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THE HAZARD OF SPARKS FROM ALUMINIUM PAINT PART 3. THE EFFECT OF AGEING OF THE PAINT FILM

by

E. H. Coleman and P. S. Tonkin

### SUMMARY

Seven aluminium paints have been tested over a period of four years to ascertain whether ageing at atmospheric temperature increased the tendency to emit sparks.

Ageing did not increase the tendency to spark emission.

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Fire Research Station, Boreham Wood, Herts.

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#### INTRODUCTION

In the earlier investigations  $\binom{1}{2}$  into the emission of sparks from rusty iron surfaces coated with aluminium paint it was observed that preheating the paints increased the tendency for spark emission. In general, the tendency to produce sparks increased with the preheating temperature up to about 250°C, and at preheating temperatures above this the sparks were generally less bright. It appeared that the increase in liability to spark emission was associated, to some extent at least, with embrittlement of the paint film. Embrittlement of the paint film can be caused by ageing at atmospheric temperatures as well as by heating and therefore some experiments have been made to investigate whether ageing of paint films at room temperatures increases the chance of producing sparks from aluminium paint applied over rusty steel.

### EXPERIMENTAL

Some of the paints used for the previous tests produced no sparks until they had been preheated and therefore would be considered to be safe paints for general use. On the assumption that preheating and ageing would be analagous, fresh samples of seven of these paints were obtained and used for the present series of tests. The paints and the results of the earlier tests are described in Table 1. As before, the paints were applied by brushing on to both sides of rusted steel plates 8 in. x 3 in. x  $\frac{7}{2}$  in. and they were allowed to dry for two days. Some specimens were then tested, and others were preheated for a further two days at temperatures selected by consideration of the earlier work. In the previous tests one specimen was successively heated to progressively higher temperatures, but that method was not suited to the present work, and each specimen was heated to one temperature only. The preheating temperatures are given in Table 1.

The prepared specimens were tested by striking them in a dark room, 20 times with a steel rod 12 in.  $x \frac{3}{4}$  in. diameter weighing  $1\frac{1}{2}$  lb. Those from which sparks were obtained were then tested by striking 50 times in an explosion box through which a mixture of 18 per cent town's gas in air was passed. The tests were repeated after storage in the laboratory for one, two and four years. The same operator carried out all the tests. The results of the tests are given in Table 1.

#### RESULTS

A nitrocellulose paint (No. 20) was the only paint from which sparks were obtained from unheated specimens, all of the others required preheating. In no instance were any of the sparks incendive.

It will be noticed that two of the paints, No. 11 alkyd base and No. 18 bituminous, emitted incendive sparks in the earlier tests but not in the present series, and that sparks were obtained from the silicone paint No. 16 and the nitrocellulose paint No. 20 in the present tests but not in the earlier tests. The reasons for these differences of behaviour are not known. They may be due to the different effects of heating to successively higher temperatures as in the earlier tests and heating to one temperature only as in the present series, but it is also possible that the manufacturers had modified the compositions in the three or four years between providing the first and present samples. Ageing appears to reduce the tendency to emit sparks, and, excepting No. 20, no paint emitted brighter sparks from the aged than from the freshly prepared specimens. With the nitrocellulose paint No. 20, slightly brighter sparks were emitted at one year by both the heated and unheated specimens. At two and four years, however, the sparks were less intense.

It may be concluded therefore that in the conditions of the tests ageing of these paint films did not induce an increased tendency to produce sparks, and they were no more hazardous than when applied. This was so whether the paint had or had not been preheated. Brighter sparks were produced from the preheated than from the unheated specimens, and in appears therefore that preheating produces greater effects than ageing.

The conditions of the paint films after 4 years have been noted in Table 1. The condition is possibly worse than it would be in practice since the paints were applied to rusty and inferior surfaces, which, in practice would probably have been cleaned or wire brushed.

#### REFERENCES

- 1. E. H. COLEMAN and Z. W. ROGOWSKI. The hazard of sparks from aluminium paint. Part 1. Preliminary investigation. F.C. Note 28/1950.
- 2. E. H. COLEMAN and Z. W. ROGOWSKI. The hazard of sparks from aluminium paint. Part 2. The examination of a series of commercial paints. F.C. Note No. 33/1950.

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TABLE 1

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## The effect of ageing of paint films on the production of sparks

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	PAIN	2	RBSULTS					· · · · · · · · · · · · · · · · · · ·
Ref No.		Prebasting temperatures (2 days) oc	Present work (no sparks caused explosions)					、 、
			Then prepared	After 1 year	After 2 years	After 4 years	Condition of paint film at end of test	Earlier work
7	Food oil paint for weather exposure.	None 150 250	77 R	No sparks. """ Feeble sparks.	No sparks. "" Very feeble sparks.		Good. Slight flaking. Fair.	Forble sparks after heating successively to 150P and 250°C.
9	Long oil paint. Woather registant.	None 150	No sparks. A few very feeble sparks	No sparks.	No aparka ""	No sparks. ""	Pair.	Feeble sparks after heating successively to 150° and 250°C.
11	Alkyd base for temperature up to 150°C.	None 200 300	Bright sparks.	No sparks, — Bright sparks, Very bright sparks,	No. sparks, Occasional bright sparks, Vary: bright sparks,		Good. Fair. — — — — — — — — — — — — — — — — — — —	Explosion at fourth -stroke after heating successively to 150°, 200° and 300°C.
16	Silicone base for temperature up to 600°C.	None 400		No sparks. Bright sparks.	No sparks, Occasional bright sparks.		Fair.	No sparks after heating successively to 150°, 200°, 250°, 300°, and 400°C.
18	Bituminous.	None 150	No sparks. Very feeble sparks.	No sparks. ""	No sparks. ""	No 5parks.	Fair.	Brplosion at 23rd stroke after heating successively to 150° and 200°C.
20	Nitrocellulose. Weather resistant,	None 400	Some bright and some	Some bright and some feeble sparks. Bright sparks.	A few feeble sparks,		Fair. Poor.	No sparks after heating successively to 150°, 200° and 400°C,
21	Nitrocellulose lacquer.	None	No sparks.	No sparks.	No sparks.	Paint film failed. Not tested.	Flaked badly.	No sparka.

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