

CASE REPORT

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A Case of Arson?

A vehicle owner reported to his insurance company that as he was changing a rear wheel the vehicle fell off the jack and the fuel tank was ruptured and caught fire. A bumper jack in conjunction with an adjustable stand was used. The questions to be answered were these:

1. Were the events, as described by the owner, likely to lead to a fire?
2. If the owner's description was not likely, was there an alternative, reasonable explanation for the fire consistent with an examination of the vehicle?

Examination

A visual examination of the remains of the vehicle showed that the gas tank had been punctured at one position and that there were indentations at a second position. The jack was in the "down" position, that is, the position for lowering the vehicle. The stand was unusual in that the top flat section was missing. Figure 1 shows the indentations at Position 1 and a hole at Position 2. The stand is shown to the right of the gas tank.

Figure 2 is a close-up photograph of Position 1 in Fig. 1. Note that there is a superficial mark in the bottom left and there are three similarly shaped indentations in the center of the photograph. The top indentation is the deepest. No object that would produce indentations of this shape could be found on the vehicle. The top edge of the stand did not match the indentations. The top indentation appeared to have penetrated the terneplate (lead-tin alloy) coating, exposing the steel base. No rusting had occurred, suggesting that the indentation was recent.

A close-up photograph of Position 2 of Fig. 1 is shown in Fig. 3. Also shown in this figure is the match between the top edge of the stand and the hole in the gas tank at Position 2, demonstrated by bringing the edge of the stand close to but not touching the hole in the gas tank.

The fire damage to the vehicle suggested that the fire had spread from the gas tank. Figure 3 confirms that there is a hole through which gas leaked at Position 2.

Discussion

The events leading to the hole at Position 2 did not appear to be accidental. The stand that had made the hole was lacking the top flat section and the jack was in the down

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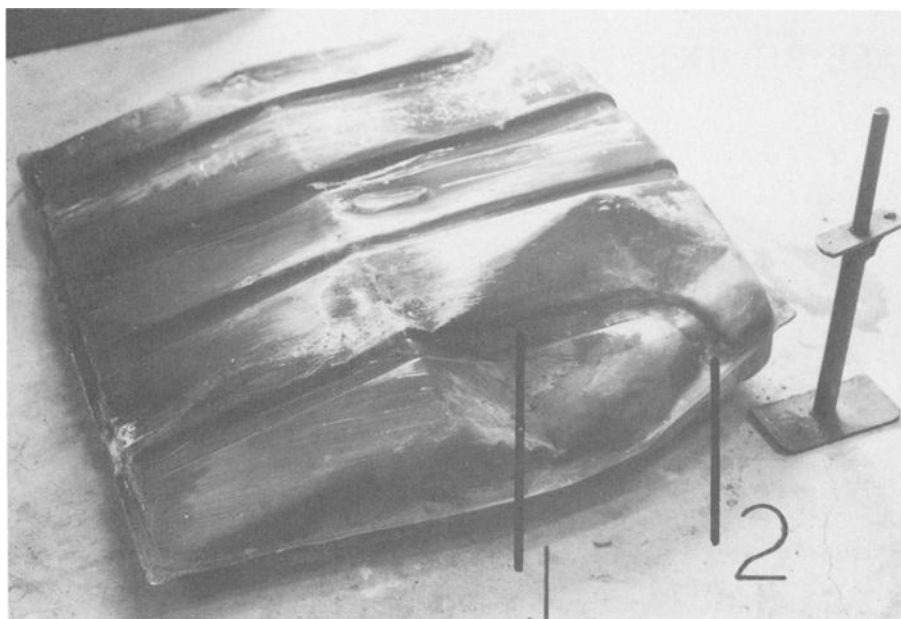


FIG. 1—Photograph of the gas tank and stand. The positions of indentations (1) and a hole (2) are shown at a higher magnification in Figs. 2 and 3, respectively.

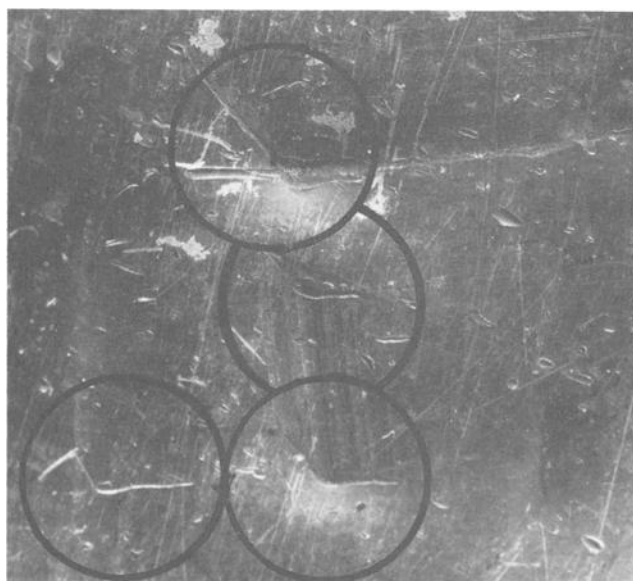


FIG. 2—Close-up photograph of Position 1 of Fig. 1. Note that, in addition to the superficial mark in the bottom left, there are three similarly shaped indentations in the center of the photograph.



FIG. 3—This close-up photograph of Position 2 on the gas tank shows that the hole can be matched with the top, sharp edge of the stand.

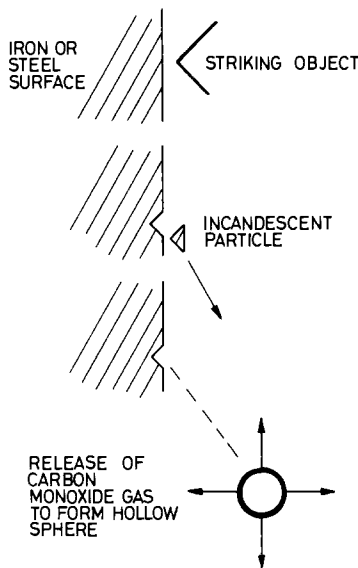


FIG. 4—Schematic representation of the mechanism of mechanical sparking.

position, indicating that it was being used to lower the vehicle. Also, there were other indentations of recent origin close to the hole that could not be explained in terms of contact with any other part of the vehicle or the top edge of the stand. It is probable that these indentations were made by the flat section before its removal.

Having established that the puncture of the gas tank did not appear to be accidental, we considered the probability of the initiation of the fire being accidental. Because there were no electrical leads or connections located underneath the vehicle near the puncture, the possibility of electrical sparking could be discounted. The other possible accidental ignition source is mechanical sparking.

The mechanism of mechanical sparking is shown schematically in Fig. 4. A particle of a ferrous alloy (iron or steel) must be torn from the surface with sufficient energy built up in the particle for it to exceed the ignition temperature for iron, which is approximately 800°C. If this temperature is exceeded, the iron will oxidize readily with release of heat, that is, burn. The oxidation of carbon within the iron or steel blows the particle into a hollow sphere, thus producing the spark. The outer surface of the gas tank was covered with a coating of terneplate, which cannot be made to spark. Thus the puncturing by the stand would not cause a mechanical spark. Sparking cannot occur if the gas tank falls onto a hard abrasive surface such as the road surface. The stand would be expected to remain in position while puncturing the gas tank. Thus there is no reasonable explanation for the production of a mechanical spark when the gas tank ruptured.

Conclusion

The results of the examination were found to be inconsistent with either the accidental collapse of the jack or with accidental ignition. The results were consistent with the following sequence of events. The owner tried several times to puncture the tank with the stand. Initially, the flat surface was attached to the stand; it failed to puncture the tank, but it did leave indentations at Position 1. The owner then removed the flat surface and, after repositioning the stand beneath the tank, lowered the vehicle until the tank was punctured. The escaping gas was then lit.

Summary

A vehicle was claimed by the owner to have caught on fire when a rear wheel was being changed. Consideration of the events described by the owner indicated that the suggested sequence of events was highly unlikely. Examination of the remains of the vehicle revealed data suggesting arson.

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