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O T T A W A June 12, 1945.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1886.

Behaviour of Foot Valves and Steam Cocks for 60-Ft. Phoenix Steel Nesting Barges S/4 Under Corrosive Conditions.

(Copy No. 10.)

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Background:

A letter dated May 15, 1945, File 79-4-P-5; 79-4-B-6F, from Mr. H. B. Percival of the Office of the Transport Controller, Department of Transport, 261 St. Sacrament St., Montreal, Quebec, requested that a complete zinc-coated steel foot valve and a three-way bronze steam cock (both for 60-ft. Phoenix Steel Nesting Barges S/4) be tested for corrosion resistance. The unprotected threads on the foot valve were coated with a black, removable, organic protective coating (see Figure 1). The valve included a leather part to which a bronze plate was attached by means of a steel nut, bolt and washer (see Figure 2).

(Continued on next page)

(Background, cont'd) -

The letter read in part:

"These barges are for storage and eventually service, in the Pacific Area.

These two valves will be packed in a wooden case lined with waterproof paper.

This equipment will be in storage and transit altogether for at least twelve months before being assembled with the barges and made ready for service.

The storage and transport area conditions will be approximately as follows:

1. Temperature ranging from 20° F. below zero, up to 110° F. above zero.
2. Fresh water air conditions.
3. Salt water air conditions.
4. In the salt water air conditions the temperature probably will range from 80° F. above zero up to 110° F. The humidity will be relatively high, possibly running as high as 95 per cent at times."

TESTS PERFORMED:

As only one valve of each kind was submitted for test it was decided to test them under the more severe conditions listed above, i.e., salt spray at 95° F. using a 20 per cent salt (sodium chloride) solution. In this test the combined effect of salt, comparatively high temperature and high humidity would be observed.

Zinc-Coated Steel Foot Valve.

The parts of the foot valve were hung in the spray cabinet separately so that the effect of the salt spray on each part could be determined.

After 24 hours: White corrosion product from the zinc coatings showed quite plainly.

(Continued on next page)

(Tests Performed, cont'd) -

A few tiny iron rust spots were present on the large washer.

The threads which were covered with the black removable organic coating showed spots of iron rust.

The bolt and nut which were attached to the leather were considerably corroded.

After 170 hours: Considerable iron rust showed in the white zinc corrosion product on the two largest parts.

After 280 hours: Deterioration more advanced.

The condition of the exterior of the largest part is shown in Figure 3.

The condition of the exterior of the large perforated part is shown in Figure 4. The heads and threads of the two bolts were badly rusted.

The condition of the large washer is shown in Figure 5. Rust spots are encircled.

The condition of the steel and bronze parts attached to the leather is shown in Figures 6a and 6b.

The test was discontinued.

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Bronze Steam Cock.

The bronze three-way steam cock was hung in the salt spray cabinet as received.

After 24 hours: Corrosion noted inside and out.

After 200 hours: Serious corrosion outside and especially inside of the valve.

One flat surface was rubbed with emery cloth to expose the fresh metal for comparison.

See Figure 7.

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Conclusions:

1. Bronze and zinc-coated steel articles will corrode if allowed to come in contact with 20 per cent salt spray at 95° F. and high atmospheric humidity. If the time of the contact is

(Conclusions, cont'd) -

long the corrosion will be serious.

2. In order to prevent corrosion of this kind the salt spray should be prevented from coming in contact with the metal surfaces.

3. It is considered bad practice, from the standpoint of corrosion, to have two different metals, such as bronze and ordinary steel, in contact with one another. This is borne out by the results of this test as shown in Figures 6a and 6b.

4. Removable protective organic coatings should not be relied on under the more severe corrosive conditions.

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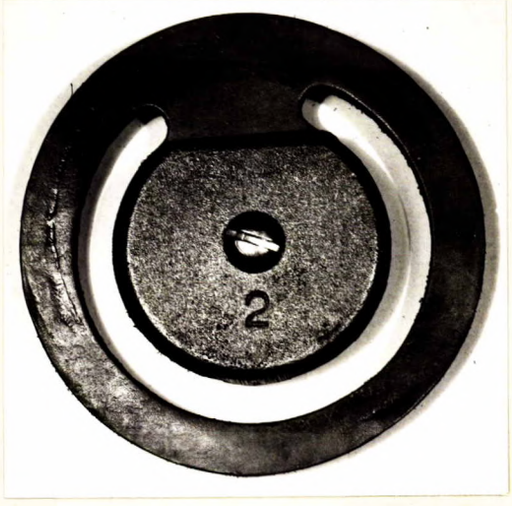
Figure 1.

ZINC-COATED STEEL FOOT VALVE BEFORE THE CORROSION TEST, SHOWING THE BLACK REMOVABLE ORGANIC COATING ON THE THREADS.

(Magnification: approximately 0.5).

Figure 2.



LEATHER PART WITH BRONZE PLATE ATTACHED BY STEEL NUT AND BOLT, BEFORE THE CORROSION TEST.

(Magnification: approximately 0.5).

Figure 3.

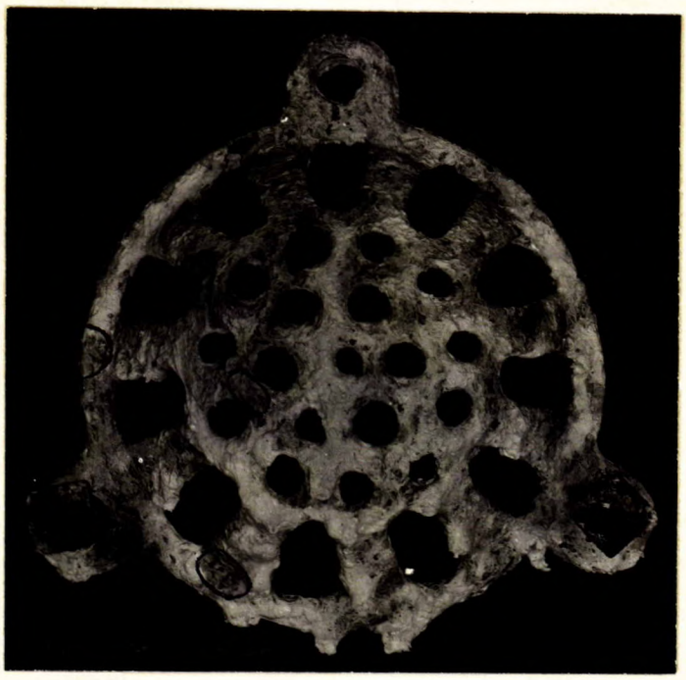
EXTERIOR OF LARGEST PART OF THE ZINC-COATED STEEL FOOT VALVE, AFTER 280 HOURS IN THE SALT SPRAY CABINET.

(Magnification: approximately 0.5).

The white material is zinc corrosion product. The large patches of iron rust on the white material are much less evident in the photograph than on the actual sample. A few of them are encircled.

The considerable amount of rusting on the threads is shown inside the rectangular area.

Figure 4.



EXTERIOR OF THE LARGE PERFORATED PART OF THE ZINC-COATED STEEL FOOT VALVE, AFTER 280 HOURS IN THE SALT SPRAY CABINET.

(Magnification: approximately 0.6).

The white material is zinc corrosion product. Several of the large patches of iron rust on the white material are encircled.

The heads of both bolts are badly rusted.

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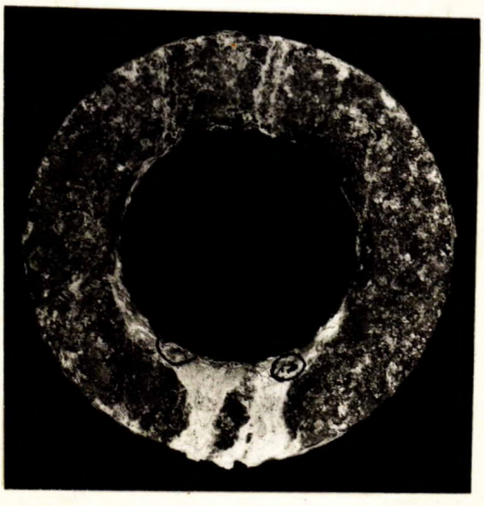
Figure 5.



LARGE ZINC-COATED STEEL WASHER AFTER 280 HOURS IN THE SALT SPRAY CABINET.

(Magnification: approximately 0.6).

The white material is zinc corrosion product. Patches of iron rust are encircled.

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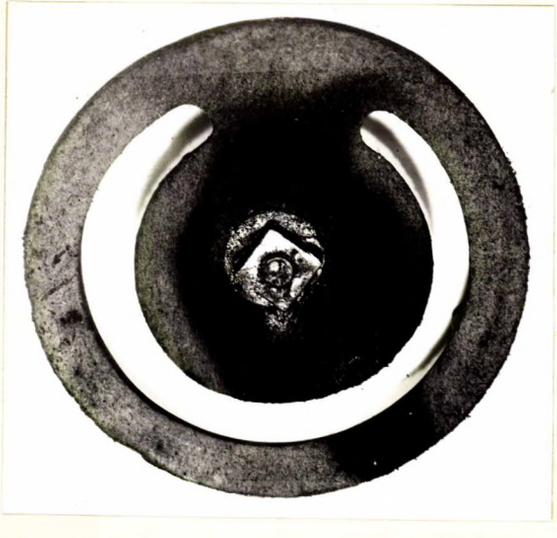
Figure 6.

(a)



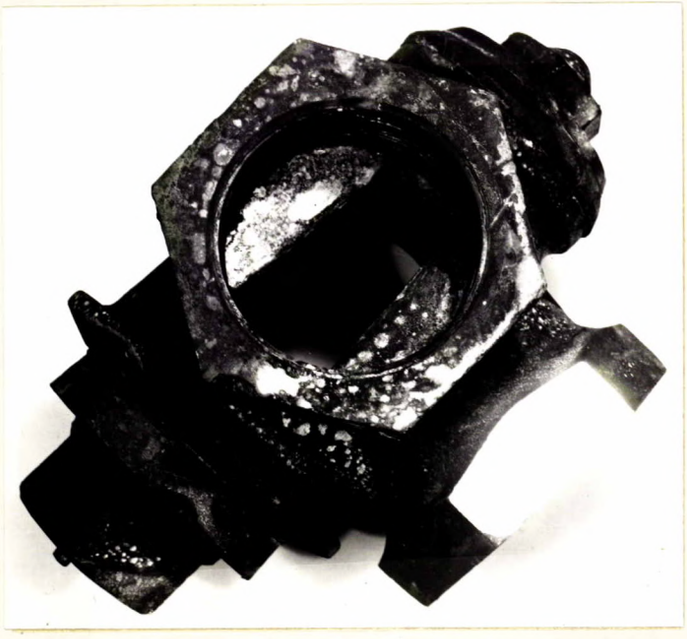
(b) Reverse Side.

LEATHER PART WITH BRONZE PLATE ATTACHED BY STEEL NUT, BOLT AND WASHER, AFTER 280 HOURS IN THE SALT SPRAY CABINET.

(Magnification: approximately 0.5).

The steel parts are badly corroded. The small amount of corrosion on the bronze plate may not be serious.

Figure 7.



BRONZE THREE-WAY STEAM COCK AFTER
200 HOURS IN THE SALT SPRAY CABINET.

(Magnification: approximately 0.5).

The bright surface at the lower right was emeried to expose fresh metal in order to obtain a comparison with the corroded surface.

The corrosion of this Cock is more serious than is indicated by the photograph.

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