Dec. 4, 1962 F. C. MOORE 3,066,365

DESTRUCTIBLE REINFORCED SAND CORE FOR METAL CASTING

Filed July 2, 1958

FIG. 1

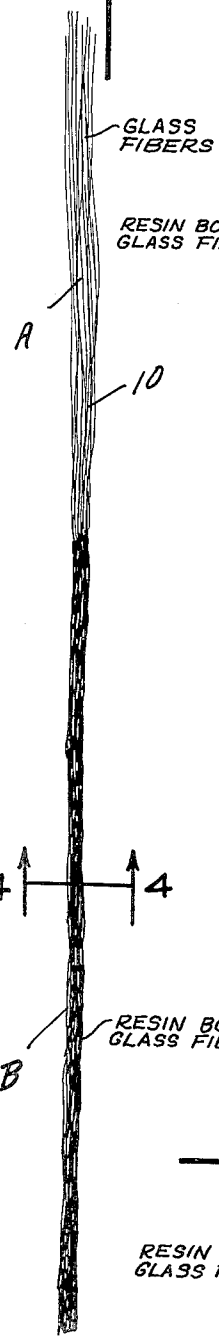


FIG. 2

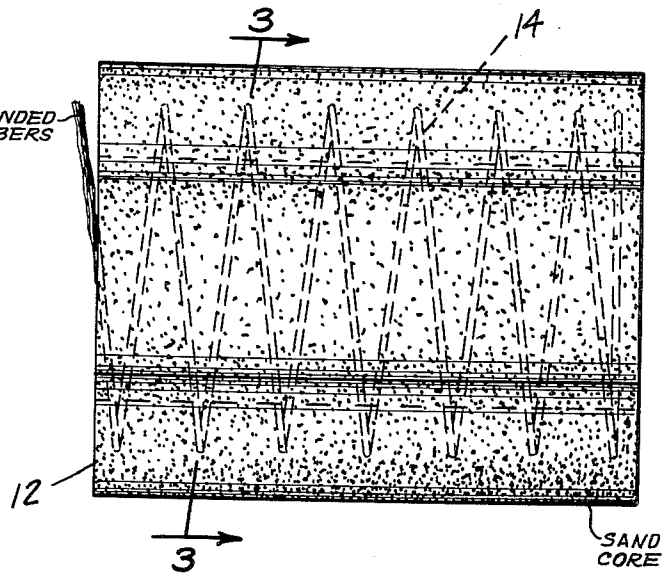


FIG. 3

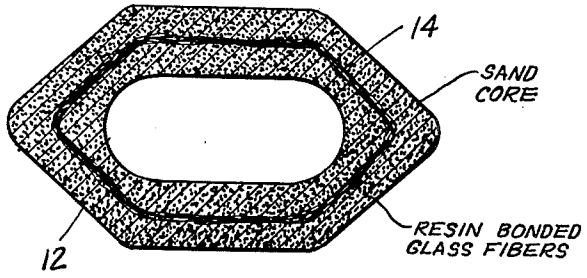
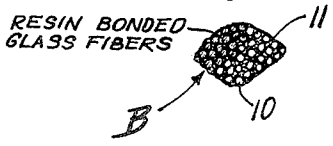


FIG. 4



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DESTRUCTIBLE REINFORCED SAND CORE FOR METAL CASTING

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This invention relates to a destructible reinforced sand core for metal casting used for casting metals and more particularly, it relates to a fabricated core reinforced with destructible, resin bonded glass fiber filaments.

In the manufacture of various castings such, for example, as automotive cylinder heads or engine blocks, it is customary to provide reinforcement structure within the cores used for forming chambers within the cylinder head or engine block such, for example, as "water jackets." Conventional reinforcement structure comprises wire disposed within the core in such a manner as to provide the necessary reinforcement when the core is placed in the mold and during pouring of the casting and cooling thereof.

Automotive engines have become more and more complex as the designs have provided greater power. Consequently, removal of the cores from the casting has become more and more difficult. It has been the practice in foundries to shake the castings, thereby to disintegrate the cores so that the core material may fall from the casting in relatively small pieces. However, such shaking does not provide removal of the wire or rod reinforcement, and because of the complex structure of automotive cylinder heads and engine blocks, removal of such rod or wire has become increasingly difficult. In fact, the rod or wire frequently becomes welded to the casting and its complete removal is almost impossible.

Accordingly, the principal object of this invention is to provide a reinforcement structure for cores of such character that it may provide adequate reinforcement of the core during formation of the core, placement of the core in the mold, and during the casting process, said reinforcement structure also being of such character that it will fracture or otherwise become sufficiently deformed during the shaking process of core removal that it is readily removable by means of the shaking process.

Another object of this invention is to provide core reinforcement structure which is substantially more economical than conventional core reinforcement structures.

Still another object of this invention is to provide a core reinforcement structure comprising fibrous material treated with a plastic material to form a wire-like or rod-like reinforcement structure of such character that it will have sufficient resistance to shear and elongation forces that it will retain its own shape and support a core material during placement of the core in a mold, pouring of a casting and cooling thereof.

A still further object of this invention is to provide a core reinforcement structure consisting of fibrous material treated with plastic material to form a wire-like or rod-like structure, the fibrous material and plastic material being of such character that the reinforcement structure will adhere to the core material when the core is baked, that no excessive amount of gas will be given off during baking of the core or pouring of the casting, that temperatures of the order of 400° F. to 550° F. will have no material effect on structural strength, that any carbonization which may occur will occur within the range of 500° F. to 1500° F. and that such carbonization will have no deleterious effect on structural strength.

In accordance with this invention there is provided a

core reinforcement structure comprising a plurality of glass fibres arranged in more or less parallel relation to one another and adhered to one another to form a wire-like or rod-like member by means of a thermosetting material of the phenolic or polyester resin classes.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

FIG. 1 is a top plan view of a core reinforcement structure consisting of elongated glass fibres, one portion of said fibres having been treated with a plastic material to form a unitary structure.

FIG. 2 is a side elevation view of a core incorporating one example of the core reinforcement structure of this invention.

FIG. 3 is a cross section taken on line 3—3 of FIG. 2.

FIG. 4 is an enlarged cross section taken on line 4—4 of FIG. 1.

The fundamental structure of this invention is illustrated in FIGS. 1 and 2 wherein a core reinforcing structure is formed of a plurality of glass fibres 10 arranged in more or less parallel relationship with one another and adhered to one another by means of a web 11 of plastic material. The portion A of FIG. 1 illustrates the arrangement of glass fibres prior to formation of the plastic web, while portion B of FIG. 1 illustrates the glass fibres after they have been joined to one another by the web 11. Thus, it is readily apparent that a wire-like or rod-like structure has been formed, and this structure will have substantial resistance to shear forces as well as elongation forces.

The glass fibres 10 may be individual fibres or strand-like combinations of individual fibres. Any well known glass composition may be used so long as it is within a class of glass compositions to which plastic materials such as phenolic resins, polyesters and other suitable plastic materials will adhere. For example, glass fibres are readily obtainable in what are commonly known as glass rovings which are several hundred feet in length and consist of a plurality of strands of individual glass fibres, although it should be understood that the individual fibres are not twisted into true strands, and the strands are not twisted about one another. It will be further understood that the glass should be a fibre glass which has been threaded to enhance adhesion of plastic materials.

Plastic materials such, for example, as phenolic resins and some of the polyester resins have been found to be well adapted for forming the web between the glass strands and fibres. For example, the portion B of FIG. 1 may be formed by impregnating, by dipping, spraying, or otherwise coating the fibres and strands with a phenolic resin containing hexamethylenetetramine as a curing agent. The resin may be diluted in alcohol to a viscosity slightly heavier than that of water, and the glass strands may be dipped in the resin by means of a conventional and continuously operating dipping machine such, for example, as machines used for coating wire with enamel or similar coating materials. The resulting combination of fibre and resin may then be cured by a catalyst method or by subjecting it to heat of the proper degree and duration.

It will be readily understood that this invention is not limited to the use of the specific plastic materials disclosed herein as any plastic material will be satisfactorily operative so long as it provides, in combination with the glass fibres, a reinforcing structure which is sufficiently rigid to hold its shape and support a core composition while the core is being baked, placed in a mold and metal is poured around the core. The plastic material must also have the ability to adhere to the core composition when the core is being baked. The plastic mate-

rial must withstand a core baking temperature of 400° F. to 550° F. and maintain sufficient strength to reinforce the core during the baking process.

Any plastic material which carbonizes within the range of 500° F. to 1500° F. during the casting process has been found to retain the necessary structural strength to maintain the necessary reinforcement of the core. The carbon has been found to adhere to the core sand and the glass fibres to a degree sufficient to provide the desired reinforcement.

After the casting process is completed, the core, together with the reinforcing structure of this invention, may be removed by shaking of the casting in the conventional manner. The reinforcing structure breaks up when the core composition breaks and, hence, the reinforcement either rattles out of enclosed areas within castings or may readily be extracted.

FIGS. 2 and 3 illustrate an example of a core having the reinforcing structure of this invention. The core 12 may be formed of conventional core composition including core sand and conventional binding materials such as a suitable starch. The core 12 is provided with a reinforcement structure 14 approximately in the form of a spiral and corresponding to portion B of FIG. 1 of the drawings. While the core 12 has been shown approximately in the form of a hexagon, it will be obvious to those skilled in the art that cylindrical, rectangular, triangular or other geometric shapes are equally receptive to the reinforcement structure incorporating this invention. The reinforcement structure 14, for example, may be formed in a hexagonal shape by first forming a linear structure such as shown in FIG. 1 and then bending the linear structure at the proper points to form the desired geometric configuration. Alternatively, the glass roving corresponding to portion A of FIG. 1 may be placed on a form having the desired geometric configuration, and the plastic material may be applied by dipping the formed roving in liquid plastic material.

From the foregoing description, it will be apparent that this invention provides a reinforcing structure for cores which is substantially cheaper than conventional metallic wire. The invention overcomes the disadvantages of metallic wire in that it does not fuse with metallic castings and readily breaks up with the core and rattles out of enclosed areas in castings where it is often impossible to remove metallic wires. The invention also provides a core reinforcing structure which maintains its original strength and shape during core baking and which will carbonize when subjected to the heat of pouring a casting. The structural strength of the reinforcement structure is enhanced by the bond provided by the plastic material between the core sand and the glass fibres. The reinforcement structure is easily formed into various shapes and does not create any problems with respect to emission of gas which might deform cores and molds. A further advantage resides in the fact that the core reinforcing structure of this invention is much lighter in weight than equivalent metallic wire structures, thereby reducing shipping costs.

The invention claimed is:

1. A baked, rigid sand core for use in metal casting comprising sand bonded together with a binder and a temporary, destructible reinforcing structure bonded to the sand within the core, said reinforcing structure comprising a plurality of continuous filament, glass fibers bonded together in parallel relation by and coated with a thermosetting resin in sufficient amount to render the structure stiff and wire-like, said resin being capable of being carbonized within the range of 500 to 1500° F. by the heat emitted during the casting of the metal but not capable of being carbonized below 400° F. so as to maintain structural strength during core baking temperatures above 400° F.

2. A method of forming a sand core for metal casting which comprises forming a temporary, destructible reinforcing structure by coating and impregnating a plurality of continuous filament glass fibers in parallel relation with a thermosetting resin in sufficient quantity to render the coated glass fibers stiff and wire-like, said resin being capable of being carbonized within the range of 500 to 1500° F. by the heat emitted during the casting of the metal but not capable of being carbonized below 400° F. so as to maintain structural strength during core baking temperatures above 400° F. combining the reinforcing structure with sand and a binder therefor with the sand surrounding the reinforcing structure to form the core and baking the core.

3. In the method of preparing a casted metal article wherein the metal article is cast into a mold and around a sand core bonded together with a binder and the casting is subsequently shaken to disintegrate the core and permit it to be readily removed from the casting, the improvement which comprises providing said sand core with a reinforcing structure bonded to the sand within the core, said reinforcing structure comprising a plurality of continuous filament, glass fibers bonded together in parallel relation by and coated with a thermosetting resin in sufficient amount to render the structure stiff and wire-like, said resin being capable of being carbonized within the range of 500 to 1500° F. by the heat emitted during the casting of the metal but not capable of being carbonized below 400° F. so as to maintain structural strength during core baking temperatures above 400° F.

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