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COMBUSTIBILITY OF AUTOMOBILES: RESULTS OF TOTAL BURNING

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Over the years of existence of automobile insurance, many thousands of automobiles have been burned to defraud insurance companies. As a consequence of this criminal activity, specialists have been developed to cope with the problem. As in other dedicated activities, the literature of automobile arson investigation has its "myths" that persist. One of these misconceptions is that a car does not contain sufficient combustible material to burn to a shell. It is presumed that kerosene, gasoline, or other inflammable liquid must be used as an aid. Further, if the remains of a total fire show certain signs, such as, icicling of glass, buckling of the roof, sagging of the springs or other manifestations of high heat, these are considered as evidence of the use of aiding accelerants (1, 2, 3, 4, 5, 6, 7). As will be shown in this report, these clues above are not reliable evidence of arson.

This research is the outgrowth of two mysterious automobile fires on the Michigan State University Campus at East Lansing. Within fifteen minutes, two cars, fifty feet from each other burst into flames under suspicious circumstances. No evidence of accelerants could be recovered from the residue. As a consequence, questions arose as to the combustibility of automobile interiors. The best answer to this question could be discovered by controlled burning of cars.

Several auto salvage concerns cooperated by placing cars at our disposal. Generally, these cars were 1949 to 1951 vintage and were complete as to upholstery, flooring, windows, and tires. The majority still had engines and had been driven to the salvage yard. The major defect was represented by corroded rocker panels and soiled interior.[1] All of the cars tested had cloth seat and back covering.

Single cigarettes were lit and placed at the juncture of the seat and back rest or on the seat surface midway between the front edge and the back rest. Table 1 shows the time interval between the placing of the cigarette and the outbreak of flames.

The first phase of ignition consisted of scorching of the fabric and penetration of decomposition below the position of the cigarette. At this time, the cigarette might be completely consumed, leaving an area of char slightly longer and wider than the cigarette.

During the second phase, the cushion material slowly smoulders producing an enlarging area of scorched fabric. Whisps of smoke begin to fill the interior, and a brown distillate condenses on the windows. The temperature of the exterior of the body gradually rises until the outside surface is too hot for comfortable skin contact.

As the smouldering continues, a point is reached where the back or seat is completely tunneled and where ignition temperature is reached. Phase three, visible flames begin. The threshold period of phase three may consist of the rise and fall of flames as the oxygen is renewed and depleted

[1] Recent test conducted by one of the authors, in conjunction with a training seminar for Illinois State Police, Motor Vehicle Investigation, indicates that the extent of damage may be closely related to the degree of ventilation.

An attempt was made to burn a tight car with windows and doors closed. Although the cigarette ignited the upholstery, no flames were observed. After an interval of approximately two hours, the vehicle was examined. The interior was completely charred; however, the windows and metal structure suffered little damage. To demonstrate the lack of combustible residue, attempts were made to ignite the interior using inflammables with very little success. Other cars in the test group having perforated bodies burned with little difficulty.

Table I

Car	Cigarette In	Flames	Interval	Remarks
'53 Plymouth	1:40 PM	2:30 PM	50 min.	Plastic cover failed to ignite
'57 Dodge	2:00 PM	4:30 PM	150 min.	1st cigarette burned out
'49 Plymouth	1:35 PM	3:25 PM	110 min.	
'50 Chev.	11:15 AM	12:55 N	100 min.	1st cigarette burned out
'50 Olds. 88	10:37 AM	12:08 N	91 min.	
'49 Pontiac	10:50 AM	3:25 PM	275 min.	
'50 Ford	10:40 AM	12:55 PM	135 min.	
'51 Chev.	10:50 AM	1:05 PM	135 min.	Snow & ice on ground—2nd cig.
'49 Chev.	10:45 AM	*		Temp. 13°F.—4th cigarette ignited
'49 Chev.	7:35 AM	10:10 AM	155 min.	Temp. 4°C

* Extinguished at 12:00 N—Char 8″ dia.

until a point is reached where window glass cracks admitting a steady stream of air. At this point, the fire accelerates rapidly, flames shoot out of broken windows for 4–5 feet, the laminate between window glass boils, and the exterior paint burns.

The intensity of the fire, fed by normal contents of the car, is enough to ignite tires, penetrate the fire wall and melt the carburetor, melt all of the body solder and most of the die cast fixtures, and ignite brake fluid after burning through brake lines. This phase of intense, active burning lasts for twenty to thirty minutes. After the combustible material is consumed, the fire quickly dies, leaving a very hot car. With only one exception, all of the cars ignited by cigarette, Table 1, were permitted to burn to completion.

When the burned car was cool enough, the interior was examined. Inevitably the springs were sagged and without temper, the roof was buckled, and there was evidence of icicling of the glass of windows and windshield. In cases where the tires were permitted to burn, the rear springs lost temper, leaving the body sag to the ground. (In order to permit removal of the car from the test area, it was our practice to cool the tires with a fog nozzle to prevent their burning).

Comparison studies were attempted. It was our objective to burn pairs of cars of identical make and model, one by cigarette and one by gasoline. Although several cars were burned with gasoline and companion cars ignited by a cigarette, no definite conclusion could be reached as to the validity of buckled roof, sagged springs, icicled glass, penetration through the fire wall as evidence of accelerants. In fact, from this limited study, it is our opinion that the destruction may be less if a car is burned with accelerants than when burned by cigarette ignition. The rapid combustion in the case where gasoline is used does not permit sufficient heat to be conducted to all parts of the vehicle. Slow cooking with a cigarette seems to bring more of the auto body to destructive temperatures.

In order to determine the interior temperatures attained by the contents above, thermocouples were placed at ceiling, middle, and floor levels of one of these cars burned by a cigarette. For a period of fifteen minutes, during phase three, the temperature at the ceiling thermocouple exceeded 1500°F. This is well above the point at which spring steel loses its temper. Verification of the lack of usefulness of seat spring temper could be found in studies which were made of spring steel before and after burning, with and without accelerants. Hardness tests showed similar loss of temper in both circumstances of burning.

Since the beginning of these tests, the authors have seen late model cars after being discovered and extinguished in phase two of the combustion cycle. It is our opinion that, undiscovered, these cars would have progressed to phase three. The extent of phase three could not be determined since we were unable to procure a new car for this experiment.

The authors have attempted to show that cars can be ignited with a cigarette. Further, that extreme care must be exercised in the interpretation of the carcass of a totally burned automobile. Valid suspicions may be in order, but substantial proof of arson cannot be discovered.

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