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DEPARTMENT OF MINES AND RESOURCES
BUREAU OF MINES
CANADA

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Ottawa, November 9, 1946.

R E P O R T
of the
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2134.

Composition and Corrosion-Resisting
Properties of Oils to Specification
A.X.S. 934.

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(Copy No. 6.)

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BACKGROUND:

A letter (File HQ.543-H-370 Vol. 2 (DME) DME/
V 8-2-0) dated Sept. 5, 1946, was received from Col. J.W.
Bishop, Director of Mechanical Engineering, Department of
National Defence, Army, Ottawa, Canada, requesting that
three samples of oil to Specification A.X.S. 934 be in-
vestigated with regard to corrosion preventive properties.
The letter read in part:

" May these samples also be examined for sludge
or other foreign matter.

" As it is deemed necessary to determine by
users' experience the length of time corrosion
preventive oils manufactured to specification
A.X.S. 934 give protection to component parts of
vehicles, these three samples of oil were removed
from the crankcases of vehicles which were prepar-
ed for storage approximately six months ago and
have been stored in the open."

(Background, cont'd) -

The samples of oil were supplied by the Directorate of Mechanical Engineering, and were labelled:

(1) 82-443, Differential, Self-propelled Lorries, 3 ton
 d/28/8/46
 40 m m
 L. s/d
 2/46
 I

(2) 82-471, Transmission, Self-propelled Lorries, 3 ton,
 d/28/8/46
 40 m m
 L. s/d
 2/46
 III

(3) 82-485, Crankcase, Self-propelled Lorries, 3 ton,
 d/28/8.46.
 40. m m
 L. s/d
 2/46
 II

INVESTIGATION:

The following tests were performed in the Fuel Research Laboratories of the Bureau of Mines:

Test	Differ- ential	Trans- mission	Crankcase
Water and sediment, % by vol. (centrifuge method)	0.65	0.45	0.25
Water, % by vol. (A.S.T.M. method D.95)	0.2	0.4	0.2
Sediment, % by vol. (by extraction)	0.11	Trace.	0.05
A.S.T.M. Precipitation No.	0.05	0.12	0.03
A.S.T.M. Colour No. (Union)	Dark green.	5+(Light red)	Dark red.
Viscosity (of filtered oil) centistokes at 100° F.	52.5	66.0	50.3
centistokes at 210° F.	7.0	8.3	6.7
Equivalent Viscosity, seconds (of filtered oil)			
Saybolt Univ. at 100° F.	243	305	233
Saybolt Univ. at 210° F.	49	53.3	48

(Investigation, cont'd) -

The following tests were performed in the Physical Metallurgy Research Laboratories of the Bureau of Mines:

Protection (Par. E-4, Spec. A.X.S. 934)

The results of the test were as follows:

Differential - One panel perfect and the other one had rust under suspension hole on both sides. (See Figure 1.)

Transmission - The panels had a few rust spots on both sides. These spots increased as the test was continued for an extra 50 hours. (See Figures 2a and 2b.)

Crankcase - One panel perfect on one side and the other side rusted under suspension hole and a few spots on surface. The other panel had rust under suspension hole on both sides; also, a few spots over surface. These spots continued to increase slightly as test was continued for an extra 50 hours. (See Figures 3a and 3b.)

Acid Neutralization Property (Par. E-5, Spec. A.X.S. 934)

The results of this test were as follows:

Differential - One panel rusted and other one practically unaffected. (See Figure 4.)

Transmission - Both panels practically unaffected. (See Figure 5.)

Crankcase - Both panels rusted. (See Figure 6.)

In Figures 4, 5 and 6, a panel treated with hydrobromic acid but not with oil is included for comparison. It will be noted that this panel is much more severely corroded than any of those that were treated with hydrobromic acid and then with oil.

(Investigation, cont'd) -

Salt Water Immersion (Par. E-6, Spec. A.X.S. 934)

The results of this test were as follows:

Differential - Considerable rust on both panels.

(See Figure 7.)

Transmission - Small amount of rusting. (See Figure 8.)

Crankcase - A few fairly large rust spots.

(See Figure 9.)

CONCLUSIONS:

From the various tests performed in the Physical Metallurgy Research Laboratories it is concluded that:

1. In the Protective Test, the oils may be arranged as follows: differential (best), crankcase, transmission (worst).

2. In the Acid Neutralization Test, the oils may be arranged as follows: transmission (best), differential, crankcase (worst). It was further concluded that all three oils gave a great deal of protection against this type of corrosion.

3. In the Salt Water Immersion Test, the oils may be arranged as follows: crankcase (best), transmission, differential (worst).

From the test of the Fuel Research Laboratories we conclude that:

1. In the Water and Sediment Test, the oils may be arranged as follows: crankcase (best), transmission, differential (worst).

2. In the Water Test (A.S.T.M. method D.95), the oils may be arranged as follows: differential and crankcase the same, transmission (worst).

(Conclusions, cont'd) -

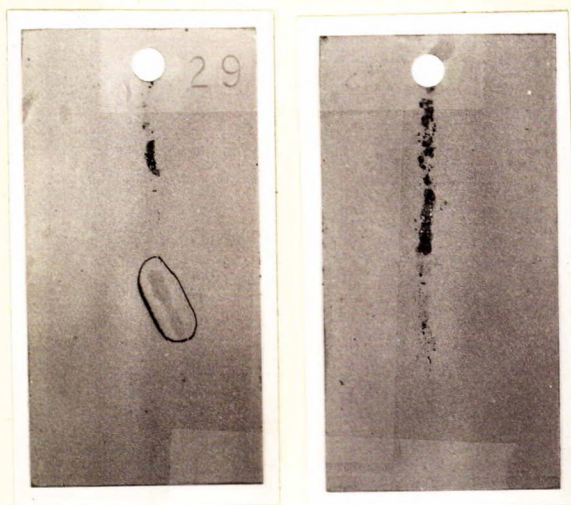
3. In the Sediment Test (by extraction), the oils may be arranged as follows: transmission (best), crankcase, differential (worst).

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WD:RRR:GG.

(Figures 1 to 9)
(follow, on Pages)
(6 to 9.)

Figure 1.

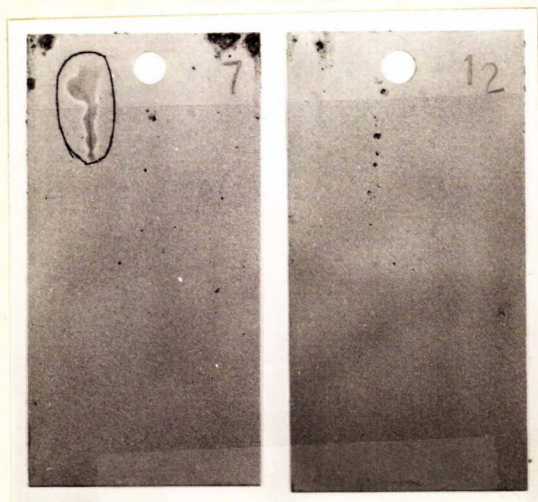


(a)

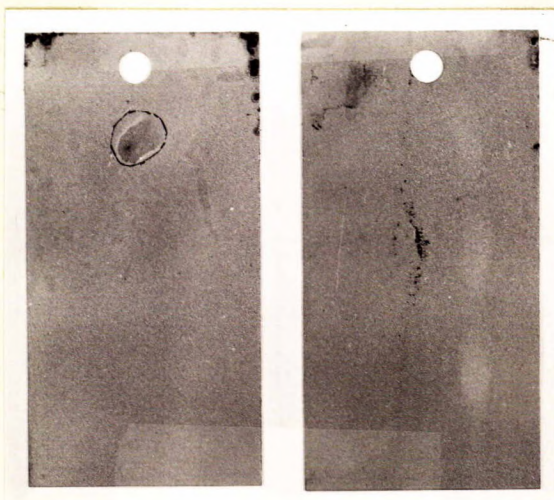
(b) Reverse of (a).

From Differential.

Figure 2.



(a)



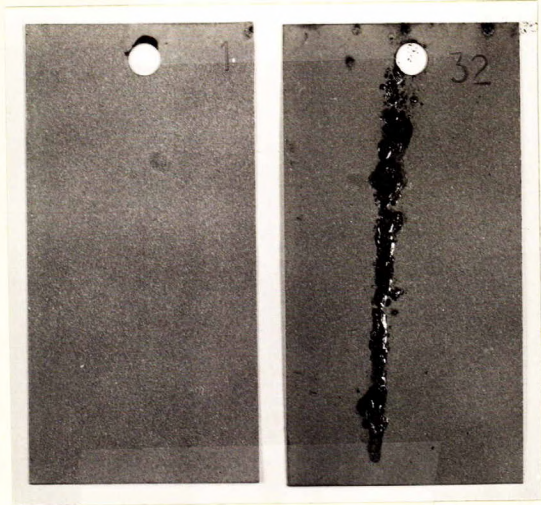
(b) Reverse of (a).

From Transmission.

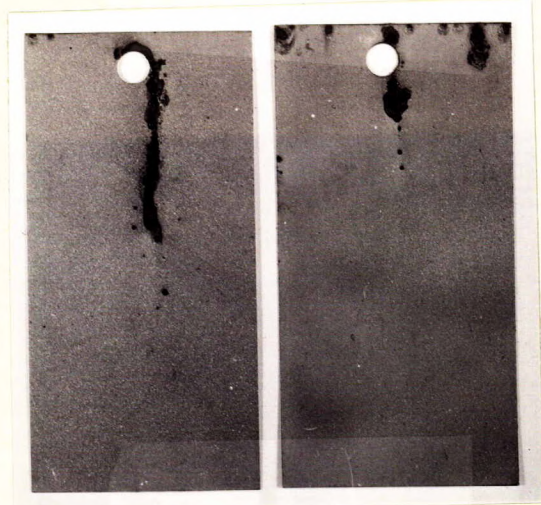
OIL-COATED SAMPLES OF STEEL AFTER PROTECTIVE
TEST (PAR. E-4, SPEC. A.X.S. 934).

Note: Circled marks on photographs do not indicate corrosion.

Figure 3.



(a)

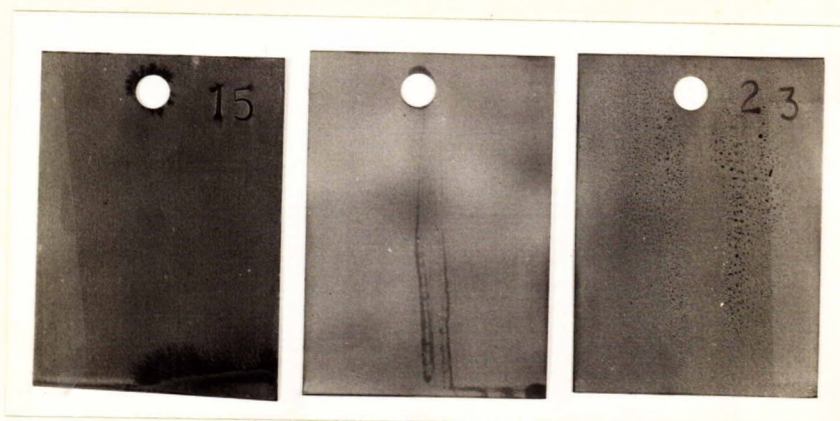


(b) Reverse of (a).

From Crankcase.

OIL-COATED SAMPLES OF STEEL AFTER PROTECTIVE
TEST (PAR.E-4 SPEC. A.X.S. 934)

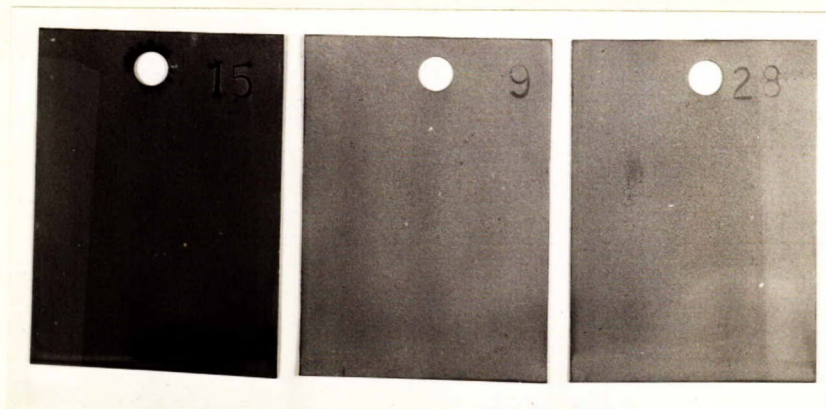
Figure 4.



From Differential.

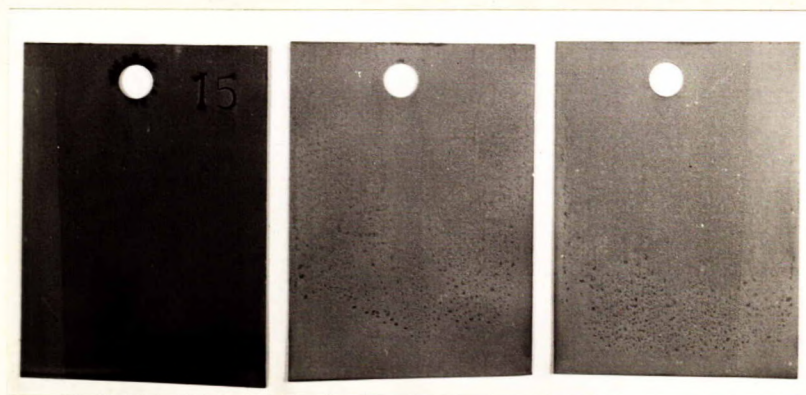
Note: The long vertical streaks do not indicate corrosion.

Figure 5.



From Transmission.

Figure 6.

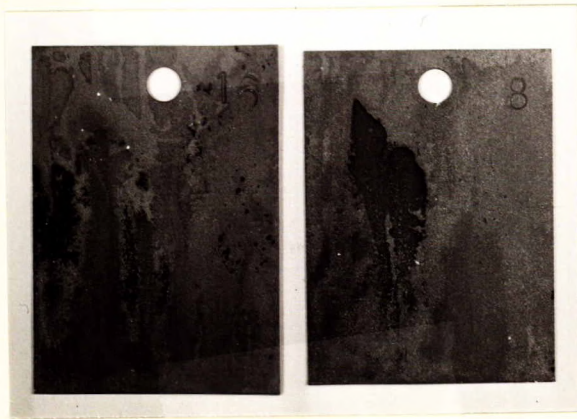


From Crankcase.

OIL-COATED PANELS AFTER ACID NEUTRALIZING PROPERTY TEST.

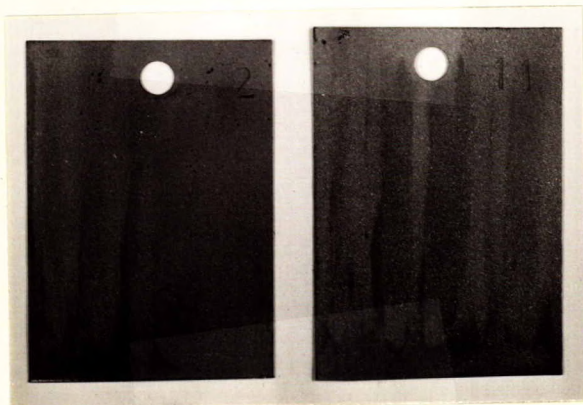
Note: The left-hand panel in each of the above figures was given the acid treatment only. It is included for comparison.

Figure 7.



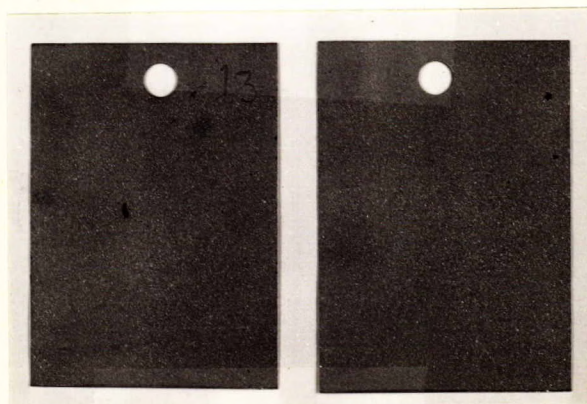
From Differential.

Figure 8.



From Transmission.

Figure 9.



From Crankcase.

OIL-COATED PANELS AFTER SALT WATER IMMERSION TEST.