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O T T A W A   November 28, 1945.

REPORT

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1969.

Investigation of Adhering Sand on
Light Steel Casting.

(Copy No. 10.)

Bureau of Mines
Division of Metallic
Minerals

Physical Metallurgy
Research Laboratories

CANADA
DEPARTMENT
OF
MINES AND RESOURCES

Mines and Geology Branch

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Origin of Request and Object of Investigation:

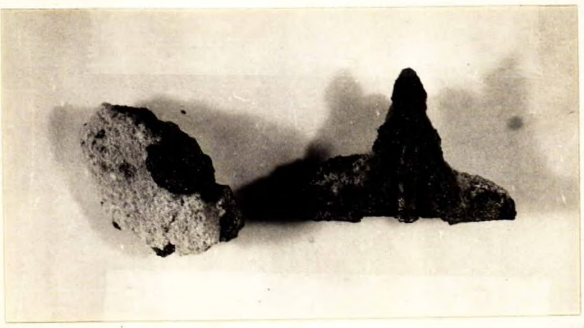
On November 23, 1945, a problem of sand adhering to light steel castings, which was being encountered at the Riverside Iron Works, Calgary, Alberta, was submitted by Mr. W. J. McGill, Alberta representative of the Research and Development Branch of the Department of Reconstruction. Samples of sand which had peeled with difficulty, and a small sample of the facing sand, accompanied the request. It was stated that this problem occurred only on light steel castings. These were poured at a high temperature (3000°-3050° F.).

Examination of Samples:

The adhering sand had a dark layer about 1/8 of an inch thick next to the casting. This was non-magnetic, indicating the absence of metallic iron. Iron was present in the form of oxide and silicate. This oxide-silicate was also present on the surface of chaplets (Figure 1).

The sample of facing sand analysed 0.08 per cent carbon.

Figure 1.



FORMATION OF IRON SILICATE
AROUND CHAPLETS.

Discussion:

This appears to be an example of oxide penetration, of the type discussed by H. W. Dietert, R. L. Doelman and R. W. Bennett in "Mould Atmosphere Control," Trans. A.F.A., Vol. 52, No. 4, pp. 1053-1077. This defect is caused by the metal oxidizing and forming a silicate with the sand. This silicate is very fluid at temperatures over 2200° F. and permeates the sand, causing it to adhere. Adherence of the sand to chaplets indicates that the metal does not have to be molten for this to occur, as the shanks of the chaplets would not receive enough heat to melt them.

Adhering sand of the oxide type will usually flake off after heat treatment. This may suggest an explanation for the good peel which is experienced on large castings. The

(Discussion, cont'd) -

longer cooling period of the large castings may allow time for the formation of a scale, which flakes off the casting. When smaller castings are heat treated, a similar scale is formed, which allows the sand to peel. H. F. Taylor and R. E. Morey (discussion, ibid.) describe an experiment which indicates that the size of the casting as well as the pouring temperature is a critical factor in this type of penetration. Two identical steel castings were poured in new facing sand. The metal was bled out of one of these at the end of 30 seconds, and the other was allowed to cool in the mould. The sand stuck tightly to the bled casting, but peeled freely from the other one.

Organic binders which produce reducing gases will eliminate this type of penetration on light castings. The sample of facing sand received had very little organic binder, as indicated by the 0.08 per cent carbon. If a facing sand had 0.70 per cent cereal, as recommended by Dietert, the carbon content would be 0.25 to 0.30 per cent. For light castings an even higher cereal content is desirable.

Conclusions:

1. The adherence of sand is caused by the oxidation of iron, with the formation of iron silicate.

2. The addition of organic binders will give a better peel on these light castings, by preventing the oxidation of the metal.

Suggestions:

1. Use the present sand mix on large castings which give good peel.

2. Substitute organic binders such as cereal, molasses, or sulphite liquors, for part of the bentonite in sand mixes for light castings. A maximum of 1.5 per cent organic binder is recommended.

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