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FOUNDRY COMPOSITION AND METHOD

Thomas E. Barlow, Jackson, Ohio, assignor, by mesne assignments, to International Minerals & Chemical Corporation, Chicago, Ill.

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My invention, relating generally to foundry practice, more particularly concerns not only foundry compositions, typically foundry cores, but as well, a method of producing the same.

One object of my invention is to provide a method both of producing foundry core compositions and of producing foundry cores therefrom, which method is at once simple, rapid, certain and predictable in its results, and while appreciably minimizing the manipulative time heretofore required, demands only a small number of procedural and manipulative steps, requiring only modest labor demands of but limited skill.

Another object is to provide a foundry core composition which can be quickly and rapidly produced from materials which in themselves are inexpensive and readily available throughout the country, which is relatively free from stickiness or tackiness during production, and this with moisture content appreciably lower than heretofore employed, by the use of which composition both the surface of the core itself and the resultant cast metal surface are improved, and in which, upon the inclusion therein of the usual quantities of added binder, appreciably greater tensile strength and hardness are achieved in the finished core, or alternatively smaller quantities of customary binder additives such as commercial core oil or commercial resin core binders will produce entirely satisfactory strength and hardness in the finished core.

A further object of my invention is to provide a foundry core which can be rapidly and readily formed, and which when produced, not only displays the required high green strength and moldability, but possesses required hardness of the finished core, and this with achievement of excellent surface detail in the poured casting without necessity of employing a core wash; and in which, without detrimental results, a moderate quantity of argillaceous substances may be included along with the clean silica sand, for increased green strength.

Other objects and advantages of my invention will in part be obvious and in part more fully pointed out hereinafter, during the course of the following description.

My invention accordingly may be seen to reside, not only in the combination of substances, mixtures of materials and composition of ingredients, but as well, in the several manipulative steps, and in the relation of each of the same to one or more of the others, the scope of the application of all of which is more fully set forth in the claims at the end of this specification.

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As conducive to a more thorough understanding of my invention, it is to be recalled at this time that the production of foundry cores interposes a number of problems which are unique unto themselves, and which are encountered only in this phase of foundry practice. In short, the production of foundry cores is much more difficult than in the production of foundry molds in general. Now, it is well recognized in foundry practice that unfortunately, ordinary silica sand alone does not give rise to a core sufficiently hard or strong to answer the requirements which it must satisfy, either in its "green" or in its final "baked" form. Thus, the practice has arisen, starting some years ago, of employing a drying oil, a thermal-setting resin, or a thermal-setting pitch as an additive to the sand, in the form of a binder.

Such binders which impart desired baked strength, however, do not in themselves give rise to requisite green strength. Accordingly, to these binders are frequently included additives of which starch, dextrin, glue or other drying-type glues and binders are typical. All such additives to the silica sand are extremely expensive when compared with the cost of the sand itself, and when measured in the light of the use to which the mold is put.

Some practical difficulties as concerns the physical properties of foundry core compositions have been introduced as a result of the recently growing reliance on mechanical devices known as core blowers. The two somewhat inconsistent requirements exist for use in such machines that while the sand must have cohesiveness or "green" strength sufficient to maintain its proper shape during handling, at the same time it must be free from adhesion to the core box or mold, i. e., it must display minimum stickiness. Moreover, core sand for blowing operations must display ready flow qualities under normal operating conditions.

An important object of my invention, therefore, is to remove or to minimize in substantial measure the disadvantages and defects heretofore confronting the art, and at the same time to approach in practice the maximum theoretical characteristics of core binders under prevailing industrial practices. Another important object is to eliminate or at least to minimize the necessity for coatings or core washes. In one sense, my invention comprises a mode of improving existing binders and of increasing the commercial utilization and ease of handling them.

And now having reference to certain typical

embodiments of my invention which I now set forth simply by way of illustration, it may be noted that in general the binders heretofore employed have the effect of "setting" or hardening upon exposure either to air or to elevated temperatures, or both. They are frequently called "thermal-setting" for that reason. It is an important object of my invention to diminish the quantity of such thermal-setting binder for the various reasons hereinbefore set forth and for other reasons as well, all as will be pointed out hereinafter.

Basically, then, my invention involves the proper combination of a petroleum hydro-carbon, non-thermal-setting resin of high melting point with a thermal-setting binder of the general type heretofore employed. When this is properly done, a marked improvement is achieved in the effect of the binder, all as will hereinafter be pointed out, and upon the total quantity of such thermal-setting binder which is required. To achieve successful blending of the non-thermal with the thermal-setting binders, and to insure compatability of my non-thermal setting binder both with the thermal-setting binder and the water content of the sand, I employ an emulsifying agent and an aromatic solvent for the thermo-plastic hydrocarbon.

As has already been suggested, my invention has applicability to all three known types of thermal-setting binders, including the oils, resins and pitches. Within each of these three classes the modifications possible are too numerous for ready discussion. They have, however, in common the general characteristic that they set or harden in such manner as to bond the sand together in a hard stable mass through the application of air or heat, or both. My first discussion, therefore, will be directed to the treatment of the oil type of binder.

It may be stated without fear of successful contradiction that the core binders most commonly in use at the present time are the "oils." These binders are either formed entirely of, or contain, an appreciable amount of polymerizing or drying oils, such as tung-oil, soy-oil, and similar thermal- or air-setting organic oils. Since they display little or no ability to bond sand at room temperature, that is since in foundry parlance they display no "green" strength, these oils are commonly admixed with cereals, dextrin, starch, clay or other adhesives. While these additives impart requisite green strength, there are certain undesirable features attendant upon their use, as will be pointed out. Moreover, since these drying oils oxidize to at least some extent at room temperatures they display a certain amount of stickiness, i. e., absence of ready flow qualities.

Now, I have discovered that when such binders, either alone or when admixed with substances imparting green strength thereto, are combined in proper manner with a thermoplastic or non-thermal-setting hydrocarbon, either vegetable or mineral, and when this last-mentioned hydrocarbon is suspended, along with a suitable emulsifying agent, in proper carrier, this characteristic stickiness is no longer evident.

Perhaps the most active or important ingredient in my new additive is the non-thermal-setting hydrocarbon resin. For this purpose I employ a petroleum-base resin having a melting or softening point of approximately 325° F. and a decomposition point of approximately 600° F. Its ductility or plasticity at room temperatures is such that it is not activated by aromatic solvent or by bonding agents, such as drying oil, thermal-setting resins or any solvents which are normally used in introducing such binders into core sand. This latter point is most important, for should the thermoplastic hydrocarbon resin be plasticized or activated by the solvents, it will produce a continuous phase and thereby dominate the physical properties of the core. Because of the non-thermal-setting qualities of the resin, the resultant core in which its physical properties predominate will be soft and weak.

It is important that the resin employed have a melting point below that at which drying oils or thermal-setting resins become set or hard. That is, the melting point must not exceed 400° F. For, if this requirement is not satisfied, then the thermo-plastic resin would quite likely enter into the bonding phenomenon. Or, because of its thermoplastic characteristics, it would detrimentally reduce the hardness and strength of the baked core. With a melting point below the setting or hardening temperature of the thermal-setting resins, however, the thermo-plastic resin melts and serves to coat the sand grains before hardening takes places, and in this manner effectively removes itself from the binding phenomenon. Thus removed, the melted thermoplastic resin does not detract from the baked core properties. In this regard, Vanadiset is found to be eminently satisfactory.

Vanadiset is a non-thermal setting petroleum pitch which is substantially free of products that are volatile below about 550° F. It is black in the mass, fractures conchoidally and gives a brown streak on porcelain. The specific gravity at 77° F. is about 1.12 and the molecular weight about 3200. It softens at 170° F. to 340° F. and is soluble in carbon disulphide, benzene and other aromatic solvents. Vanadiset essentially consists of asphaltenes 20% to 70%, asphaltic resins 5% to 15%, and oil constituents 26% to 51%, with carbenes not over about 1%. Chemical analysis reveals that it contains about 21% to 64% unsaturated hydrocarbons, with the fixed carbon content amounting to about 36% to 18% and the hydrogen content about 9% or less. The ash content is less than ½% of which vanadium is the principal constituent. (See, United States Patent 2,409,437 and the Bulletin of October 1, 1947, of the Wilson Carbon Company, Inc., 60 East 42nd Street, New York 17, New York.)

From a purely theoretical position, and in order to impart maximum flow qualities to the sand and maximum freedom from stickiness, as well as to keep the moisture content of the sand to a minimum, I would prefer to employ for the thermo-plastic additive a binder comprised 100% of the thermo-plastic hydro-carbon. From a practical standpoint, however, and from necessity, I introduce along therewith both a solvent and an emulsifier. This solvent serves as a carrier for the thermo-plastic resin and permits the same to be readily distributed through the sand mixture. The solvent employed must be compatible with the resin which I use; and through experience I find aromatic petroleum solvents to be preferable. I have, however, used kerosene and mineral spirits with some success. Since it is quite likely that the solvent itself probably detracts to some extent from the maximum benefits attendant upon the addition of thermo-plastic resin, I maintain the quantity of such solvent at a minimum consistent with obtaining workable viscosity and fluidity in the combina-

tion, the solvent amounting only to some 10% as a minimum.

Moreover, since water is the moistening element usually employed in foundry compositions, particularly core sands, my additive must not only be compatible with thermal setting resins and thermal-setting pitches, but as well, reasonably compatible with water. To satisfy this requirement, I employ an emulsifier. To this end, I incorporate in the additive up to 5% by weight of a soap or a combination of tall-oil and ethylamine. Other than to insure the compatibility of the thermo-plastic resin with both water and the drying oils and thermal-setting resins, the emulsifier does not enter into the action, and has no direct bearing on the core effect obtained. Similarly, stearines, lubricants or humectants may be included in the basic additive to improve certain results thereof. These, however, are in no sense a substitute for all or any part of the basic additive.

A simple and typical embodiment of the basic additive is as follows:

	Percent
Vanadiset resin	about 31
Aromatic solvent	about 66
Soap (12% diethylamine—88% tall-oil)	about 3

In treating foundry core sand, the sand first is mulled with core oil, this amounting to some one to six quarts for 1000 pounds of silica sand. Along toward the end of the mulling cycle, I introduce my new additive in the amount of one-half pint to two quarts for the proportions of sand and core oil noted. The mulling is then continued until thorough mixing is had and the treated core sand is ready for use.

When my new additive is employed in small amounts, say from one-half pint to about one quart per 1000 pounds of core sand containing a core-oil mixture, either with or without other additives imparting green strength thereto, a marked improvement is displayed in the ability of the sand to flow into position in the core box. Moreover, a marked decrease is observed in the formation of sticky films on the core boxes, on the tools, and on the person of the operators. The presence of such additives is found to prevent plugging or closing of screens, vents and other portions of equipment used for blowing the core sands into the core box. All of these advantageous features sum up to the fact that effective use of blowing machines can be achieved with foundry compositions produced according to the practice of my new invention.

As an illustrative embodiment, in a 1000 pound batch of sand wherein I employ a linseed-base drying oil, together with cereal or corn flour to impart green strength thereto, with water admixed thereto I find that the inclusion of one-half pint of my new additive, comprising a thermo-plastic hydrocarbon in the presence of an emulsifier and a solvent, permits a reduction of one pint in the amount of drying oil used, as well as the elimination of the approximately one-half pint of kerosene which was formerly required as a lubricant or release agent. That is, where three pints of drying oil were heretofore required, by my practice this can advantageously be reduced to two pints.

Moreover, the necessity of cleaning or washing the core boxes with kerosene or lye to remove the adherent sand is completely eliminated. Finally, the average weight of the blown core I find to be

increased approximately 6%. This indicates a substantial improvement in density without noticeable increase in cost. Improved surface detail is observed. This increase in density in turn apparently is attendant upon the improved flow qualities of the sand following upon the inclusion of my new binder additive. Smoother cores are observed to result, with accurate attention to surface detail, and with minimum penetration of the molten metal into the face of the core. The necessity for dipping or washing the cores is minimized and the smoother casts resulting are accompanied by a reduction in the number of rejects occasioned by improper dimensioning of the cored sections of the castings.

I have discovered that the inclusion of thermo-plastic hydrocarbon in proper manner in accordance with the teachings of my invention appreciably diminishes the detrimental stickiness of the core composition as heretofore observed. Probably because of this, I have further observed that when my new composition is employed, there is no longer necessity for frequent cleaning of the blowing equipment and of the flasks to remove the sticky film formations. This advance in the art assumes considerable importance when it is considered that I materially increase the rate of core production by decreasing both the number and duration of non-productive steps and the amount of labor employed in connection therewith. Moreover, absence of stickiness is accompanied by appreciable reduction in the plugging or obstruction of vents in core blowers and the like. That this last feature involves appreciable improvement in quality of product is evident when it is considered that when carried to a certain point obstruction of these vents prevents the proper manufacture of a sound or solid core. This is due to the fact that the free egress of air from the flask through the vents is blocked. The trapped air creates back pressure which, building up upon flow of sand therethrough, eventually prevents the sand from filling the core-box cavity and conforming to the outline of the core.

It has long been recognized in the art that the pick-up or absorption of water by the baked core, an undesirable characteristic of baked core composition, sharply reduces the strength and hardness of the core. In this respect I have observed a further highly important advantage inherent in the use of my new composition in that the finished core formed of such composition displays a strongly water-repellant characteristic. This is probably due to the fact that the thermo-plastic resins which I use are in themselves essentially water-repellant, in the absence of the proper emulsifying agent and organic solvent. Thus, in the green state, after packing about the mold, it is true that these core compositions are water-absorbent. However, the emulsifying agent and organic solvent are driven off and destroyed during the baking process. The thermo-plastic resin retained in the core following the destruction of the emulsifying agent and organic solvent I find imparts its water-repellant characteristic to the baked core in highly satisfactory manner.

Among the advantages attendant upon my new practice may be listed the reduction of undesirable gas formations. Moreover, it appreciably enhances the economy of the core formation in that it frequently permits a substantial reduction in the amount of drying oil or thermal-setting binders employed. It is highly significant that this decrease in amount of thermal-setting binders can be achieved despite the fact that

none of my newly incorporated ingredients need be thermal-setting. For emphasis, I repeat that the resin additive which I employ should be thermo-plastic and I prefer that it be actually incapable of exhibiting in itself any appreciable "baked" strength. It is well known of course that the solvent and emulsifier do not serve to impart baked strength.

Returning now to a consideration of thermal-setting pitches as binding ingredients, this is not nearly so widespread as is the use of drying oils. Nevertheless, my researches in that direction disclose appreciably enhanced results attendant upon the practice of my invention, when used in conjunction with known pitch-type binders. Just as in the case of the oil-sand cores, increased flowability of the sand attends upon my new practice, along with the achievement of desired good properties with diminished water content, greater workabality of the composition and less sticking in the core boxes.

These differences effectively bring into relief the basic differences attendant upon the use of thermal-setting asphaltines or pitches as core binders on the one hand, and the use of non-thermal-setting hydrocarbon resin additives on the other hand; and this is true even though I use petroleum-base materials which are sometimes loosely likened to and classified along with the asphaltines. The essential point according to the teaching of my invention is that such additives be thermo-plastic rather than thermal-setting.

The practice also has arisen of employing, as the binding substance for imparting dry strength to the foundry composition, thermal-setting resins. Of these, urea-formaldehyde, phenol-formaldehyde and melamine-formaldehyde are typical. This use is sometimes encouraged due to the fact that these additives bake more quickly than do the drying oils, and are relatively low in gas evolution. Moreover, the residue from such cores appears to be more compatible with molding sands, and therefore, when broken up, can be mixed with fresh sand and reused, so that the operating costs are somewhat diminished. I do not know whether this increased compatibility of the treated sands as they are knocked out of the flask with fresh molding, either natural or synthetic, is due to a quality inherent in such resin additives, or whether this is simply a practical manifestation of the mact that in industrial operation, these resins are more likely to be polymerized or "baked" because they can set quickly, and in the absence of oxygen.

These formaldehyde-base resins display a number of undesirable features, however, which detract considerably from their satisfactory use in practice. Included among these may be noted an inherent tendency to stick or adhere within a core box or the like, and as well, a requirement of comparatively large quantities of water. These two characteristics greatly limit the ready use of sands treated with thermal-setting resin binders in the mechanical core blowers such as I have referred to hereinbefore.

It may be noted at this point that while theoretically it is entirely possible to obtain excellent dry strength in cores formed from foundry compositions using thermal-setting resins as binders in the presence of moisture contents below 3%, it is a significant yet very real fact that these theoretical possibilities are not achieved in commercial practice. The art has not as yet pinpointed the exact cause of this failure to realize theoretical maximum results in actual practice, but I advance the suggestion that perhaps it is attributable to the comparatively low efficiency of known commercial mullers or mixing equipment. It may be that the additive according to my invention results in increased muller or mixing efficiency, the additive perhaps serving as a catalyst with respect to the efficiency of mixing, rather than accomplishing simply an increased readiness of flow of the sand.

The desire to employ core blowers being postulated and readily understandable, a practice has arisen in the art, where thermal-setting resin binders are employed, which is undesirable in itself. This practice comprises the use of higher percentages of water as an additive to the composition during the mulling process. This develops the dry strength and hardness, but increases the undesirable stickiness and impairs the flow qualities of the composition during the blowing operation. To off-set this, the increase in water content is accompanied by the addition of "release agents" which will counteract the undesirable stickiness. Illustrative of those are stearic or oleic acid, kerosene or petroleum lubricants. For generally similar purposes, and as a possible substitute of said release agents, clay or added quantity of cereal may be employed.

These attempts to alleviate the undesirable stickiness resulting from increased water, however, are characterized by an inherent weakening or softening of the final product. For one reason or another, all such additives detract from the theoretical maximum qualities of the core. Despite this, they have been necessary heretofore in order that foundry compositions may be produced satisfying commercial requirements.

In contradiction to all the foregoing, the preparation of foundry compositions according to my new practice permits the ready and practical use in the foundry of these thermal-setting resins, with realization of the desirable characteristics attendant upon such use, at a lower moisture content than has heretofore been possible, and at the same time to avoid stickiness, and as well, the necessity of the use of release agents of either of the two types just referred to. Moreover, rather than detract from the properties of the resulting core, I find that the new ingredients employed according to my invention augment and improve these properties.

Because of certain characteristics of the thermal-setting resin, the process of introducing the thermo-plastic binder according to my invention is somewhat different from the case where core-oils are used. Whereas, in the case of drying oils, a small amount of the thermo-plastic binder may be added at any time during the mulling cycle, but preferably at the end thereof and after all other ingredients have been introduced, quite on the contrary, in the case of thermal-setting resins, optimum results are achieved when my new ingredients are mixed with the thermal-setting resins before either the thermo-plastic or thermal-setting binder is added to the sand in the mix. While I have added the new ingredients to the resin-containing composition in other manners and at other intervals in the mixing cycle with good effect, uniformly the resulting sand composition has proved to be not as satisfactory as when the thermo-plastic and thermal-setting resins are admixed prior to introduction into the sand.

Moreover, I have found that the amount of thermo-plastic resin required is greater in pro-

portion to the thermal-setting resins than in the case of drying oils, in order to achieve satisfactory results. Probably this is due to the inherent stickiness of the thermal-setting binder. When employing say a 62% solution of phenol-resin in water as the thermal-setting resin, I have achieved excellent results by admixing approximately one-half pint of 31% solution of thermal-plastic resin with one quart of the water solution of phenol-resin. This is added to 1000 pounds of clean silica sand. The foregoing is to be taken as merely illustrative of the general range of proportions. It is by no means intended to be limitative.

The permissible range of ingredients in my core composition is quite broad, ranging from some one pound of the thermal-setting resin and one-half pound of the thermal-plastic resin up to about thirty pounds of each for 1000 pounds of sand. So too, the permissible relative ranges of the two ingredients may widely vary. The lower limit of the thermo-plastic resin depends upon the stickiness of the thermal-setting resin involved. If the stickiness of the latter is high, then a larger amount of the thermo-plastic resin must be employed. The upper limit is determined somewhat from a practical standpoint. In general, it is the point at which the thermo-plastic hydrocarbon predominates the core mix, and so predominating, reduces the hardness and strength of the core below certain critical values.

The thermal-plastic resins do not in themselves impart adequate baked strength or other baked properties, and I do not believe that the use of the thermo-plastic resin would be practical from a commercial standpoint where it would be present in an amount greater than the quantity of thermal-setting resin employed. As an upper limit then, the composition would comprise 50% thermal-setting resin by weight, and 50% thermal-plastic resin. I find, however, that no apparent advantage attends upon using more than a minimum quantity, the amount needed to limit stickiness within a workable range, since the thermo-plastic binder is intended simply to permit utilization of thermal-setting binders with maximum effect, and is not in itself intended to serve as the strength-imparting binding element. This amounts to about 10%, by weight. I will discuss, however, at a later point herein, one technical exception to the foregoing.

I have suggested hereinbefore that one compromise solution of the problem of the increased stickiness resulting from high moisture content in the presence of thermal-setting resins has been to employ release agents, which have the effect of minimizing this stickiness. The necessity of this practice has been deplored by the art, because these release agents impart undesirable physical properties to the baked core, or at least, detract from the desired good qualities thereof.

I have found, however, that an important advantage attendant upon the proper inclusion of thermo-plastic resins in the sand composition is that the commonly used release agents such as stearic acid, oleic acids, or fatty acids of high molecular weight no longer detract from the physical properties of the baked core. On the contrary, and quite apart from the common expectation, I find that such release agents, when incorporated into foundry compositions in which a thermo-plastic resin is properly included often results in an actual increase in the desired qualities of the finished core. In no sense, however, do they comprise substitutes for the basic ingredients of my new composition.

To illustrate the practical value of my invention, it may be noted that I have already successfully and commercially placed my invention in use in an operation which had theretofore been typical of the practice employing thermal-setting resins. By the proper incorporation of my thermo-plastic resins therein, I find that for any given moisture content, cores of greater strength and hardness are produced than had hitherto been possible. Particularly are the desirable properties of such core sands enhanced when moisture contents of below 3% are employed. Moreover, although moisture contents below 3% are desirable for core-blowing techniques, so that increased flow qualities are obtainable, I find that blown cores can be readily produced according to the practice of my invention with moisture contents as high as say 4.2%, and this without the usual stickiness and lack of flow qualities ordinarily attendant upon such elevated moisture content.

In the practice of my invention, I find that the ready-flow qualities of my new foundry composition effectively increase the rapidity of core formation, and thereby achieve a corresponding reduction in production costs. Further, important reduction in operating costs attend upon the elimination from the composition of the release agents which counteract stickiness, an elimination which, desirable but not essential, has heretofore been virtually impossible of achievement. Also eliminated in substantial measure are the use of counteracting adhesives, which serve as green strength binders, and which materials in themselves represent a substantial element of cost. The phenomenon of "wetter feel" of the core sand embodying my new composition for a given moisture content suggests a greater compatability between the water and the thermal-setting resin. This is a possible further explanation of the success of my invention.

I have mentioned hereinbefore that the thermo-plastic resin improves the finish detail of the resultant casting. Further to improve this finished appearance, I may, where desired, introduce additional carbon into the foundry composition, thereby completely eliminating the necessity for coatings and core washes, and this without detracting one whit from the value of the new process. In point of fact, my new composition actually permits the use of certain forms of carbon which previously could not be used because of their tendency to soak up the binder, such as drying oil, or otherwise to detract from its effectiveness.

If handled properly, the thermo-plastic hydrocarbon which I employ may be used as the additional carbon material, without detracting from the effectiveness of my invention. In this instance, the amount of thermo-plastic hydrocarbon may actually exceed the amount of thermal-setting binder such as phenolic formaldehyde or urea-formaldehyde. This is the technical exception to which I have hitherto referred.

Thus, it will be seen that there are provided in my invention a method and composition in which there are achieved many new and unforeseen advantages. When my composition is incorporated in a sand mix along with a thermal-setting or air-setting binder, efficient mulling is obtained in absence of excess moisture. The core sand may be readily blown into position about the core pattern, giving sharp definition. The sand

flows freely without stickiness. Necessity of cleaning the blowing apparatus and the mold is materially diminished. Use of release agents is diminished. All these and many other highly advantageous results attend upon the practice of my invention, and this while obtaining castings of sharp definition and close dimensions, without the necessity of facing washes and with diminished labor costs.

Once the broad aspects of my invention are disclosed, many embodiments thereof will readily suggest themselves to those skilled in the art. Accordingly, I desire the foregoing disclosure to be considered as simply illustrative, and not by way of limitation.

I claim:

1. Method of producing a foundry core sand composition comprising admixing with sand a sufficient quantity of binder possessing thermal-setting qualities to impart required strength and hardness to the baked core, imparting improved flow qualities while relieving stickiness and the amount of required moisture by introducing into the mix a binder additive, the binder additive consisting essentially of 90% to 30% Vanadiset resin binder, 10% to 70% aromatic solvent and effective amounts up to 5% of soap emulsifier, the Vanadiset resin binder amounting to from 10% to 50% of the combined weight of the two binders, and mixing the additive thoroughly with the sand and binder.

2. The method of producing a foundry core sand composition comprising admixing with sand in the proportions of 1,000 lbs. of sand, 1 to 6 quarts of thermal-setting drying oil, imparting improved flow qualities while relieving stickiness and the amount of required moisture by introducing into the mix ½ pint to 2 quarts of Vanadiset resin binder in at least 10% aromatic solvent and effective amounts up to 5% of soap emulsifier, with the Vanadiset amounting to from 10% to 50% of the combined weight of drying oil and Vanadiset, and mixing the additive thoroughly with the sand and binder.

3. The method of producing a foundry core sand composition comprising admixing in the proportions of 1 lb. to 30 lbs. of thermal-setting resin, ½ to 30 lbs. of Vanadiset present in aromatic solvent in the amount of at least 10% by weight of Vanadiset, and effective amounts up to 5% of soap emulsifier, with the Vanadiset resin amounting to from 10% to 50% of the combined weight of resin and Vanadiset, and adding the same to 1,000 lbs. of core sand and thoroughly mixing.

4. A foundry core sand composition essentially consisting of the proportions: 1,000 lbs. of core sand, 1 to 6 quarts of drying oil, ½ pint to 2 quarts of Vanadiset resin binder dissolved in 10% to 70% by weight of aromatic solvent and effective amounts up to 5% by weight of soap emulsifier, with the Vanadiset amounting to from 10% to 50% of the combined weight of drying oil and Vanadiset, said composition having improved flow qualities, less stickiness and reduced moisture requirement as compared to compositions of the same ingredients without solvent and emulsifier.

5. A foundry core sand composition consisting essentially of the proportions: 1,000 lbs. of silica sand, 1 to 30 lbs. of thermal-setting resin, and ½ to 30 lbs. of Vanadiset resin binder present in aromatic solvent in the amount of 10% to 70% by weight of Vanadiset and effective amounts up to 5% by weight of soap emulsifier, with the Vanadiset amounting to from 10% to 50% of the combined weight of resin and Vanadiset, said composition having improved flow qualities, less stickiness and reduced moisture requirement as compared to compositions of the same ingredients without solvent and emulsifier.

6. A binder for foundry core sands consisting essentially of thermal-setting resin and additive consisting of 90% to 30% Vanadiset resin, 10% to 70% aromatic solvent, and effective amounts up to 5% of soap emulsifier consisting of a minor amount of di-ethylamine and a major amount of tall-oil.

THOMAS E. BARLOW.

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