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Protection of 18/8 Castings with Red Lead,

WATERTOWN ARSENAL MA

20 FEB 1936

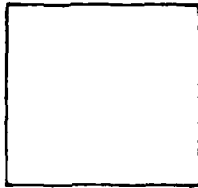
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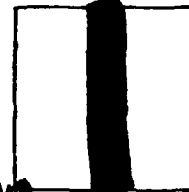
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February 20, 1936

Protection of 18/8 Castings with Red Lead

Object

To study the effect of red lead paint on the corrosion of 18 Cr/8 Ni (C.R.S. #1 and C.R.S. #7) castings and strip, stainless iron strip, and Monel metal strip.

Recommendation

The practice of coating 18 Cr/8 Ni castings with red lead paint should be continued. When practicable, surfaces of 18 Cr/8 Ni castings should be ground with wheels of grit 24 or smaller.

Conclusions

1. Red lead paint offers definite protection to 18/8 castings immersed in sea water.
2. Castings with ground surfaces show less tendency to stain and to corrode than do castings with surfaces in the as-cast condition.
3. Defects like blowholes are greater factors in causing and accelerating corrosion than are rough, as-cast surfaces.
4. "Free-machining" 18/8 has a slightly greater tendency to stain than regular 18/8.

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5. Corrosion in and around blowholes in "free-machining" 18/8 is localized; corrosion spreads through a large area around blowholes in regular 18/8. It is not known definitely what other factors influence this other than chemical constitution.

6. The presence of drilled holes of any diameter above 1/64" or depth up to 1/4" is of no significance in initiating corrosion of 18/8 castings.

7. Red lead also adheres well to polished stainless iron and Monel metal, and protects them from tarnishing and scaling.

Introduction

When a metal is immersed in an electrolyte like sea water, a certain area of that metal may be more accessible to dissolved air or oxygen than an adjacent area. Consequently, one area becomes richer in oxygen than the other, and a cell of the differential oxygen concentration type is established. The area richer in oxygen becomes the cathode (protected), and the area poorer in oxygen becomes the anode (corroded). The anodic area dissolves, a focus of corrosion is established, and general pitting and progressive corrosion results.

When red lead covered only part of a stainless steel surface it was not known whether the coat of paint would act as a screening agent in preventing access

of air or oxygen to that part of the surface and, thus, establish a differential oxygen concentration cell when immersed in sea water or exposed to a sea salt spray. The purpose of this investigation is to study that possibility.

Materials

Regular (C.R.S.#1) and "free-machining" (C.R.S.#7) castings, Nos. 701 and 703, were used. Also, strips of 18 Cr/8 Ni, of 12 Cr/0.1 C, and of Monel metal.

The analysis of the regular stainless casting No. 701 is: 0.6 C, 0.38 Mn, 0.76 Si, 0.02 S, 0.008 P, 10.95 Ni, 22.11 Cr.

The analysis of the "free-machining" stainless casting No. 703 is: 0.075 C, 0.35 Mn, 0.895 Si, 0.030 S, 0.007 P, 11.34 Ni, 22.14 Cr, 0.16 Se.

Method

Part (a)

Two regular 18/8 castings and two "free-machining" 18/8 castings were prepared so that two ground surfaces and two as-cast surfaces were obtained. Half of the ground surface and half of the as-cast surface of each casting were painted with one coat of red lead. A series of holes with diameters ranging from 1/34" to 1/4" and depths varying from 1/8" to 1/4" were drilled in the ground surface and in the as-cast surface. On the ground

surface of one of the regular 18/8 specimens was present a small blowhole. All specimens were then subjected, for thirty days, to a synthetic sea salt spray.

Results

Part (a)

The as-cast surfaces on "free-machining" specimens showed extensive discoloration. Surfaces covered by red lead were unaffected.

The regular 18/8 specimen which contained an exposed blowhole on the ground surface showed progressive corrosion in the region of the blowhole. Corrosion spread outward from the blowhole and extended to the as-cast surface on the reverse side, causing marked discoloration. Slight rusting of the as-cast surface and an unchanged ground surface were observed on the other specimen of regular 18/8.

There was no visible change in the vicinity of the drilled holes.

All surfaces covered with red lead remained unchanged.

Method

Part (b)

Three "free-machining" castings and three regular 18/8 castings were prepared as in part (a), leaving

several ground surfaces and several as-cast surfaces. Part of the ground surface and part of the as-cast surface of each specimen was painted with one coat of red lead. On the ground surface of one of the "free-machining" specimens was exposed a medium-sized blowhole. A blowhole in the ground surface of an ordinary 18/8 casting was painted with a coat of red lead. All six specimens were then placed in a sea salt spray for eight months.

Results

Part (b)

The uncoated, ground surfaces of the regular 18/8 specimens were moderately discolored. The ground surfaces and surfaces covered with red lead were unchanged.

As-cast surfaces on the "free-machining" specimens were extensively discolored. Ground surfaces were slightly discolored. Corrosion in the blowhole was severe, but showed no tendency to spread to adjacent areas.

All surfaces covered with red lead remained unchanged.

Method

Part (c)

Two "free-machining" castings and one regular 18/8 casting were prepared as before, each specimen having

several ground surfaces and several as-cast surfaces. A portion of each surface was covered with a coat of red lead. All specimens were then immersed in synthetic sea water for thirty days.

Results

Part (c)

The as-cast surface of the "free-machining" specimens were slightly discolored. All other surfaces of all specimens were unchanged.

Method

Part (d)

Two pairs of each type of casting were prepared as in the previous tests. On the ground surface of one of the "free-machining" castings was a large blowhole. All specimens were immersed in synthetic sea water for eight months.

Results

Part (d)

All surfaces of the regular 18/8 specimens were unchanged.

The uncoated, as-cast surfaces of the "free-machining" specimens were severely stained. Extensive corrosion occurred within the blowhole on the ground surface. There was no tendency for the corrosion to spread to adjacent ground surfaces.

All surfaces coated with red lead remained unchanged. A portion of a blowhole covered with red lead showed staining and rusting.

Method

Part (e)

Three pieces of Monel metal, each 1" x 2 1/2", were polished with 00 emery paper. On one of the faces of each specimen was painted a stripe of red lead. Three pieces of stainless iron and six pieces of 18/8, all approximately the same size, were similarly prepared and painted. All specimens were then placed in a sea salt spray for eight months.

Results

Part (e)

On the uncoated surfaces extensive scaling, pitting, and progressive rusting were observed with the stainless iron specimens. Surfaces covered by red lead were unaltered.

The 18/8 specimens showed moderate tarnishing and slight rusting on the uncoated surface. No change was observed in the surface coated with red lead.

Tarnishing, slight pitting, and scale formation were observed on the uncoated surfaces of Monel metal. Surfaces covered with red lead remained unchanged

Discussion

Castings of "free-machining" 18/8 and of regular 18/8 were prepared to give as-cast surfaces, ground surfaces, and surfaces coated with red lead. In several specimens a series of holes of various diameters were drilled. Tests to which various specimens were then subjected, were thirty days immersion in sea water, eight months immersion in sea water, thirty days in sea salt spray, and eight months in sea salt spray. Parallel tests were conducted with strips of 18/8, stainless iron, and Monel metal. It was found that red lead offers definite protection from corrosion, and that ground surfaces show less tendency to stain and corrode than do surfaces in the as-cast condition.

Respectfully submitted,

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