(14) WA 317/2

Report No. 317/2
Watertown Arsenal
Problem No. A-7

(11) 27 Mar 43

(12) 15

AD-A951179

COATED SHEET METAL

(6) Coated Iron Sheet Manufactured By The Oscar Bach Process,

OBJECT (10) M. Jacobson

To conduct an examination of so-called non-corrosive coated iron sheet metal manufactured by Oscar B. Bach Studios, Inc., New York City.

CONCLUSION

1. Metal treated by the Oscar Bach Process may be expected to prove generally satisfactory in withstanding the effects of ordinary atmospheric exposure; but its general suitability as a corrosion resisting material is considered limited.

2. Since it is reported by the manufacturer that the process comprises a thermo-chemical treatment applied at about 800°F, it is believed that it may be impractical or undesirable to subject many metal components to such elevated temperatures.

3. The coating produced by the subject process is unaffected by grease, oil, and many of the common solvents and displays fair to poor resistance against hydrochloric and sulfuric acids; resistance to chemical attack by agents such as nitric acid, glacial acetic acid, ammonium hydroxide, and the caustic alkalis is considered to be very poor.

4. Excellent adhesion and resistance to abrasion are possessed by the coating; and in these respects the Oscar Bach Process may offer improvement over some types of commercial synthetic resin finishes in certain applications.

M. Jacobson
M. JACOBSON
Asst. Chemist

APPROVED:

4/8

LT. COL. [illegible]
FOR H. H. ZORNIG
Colonel, Ordnance Dept.
Director of Laboratory

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O.O. 470.1/19799
W.A. 470.1/6538 3rd Ind. Mann/MJ/mtd

Watertown Arsenal, Watertown, Massachusetts, April 7, 1943

To: Chief of Ordnance, U.S.A., Pentagon Building, Washington, D.C.
Attn: SPOTB

1. Inclosed are five copies of Watertown Arsenal Report No. 317/2, entitled "Coated Sheet Metal - Coated Iron Sheet Manufactured By the Oscar Bach Process".

2. A copy of this report has also been sent to Rock Island Arsenal, Frankford Arsenal, and Springfield Armory.

3. It is understood that one copy of this report is to be filed in the Ordnance Technical Library. Index cards are inclosed for that purpose.

4. Results of the present investigation indicate that the adherent organic coating produced by the Oscar Bach Process is unaffected by many of the common solvents, possesses satisfactory resistance to salt spray corrosion, but displays only limited resistance to the corrosive action of the common acids and alkalis.

For the Commanding Officer:

s/t H.H. Zornig
Colonel, Ordnance Dept.
Director of Laboratory

2 Incls.
Rpt. 317/2 (five copies)
Index cards

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INTRODUCTION AND TEST PROCEDURE

The examination of so-called non-corrosive sheet metal manufactured by the Oscar Bach Process was requested by the Office, Chief of Ordnance(1). In reply to a letter (2) sent by this Arsenal, some information pertaining to the process was furnished by Oscar B. Bach Studios, Inc. (3)

The sample furnished for test purposes represented the process as applied to a piece (10" x 7 1/4" x .012") of ordinary soft iron sheet metal similar to that used in the manufacture of tin cans. Both surfaces of the sheet metal sample possessed a smooth continuous black coating. The Oscar B. Bach Studios reported that the process involved baking of the organic coating at oven temperatures of approximately 800°F. No further technical information pertaining to the composition of the coating or actual manufacturing details has been made available to this Arsenal.

The tests to which the sample sheet material were subjected are described in the following paragraphs:

1. Physical Characteristics

A. Thickness - The thickness of the coating was determined at various positions over both surfaces of the entire sample sheet by means of an Aminco-Brenner "Magne-Gauge" magnetic thickness tester.

B. Adhesion - The adhesion of the coating to the base sheet metal was tested by scraping the surface of the coating with a sharp knife blade. A small panel of the test material was also subjected to a 180° bend test performed over a mandrel 1/8" in diameter.

C. Abrasion Resistance - Resistance to abrasion was determined in essentially the same manner as described in paragraph F-3j, of Spec. AXS-736, Varnish, Phenolic, Baked (Un-Pigmented), wherein the abrasive material, standard Ottawa sand-was allowed to fall from a height of 3 feet through a 3/4" i.d. tube onto the surface of the test specimen. The test procedure was repeated until the area abraded through to the metal was at least 2 mm. in diameter.

D. Thermal Stability - Small duplicate panels of the sheet metal were subjected to three complete cycles of alternate exposure to a temperature of -40°F ± 1°F. for a period of 3 hours and then to a temperature of 175°F ± 1°F. for a period of 12

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(1) O.O. 470.1/19799; W.A. 470.1/6538, See Appendix A
(2) W.A. 470.1/6561
(3) W.A. 470.1/6607

hours. The panels were examined at the end of each freezing and heating period for evidence of cracking or other surface changes.

2. Solvent Resistance - Strips of the sample sheet metal were tested at room temperature for resistance to the effects of immersion in the following solvents: gasoline, ethyl alcohol, ethyl ether, toluene, chloroform, acetone, trichlorethylene, carbon tetrachloride, and methyl acetate. In the case of toluene a 1-hour test was also included wherein a boiling solution was employed. Inspection of the specimens for film softening or deterioration was made after 1 hour and also at the end of 1 week. The ability of the coating to withstand moderate to heavy scratching with the thumb or fore finger-nail was used as an indication of resistance to softening.

3. Chemical Resistance - The coated sheet metal was tested for resistance to the following chemical agents: glacial acetic acid, oleic acid, lubricating grease, lubricating oil, hydrochloric acid, nitric acid, sulfuric acid, ammonium hydroxide, sodium hydroxide, and potassium hydroxide. In the case of nitric acid and sulfuric acid, drops of the respective reagents were applied to the surface of the panels. In all other cases, panels were completely immersed in the reagent.

4. Salt Spray Resistance - By means of a razor blade two 3" x 2" panels were scratched through to the base metal along the two diagonals. The edges were protected by dipping in molten paraffin and the panels were then exposed at room temperature to continuous spray of 20% sodium chloride solution. Examination of the panels was made after 24, 48, 144, and 240 hours.

RESULTS AND DISCUSSION

1. Physical Characteristics

A. Adhesion - Upon scraping the surface of the sheet metal coating there was no indication of poor adhesion as might be evidenced by flaking or chipping of the film. The material also successfully withstood a 180° bend and showed no signs of cracking, flaking or other signs of poor adhesion.

B. Thickness - The average thickness of the coating on the sheet metal was found to be .00085 inches; whereas the maximum deviation of any single measurement from the average was only about ± 8%. The coating was considered to be very uniform in thickness.

C. Abrasion Resistance - Thirty-five liters of Ottawa sand were required to produce an abraded area of at least 2 mm.

in diameter on the test panel. Under the same conditions of test and film thickness the following comparative data were obtained with two commercial synthetic finishes applied to panels of SAE-30 steel:

AXS-750, Primer, Synthetic, Rust-Inhibiting (Forbes Varnish Co.) = 15 liters
Opex Sealer, Brown (Sherwin-Williams Co.) = 10 liters

Superior resistance of the subject sheet metal coating to wear due to abrasion is indicated.

D. Thermal Stability - There was no evidence of cracking, warping, or other surface or dimensional changes in the sheet metal after the completion of the alternate freezing or heating cycles. These results indicate the ability of the subject material to withstand sudden changes in temperature with no adverse effects.

2. Solvent Resistance - The resistance of the coated sheet to various common solvents is shown in Table I. Results indicate that the coating is not readily affected by many of the common solvents; although slight softening is experienced in the case of chloroform, acetone and trichlorethylene.

TABLE I

SOLVENT RESISTANCE AT ROOM TEMPERATURE

Solvent	Conditon of Coating After 1 Hour	After 1 Week
Gasoline	No Change	No Change
Ethyl Alcohol	No Change	No Change
Ethyl Ether	No Change	No Change
Toluene	No Change	No Change
"	(1) No Change	----
Chloroform	(2) Slightly Softened	----
Acetone	(2) Slightly Softened	----
Trichlorethylene	(2) Slightly Softened	----
Carbon Tetrachloride	No Change	No Change
Methyl Acetate	No Change	No Change

(1) At boiling temperature
(2) Top film of coating easily scratched with thumbnail

3. Chemical Resistance - Observations of the effects of various reagents on the sheet metal coating are summarized in Table II. The coating showed adequate resistance to the effects of grease and oil, even when continuously exposed at slightly elevated temperature. Hydrochloric and sulfuric acid

produced a slight attack whereas nitric acid readily corroded the coating. The coating was badly attacked by strong ammonium hydroxide and was completely dissolved upon continued immersion in strong solutions of the caustic alkalis. Oleic acid showed no effect whatsoever on the coating. On the other hand immersion in glacial acetic acid resulted in severe blistering and peeling.

TABLE II

CHEMICAL RESISTANCE AT ROOM TEMPERATURE

Chemical Agent	Condition of Coating	
	After 1 Hour	After 1 Week
(1)Glacial Acetic Acid	(2)Slight Softening	Badly Peeled and Blistered
Oleic Acid	No Change	No Change
(3)Lubricating Grease	(4)No Change	No Change
(5)Lubricating Oil	(4)No Change	No Change
(1)Hydrochloric Acid		
1%	Slight Staining	(2) Slight Softening, Staining
10%	Uniform Wt.Stain (2)Slight Softening	Uniform Wht. Stain(2)Slight Softening
Nitric Acid		
1%	Blistering, Coating easily flaked off with thumbnail	---
10%	Blistering, Coating easily flaked off with thumbnail	---
Sulfuric Acid		
1%	No Change	(2)Slight Softening.Wht.Stain
30%	No Change	(2)Slight Softening.Wht.Stain
Ammonium Hydroxide		
10%	No Change	Badly cracked and peeled
30%	Badly blistered	---
Sodium Hydroxide		
1%	No Change	Peeling of skin-like layer of coating
10%	(2)Slight Softening	Coating completely stripped from sheet metal

TABLE II (CONT'D)

Chemical Agent	After 1 Hour	After 1 Week
Potassium Hydroxide 1%	No Change	Peeling of skin-like layer of coating
10%	(2)Slight Softening	Coating completely stripped from sheet metal

(1) Edges of panel protected with paraffin.
(2) Top Film of coating easily scratched with thumbnail
(3) Semi-fluid aluminum-base grease
(4) At 175°F
(5) SAE-30 Grade
(6) All concentrations shown in % by weight in distilled water.

4. Salt Spray Resistance - In Table III are shown the results obtained upon exposure of the subject material to 20% salt spray atmosphere. The coating itself proved highly effective in withstanding the corrosive effect of the salt spray. After about 48 hours, rusting of the steel at the scribe marks occurred. At 144 hours slight undercutting of the film was evident; while at the end of 240 hours of exposure, undercutting had advanced somewhat further and two pinhole rust spots had appeared on the coated regions of each of the test panels.

TABLE III

RESISTANCE TO 20% SALT SPRAY AT ROOM TEMPERATURE

Elapsed Time (Hrs.)	(1) Condition of Panels
24	Excellent. No visible change either on coated regions or at scribe marks.
48	Slight rust formation at scribe marks. No change on coated regions.
144	Slight blistering of film adjacent to scribe marks. No change on coated regions.
240	Coating 1/16 in. either side of scribe marks readily flaked off with thumbnail. Two minute rust spots on coated regions of each panel.

(1) Edges protected with paraffin

GENERAL CONSIDERATIONS

Results of the present tests indicate that the coating produced by the Oscar Bach Process would be expected to prove generally satisfactory in withstanding the effects of ordinary atmospheric corrosion. The coating appears to be immune to the solvent action of gasoline, grease, oil, ether, carbon-tetrachloride, methyl acetate, alcohol and toluene; but it exhibits some softening when allowed to remain in contact with chloroform, acetone or trichlorethylene. In applications involving exposure to hydrochloric acid, nitric acid, sulfuric acid, glacial acetic acid, ammonium hydroxide and the caustic alkalis, effects ranging from slight softening to complete decomposition of the coating may be expected.

The flexibility and adhesion of the coating produced by this process, however, are noteworthy; and in this respect the process may offer advantages over some types of synthetic resin finishes in certain applications.

Most baking varieties of organic finishes are heated at oven temperatures ranging between 300 - 400 F., whereas it is to be noted that the Oscar Bach Process is reported to require a baking temperature of about 300°F., -- a temperature to which it may not be desirable or practical to subject certain metal components. The inability to employ directly soldering or brazing operations on metal parts possessing organic films constitutes another general limitation on protective finishes of this type.

There are, currently, at this Arsenal no applications where it is considered that the adoption of the Oscar Bach Process would offer decided improvement in corrosion resistance or would effect appreciable economies in materials.

APPENDIX A

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WAR DEPARTMENT
Office of the Chief of Ordnance
Washington, D.C.

To insure Prompt
Attn. in Replying
Refer to
OC No. 470.4/19749

January 26, 1943

Attn.Of
SPOTB

Subject: Non-Corrosive Sheet Metal Manufactured Under the Oscar Bach Process

To: Commanding Officer
Watertown Arsenal
Watertown, Mass.

1. There is inclosed herewith a sample of a so-called non-corrosive sheet metal manufactured under the Oscar Bach Process. This sample was submitted to this office by the War Production Board with a request that an examination be made. It was reported that the process can be applied to any kind of metal and renders it as non-corrosive as stainless steel. The sample herewith shows the process on ordinary soft iron sheet metal same as used for tin cans. The War Production Board reported that the only tests they had made so far were made by Standard Brands Incorporated. A copy of their report is attached.

2. It was reported that the producer of this metal is Mr. Oscar Bach, 610 Fifth Avenue, New York City, who is a German born naturalized United States citizen. The following is quoted from the letter from the War Production Board: "Iron Age refers to Mr. Bach as 'the foremost metal craftsman of this Country'. He was decorated by the German Government for his work in stainless steel." The present product is reported to be a result of work done in marine stainless steel ornamental work which Mr. Bach has executed on a considerable number of ocean liners. After some years it was noted that the colored stainless steel which he developed stood up better than the uncoated stainless steel. The War Production Board is particularly interested because if the process can serve a useful purpose in the war program, it will be possible to convert facilities that are now standing idle in every section of the Country to the manufacture of this product and female labor can be used thereby releasing men for other critical products.

3. It is requested that an examination be made of this process and at least two copies of a report be submitted to this office at an early date. It would be appreciated if the report could be expedited since the War

Production Board is interested in having the Ordnance Department give them an indication as to whether or not this process offers any promise. Especial attention should be given to the Process to ascertain whether or not it could be used as substitute for terne plate in ammunition boxes. It is suggested that, if desirable, contact be made with Mr. Bach in order that further details relative thereto may be obtained directly from him. A similar sample and letter is being sent to Frankford Arsenal.

By Order of the Chief of Ordnance:

S. B. RITCHIE
Colonel, Ord. Dept.
Assistant

Incl.
Sample of sheet metal
Report

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HCM/MJ/mtd

February 4, 1943

Laboratory

Mr. Oscar Bach
610 Fifth Avenue
New York, New York

Dear Sir:

Reference is made to the Oscar Bach process for the manufacture of so-called non-corrosive sheet metal.

The above mentioned has been brought to the attention of this Arsenal by the Office of the Chief of Ordnance, Washington, D.C. with the view to conducting certain laboratory studies to determine the general suitability of the process for Ordnance applications.

Since very limited technical data has been made available, it is requested that further general information relative to this process be furnished. In addition, comments pertaining to the following specific questions are requested:

(1) What is the general chemical chemical nature of the coatings produced by the Bach process?
(2) In connection with the processing, is it possible under some conditions to employ an air-drying operation in place of bake-drying?
(3) Prior to processing, is stringent metal surface preparation prescribed?
(4) Is the coating produced by this process considered to be inhibitive with respect to its behavior toward steel?

Your cooperation in furnishing the above information will be appreciated.

For the Commanding Officer:

H. H. ZORNIG
Colonel, Ord. Dept.
Director of Laboratory

C
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P
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OSCAR B. BACH STUDIOS
610 Fifth Avenue, N.Y.
La Maison Francaise
Rockefeller Center

February 26, 1943

Commanding Officer
War Department
Watertown Arsenal
Watertown, Massachusetts

Attention: H.H. ZORNIG, Col., Ord. Dept.

Dear Sir:

This will acknowledge your inquiry dated February fourth, with reference to non-corrosive treatment of sheet metal. Answering your specific inquiries, please note following:

1. Process is a thermo chemical treatment applied in an oven at temperature of about 300°F.
2. It is not possible to use any time air drying in place of bake oven.
3. Stringent metal surface preparation is required, preferably sand blast.
4. Surface produced is considered to be inhibitive with respect to its behavior toward steel.

We refer you to Chemical Warfare Service, New York Office, attention of Captain Henry, for reference to detailed tests they have made prior to their selection and approval of this process.

Any further information we will be glad to furnish.

Very truly yours,

Oscar B. Bach

OBB:WO