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THIN-WALLED STEEL CASTING AND
METHOD OF MAKING SAME

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This invention relates to a metallurgical process and more particularly to a thin-walled ferrous metal casting and method of making same.

There are numerous places where a thin-walled ferrous metal or steel casting of intricate shape is desired. Where the shape is quite complicated it becomes too expensive to fabricate the shape from steel stampings either as a whole or made up from individual stampings copper brazed together. It is an object of this invention to provide a new and improved thin-walled article and method of making same.

A specific object of my invention is to provide a thin-walled ductile steel casting of intricate shape from a ferrous metal casting of high carbon content in which there is no free carbon.

Another object of my invention is to provide a thin-walled ductile ferrous metal casting which may be heated to high temperatures without becoming mushy or without any permanent change in dimension.

In carrying out my invention I first cast a thin-walled article of desired shape of a high carbon content cast iron of such composition that the casting contains no free carbon. The fluidity of such a high carbon composition permits casting in very thin sections.

One specific example of a high carbon iron that may be used in carrying out my new and improved process is as follows:

	Percent
Carbon	3.50
Manganese	1.00
Silicon	1.00
Sulphur and phosphorus low, e. g. less than	.10
Iron	Balance

I do not wish to be limited to this composition as other compositions may be used so long as the metal has sufficient fluidity to be cast into thin sections and so long as the composition is one in which substantially no free carbon will be present in the casting. In general, a range of 2.5% to 4.3% carbon may be used.

After making the thin-walled casting it is decarburized so that a ductile ferrous metal or low carbon steel casting results. The decarburization is preferably accomplished by subjecting the casting to the influence of moist hydrogen or other highly decarburizing gas at a high temperature for a period of time sufficient to completely or substantially completely decarburize the casting. The use of moist hydrogen at a high temperature enables the decarburization to take place rapidly and thus attain the desired

result before graphitization precipitates any free carbon in the casting. The temperature of the moist hydrogen may preferably be within the range 1600°-2000° F.

The time necessary to decarburize the casting will vary with the thickness of the walls and the temperature of the moist hydrogen or other decarburizing gas. As an example, a section .030 inch thick will become decarburized in the presence of moist hydrogen at 1800° F. in about two hours.

In order to facilitate the rate of decarburization during the hydrogen treatment a certain amount of vanadium may be added. For example, amounts within the range .35% to .55% may be used. The vanadium will have the additional advantage of improving the physical properties of the final product by preventing the formation of any primary graphite in the metal as cast.

The result of decarburizing the high carbon ferrous metal casting will be a ductile ferrous metal or steel casting containing neither free carbon nor sufficient combined carbon to make it brittle. Such castings may be used, for example, for copper brazing to other steel parts without such change in shape or dimensions as to interfere with the brazing operation. Temperatures up to 2100° F. may be used without the article becoming mushy or without any permanent change in dimensions, such as would be the case with cast iron or malleable iron articles.

It will be understood that thin-walled articles of many different shapes may be made by my process and that many changes not specifically enumerated may be made without departing from the spirit of my invention and therefore I do not wish to limit the patent granted thereon except as necessitated by the prior art.

I claim:

1. The method of making a thin-walled ductile ferrous metal article of sheet metal thickness which comprises subjecting a thin-walled ferrous metal casting of sheet metal thickness of high carbon content having no free carbon and having vanadium present within the range .35% to .55% to the influence of a decarburizing gas at a high temperature until the casting contains substantially no combined carbon and no free carbon whereby the article may be heated up to 2100° F. without becoming mushy or undergoing permanent change in dimensions.

2. The method of making a thin-walled ferrous metal article which comprises providing a thin-walled casting of sheet metal thickness of approximately the following composition: 3.50%

carbon, 1.00% manganese, 1.00% silicon, .35 to .55% vanadium, less than .10% sulphur and phosphorus and the balance iron, said casting having its carbon all in combined form, and then
5 decarburizing said casting by subjecting the same to the influence of moist hydrogen at a temperature within the range of 1600°-2000° F. until the article contains approximately no combined carbon and contains no free carbon whereby the
10 article may be heated up to 2100° F. without becoming mushy or undergoing permanent change in dimensions.

3. The method of making a thin-walled ferrous metal article which comprises providing a casting having a wall of approximately .03" in thickness of substantially the following composition: 3.50% carbon, 1.00% manganese, 1.00% silicon, .35 to .55% vanadium, less than .10% sulphur and phosphorus and the balance iron, said casting
15 having its carbon all in combined form, and decarburizing said casting by subjecting said casting to the influence of moist hydrogen at a temperature within the range of 1600°-2000° F. until
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said casting contains substantially no combined carbon and contains no free carbon whereby the article may be heated up to 2100° F. without becoming mushy or undergoing permanent change in dimensions.

4. As a new article of manufacture, a casting having walls of sheet metal thickness of ductile, ferrous metal containing vanadium and having no free carbon and approximately no combined carbon whereby the article may be heated up to 2100° F. without becoming mushy or undergoing permanent change in dimensions, said casting having been formed by decarburizing substantially completely a casting having walls of sheet metal thickness of high carbon content cast iron containing no free carbon and having .35% to .55% vanadium, the decarburization having been carried out by subjecting the casting to the presence of moist hydrogen at a temperature within the range 1600°-2000° F. for a time sufficient to decarburize substantially completely the thin walled casting.

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