of the bituminous material selected. The point is to use at least enough furfural residue to prevent the grains of bitumen from amalgamating, but not enough to impair the adhesiveness of the final product when used. While 10 per cent furfural residue content may be adequate for some bitumens, such as pitch, as much as 30 per cent furfural residue may be necessary to properly protect some asphalts against amalgamation of particles. Likewise, the upper limit of amount of furfural residue which may be used depends on the nature of the bitumen and the nature of the molding operation. Thus, 70 per cent of the furfural residue is not absolutely the upper limit of the amount which may be used, provided the bituminous material is selected in relation to the molding operation so that the admixture is sufficiently adhesive in fact under the conditions under which it is actually used.

As examples of mixtures which have proved satisfactory in commercial use, 60 parts furfural residue by weight and 40 parts of petroleum by-product asphalt of 250° F. melting point (ball in ring) are ground together to constitute a homogeneous admixture. Or 30 parts by weight furfural residue are similarly ground with 70 parts by weight high melting point coal tar pitch having a melting point of from 290 to 310° F. (ball in ring).

These compositions have advantages over straight bituminous plastics in many additional respects. In the first place, the presence of furfural residue tends to facilitate the intermixture of the asphalt and the sand grains, that is, it tends to make them go together so that their masses interpenetrate more readily than if furfural residue is not present. Additionally the water repellent tendency of the bituminous plastic and mixtures of it with sand is materially reduced by the furfural residue. In the next place, the sands made up with bituminous plas-

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tics and furfural residue pack better than a similar molding sand without the furfural residue. Also, the acidity of the furfural residue beneficially controls the tendency of the clay particles to swell in the presence of moisture.

When the hot metal is poured into a mold, constituted by the sand grains, clay particles, bituminous plastic and furfural residue, the quick combustibility which is necessary to control the sand expansion is provided by the furfural residue. Also, when bituminous plastics are used without furfural residue there is a tendency for the inner surfaces of the mold to be formed into cokelike masses by the hot metal. The furfural residue tends to prevent the formation of these cokelike masses. The furfural residue itself comprises fixed carbons and carbons which are readily volatilized in desirable proportions so that its use inherently imparts balance to the characteristics of the molding sand.

It is also possible to incorporate into a molding sand any other desired carbonaceous materials, in addition to the admixture of bituminous plastic and furfural residue. However, as previously intimated, the exact blend of ingredient for constituting a molding sand suitable for any particular molding operation is an empirical matter, in the sense that there are, and can be, no standards. In all cases, the blends must be, and are, built up by choosing particular combinations of silica grains, clay particles, and carbonaceous additives. Thus, the carbonaceous additive of this invention provides the blender of molding sands with a unique bituminous plastic which is devoid of the objectionable qualities of the previously available bituminous plastics and is possessed of positive and desirable characteristics of its own.

Having described our invention, we claim:

1. A carbonaceous additive for molding sand, said additive comprising 90 to 30 per cent pulverized bituminous plastic by weight and 10 to 70 per cent pulverized furfural residue said furfural residue being the solid residuary product resulting from the acid hydrolysis of pentosan containing material to form furfural by weight mixed together to constitute a homogeneous body which does not cake in storage but has adhesive properties when used.

2. A carbonaceous additive for molding sand, said additive comprising substantially 40 per cent pulverized high melting point coal tar pitch by weight and substantially 60 per cent pulverized furfural residue said furfural residue being the solid residuary product resulting from the acid hydrolysis of pentosan containing material to form furfural by weight mixed together to constitute a homogeneous body which does not cake in storage but has adhesive properties when used.

3. A carbonaceous additive for molding sand, said additive comprising substantially 30 per cent pulverized petroleum by-product asphalt by weight and substantially 70 per cent pulverized furfural residue said furfural residue being the solid residuary product resulting from the acid hydrolysis of pentosan containing material to form furfural by weight mixed together to constitute a homogeneous body which does not cake in storage but has adhesive properties when used.

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No references cited.