United States Patent Office 3,205,105 Patented Sept. 7, 1965

3,205,105

CASTING CLEANING

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No Drawing. Filed Mar. 11, 1963, Ser. No. 264,022
11 Claims. (Cl. 156—18)

This invention relates to the iron founding art and is more particularly concerned with a process for rapidly and economically removing fins from ferrous castings. The procedure taught by this invention is particularly applicable to the removal of internal fins which are shielded by the configuration of the casting from the usual mechanical de-finning expedients.

In the preparation of cores and molds for the recpetion of molten metal in the manufacturing of ferrous castings, the joints between sections of the molds or cores are often imperfect. These imperfect joints permit metal to flow in between the mold sections and result in the production of thin metallic fins which are firmly attached to the remainder of the casting. The removal of these fins from external portions of the casting is readily accomplished by ordinary mechanical means. However, these fins are often located internally of a casting so that they are shielded from mechanical removal. No satisfactory means of dealing with these internal fins has been found. This difficulty is particularly apparent in complex castings such as internal combustion enginge cylinder heads, although it is by no means limited to this structure. The fins occurring internally in internal combustion cylinder heads often block or partially block cooling water passages with the result that hot spots and warpage are inevitable when the engine is operated.

Accordingly, it is an object of this invention to provide a means for economically and rapidly removing fins from iron castings.

It is a further object of this invention to remove fins which are located in the casting so that their removal by mechanical means is difficult or impractical.

This invention is predicated upon the fact that the rate of recation between an iron object and elemental chlorine is dependent upon two factors. The first factor, of course, is the temperature obtaining within the system. The second factor is the thickness of the iron object. The reaction between iron and elemental chlorine results in the production of readily volatile ferric chloride. This reaction in common with most inorganic reactions is accelerated by increasing the temperature. The sensitivity of the speed of this reaction to the thickness of the iron follows from the inability of thin iron to dissipate the heat resulting from the initial reaction between the iron and the elemental chlorine. In thick iron this heat is dissipated into the mass as fast as it is generated and the temperature of the iron-elemental chlorine interface cannot rise appreciably. In the case of thin iron, the heat produced by the initial iron-elemental chlorine reaction serves to raise the temperature of the entire thin mass which, in turn, increases the rate of reaction between the elemental chlorine and the iron. This precipitates an exponential increase in the rate of reaction between the elemental chlorine and the iron. Under such circumstances, thin iron masses quickly incandesce and disappear in the form of volatile ferric chloride. The interdependence between the thickness of the iron and the temperature at which an exponential reaction can be initiated can be appreciated from the fact that steel wool will incandesce in chlorine at a temperature less than the boiling point of water while iron as thick as thirty-thousandths of an inch will not incandesce until a temperature of about 500° F. is employed. This higher temperature is probably fixed

to some extent by the fact that it is just under the melting and boiling point of ferric chloride.

In the execution of this invention it is contemplated that at least the fins of the casting be heated to a temperature to permit the initiation of this exponential reaction when exposed to elemental chlorine. In most cases, and particularly in the case of internal fins, it is expedient to heat the entire casting to an appropriate temperature and then expose the entire casting to elemental chlorine. Air should be removed as completely as possible from the system to avoid the production of relatively inert iron oxide and the deleterious presence of inert nitrogen. The elemental chlorine should be applied to the casting in such a way that it does not physically cool the fins below the point at which the exponential reaction will take place. This may be accomplished by simply immersing the casting in quiescent elemental chlorine. It is unnecessary to provide for circulation of the elemental chlorine if the system is free of air. The products of reaction of iron and elemental chlorine can only be ferrous chloride and ferric chloride. Ferric chloride is in itself highly corrosive to heated iron and ferrous chloride will react with elemental chlorine to produce ferric chloride. Consequently, no circulation of the elemental chlorine past the fins is necessary. On the contrary, excessive movement of the elemental chlorine through the casting tends to blunt the difference in the action of the elemental chlorine upon the fins and the mass of the casting. Such excessive movement tends to accentuate the attack of the elemental chlorine upon the mass of the casting and to cool the fins below the point at which they will incandesce.

It is preferred to remove from the casting such as an internal combustion engine cylinder head all of the sand both externally and internally before treating with elemental chlorine. This may be done by treatment with chemical cleaning agents such as molten sodium hydroxide or mechanically as by a stream of a high energy metal shot. The cleaned casting is then heated to a temperature of between 500° F. and 800° F., depending upon the thickness of the fins which it is desired to remove. The higher temperature favors the attack of thicker fins. The heated casting may then simply be immersed in elemental chlorine and the reaction allowed to go to completion. However, it is preferred to place the casting in an enclosure and evacuate from the enclosure all possible air. The evacuated enclosure is then filled with elemental chlorine and the reaction allowed to proceed. It may be advantageous to flush the container at least once with elemental chlorine followed by a second evacuation before admitting the elemental chlorine upon which reliance is placed for the cleaning.

In the case of external fins, it is unnecessary to heat the entire casting. The cleaned casting may be placed in a refractory lined container heated to a temperature sufficiently high to initiate the desired exothermic reaction. This container is filled with chlorine and the casting immersed in the chlorine. The minor bulk of the fins will cause them to preferentially heat to the temperature at which the exponential reaction will take place.

I claim as my invention:

1. The process of removing fins from a ferrous object comprising exposing such object and fins to elemental chlorine while said fins are heated sufficiently to cause them to react exothermically with the elemental chlorine at an exponentially increasing rate while maintaining the remainder of the object at a temperature at which such exponentially increasing rate of reaction with elemental chlorine does not occur and terminating the exposure of the object to the elemental chlorine when the fins have been substantially converted to ferric chloride.

2. The process of removing fins from a ferrous casting comprising exposing such casting and fins to elemental

chlorine while such fins are heated sufficiently to cause them to react exothermically with the elemental chlorine at an exponentially increasing rate while maintaining the remainder of the casting at a temperature at which such exponentially increasing rate of reaction with elemental chlorine does not occur and terminating the exposure of the casting to elemental chlorine when the fins have been substantially converted to ferric chloride.

3. The process or removing fins from a ferrous casting comprising exposing such castings and fins to elemental chlorine while such fins are heated at least to the boiling point of water to cause them to react exothermically with the elemental chlorine at an exponentially increasing rate while maintaining the remainder of the object at a temperature at which such exponentially increasing rate of reaction with elemental chlorine does not occur and terminating the exposure of the casting to elemental chlorine when the fins have been substantially converted to ferric chloride.

4. The process of removing internal fins from a ferrous casting comprising heating said ferrous casting and fins to a temperature at least as high as the boiling point of water, exposing the heated fins to elemental chlorine to cause them to react exothermically with the elemental chlorine at an exponentially increasing rate while the remainder of the casting reacts with the elemental chlorine at an essentially constant and much slower rate, and terminating the exposure of the casting to elemental chlorine when the fins have substantially all been converted to ferric chloride.

5. The process of removing internal fins from a ferrous casting comprising heating said ferrous casting and fins to a temperature between 500 and 800° F., exposing the heated fins to elemental chlorine to cause them to react exothermically with the elemental chlorine at an exponentially increasing rate while the remainder of the casting reacts with the elemental chlorine at an essentially constant and much slower rate, and terminating the exposure of the casting to elemental chlorine when the fins have substantially been converted to ferric chloride.

6. The process of removing internal fins from a ferrous casting comprising heating said ferrous casting and fins to a temperature between 500 and 800° F., exposing the heated fins to elemental chlorine to cause them to react exothermically with the elemental chlorine at an exponentially increasing rate while the remainder of the casting reacts with the elemental chlorine at an essentially constant and much slower rate, and terminating the exposure of the casting to the elemental chlorine when the fins have substantially been converted to ferric chloride, the temperature of the elemental chlorine and the relative movement between the elemental chlorine and the fins being chosen so that the physical cooling effect of the elemental chlorine does not cool the fins below the point at which an exponentially increasing rate of reaction is possible.

7. The method of removing internal fins from a ferrous casting comprising heating said ferrous casting and fins to a temperature between 500 and 800° F., immersing the casting and fins in essentially quiescent elemental chlorine to cause them to react exothermically with the elemental chlorine at an exponentially increasing rate while the remainder of the casting reacts with the elemental chlorine at an essentially constant and much slower rate, and terminating the exposure of the casting to the elemental chlorine when the fins have been substantially converted to ferric chloride.

8. The process of removing fins from a ferrous casting comprising supplying heat to the casting sufficiently rapidly to heat the fins but not the mass of the casting to a temperature at least as high as the boiling point of water, exposing the heated fins to elemental chlorine to cause the chlorine to react with the fins exothermically and at an exponentially increasing rate while the temperature of the mass of the casting remains at a point when the reaction with the elemental chlorine is at a much slower and uniform rate, and terminating the exposure to elemental chlorine when the fins have been converted to ferric chloride.

9. The process of removing fins from a ferrous casting comprising supplying heat to the casting sufficiently rapidly to heat the fins at least locally to a temperature of 500 to 800° F. while the mass of the casting remains substantially cooler, exposing the heated fins to elemental chlorine to cause the elemental chlorine to react with the fins exothermically and at an exponentially increasing rate while the temperature of the mass of the casting remains at a point where the reaction with the elemental chlorine is at a much slower and uniform rate, and terminating the exposure to elemental chlorine when the fins have been converted to ferric chloride.

10. The process for removing fins from a ferrous casting comprising heating the casting to a temperature sufficiently high to cause the fins to react exothermically and at an exponentially increasing rate with elemental chlorine, placing the casting in an enclosure, evacuating the air from the enclosure, adding elemental chlorine to the evactuated enclosure and permitting the elemental chlorine and the fins to react until the fins have been substantially converted to ferric chloride.

11. The process for removing fins from a ferrous casting comprising heating the casting to a temperature sufficiently high to cause the fins to react exothermically and at an exponentially increasing rate with elemental chlorine, placing the casting in an enclosure, evacuating the air from the enclosure, adding elemental chlorine to the evacuated enclosure, again evacuating the enclosure, adding elemental chlorine again to the evacuated enclosure and permitting the elemental chlorine and the fins to react until the fins have been substantially converted to ferric chloride.

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