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FIRE IN PAINT SPRAY BOOTH DUCTING

by

P. C. Bowes and G. W. V. Stark

Summary

A fire occurred in extraction ducting from paint spray booths, a solvent-wash booth, and a paint dip tank and drip tray hood, exhausted by a common exhausting system. The most likely cause would appear to be spontaneous heating of paint residues in an inaccessible part of the extraction system that could not be cleaned.

November, 1954.

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Fire Research Station,  
Boreham Wood, Herts.

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## (1) Introduction

A fire occurred in extraction ducting in a painting department at the factory of Messrs. Hoover Limited, Perivale, on 28th September, 1954. The incident was visited by the authors, with Mr. Squires (Fire Prevention Officer, Middlesex Fire Brigade) on 29th September. Others present were Mr. F. Halstead, Chief Fire Officer, Hoover Limited, and Mr. Derby, Production Manager for the Paint Department.

## (2) Description of ducting

The ducting involved in the incident extracted waste products from (a) a hood over a solvent wash tank used for cleaning metal parts (b) a back-to-back double paint spraying booth, and (c) a hood over a heated dip tank and drip tray.

A sketch plan of the ducting is shown in Figure 1. The rectangular ducts C and G, (Section 24 x 15 in., and 24 x 9 in. respectively), outside the first floor of the steel frame factory building were suspended close to the glazing, which was of wired glass. There were no means of entering this external ducting for cleaning purposes. The part of ducting G that was inside the factory building was provided with a number of sliding shutters for this purpose, but none were apparent in the length of ducting H (section 12 in. x 4 in.). A hand operated shutter, E, was provided for isolating the solvent wash tank from the ducting, but no further shutters were fitted to the system. The paint in the dip tank, and the tunnel above the drip tray, were said to be heated above 90°F.

## Incident

The incident occurred shortly after 2.00 p.m. on 28th September, 1954. We were told that an employee saw smoke coming from the extractor fan chamber. In accordance with standing instructions, he immediately switched off the fan, and, as soon as he did this, he heard a loud "woof" in the ducting. We were also told that an employee working at the spraying booth K, was made aware of the fan being stopped by the paint spray being blown out of the spray booth, and he reported this to his foreman. A little smoke was then observed coming out of the booth; this was followed a few seconds later by a rumbling sound in the ducting, and the emission of large clouds of smoke from the booth. The foreman said that he immediately ran to close the shutter E, and then telephoned the Factory Fire Brigade.

Mr. Halstead said that, when he examined the ducting after the incident, the shutter E was open.

The fire was attacked by the Factory Fire Brigade and the Middlesex Fire Brigade, and it was two hours before the fire in the ducting was completely extinguished. The metal plates sealing the opening into the duct C at F were removed to attack the fire, and the burnt residue inside was found to be 3 to 4 inches thick (a sample of this was obtained).

The discoloration of the areas of ducting marked by cross hatching in the sketch plan indicated that they had been heated strongly, while that on the underside of ducting C showed that the fire in this section had followed a zig-zag path. Soot blackening was noticed at a joint between the sections of the large trunking A, and at the sliding shutters on ducting G. The bottom panes of wired glass in the paint store, adjacent to the external ducting C, had been crazed. The wall behind the solvent wash tank D was somewhat soot blackened. The small section ducting H did not appear to have been involved.

Discussion

The sequence of events reported for this incident are consistent with the initial presence of a smouldering fire in the ducting, followed by a vapour phase ignition when the fan was switched off. The vapour ignition was probably precipitated by a change in the concentration of solvent vapour in the ducting, brought about by the reduction in air velocity. The vapour ignition was followed by a more general and intense fire in the duct.

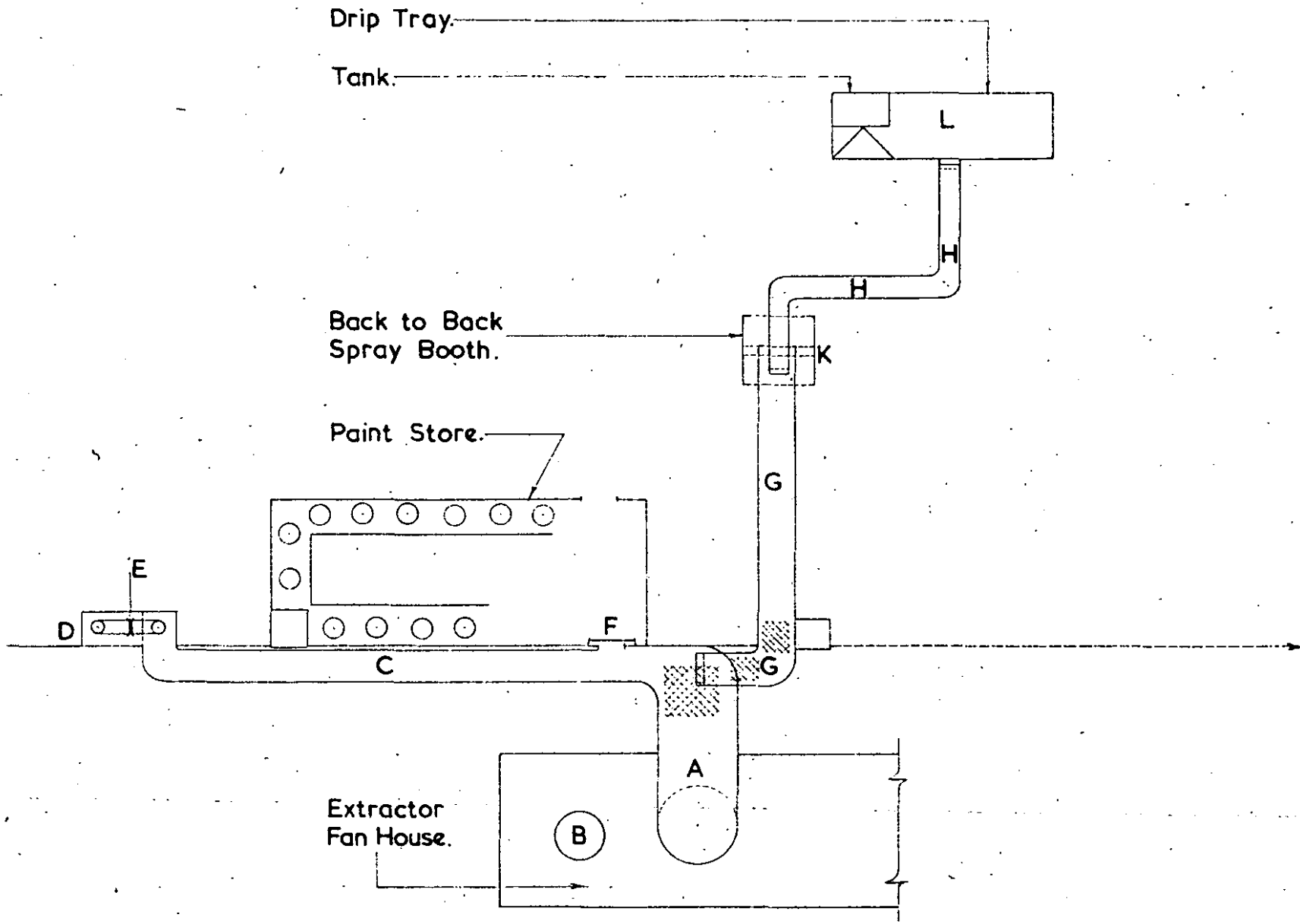
The initial smouldering fire could have been induced in two ways:-

1. The spontaneous heating of residues of paint containing drying oils in the ducting,
2. the introduction of a source of ignition e.g. smouldering material, into the ducting.

Mr. Halstead said that residues of paint of the kind used in the paint spraying booth were known to heat up and smoulder when put into waste bins. This suggests strongly that the fire was due to spontaneous ignition in the deposit somewhere in the ducting. However, the possibility of the introduction of a source of ignition, such as the careless disposal of a cigarette end into the ducting, cannot be entirely ruled out. It may be noted that a piece of aluminium foil of the kind used to wrap cigarettes was found in the burnt residue taken from ducting C.

It is not possible to say where the fire started, but it is unlikely that the heavy paint residue in ducting C was primarily involved, unless the fire was initiated by a cigarette end, because the residue was said to consist of nitrocellulose based aluminium paint, which is not liable to spontaneous heating from ordinary temperatures. Also this ducting was last used to extract paint over spray about four years ago, and, after such a lapse of time, spontaneous ignition would be very unlikely to occur, even if some oil-based paint had been used. On the other hand paint residues from the spraying booth K could be expected to collect at the junction of the smaller ducts with the main, large diameter, extraction trunking where the air velocity would be suddenly reduced, and it was at this point that the fire appeared to have been most intense.

Mr. Halstead said that he proposed to recommend that means be provided for the cleaning of all ducting, inside and outside the factory buildings, together with the installation of automatic shutters operated by fusible links, to isolate any section of ducting affected by fire. It is thought that this system would not give protection against vapour explosion, and a system such as a pressure operated device that would operate more rapidly, would appear to be more appropriate.



- A. Main Extractor Trunking  $\approx$  4'-0" dia.
- B. Exhaust Funnel to air.
- C. External Ducting  $\approx$  2'-0" x 1'-3"
- D. Solvent Wash Tank and Hood.
- E. Isolating Shutter in Ducting.
- F. Sealed Ducting Outlet  $\approx$  3'-0" x 3'-0"
- G. Ducting to Spray Booth  $\approx$  24" x 9"
- H. Branch Ducting to Dip Tank and Drip Tray  $\approx$  12" x 4"
- K. Back to Back Spray Booth.
- L. Dip Tank and Drip Tray.

External Wall of  
Factory Block.  
Glazed Steel Frame Building.

Scale :  $\frac{1}{8}$ " = 1 foot.

FIG. 1. SKETCH PLAN - LAYOUT OF DUCTING.