Patented Aug. 23, 1938 2,127,535

# UNITED STATES PATENT OFFICE

2,127,535

## CORE BINDER

Charles Marshall Saeger, Jr., Bowmanstown, Pa.

No Drawing. Application February 17, 1930, Serial No. 429,227

6 Claims. (Cl. 22—188)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

My invention relates to a new and useful method of making molds and cores for metal castings.

Previously in this art the hot metal coming in contact with the mold and core surfaces causes the sand in contact to burn into the adjacent surfaces of the metal and produces castings of rough exterior and interior surfaces, which surfaces are formed of an integral film of mixed metal and sand. This, as well as the removal of the cores and the cleaning of the un-integral sand from the casting, has heretofore been an expensive, laborious and dusty task frequently requiring the use of pneumatic chisels and other tools, while in the machining of such castings the integral film of sand and metal is difficult to machine unless the tool in its first cut penetrates beyond the depth of such film.

In the prior art many cracked castings have been produced due to hard cores and molds which do not crush readily as the metal casting cools, contracts and solidifies, and such castings are a constant source of substantial loss in all foundries but more especially in aluminum and kindred metal castings.

A further constant source of substantial loss in the prior art of metal casting has resulted from mold and core blows due to the low permeability of the sand forming such molds and cores.

In the past many endeavors has been made to overcome these very objectionable conditions and losses. Some of these attempts have been to form the molds and cores of green sand, which is the ordinary molding sand of commerce, but the liability of such molds and cores to be washed in part into the molten flowing metal being cast prevents or renders hazardous, their use in many cases.

To provide molds and cores of more strength than possessed by green sand molds and cores, it heretofore has been common practice to embody a binder in the sand of, either or all, clay, molasses and water, flour and water, and oil, and to indurate such molds and cores by baking. Such molds and cores have all the aforesaid defects except the tendency to wash into the flowing molten metal, while the thus formed harder molds and cores increase the cracking liability of the castings as well as tend to increase the liability of the castings to blow due to the lesser porosity of such molds and cores.

Heretofore volatile substances have been employed in and about the foundry in the molding and core rooms, for instance in applying the same to the mold or core as a whole or to the surfaces thereof and then ignited to dry the mold sufficiently before the molten metal was cast therein or thereabout; but such a practice adds a very substantial fire hazard and explosion hazard. Furthermore, such volatiles become impregnated in the air, breathed by the operatives, which tend to harmfully affect the operatives physically and in their efficiency.

Heretofore in the production of molds and cores employing the binders of the prior art with their respective solvents or diluents, it has been the practice to bake such molds or cores with a heat sufficient to break down and gasify, in whole or in substantial part, the binding material ingredients which would otherwise tend to blow or otherwise injure the casting to be made therein. This high heat involves an expensive process which results in many cores and molds, in whole or in part, becoming too hard and resulting in cracked castings and/or becoming so dense that the casting gases cannot escape therethrough with the result that the casting is lost because much of its essential metal is blown out of the mold by the escape of such gases through the opening or openings by which the molten metal enters the mold.

The object of my present invention is to provide a method and means for foundry practice which overcomes the objections and difficulties heretofore stated among others.

To attain these and other objects, and in accordance with the general features of this unitary invention of related and interdependent components, my improved method contemplates a binder for the ingredients of molds and/or cores which does not have to be burnt from or broken down and gasified in whole or in part in the mold and/or core before the same may advantageously be employed in the making of the casting, and which results in the production of a better mold and/or core of higher efficiency and economy. It further contemplates that the binder for the mold and/or core which contains an ingredient or ingredients which will remain in the mold or core at least until during the making of a casting in such mold and/or core, and that the heat reaction between the cast metal and the mold and/or core will commence to decompose or break down or gasify in whole or in part one or more of the binding ingredients which will result in the production of clean solid castings in whose surfaces particles of the mold and/or core will not be embedded or otherwise adhered thereto and which may be more readily cleaned.

In my present invention I employ any of the

classes of thermoplastics which have rubber-like characteristics such as chlorinated rubber and each member of the class of halogenated rubber and derivatives thereof, plastic derivatives of rubber, rubber or scrap rubber, either or both, that has been subjected to an elevated temperature alone or in the presence of sulphuric acid or a sulphonic acid or a sulphonyl halide, balata, gutta percha, chicle, jelutong, and other rubber-like gums, such as the inferior guttas, representatives of which are gutta siak, gutta soh, gutta sundik, gutta jangkar, gutta hangkang. It may also include dispersions of one or more of said substances as well as mixtures in which one or more of said substances are substantially present. It is also contemplated that one or more of said substances may be used with a solvent which reduces the same substantially to a liquid which is applied to or commingled with the material forming the mold or core. This is only one of the convenient ways for obtaining such a mixture with the sand or other constituents forming the mold and/or core. Another way of obtaining the same intimate mixture is that the one or more of said substances be reduced to a powdered or granular form which may either be mixed in such condition with the sand or other constituents of the mold or core or the granules or particles of such substance or substances may be mixed with water or other liquid and then mixed with the constituents of the mold or core; or instead of being intimately mixed throughout the premolded molding sands. The molding or core sands of the prior art may be used in making the mold or core and then a mixture containing one or more of the said classes of thermoplastics in the form of a liquid may be coated, sprayed, or otherwise applied to the surfaces of the mold or core, said liquid being either as a liquid liquefied by heat, or by solvents or in emulsions or dispersions.

Instead of applying the plastic to the surface of the mold or core, the plastic preferably in a powdered form may be applied to the exterior surfaces of the mold or core by being dusted or air sprayed or otherwise applied thereon, the molding consistency of the sand forming the mold or core being normally such as will ordinarily enable the dry plastic, especially in powdered form, to substantially adhere to such surfaces.

In the production of molds and/or cores requiring relatively large volumes of sand, the surfaces of the mold and/or core adapted to be exposed to the casting may be formed of sand mixed with the plastic and then the remainder of the mold and/or core made of the ordinary sand of the prior art.

Those skilled in the art will readily determine which of the foregoing, or combination of the foregoing, steps may be most advantageous employed in the production of any given casting from any given material; and such exemplification is indicative of the facility with which those skilled in the art may practice my method in other advantageous ways.

To demonstrate the practical utility of my said method it has been necessary for me to make molds and/or cores embodying my said method and invention, and including separately, many of the before mentioned, and included materials, and to form castings therewith.

In using balata I have obtained satisfactory results by using 92 per cent of sand or other mold and/or core constituents with 8 per cent of balata; or 40 parts to 3½ parts by volume. In molds and/or cores so made the green strength thereof just after molding was 3 lbs. per square inch; while after 24 hours' air drying the strength of such mold and/or core was 12.1 lbs. per square inch, while its permeability was 376 cc. which equals the number of cubic centimeters of air forced through a standard sand specimen in one minute time flowing through a given volume of such mold and/or core. In using another substance in said group or class of thermoplastics, I have employed the material which is known to the trade as "Vulcalock" in the same percentage and parts aforesaid which resulted in the production of a mold and/or core whose green strength just after molding was 3.5 lbs. per square inch; whose strength after 24 hours of air drying was 135 lbs. per square inch, and whose permeability was determined as being 136 cc. as heretofore defined.

In practice with the above specified constituents of the class as well as with other constituents of the stated class of thermoplastics, it is desirable that the amount of a given thermoplastic mixed into the sands or other components of the mold and/or core be sufficient to give the requisite strength to the mold and/or core. Molds and/or cores of one kind may require a different strength than for another mold and/or core. Also different strengths may be required in molds and/or cores for the production of the same casting but from different metals. These strengths are readily determined by those skilled in the art and the proportion of the different constituents of the before stated class of thermoplastics to be used for obtaining such required strengths in the mold and/or core may also be readily determined by those skilled in the art from their stock of common knowledge and experience applied in general accordance with the invention herein afforded.

Under favorable conditions where the strength of the ordinary green sand mold or core of the prior art would be 2.4 lbs. per square inch, my said method of producing a mold or core results, for instance, in the same having a corresponding strength of 10.8 lbs. per square inch and very much higher, when desired, and yet the permeability of my sand molds and cores is as great as, if not greater than, the green sand molds and core so that practically no castings are lost from shrinkage or the blowing of either molds or cores.

In the practice of my method where the binder ingredient or ingredients, is, or are applied to the molding sands after such ingredient or ingredients have been mixed with a volatile solvent, it is desirable that the same be removed therefrom by evaporation either at atmospheric or a higher temperature and the products either removed from the premises or the same may be recovered and redistilled for this re-use.

When one or more members of said group or family of thermoplastics be used in their water dispersion and then mixed with the molding sand, the surplus moisture of the resulting mold or core may be removed by evaporation to the desired consistency or degree.

When the one or more constituents of the aforesaid class of thermoplastics is used in a pulverized or powdered state, the same may be intimately mixed with the molding sand, each in a more or less dry state and after such intimate mixture if the mix does not contain moisture to the requisite molding consistency enough moisture may be added to supply such need.

This mixing may be done in periods more or

less remote from the time when the molding constituent is desired to be molded; and the sand or other body of the molding material mixed with said thermoplastic may be conveniently used for making molds or cores promptly after the mixture of the sand and the thermoplastic.

When a dry powdered or hydrated thermoplastic is mixed with the molding sand and such mixture later becomes too dry for advantageous molding the requisite amount of additional water may be added in retempering the molding constituents. However, this would normally afford no greater strength than the green sand mold or core of the prior art; but when greater strength would be required the mold and/or core may be treated so as to substantially plasticize at least the exterior surfaces of the particles of the plastic intimately divided in the mold or core so as to produce a stronger binding of the components of the mold or core. This plasticizing may be conveniently accomplished by the application to the mold or core of a moderate heat to the degree and general period of time requisite to produce the plasticity and strength desired.

The subject matter of this application is a continuance in part and an improvement upon my copending application, Serial No. 332,225.

The invention herein described may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon or therefor.

As to certain features set forth in the foregoing specification see also my co-pending applications Serial No. 322,225, filed January 12, 1929, for Method and means for foundry practice, and Serial No. 332,226, filed January 12, 1929, for Process and product for coating molds and cores.

Having now so fully described my invention that others skilled in the art may therefrom make and use the same, what I claim and desire to secure by Letters Patent is:

1. Molding or core sand containing balata as a binder.

2. Molding or core sand containing a plastic derivative of rubber as a binder.

3. A foundry mold or core comprising granules of a refractory substance and a binder which comprises a halogenated rubber derivative.

4. A foundry core comprising sand and a binder which comprises a halogenated rubber derivative in a volatile organic solvent.

5. A foundry mold or core comprising sand and a binder which comprises a chlorinated rubber derivative.

6. A foundry mold or core comprising sand and a binder which comprises chlorinated rubber.

CHARLES MARSHALL SAEGER, JR.