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FORMING HOLLOW CAST ARTICLES

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This invention relates to the production of hollow castings. It more particularly refers to improvements in the production of cast metal articles having void spaces therein.

It is known to produce cast articles having voids therein by forming soluble cores and casting the desired article about the core or cores. After the article has been cast, the cores are dissolved out thereby leaving the desirable voids in the casting. One particularly desirable application of this practice is in the manufacture of cylinder blocks for internal combustion engines. Channels for cooling water are suitably cast into the block by the referred to technique of fugitive cores.

It has been the practice in the past to utilize water soluble materials as the fugitive cores since they can be dissolved and washed out most easily and economically. Exemplary of the water soluble core materials which have been used are metal halide salts particularly sodium and potassium chloride. These materials are quite inexpensive as well as easy to work with and readily recoverable.

It has been found that simple moldings and castings produced in the prior art manner are excellent. However, it has been found that in producing intricately shaped articles such as those containing sudden changes in cross-section, the stresses on the core materials, both mechanical stresses and those induced by heating, are greatly increased. The soluble core materials of the prior art have been found to be somewhat lacking in these situations.

It is therefore an object of this invention to provide an improved core material for use in producing castings containing voids.

It is another object of this invention to provide an improved process for the production of hollow cast articles.

Other and additional objects of this invention will become apparent from a consideration of this entire specification including the claims appended hereto.

In accord with and fulfilling these objects, this invention includes the production of a hollow cast article by casting such article about a fugitive core comprising at least one soluble metal halide salt and up to about 10% by weight of at least one second constituent selected from the group consisting of borax, magnesium oxide and talc. It is preferred to use water soluble cores. It is preferred, principally for economic reasons, to use sodium or potassium chloride as the metal halide salt.

Cores for use in this invention are suitably prepared by molding an appropriate mixture of metal halide and the second constituent into the shape of the void desired in the final casting. The shaped core is then dried and heated to a sintering temperature by which treatment the core shape becomes dimensionally stable and strong enough to withstand greater thermal and mechanical stresses than was possible with prior art cores.

The sintered salt cores according to the invention have also further advantageous properties. Owing to their porous sinter structure they are able e.g. to eliminate the detrimental effect of the gas formation inevitably occurring during the solidification of technical aluminum melts

by enabling the gas to escape into the sintered salt core. Furthermore the porous sinter structure effects an essential decrease of time necessary for removing the core from the casting.

More particularly, sodium or potassium chloride mixed with up to about 10% of a sintering aid (the above referred to second constituent) is placed in an appropriately shaped mold and pressed into the shape of the mold for about 1.5 to 2.5 minutes. The molded shape is then dried, e.g. for about an hour at 200° C., and then sintered, e.g. for about ½ to 1 hour at about 700° C. The sintered core shapes are then cooled to about 200° C. preferably without removing them from the sintering heating means. The thus produced sintered cores are available for use in preparing hollow castings by suitably placing them in the casting die and casting an appropriate material about them. It may in some cases be desirable to smooth out the surfaces and particularly the edges of the sintered core. This may be accomplished by sanding or grinding as the case may be.

It has been found to be desirable in making use of the thus prepared sintered cores, to preheat them prior to insertion in the casting mold. Alternatively, it may be practical to transfer the cores hot from the sintering step described directly to the casting mold. It has been found advisable to provide the sintered core at a temperature of about 250 to 300° C. where such core is to be used in the production of hollow metal castings. Where the castings are to be made of materials having a lower melting point, it may be desirable to provide the sintered cores at somewhat lower temperatures.

One specific example of a core made according to this invention contained 95 weight percent sodium chloride, 3 weight percent borax, 1 weight percent magnesium oxide and 1 weight percent talc. A mixture of these materials in the recited proportions was made into a sintered core and used to produce a hollow cast metal piece. After the casting had been cooled, the core was removed by simple dissolution in water.

The time required for the removal of the sintered salt core was only $\frac{1}{10}$ of that necessary for the removal of the salt cores of the known art.

What is claimed is:

1. In the method of forming a solid casting having at least one predetermined void space therein which comprises casting molten metal around at least one soluble salt core and then dissolving the core material; the improvement which comprises providing as said core material sintered salt comprising at least one soluble metal halide salt and up to about 10 weight percent at least one material selected from the group consisting of borax, magnesium oxide, and talc.

2. The improved process claimed in claim **1** wherein said metal halide is sodium chloride.

3. The improved process claimed in claim **1** wherein said metal halide is potassium chloride.

4. The improved process claimed in claim **1** wherein said core contains borax, magnesium oxide, and talc.

References Cited

UNITED STATES PATENTS

1,523,519	1/1925	Gibbons	106—38.9
1,554,697	9/1925	Alden	264—317
1,603,262	10/1926	Alden	106—38.9
2,420,851	5/1947	Zahn et al.	164—35
2,736,077	2/1956	Bartlett	164—36
3,131,999	5/1964	Suzuki et al.	164—16
3,218,684	11/1965	Spink	164—79

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