EA02-025

10-28-03

FORD 10/28/03 LETTER TO ODI

BOOK 1 OF 2

PART A – D

PART B

VIGO COUNTY SUPERIOR COURT
STATE OF INDIANA

407214

STATE OF INDIANA)
) SS:
COUNTY OF VIGO)

IN THE VIGO SUPERIOR COURT

CAUSE NO. 84D02 9904 CT 544

[redacted]

Plaintiff,

v.

FORD MOTOR COMPANY,

Defendant.

FILED
VIGO COUNTY SUPERIOR COURT
APR 01 1999
William L. Maxwell
CLERK

COMPLAINT

COMES now Plaintiff, [redacted], by its counsel, and for its Complaint against Defendant, Ford Motor Company, states and alleges:

1. That at all times relevant herein, Plaintiff, [redacted]) is an insurance carrier licensed to do business in the State of Indiana and insures [redacted]

2. That at all times relevant herein [redacted] insured [redacted], is an Indiana resident, residing [redacted] Terre Haute, Indiana.

3. That at all times relevant herein, Defendant, Ford Motor Company ("Ford"), is a corporation organized and existing under the laws of Indiana, qualified and licensed to do business in Indiana, and is engaged in the manufacture of Mercury Grand Marquis automobiles.

4. In 1993, [redacted] purchased a used 1992 Mercury Grand Marquis manufactured by Defendant, Ford, from Eaton Fusco Cadillac.

5. On or about April 6, 1997, [redacted] parked the 1992 Grand Marquis in her garage.

6. At approximately 11:30 p.m. that evening, [redacted] discovered that her garage and house were on fire.

[redacted]

7. [redacted] vehicle and house were severely damaged as a result of the fire.

8. On May 29, 1997, [redacted] employed Pace, Inc., in the person of Frederick F. Franklin to visit the [redacted] residence and to perform a Cause and Origin Investigation of the fire.

9. On May 29, 1997, Pace, Inc. visited the scene of the accident and made a Cause and Origin Investigation and issued its report, a copy of which is attached hereto as Exhibit A.

10. According to the Pace, Inc. Cause and Origin Investigation Report, the fire at the [redacted] residence was caused by short circuit arcing in the right, front corner engine compartment of [redacted] 1992 Mercury Grand Marquis.

11. Plaintiff and Pace, Inc. determined that a defective wiring system was the direct and proximate cause of the fire and the ensuing damage to the vehicle and house.

12. That Defendant's negligent design and/or manufacture of the 1992 Mercury grand Marquis' wiring system was a direct and proximate cause of the fire.

13. That as a result of the Defendant's negligence, [redacted] vehicle and house were severely damaged.

14. That as a proximate result of the accident, [redacted] has been required to make payments to its insured [redacted] for her loss in the amount of One Hundred Ten Thousand One Hundred and Four Dollars and Seventy-Seven Cents ($110,104.77).

15. That [redacted] is entitled to reimbursement for its payments by subrogation from Defendant.

16. That Defendant has failed and/or refused to pay the cost for damages as of this date to Hartford.

17. The 1992 Mercury Grand Marquis was built and assembled by Defendant and in doing so, Defendant, through its agents and employees, negligently and unlawfully designed and/or installed defective wiring in the right, front corner engine compartment of the 1992 Mercury Grand Marquis, which defect could have been ascertained with reasonable inspection by the Defendant.

WHEREFORE, Plaintiff, [redacted], respectfully requests the Court to enter judgment for Plaintiff and against Defendant, in the principal amount of One Hundred Ten Thousand One Hundred Four Dollars and Seventy-Seven Cents ($110,104.77), for prejudgment interest, and costs together with all other just and proper relief in the premises.

Respectfully submitted,

McCROSSON & NERZ

By: Thomas E. Schulte
Thomas E. Schulte, Esq. (20360-49)

By: Dennis F. McCrosson T.S.
Dennis F. McCrosson, Esq. (10249-49)

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[redacted]FORDA

ER02-628 35084

PACE INC. PROFESSIONAL ANALYTICAL & CONSULTING ENGINEERS, INC.

4326 Indeco Court • Cincinnati, Ohio 45241 • (513) 793-3771
1-800-PACE-000 • Fax: (513) 793-0638

VEHICLE AND GARAGE FIRE

2625 EAST THOMAS AVENUE

TERRE HAUTE, INDIANA

CLAIM NO.: 565DP07941

INSURED: [redacted]

DATE OF LOSS: APRIL 6, 1997

P.A.C.E. PROJECT NO. I-2006A

MAY 29, 1997

FOR:

ITT-HARTFORD INSURANCE COMPANY

P.O. BOX 40

WEST POINT, INDIANA 47992

PLAINTIFF'S EXHIBIT A

D462-625 38656

TABLE OF CONTENTS

1982-635 30000

1. INTRODUCTION

1.1

Professional Analytical and Consulting Engineers (P.A.C.E.) was requested by Mr. Norman Hayman of the [redacted] West Point, Indiana to investigate a fire which occurred in a house owned by [redacted] and located at [redacted] Terre Haute, Indiana, and also her 1992 Mercury Grand Marquis which was parked in her garage.

1.2

A professional opinion was requested in an attempt to determine the cause of this fire.

2. OBSERVATIONS

2.1

A site visit was conducted on April 11, 1997 by Mr. Frederick Franklin, P.A.C.E. Electrical-Mechanical Engineer. The photographs shown in this report were taken there by me at that time. Figure 1 is a front view of the

house, and Figure 2 is a view of the garage from the front. Figure 3 is a view of the house and garage from the rear.

2.2

Figures 4 and 5 look through the garage door toward the remains of the 1992 Mercury Grand Marquis which was parked in the garage at the time of the fire.

2.3

Figure 6 is a view looking through the kitchen of the house toward the doorway to the garage. Figures 7 and 8 are additional views of the kitchen. By comparing these photographs to Figures 4 and 5, it is clear that the fire originated in the garage area, in my opinion.

2.4

Figure 9 is a view of the much lighter burn damage in the dining room. Figure 10 is a view of the living room, and Figure 11 is a view of the hallway which leads to the bedrooms on the opposite end of the house from the garage.

2.5

Figure 12 looks across the engine compartment of the automobile toward the rear wall of the garage. The engine hood was made of aluminum and it has melted during the fire. Figure 13 looks toward the rear wall of the garage and the doorway to the kitchen. Figures 14 and 15 are closer views of the circuit breaker panel shown from a distance in Figure 13. These photographs demonstrate that no hole has ever occurred in the metal panels of the circuit

breaker enclosure. Thus this fire could not have been caused by a malfunction inside the circuit breaker panel, in my opinion.

2.6

Figure 16 looks toward the garage door at the front of the house. It may be observed in Figures 4, 5, and 16 that almost all the roof of the garage has been consumed, and that the timbers have fallen onto the top of the automobile. This means that the fire did not start around the periphery of the garage, in my opinion. Rather the fire started in the vicinity of the automobile, in my opinion.

2.7

Figure 17 looks down the stairway in the garage to the basement. This stairway is shown at the far left of Figure 16.

2.8

Figure 18 is another view of the engine compartment of the Mercury. Figure 19 looks across its dashboard area, and Figures 20, 21, and 22 are interior views of its passenger compartment. Figures 23 and 24 are views of the trunk of the automobile. Because the rubber tire in the trunk has never been consumed, it is clear that the fire could not have originated in this trunk, in my opinion. There was an electrical device in this trunk which assisted [redacted] by extending a wheel chair for her, but it could not have been the cause, in my opinion.

2.9

Figure 25 is a view of the remains of a romex-type cable which had traveled through the ceiling area above the automobile at the time of the fire. Figure 26 is a close view of the ends of this cable. The melted copper suggests that short circuit arcing may have occurred in this cable at some point in time, in my opinion.

2.10

Figure 27 is a view of what may be the opposite end of this same romex-type cable. Figures 28, 29, and 30 are close views of metallic melts left by short circuit arcing in this cable which occurred at some point in time. The window shown in Figure 27 is the same window shown at the middle of Figure 2 on the side wall of the garage.

2.11

Figure 31 is a view of another romex-type cable which has arced at some point in time near the garage door. I took these three sets of romex-type cables which contained copper melts with me as evidence to store at P.A.C.E. in case anyone else ever wants to see them in person.

2.12

At the middle of Figure 2 a "clean area" may be observed on the block wall. This "clean area" is an area of very intense heating. This area was approximately in line with the right, front corner of the Mercury, which is where I believe the fire originated. Figure 33 is a view of this right, front

corner of the Mercury, and Figure 34 is another view. Figure 35 is a closer view of the wiring harness remains shown in Figures 33 and 34. I believe a vehicle short circuit arc in this area is what caused this fire.

2.13

Figure 36 is another view of the partially melted right, front wheel. This wheel was much more intensely damaged than the other three wheels on the Mercury, which are shown in Figures 37, 38, and 39, in my opinion.

2.14

Figures 40, 41, and 42 are views of the garage door opener which has fallen onto the roof of the Mercury. I could find no holes in its metal cover. In my opinion, any short circuit arc inside the garage door opener would have to create a hole in the metal cover before flying copper globules could exit to cause a fire.

3. ANALYSIS

3.1

On May 8, 1997 I traveled to a Mercury dealership near my office. The service managers there told me that the power distribution center for a 1992 Mercury Marquis is located at the right, front corner of the engine compartment. The service managers told me that a plastic enclosure

contains the power distribution center. Figure 37 is a view of this area, looking forward across the right, front wheel in the subject vehicle. The larger battery cable leading toward the shelf at the top of the photograph may be observed, along with copious amounts of electrical wiring. The power distribution center is where the large battery cable connects to smaller feeder cables, and to even smaller circuit wires via fuses. Thus there is no question that some conductors in this area, which I believe was the area of origin, were energized at the time the fire occurred, in my opinion. That is, turning off the ignition switch would not de-energize all of these conductors. Many of the conductors in and around this distribution center would have voltage even when the ignition switch was turned off.

3.2

On May 16, 1997, I took the Polaroid photographs shown in Figures 44, 45, and 46. These photographs show the engine compartment of an exemplar 1992 Mercury Grand Marquis owned by an acquaintance of mine. The arrow in Figure 45 points to the plastic enclosure of the power distribution center.

3.3

A copy of a one minute videotape is enclosed which illustrates how arcs in vehicle electrical wiring can cause fires even when they are fed by 15 or 20 ampere fuses, let alone larger fuses. In this videotape, two each, 16 gauge stranded copper conductors, six feet long are connected to a 12 volts, D.C. vehicle battery. A torch is used to set up carbon path arcing. It may be observed that the arcing lasts for well over one minute and that the arcing

finally melts both copper conductors completely apart without ever drawing enough current to pop a 15 or 20 ampere vehicle fuse.

3.4

Included in the Addendum section of this report are two articles. "Vehicle Short Circuit Fires and Their Prevention" discusses in more detail why short circuit arcs can cause fires without popping a 15 or 20 ampere fuse, or larger. The article also discusses that vehicle short circuit arcs can create fires without leaving a melt on the copper conductors. This explains why I did not find any significant copper melt on the copper conductors at the right, front corner of the engine compartment. I did not remove anything from the Mercury Marquis, but rather left it entirely as I found it.

3.5

The other article, "Latent Short Circuit Defects," discusses how insulation which is damaged during the manufacture of an automobile can lie dormant for years until an arc occurs one day to cause a fire.

3.6

Because of the intense fire damage at the right, front corner of the automobile, I could not determine exactly what short circuited to cause this fire. Since the vehicle had been parked for nine hours prior to the fire, without its engine running, there would have been no other source of heating power in the vehicle to cause a fire other than a short circuit arc, in my

opinion. Thus it is my opinion that a short circuit are in the right, front corner area of the Mercury Marquis was the cause of this fire.

3.7

On May 19, 1997, I spoke to the house and Mercury owner, [redacted], on the telephone. [redacted] stated that when she discovered the fire, flames were already coming through the kitchen door between her kitchen and the garage. Thus, she never was able to look into the garage to see where the fire was burning in the garage, because the fire was already so intense at that time. She stated this fire occurred at approximately 11:30 p.m. to midnight. [redacted] stated that she had no smoke detectors in the house, and thus it was fortunate that she was awake watching the news on television when the fire occurred.

3.8

[redacted] stated that she had no gasoline cans anywhere in the garage, nor any type of other flammable liquid in the garage.

3.9

[redacted] stated that she purchased this Mercury used in 1993 from Estes Fuson Cadillac and that it had approximately 27,000 miles on it at that time. At the time of the fire, it had approximately 41,000 miles on its odometer. [redacted] stated that the Mercury never required any type of service, except routine service, and that it never had any problem at all.

Because of this, I believe that it is doubtful that it ever required anything but routine service during its first 27,000 miles, although this remains a possibility.

3.10

[redacted] stated that she last purchased a battery for the vehicle on October 31, 1995 at a service station located at the corner of Lafayette and Fort Harrison Road in Terre Haute. She remembers this date well, because she broke her leg three days later. It may be observed that the battery is also located at the right, front corner of the engine compartment in this Mercury.

4. CONCLUSIONS

4.1

Based upon the observations and analysis as set forth in this report, it is my opinion that the fire which occurred in the garage of a house owned by Ms. [redacted] at [redacted] in Terre Haute, Indiana was caused by short circuit arcing in the right, front corner of the engine compartment of her 1992 Mercury Grand Marquis.

4.2

Thus, it is my opinion that the Ford Motor Company is responsible for the

cause of the fire in the Grand Marquis and to [redacted] home and garage.

PROFESSIONAL ANALYTICAL AND CONSULTING ENGINEERS

Frederick F. Franklin
Professional Engineer
State of Indiana
Registration No. 15629

Addendum

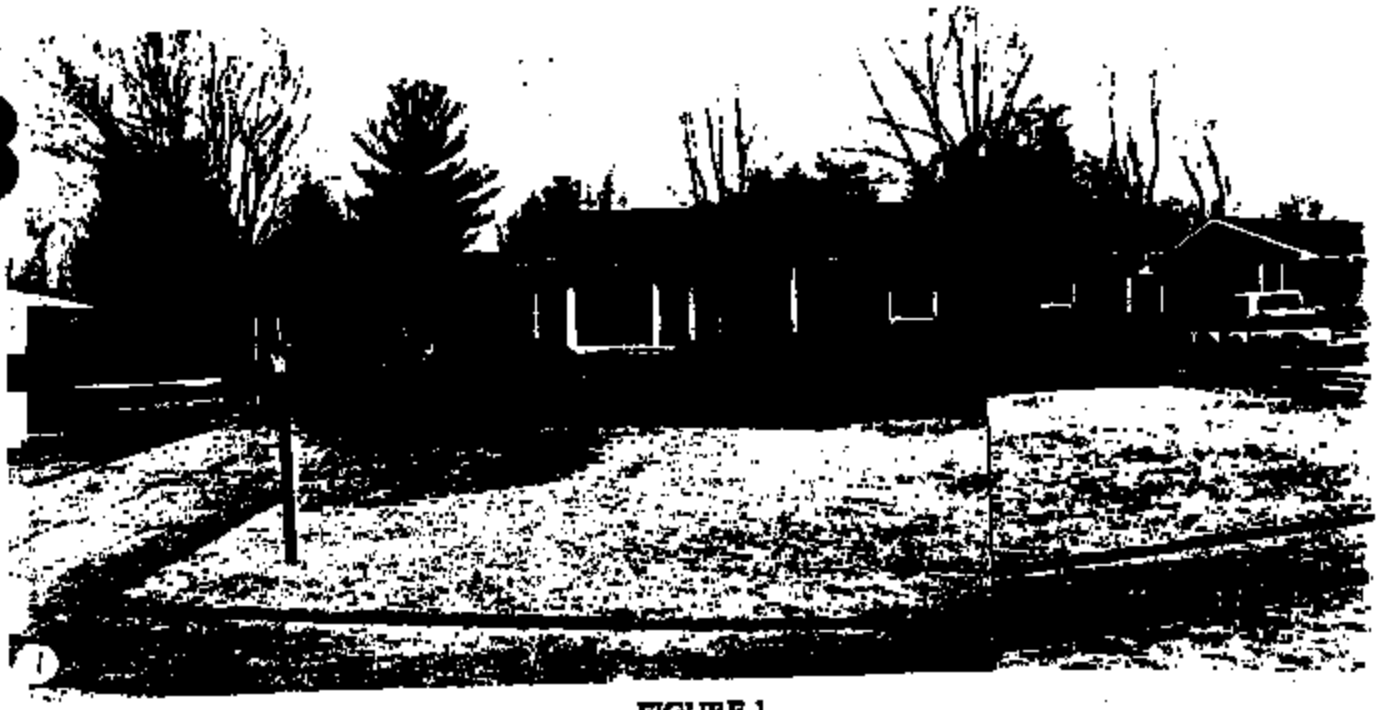


FIGURE 1

FRONT VIEW OF HOUSE AND GARAGE

FIGURE 2

VIEW OF GARAGE

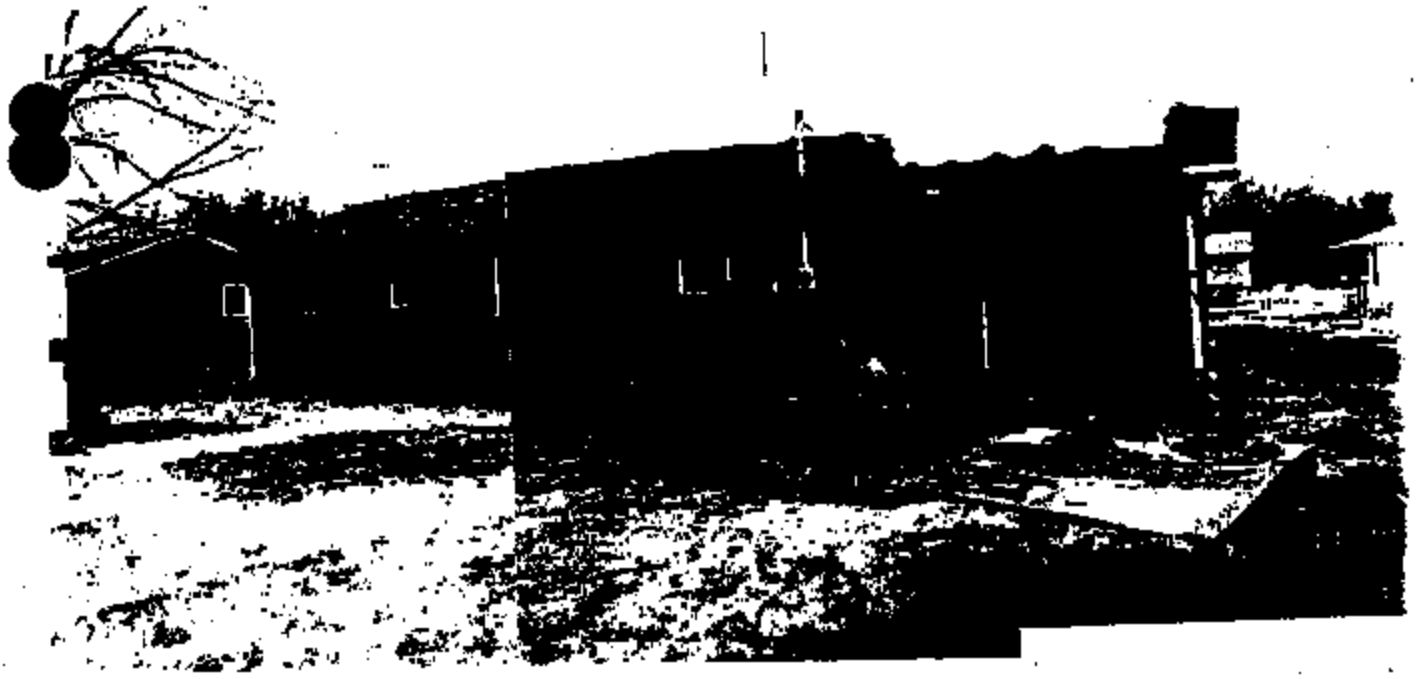


FIGURE 3

REAR VIEW OF HOUSE AND GARAGE

FIGURE 4

VIEW OF GARAGE LOOKING THROUGH GARAGE DOORWAY

FIGURE 5

VIEW OF GARAGE LOOKING THROUGH GARAGE DOORWAY

FIGURE 6

VIEW OF KITCHEN LOOKING TOWARD DOOR TO GARAGE

FIGURE 7

VIEW OF KITCHEN LOOKING TOWARD DOOR TO GARAGE

FIGURE 8

VIEW OF NORTH WALL OF KITCHEN

FIGURE 9

VIEW OF DINING ROOM

FIGURE 10

VIEW OF LIVING ROOM

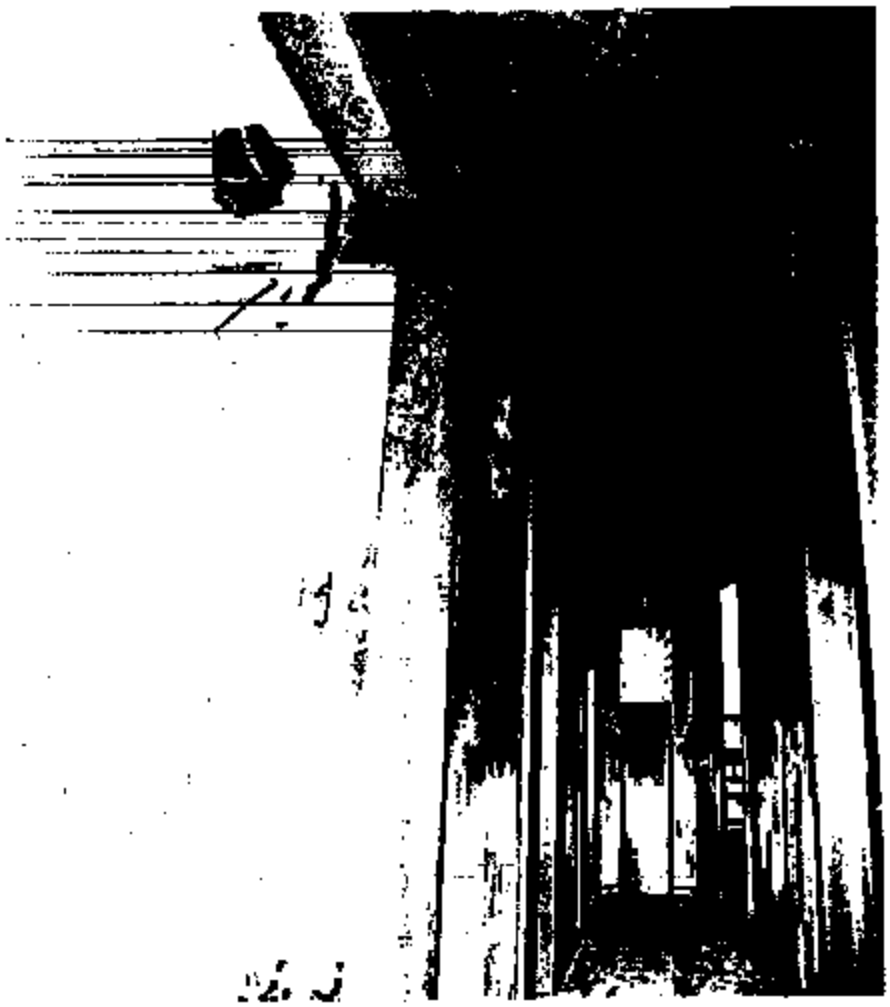


FIGURE 11

VIEW OF HALLWAY LEADING TO WEST BEDROOMS

FIGURE 12

VIEW LOOKING FORWARD ACROSS ENGINE COMPARTMENT OF MERCURY

FIGURE 13

VIEW LOOKING TOWARD SOUTHWEST CORNER OF GARAGE

FIGURE 14

VIEW OF CIRCUIT BREAKER PANEL

FIGURE 15

VIEW OF AREA ABOVE CIRCUIT BREAKER PANEL

FIGURE 16

VIEW LOOKING NORTHWARD IN GARAGE

FIGURE 17

VIEW OF BASEMENT STAIRWAY IN GARAGE

FIGURE 18

VIEW OF MERCURY ENGINE COMPARTMENT

FIGURE 19

VIEW OF DASHBOARD AREA

FIGURE 20

VIEW LOOKING REARWARD THROUGH WINDSHIELD

FIGURE 21

VIEW OF FRONT SEATS

FIGURE 22

VIEW OF REAR SEATS

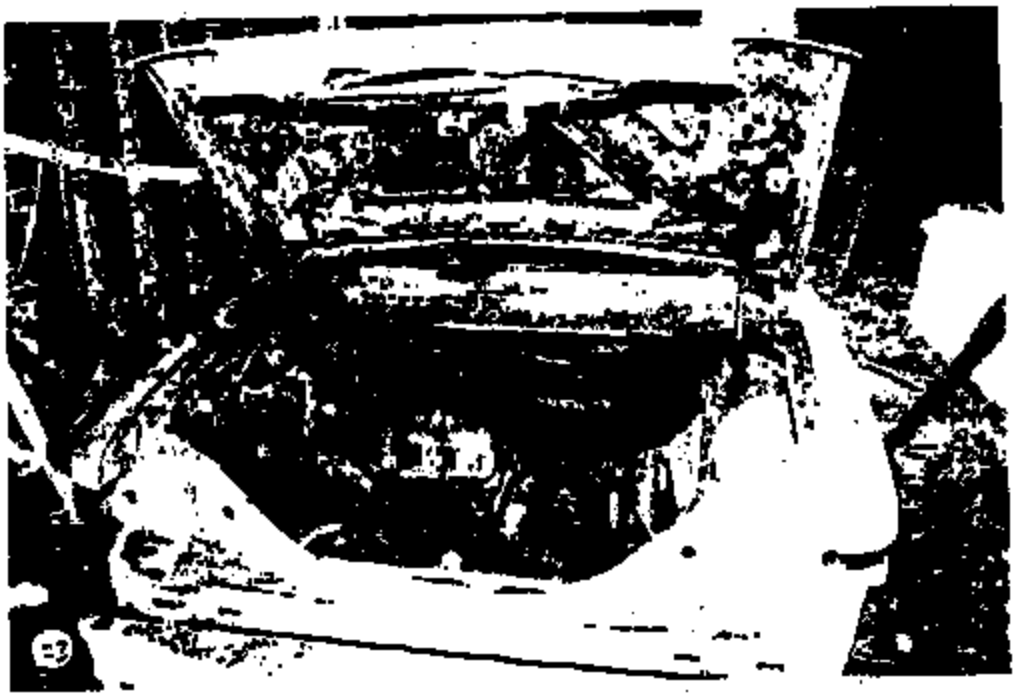


FIGURE 23

VIEW OF TRUNK

FIGURE 24

CLOSER VIEW IN TRUNK

FIGURE 25

VIEW OF ROMEX CABLE REMAINS

FIGURE 26

VIEW OF MELTED ROMEX-TYPE CABLE CONDUCTORS

FIGURE 27

VIEW OF ROMEX-TYPE CONDUCTORS NEAR NORTHEAST CORNER OF GARAGE

FIGURE 28

CLOSE VIEW OF MELTED COPPER

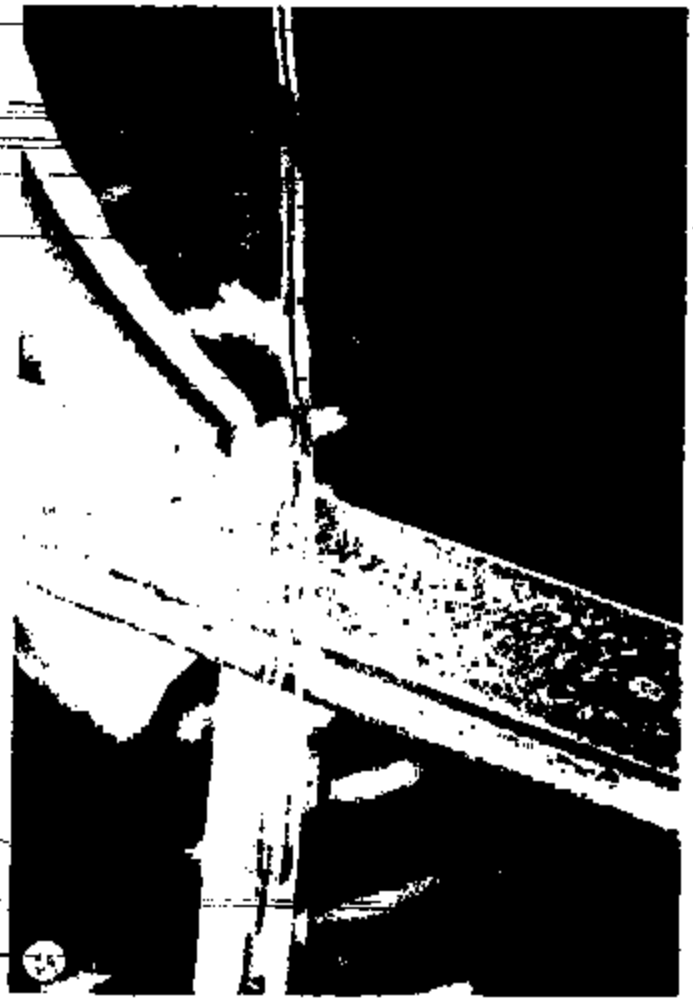


FIGURE 29

CLOSE VIEW OF MELTED COPPER

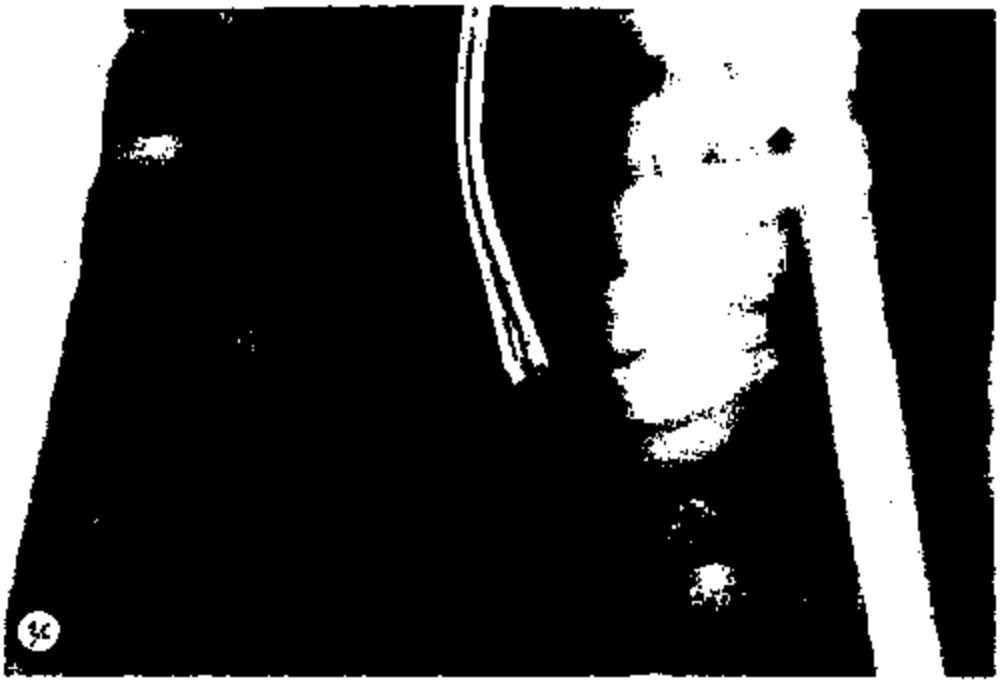


FIGURE 30

CLOSE VIEW OF MELTED COPPER

FIGURE 31

VIEW OF ROMEX-TYPE CABLE ABOVE GARAGE DOOR

FIGURE 32

VIEW OF "CLEAN AREA" ON WEST GARAGE WALL

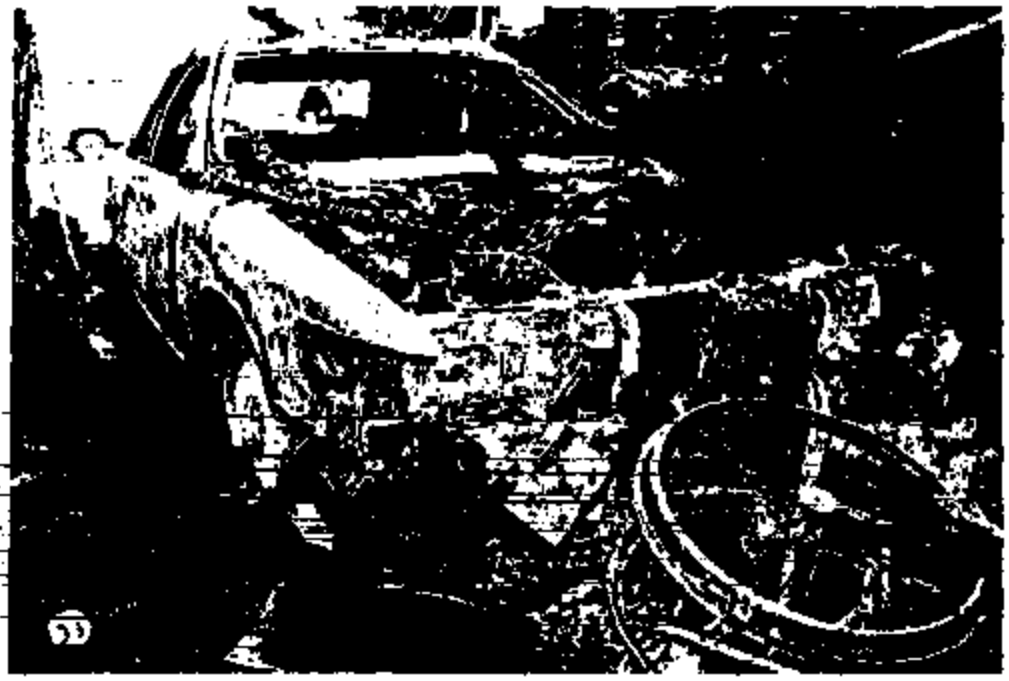


FIGURE 33

FRONT VIEW OF MERCURY

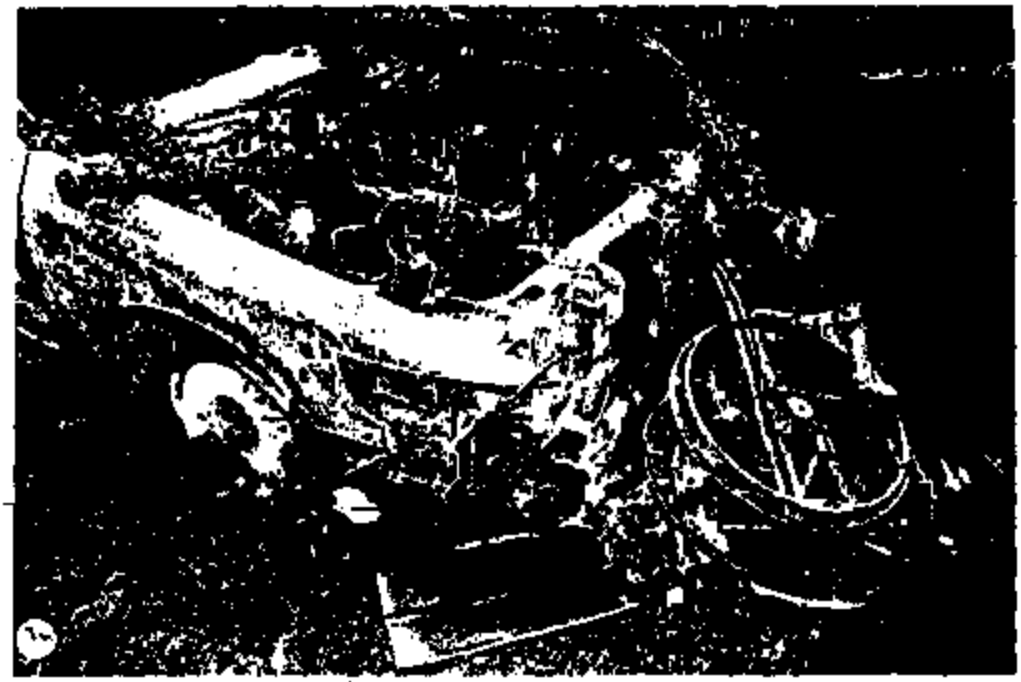


FIGURE 34

VIEW OF RIGHT, FRONT CORNER OF MERCURY

FIGURE 35

CLOSE VIEW OF RIGHT FRONT CORNER OF MERCURY

FIGURE 36

VIEW OF RIGHT FRONT WHEEL

FIGURE 37

VIEW OF RIGHT, REAR WHEEL

FIGURE 38

VIEW OF LEFT, REAR WHEEL

FIGURE 39

VIEW OF LEFT FRONT WHEEL

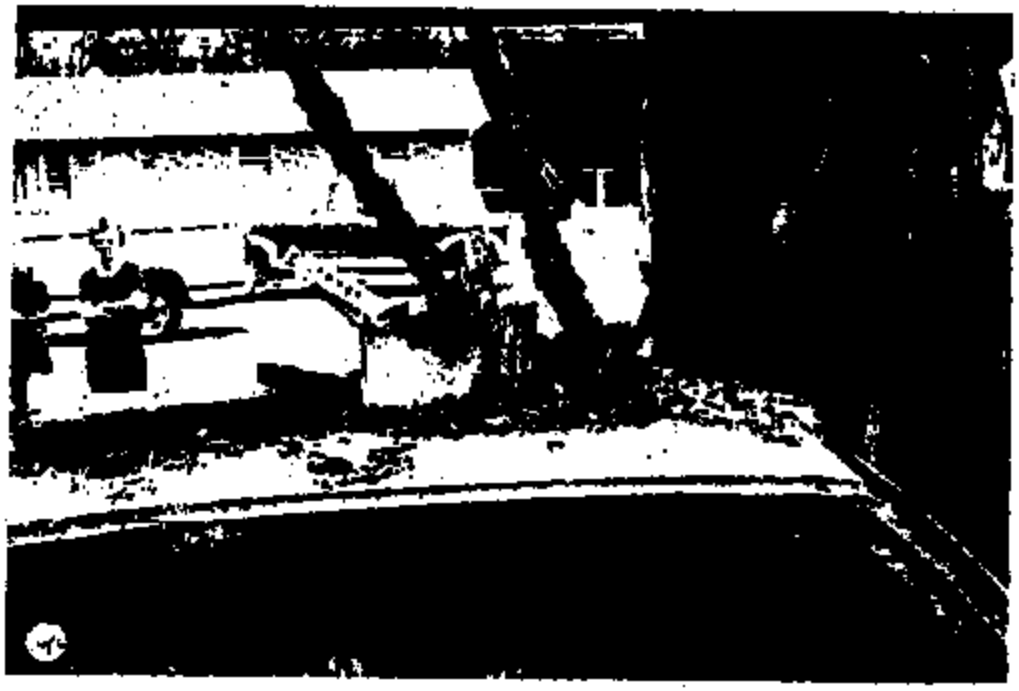


FIGURE 40

VIEW OF GARAGE DOOR OPENER REMAINS

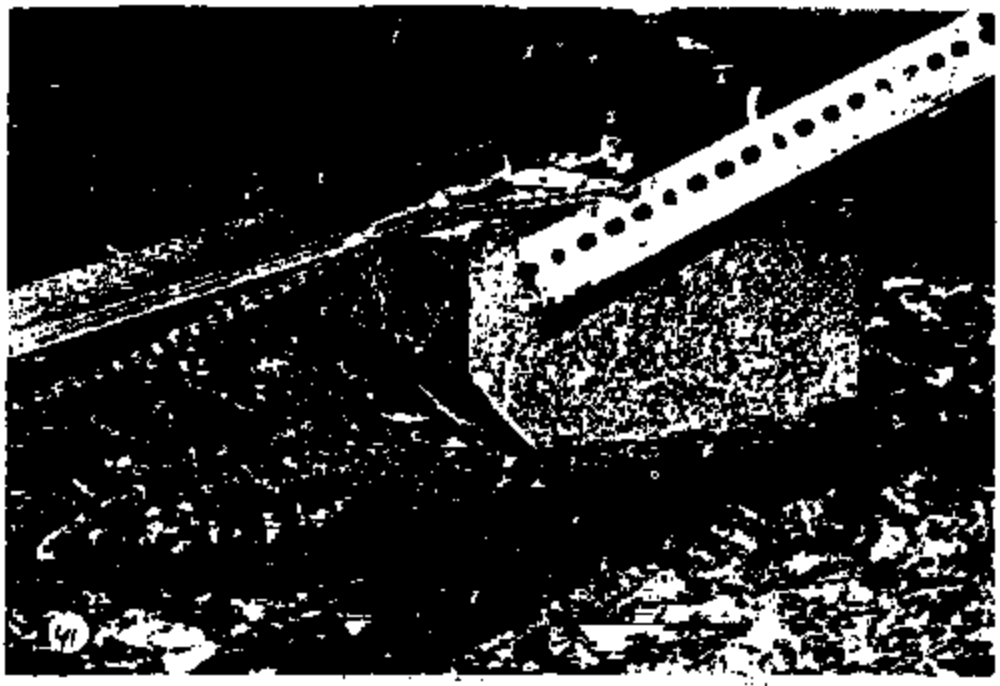


FIGURE 41

VIEW OF GARAGE DOOR OPENER REMAINS

FIGURE 42

VIEW OF GARAGE DOOR OPENER REMAINS

FIGURE 43

INSIDE VIEW OF RIGHT FRONT CORNER OF ENGINE COMPARTMENT

FIGURE 44

VIEW OF EXEMPLAR 1992 MERCURY GRAND MARQUIS

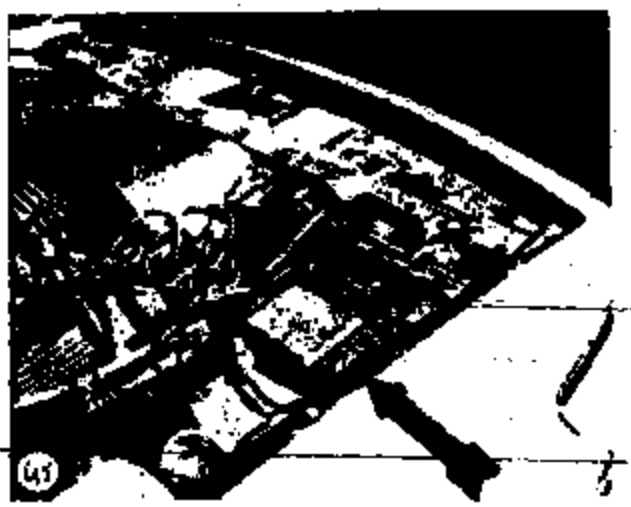


FIGURE 45

VIEW OF EXEMPLAR 1992 MERCURY GRAND MARQUIS

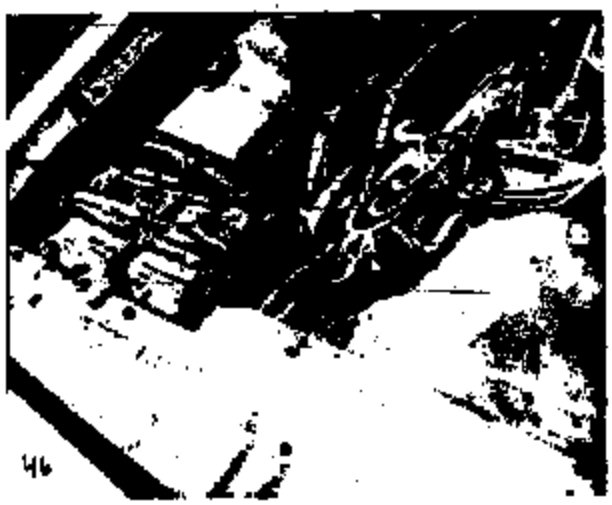
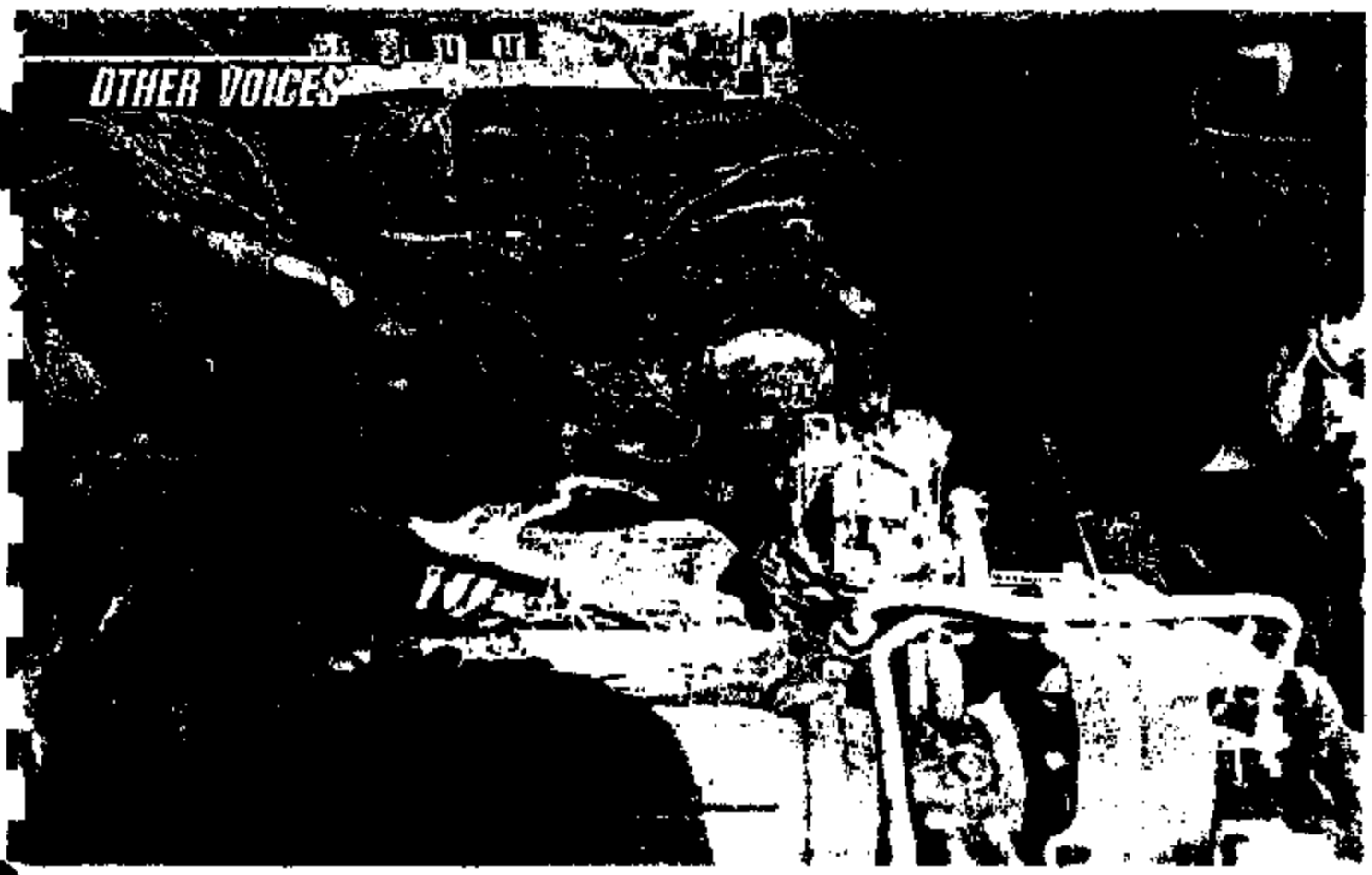


FIGURE 46

VIEW OF EXEMPLAR 1992

MERCURY GRAND MARQUIS

ADDENDUM



Vehicle Short Circuit Fires and Their Prevention

By FREDERICK F. FRANKLIN

According to NFPA statistics, nearly as many vehicle fires (447,500) occur in this country as do building fires (745,000) (*Fire Journal*, Sept. 1989). Besides smoking and arson, short circuits and flammable liquid leaks are the two primary causes of vehicle fires. Although gasoline is typically the flammable liquid involved, power steering fluid, transmission fluid, oil or ethylene glycol coolant can occasionally be the cause. Most short circuit fires and gasoline leaks can be easily prevented.

In 1983, General Motors (GM) was experiencing ongoing problems with its electric door lock switches. These switches were short circuiting and causing fires. To demonstrate the problem, GM conducted simulations. A Nov. 22, 1983 letter from M.D. Osterhoff of Fisher Body to B.R. Wanhass stated, "The door lock switch is powered by a battery feed line that is protected by a 20-ampere fuse. Misalignment of the conductor and/or improper assembly of the base to escutcheon may cause the conductor blade to contact the plated plastic escutcheon, causing a 'high resistance' short in the switch. This situation is sufficient to draw enough current and produce enough heat to start a fire and still not blow the 20 ampere fuse. Fisher Body Electrical Lab was able to simulate this situation and cause an arm-rest fire on May 7, 1983."

Those who have investigated vehicle fires know that 20-ampere fuses do not prevent short circuit fires in vehicle wiring, for the reason clearly stated by Osterhoff. The arc is not a dead short, but rather a relatively "high-resistance" arc. In simulations conducted by an independent firm, this resistance has been determined to be in the general range of 0.5 to 1.0 ohm, which results in arcing currents in the range of 12 to 24 amperes.

At 24 amperes, a 20-ampere fuse may take several minutes to pop—enough time to cause a fire. To prove that arcs will continue that long, the firm videotaped an arc that lasted well over 60 seconds. The arc finally melts both 16-gauge conductors apart, yet it never pops a 20-ampere vehicle fuse.

It was determined following numerous experiments that vehicle short circuit fires could be prevented. Figure 1 illustrates a typical vehicle fuse time-current curve. Based on this graph, it is difficult to detect much difference between a 20-ampere fuse and a 10-ampere fuse. A different configuration of this graph (Figure 2), however, illustrates that at most arcing currents, a 10-ampere fuse pops hundreds of times faster than a 20-ampere fuse.

The heating energy delivered to the arc is proportional to the opening time of the fuse. Figure 2 shows the energy allowed into an arc by each size before it pops, as a function of the current that the short circuit arc draws. Between 18 and 28 amperes of arcing current, a 20-ampere fuse allows hundreds of times more heating energy into an arc than a 10-ampere fuse. Likewise, a 10-ampere fuse allows hundreds of times more energy into an arc between 7 and 13 amperes than a 5-ampere fuse.

Reducing the heating energy (opening time) by hundreds of times reduces the probability of fire by a like amount. Therefore, effective short circuit protection can be accomplished by using smaller fuses.

Beginning in 1986, the author shared this information with various automobile and truck manufacturers. Some reward for these efforts was realized during 1991. George Farrell, manager of technical services for Littelfuse, which manufactures most vehicle fuses, indicated that GM must be listening based on the way it was utilizing fuses in the new Saturn automobile.

Photos A and B show Saturn fuse panels, while photo C shows the fuse panel from a 1988 Oldsmobile 98. As the pictures indicate, the Saturn uses mostly 5-, 7.5- and 10-ampere fuses; the Oldsmobile used mostly larger fuses. In addition, the Saturn uses many more circuits so that individual fuse ratings can be smaller. The Saturn uses 38 fuses compared to 18 in the 1988 Oldsmobile.

The author believes near-perfect protection could be obtained by using all 5-ampere fuses wired in tandem; however, this solution would be more difficult and more expensive. Apparently, GM has decided that using mostly 5-, 7.5- and 10-ampere fuses is adequate protection for most short circuit arcs. In another positive move, the Saturn uses 30-ampere fuses in place of fusible links. Also, no circuit breakers are visible (Franklin 42+).

RESIDENTIAL AND VEHICLE ARCS

It is interesting to note that both 120 volts A.C. residential arcs and vehicle wiring arcs have the same general range of electrical resistance—0.3 to 1.0 ohm (Franklin 42+). Since vehicle voltage (12 volts D.C.) is 10 times less than household voltage, from the formula:

$$P = \frac{V^2}{R}$$

the power delivered to a vehicle arc is roughly 100 times less than a residential arc. However, the vehicle arc lasts 100 times longer than a residential one; therefore, the total energy delivered to the arcs is about the same.

FIGURE 1 TYPICAL VEHICLE FUSE TIME-CURRENT CURVE

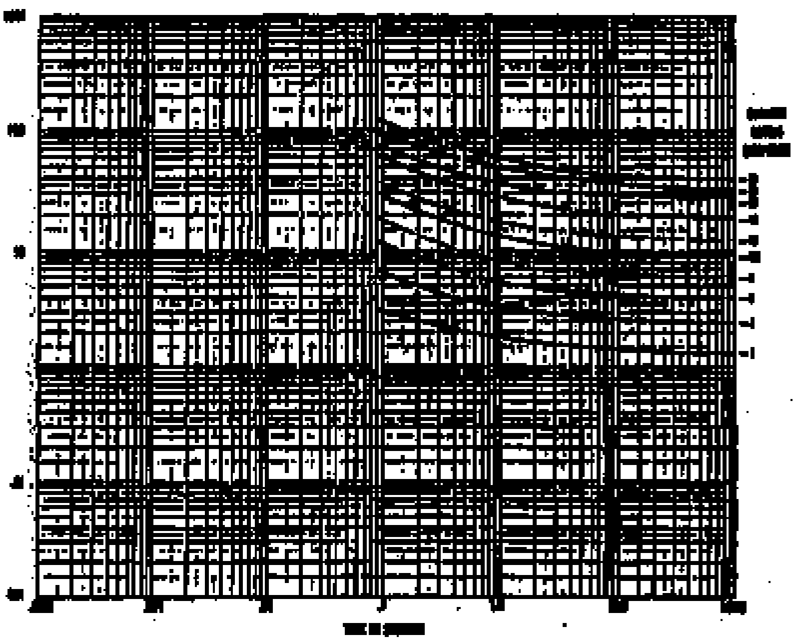
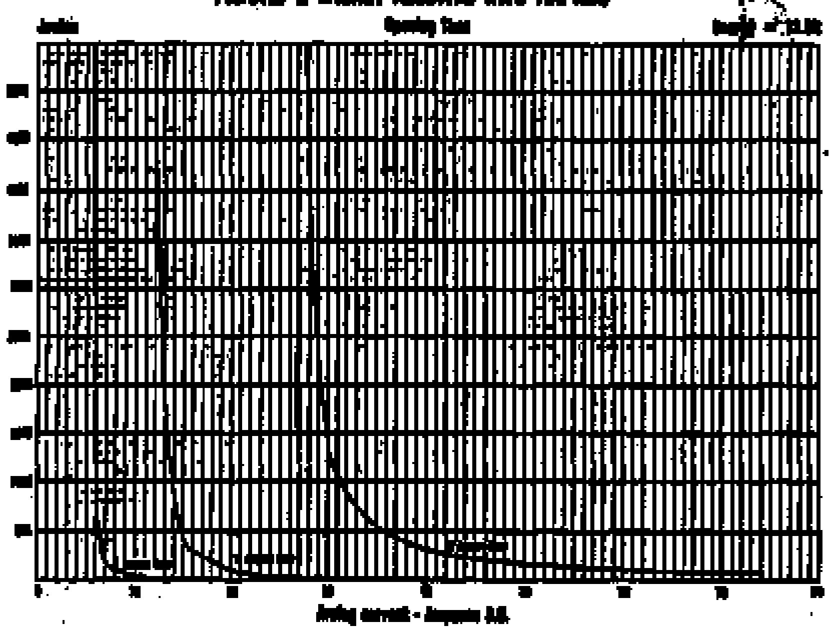


FIGURE 2 ENERGY ALLOWED INTO THE ARC



E = P × t
Energy = Power × Time
Joules = Watts × Seconds

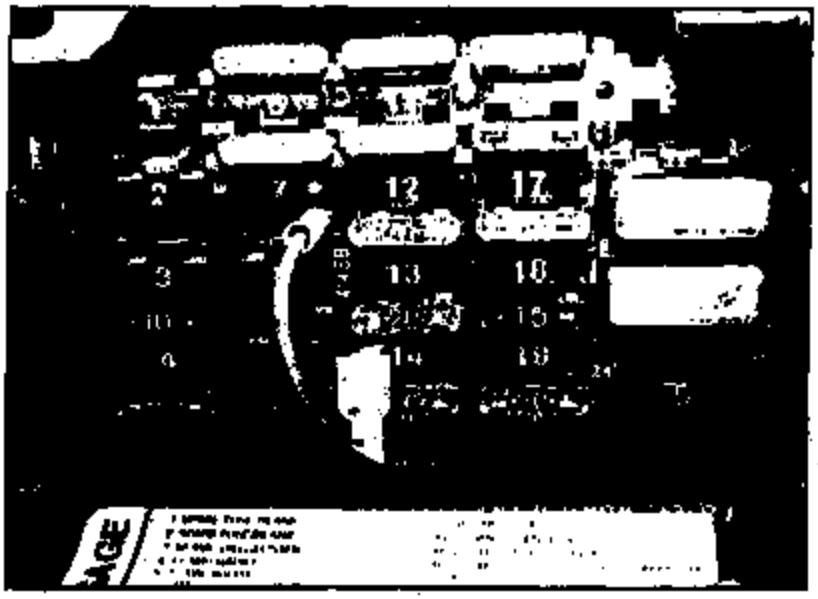
The 20,000 watts of electrical power delivered to a household arc melts copper so quickly that tens of copper globules 1/16-inch in diameter at over 2,300° F fly off in all directions, some landing up to six feet away.

Vehicle arcs are different. They are usually a very intense, localized white hot spot about 1/8-inch in diameter. In the author's opinion, both types of arcs can directly ignite electrical wiring insulation and/or plastic. Because vehicle short circuit arcing power is so much less, often no copper will remain on the wiring where the short circuit occurred. This has been confirmed in in-

*unit

ER02-035 35700

As Photo A (above) and B (right) show, the future was mostly 6-, 7.5- and 10-engine buses, while the 1990 Oldsmobile (Photo C, below) used mostly larger frames. In addition, the future used 30 fuses—compared to 15 in the Oldsmobile.



vestigations of several vehicle fires that produced limited damage.

The latent short circuit defect placed in vehicle wiring at the time of vehicle manufacture can cause an arcing fire at any time from one-half hour to years later (Franklin 38+). An independent firm investigated three separate vehicle fires at the same manufacturing plant. All three fires occurred after the cars were placed on semi-truck carriers located outside the plant.

Gasoline leaks can also cause vehicle fires. Most leaks occur at the short sections of neoprene rubber hoses inserted into the fuel line at the engine and fuel tank to dampen vibrations. Loose metal-tubing connections rarely cause such fires. However, because these rubber sections are completely consumed during a fire, those without extensive experience may have difficulty determining the fire's cause.

Both short circuit and fuel leak fires can occur while the vehicle is being driven. Typically, if a fire occurs within a few minutes of stopping or exiting a vehicle, a fuel leak is the likely cause. While the vehicle is moving, wind blows fuel away from the leak, thus preventing a fire. Once the vehicle stops, however, fuel collects in a pool and is then ignited by hot engine parts.

If the fire occurs more than 30 minutes after parking the vehicle (and smoking or arson are not involved), it is usually a short circuit fire. With a cold engine, nothing else can produce enough heating energy to ignite a fire.

Replacing rubber hose sections with a coiled, expandable metal line, like those used in brake line tubing, and reducing the size of fuses would likely prevent most accidental vehicle fires. In addition, eliminating these fires could enhance arson investigation. ■

REFERENCES

Franklin, Frederick F. "Circuit Breakers: The Myth of Safety." *Professional Safety.* June 1990: 28–31.

Franklin, Frederick F. "Latent Short Circuit Defects." *The Fire and Arson Investigator.* Dec. 1991: 38–39. Reprinted in *Professional Safety.* Sept. 1992: 36–37.

Frederick F. Franklin, P.E., is president of Professional Analytical and Consulting Engineers (P.A.C.E.), a forensic engineering firm in Cincinnati, OH. During the past 20 years, Franklin has investigated more than 250 vehicle fires, 1,400 building fires and 570 vehicle accidents of all types.

LATENT SHORT CIRCUIT DEFECTS

By Frederick P. Franklin, P.E., P.A.C.E., Cincinnati, OH.

How does a romex-type cable short circuit inside a closed wall space twelve years after an electrician installed it there? What causes a power cord lying on a carpet to short circuit suddenly and cause a fire when no one is home to move it or vibrate it in any manner? How exactly do short circuit arcs occur in the first place?

These questions have been answered after years of observing short circuit arcs in laboratory experiments and after 1000 on-the-scene fire investigations. The author noticed, in fifteen years of fire investigation, that copper and aluminum melts left on conductors by short circuits which cause fires appear the same as melts from short circuits which occur as a result of the ensuing fires. Thus, he deduced that the electrical currents producing the melts should be the same. Consequently, this hypothesis, he began burning through plastic insulation on electrical cables to create short circuit arcs, and then measuring the resulting electrical currents. That research resulted in a much better understanding of why American circuit breakers do not open quickly enough to prevent short circuit fires.[1] It also led to the conclusion that the process which initiates the arc in insulation and resultant short circuits is the same - namely, a carbon path flashover.

When a torch is used to slowly burn through the plastic insulation on an electrical cord or cable supplied by 120 volts A.C., the eventual one or two second arc that results is usually not caused because the conductors touch. Rather, it occurs because the burned plastic creates a carbon path between the two conductors. Simply stated, when the electrical resistance of this carbon path reaches a critical low value, it instantaneously breaks down into an electrical flashover (As with any flashover the actual physics includes localized heating effects, ionization, avalanching of electrons, negative resistance, and other plasma theories).

Although it is generally agreed that it takes over 350 volts A.C. to initiate an electrical discharge for even the most minute distance between two conductors in air, this carbon path theory does not violate that law, because the conducting medium here is not air but rather carbon.

The knowledge that flashovers can occur through carbon paths is as old as the electrical industry itself. Typical examples are the high voltage ceramic sting insulators in coal plants and other plants where coal or coke dust is present. If these insulators are not cleaned regularly, a carbon path flashover will eventually occur and knock out power to the plant. The author investigated one of these cases near Youngstown, Ohio in 1973.

A similar concept to the carbon path arcing described in this article is "arc tracking." This term refers to a flashover along a path or track of minerals or salts left by an evaporating water solution. Again, when the total electrical resistance or the physical makeup of the "track" reaches a critical point, a flashover and resulting arcing occurs. As with the carbon path, at over 10,000°F the precipitating medium is instantly vaporized and the arc is sustained in the air or plasma in which it takes place until the protective fuse or circuit breaker opens, or until the magnetic forces move the conductors too far apart. Arc tracking typically takes place on open surfaces, such as printed circuit boards or on the surface of solid insulators.

Why does the defect in electrical insulation sometimes take 12 years or more to reach the critical value of carbon resistance (or physical makeup) required for a flashover? Let us first look at some mechanical analogies to get a feel for other latent defects which take months or years to break down.

Figure 1 is a magnified view of a hole in a 3/4 inch copper water pipe in a new home. This hole was made when the end of the nail shown was accidentally hammered into the pipe by a drywall installer during the house construction. Six months later a water leak developed which flooded the basement. The corrosion process in this "connection" between the nail and the water pipe wall took that amount of time to break down, allowing the water to flow freely from the hole.

Figure 2 is another example of a mechanical latent defect. This photograph shows a section of plastic water tubing which was damaged when pulled against the sharp edge of a furnace duct as it was installed in the attic of a home. A water leak did not develop until 7 years later, when the plastic wall of the tube finally degraded enough to open.

A short circuit in plastic electrical insulation can be thought of as a kind of "current leak," much like the water leaks in the above examples. A very tiny leakage of water traveled through the "connection" around the nail in the copper pipe for six months and through the wall of the plastic water hose for seven years before a flood (flashover) of water current suddenly took place. Similarly, in electrical cables which have been damaged to create a tiny latent defect in the plastic between two conductors (see Figure 3), microcurrents (microamperes) flow for many years. The microcurrents gradually increase in amplitude until they become large enough to begin to carbonize (oxidize) the plastic ever so slightly. Then the carbon residue slowly builds up, lowering the electrical resistance of the carbon

1. Frederick P. Franklin, "Circuit Breakers: The Myth of Safety," The Fire and Arson Investigator, Volume 41, No. 4, June, 1991, Pages 42-46.

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FIRE AND ARSON INVESTIGATOR 38
Volume 42
Number 2
December 1991

FIGURE 1 - MAGNIFIED VIEW OF DRYWALL NAIL WHICH WAS ACCIDENTALLY NAILED INTO A ¾" COPPER WATER PIPE. IT CAUSED A FLOOD SIX MONTHS LATER.

FIGURE 2 - PLASTIC WATER TUBING WHICH BEGAN FLOODING SEVEN YEARS AFTER IT WAS CUT.

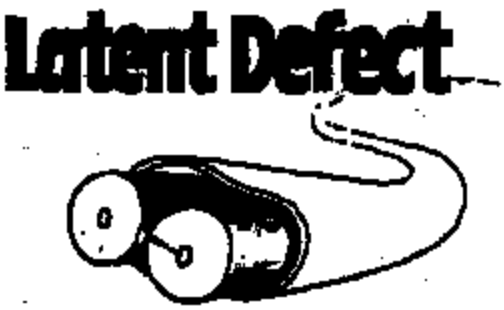

FIGURE 3 - MOISTURE IN CRACK ALLOWS MICROCURRENTS TO FLOW FOR MANY YEARS BEFORE A FLASHOVER OCCURS.

FIGURE 4 - P.A.D.E. MEGGER SHOWING READING OF 1000 MEGHOMS

path or changing its physical makeup to the critical point at which a flashover suddenly occurs.

Tests performed by an electrical engineer over 25 years ago revealed that these initial microcurrents in electrical insulation defects are carried by moisture.[2] This moisture may be in the form of humidity which finds its way into a crack in the insulation.

In other cases, as recently described in an article published by the Society of Automotive Engineers (SAE), water can "wick" its way into a conductor via capillary action, traveling many inches or feet along the conductor, within the insulation.[3] This confirms that insulation is often not perfectly air or moisture tight.

Engineers and electronic technicians use a device called a megohmmeter ("megger") to find these types of electrical defects in motors or transformers by measuring their insulation resistance. A megohm is one million ohms of electrical resistance, and a megohmmeter reads very tiny electrical faults in "megohms." Moreover, to try to force a breakdown at any potential electrical fault, a megger typically uses a 500 volt or 1000 volt source rather than the 1.5 volt or 9V volt battery used in normal ohmmeters. The user might require a reading of 50 megohms before certifying that a new or recently repaired large motor or transformer is safe to use. For units which have been through a flood or some type of physical damage, a reading of 1 megohm or 10 megohms would not be uncommon. This reading is a sign to the serviceman that the unit is likely to break down into a short circuit with continued use.

The important point here is that the serviceman would take the unit out of service even though the test is only drawing:

$$\frac{500 \text{ volts}}{10{,}000{,}000 \text{ ohms}} = 0.00005 \text{ ampere}$$

which is 50 microamperes. If you ask these servicemen what causes readings at these values, most of them would confirm that it is very tiny amounts of moisture which have found their way into the insulation. In fact, one repair procedure often utilized is to place the motor or transformer into a large oven and "bake" the moisture out of the insulation. The "baking" continues until the megger reading is acceptable, e.g. 50 megohms. This process is also used after manufacture.

The theory of moisture creating tiny electrical microcurrents in electrical insulation is well known in the electrical industry. Meggers have been used for many decades for just this reason, to test for extremely low fault currents in an attempt to prevent a catastrophic short circuit at a later point in time.

Whatever the exact mechanism by which they occur, the objective fire investigator knows that a significant percentage of fires is caused by arcing short circuits. The theories outlined in this article explain the time delay associated with most of them. The carbon path arcs created during the author's simulations remain the only good answer to how arcs occur within plastic and cloth insulation, in the author's opinion. A video tape of some of these simulations is available from P.A.C.E., Inc., 4828 Indeco Court, Cincinnati, Ohio 45241.

Once one understands carbon path flashovers, arc cracking flashovers, and the details of circuit breaker response times, the mysteries surrounding short circuit fires should evaporate.

Frederick F. Frantzis, P.E. is an Electrical Engineering graduate of The Ohio State University (1964). He is President of Professional Analytical and Consulting Engineers (P.A.C.E.).

TABLE A

Relative ages of 18 rubber-type cables which short circuited to cause fires.

<1/2 Hour	18 Years	
2 Weeks		18 Years
6 Weeks		18 Years
2 Years		18 Years
9 Years	@	30 Years
9 Years	@	40 Years
9-1/2 Years	@	50 Years
9 Years		

3. David K. Elliott, "Short Circuits and Wet Faults," I.E.E.E. Spectrum, August, 1991, Page 14.

6. Karen Gard, "Corrosion in Automotive Wiring," Automotive Engineering, Volume 909, No. 5, March 1981, Pages 52-55.

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VEHICLE FIRES

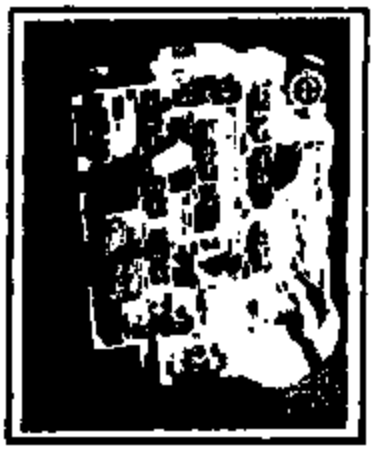
The attached color copies of fuse blocks in various automobiles demonstrate how the manufacturers are progressing toward more and smaller fuses. This provides much better protection against short circuit arcing fires. 10 ampere and smaller fuses will open roughly 100 times faster than 15 ampere and larger fuses when an arc occurs. The arc is extinguished so quickly by the 10 ampere and smaller fuses that no fire ensues. I have been told that the 1996 Lincoln Continental will have about 90 mostly smaller fuses in its fuse block.

For a complete discussion of this theory, please refer to "Keeping P.A.C.E". #50, which includes my article, "Vehicle Short Circuit Fires and Their Prevention." That article was based on information I began supplying to the automotive industry in 1987. What really got their attention was my video tape. This one minute video tape shows two each, 16 gauge stranded copper conductors, six feet long, connected to a 12 volts, D.C. vehicle battery. A torch is used to set up carbon path arcing between the conductors. The arcing current lasts for well over one minute and finally melts both copper conductors completely apart without ever drawing enough electrical current to pop a 15 or 20 ampere vehicle fuse. This video tape and my article are included with each of our reports on vehicle short circuit fires.

The color copy of fuse blocks that is attached was made with our laser color copier. We use this copier for all our reports so that you may have clear color copies of photographs pertaining to your case, as well as the original photographs.

Sincerely,

Frederick F. Franklin, President



1991 Lincoln Continental

Fuse Color Code

Amber 5 amperes
Red 10 amperes
Blue 15 amperes
Yellow 20 amperes
Green 30 amperes

1988 Oldsmobile 98

1984 Chevrolet Caprice

1995 Lincoln Continental

1993 Buick Park Avenue

Fuse extractor for inside fuse block on 1995 Lincoln Continental

1984 Chevrolet Caprice

1995 Chrysler Cirrus

THE HARTFORD

March 20, 1998

Ford Motor Company
300 Renaissance Center, Po Box 43360
Detroit, MI 48243

Claim Number: [redacted]
Key Claim Number: [redacted]
Our Insured:
Date of Loss: 04/06/97
Amount of Loss: $11,270.00
Location of Loss: TERRE HAUTE IN
Our Account No: SUB100101

407214 ✓
DU

Dear Ford Motor Company :

This company carries insurance for the above named insured. Under the coverage provisions of our policy we were obligated to pay damages in the above amount.

Our investigation indicates that the damages resulted from your negligence.

If you are insured with liability coverage, notify your carrier at once. Please write the name of the insurance company and your policy number below and return to the address shown below. If you are not insured, contact the writer at once so that arrangements can be made to settle this matter amicably and without the necessity of litigation.

INSURANCE COMPANY _____
POLICY NUMBER _____
COMPANY ADDRESS _____
_____
AGENT'S NAME _____
ADDRESS _____
_____
PHONE # _____

Description of Loss: OUR INSURED'S VEHICLE CAUGHT ON FIRE THAT IS TOTALLED

Very truly yours,

Steven Lewis
Central Recovery Office
Hartford Underwriters Insurance Co.
(973) 361-3700, ext. 317

Garden State Regional Claim Office
Rockaway 80 Corporate Center
100 Enterprise Drive
P.O. Box 5009
Rockaway, NJ 07866
973 361 3700
973 361 4486 Fax

THE HARTFORD

April 02, 1998

Ford Motor Company
300 Renaissance Center, Po Box 43360
Detroit, MI 48243

Claim Number:
Insured:
Address: [redacted]
Terre Haute, IN [redacted]
Date of Loss: 04/06/97
Amount of Loss: $11,270.00
Location of Loss: TERRE HAUTE IN
Account Number: SUB100101

407214
JV
Closed

Dear Ford Motor Company

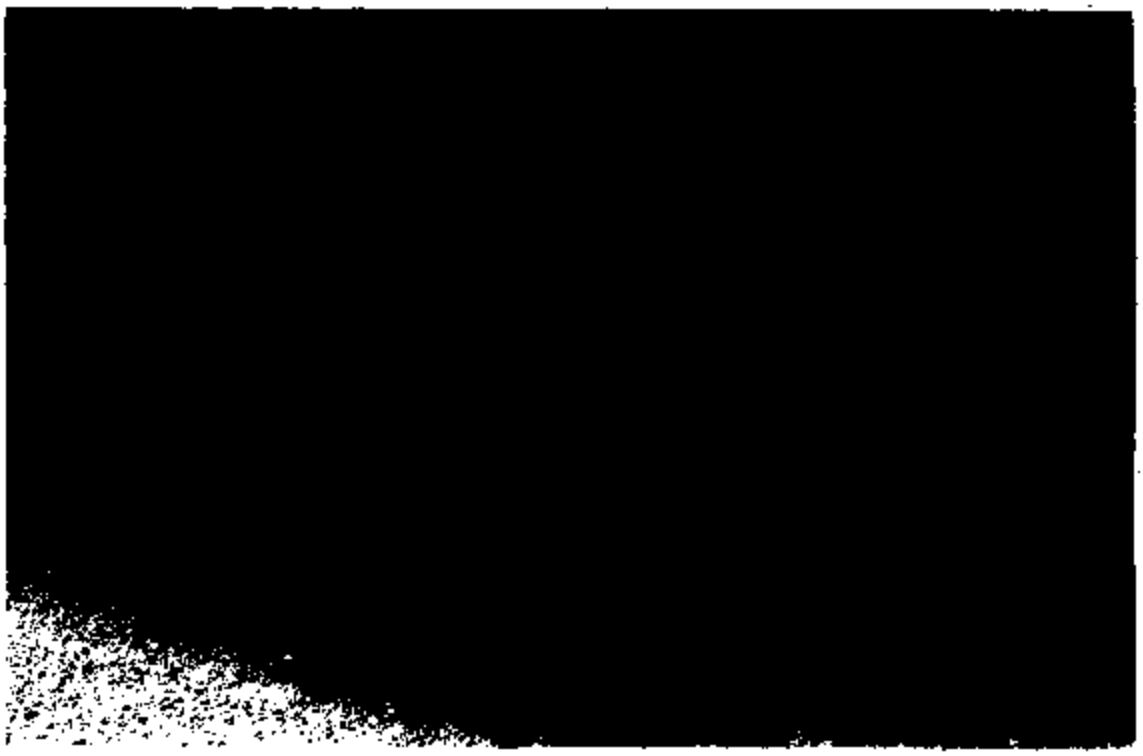
We have written to you on prior occasions advising you of our subrogation rights in connection with the above captioned claim. We have had no response from you as to your position concerning settlement of our claim.

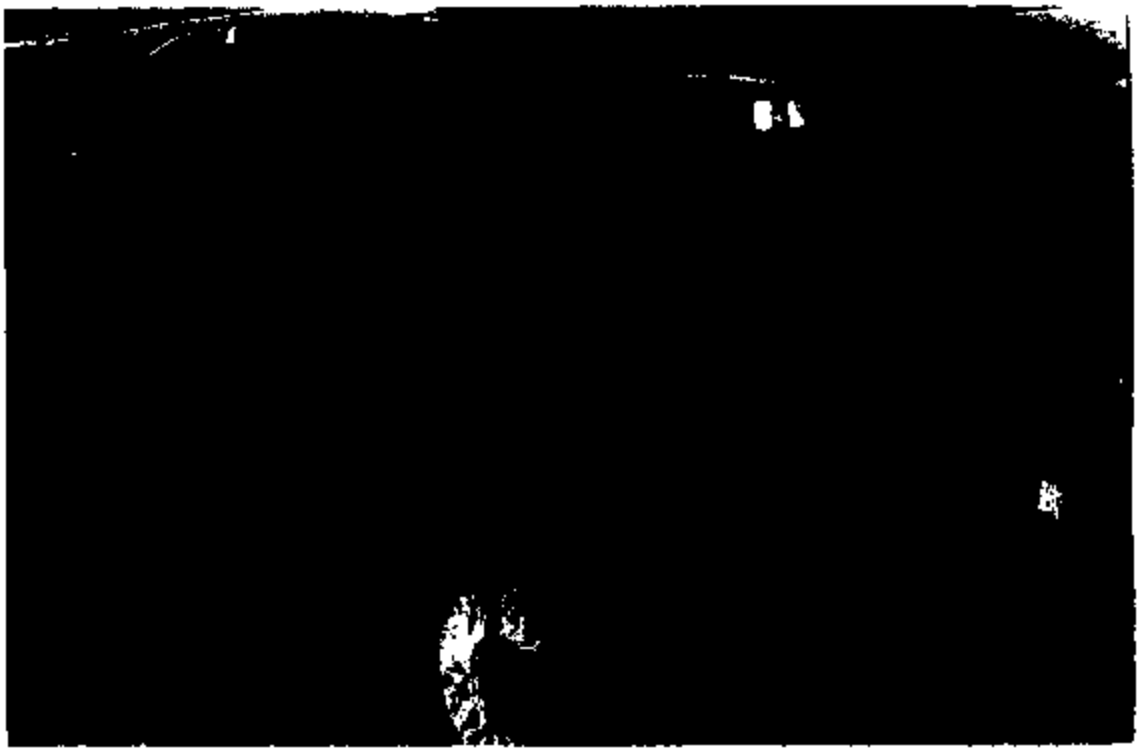
We are writing this final letter for the purpose of notifying you that we are contemplating suit within the next 20 days if we do not receive a reply. Please give this matter your prompt attention.

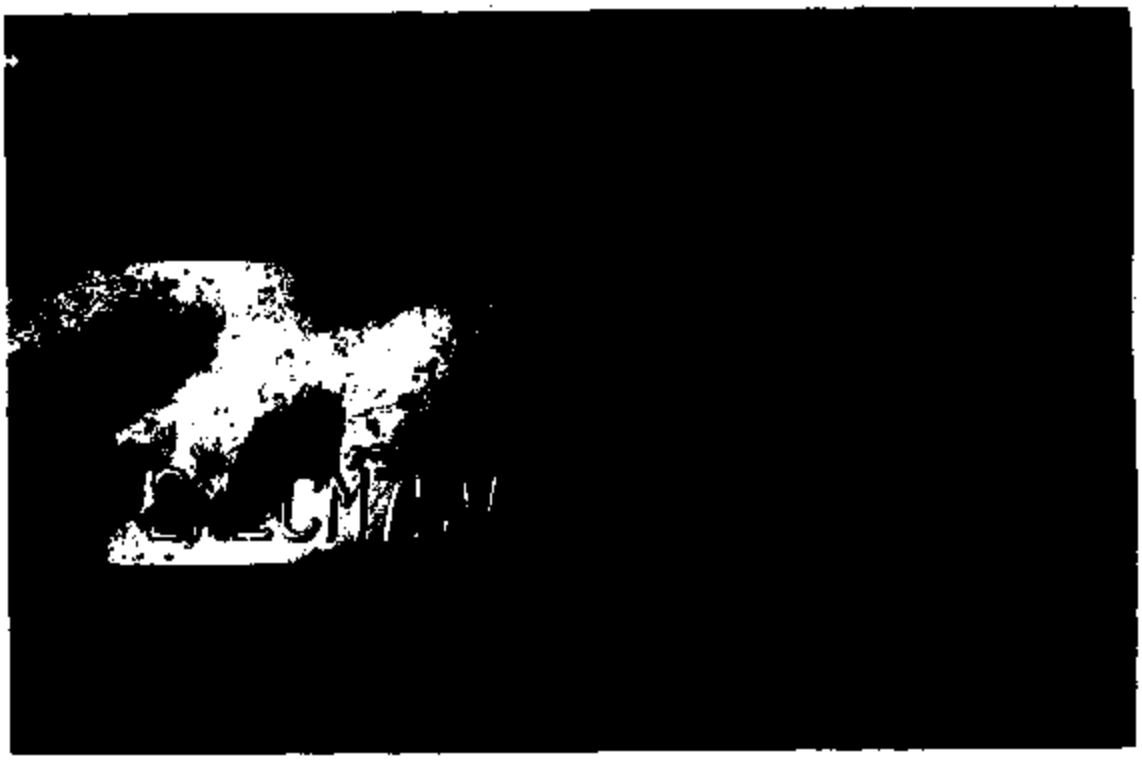
Very truly yours,

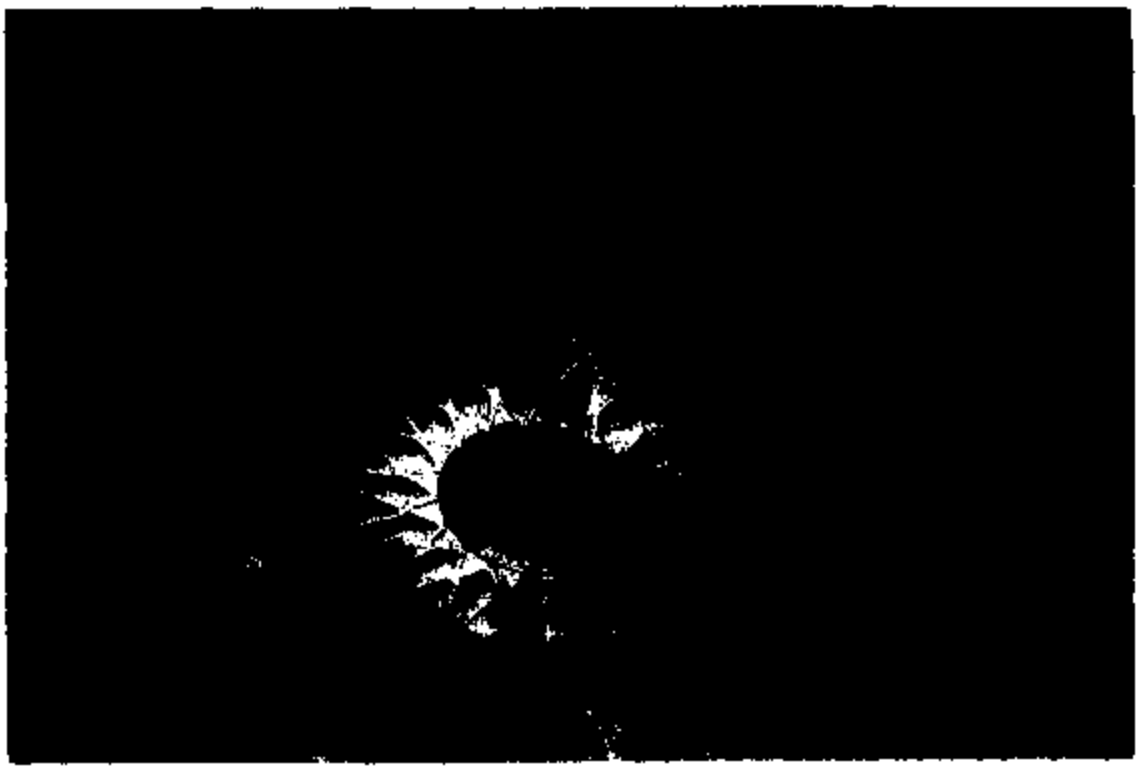
Steven Lewis
Hartford Underwriters Insurance Co.

Garden State Regional Claim Office
Roxbury 80 Corporate Center
100 Enterprise Drive
P.O. Box 5800
Roxbury, NJ 07866
973 361 5700
973 361 4486 Fax









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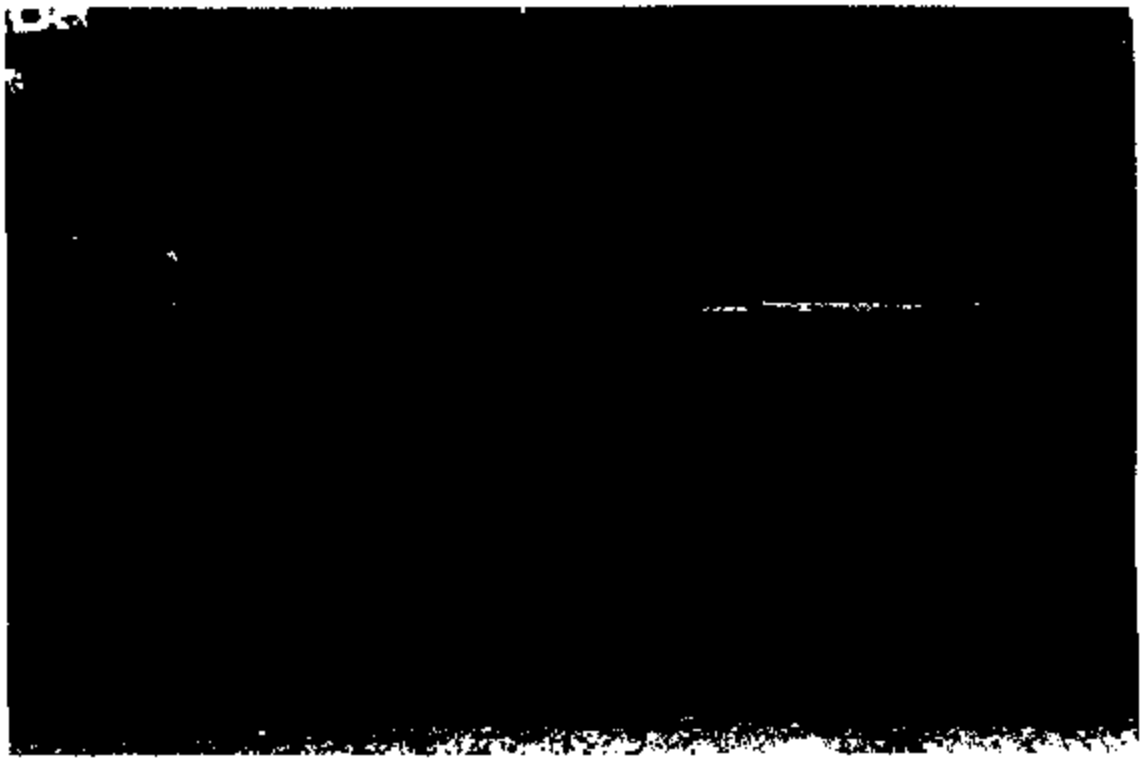

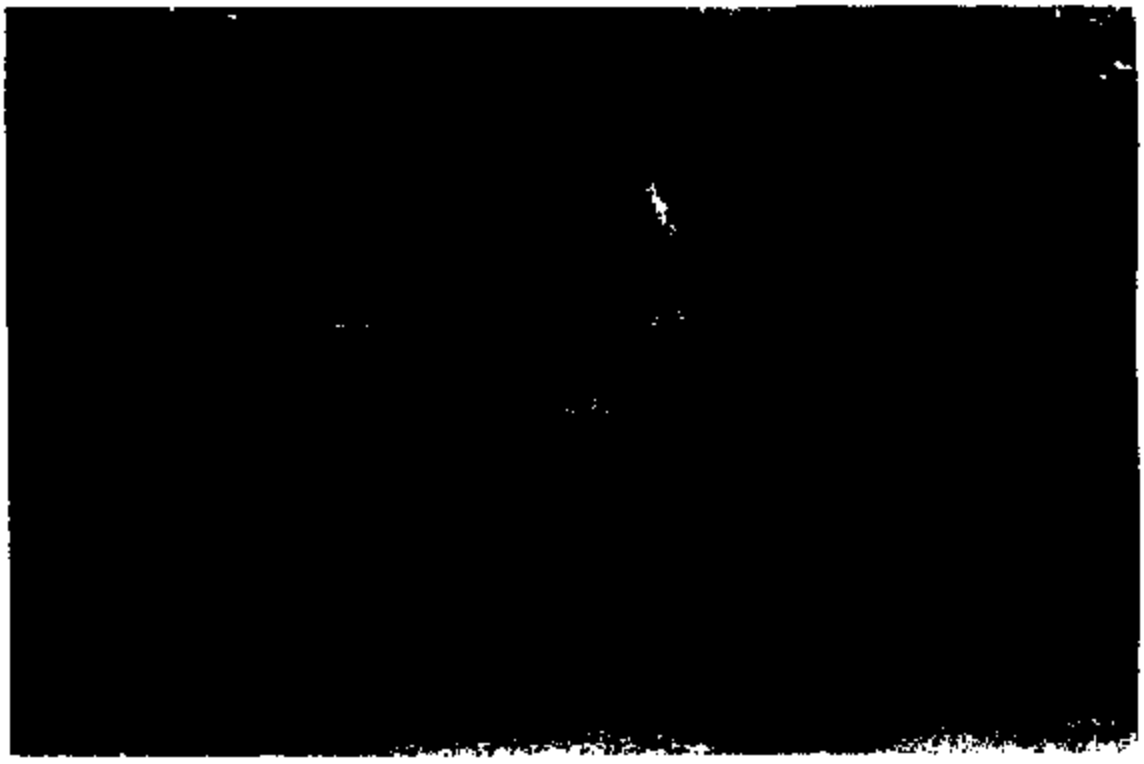

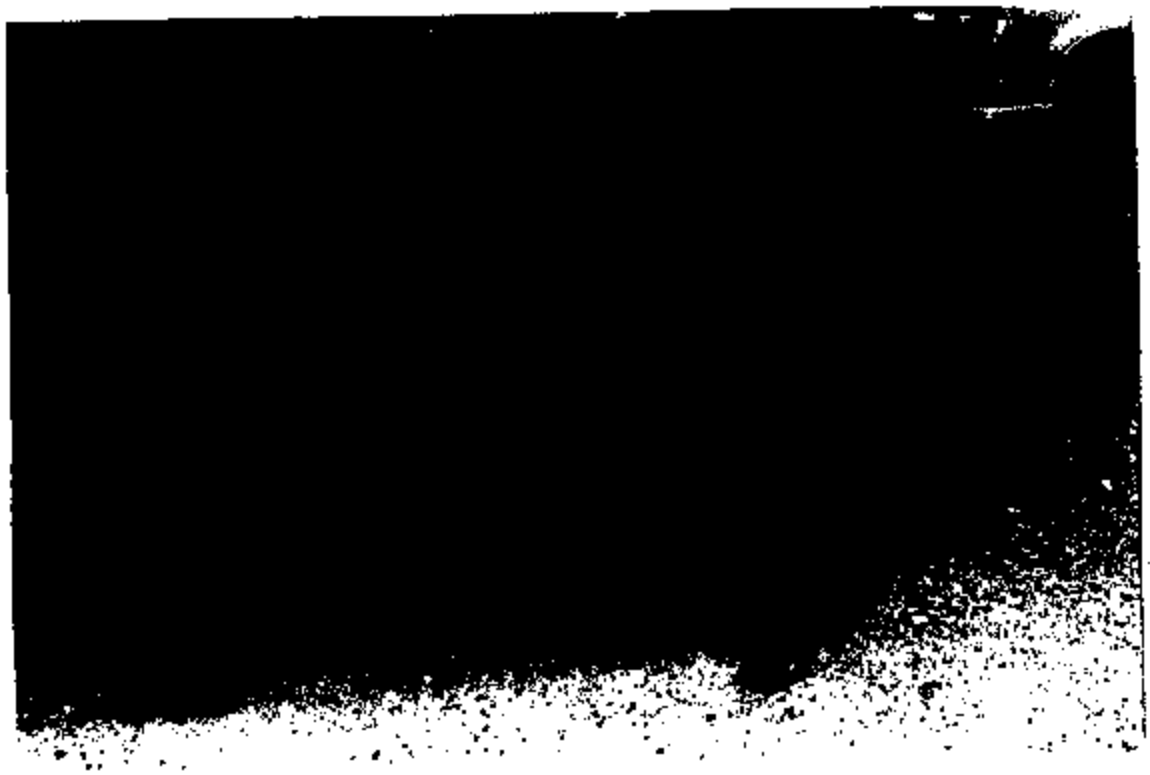

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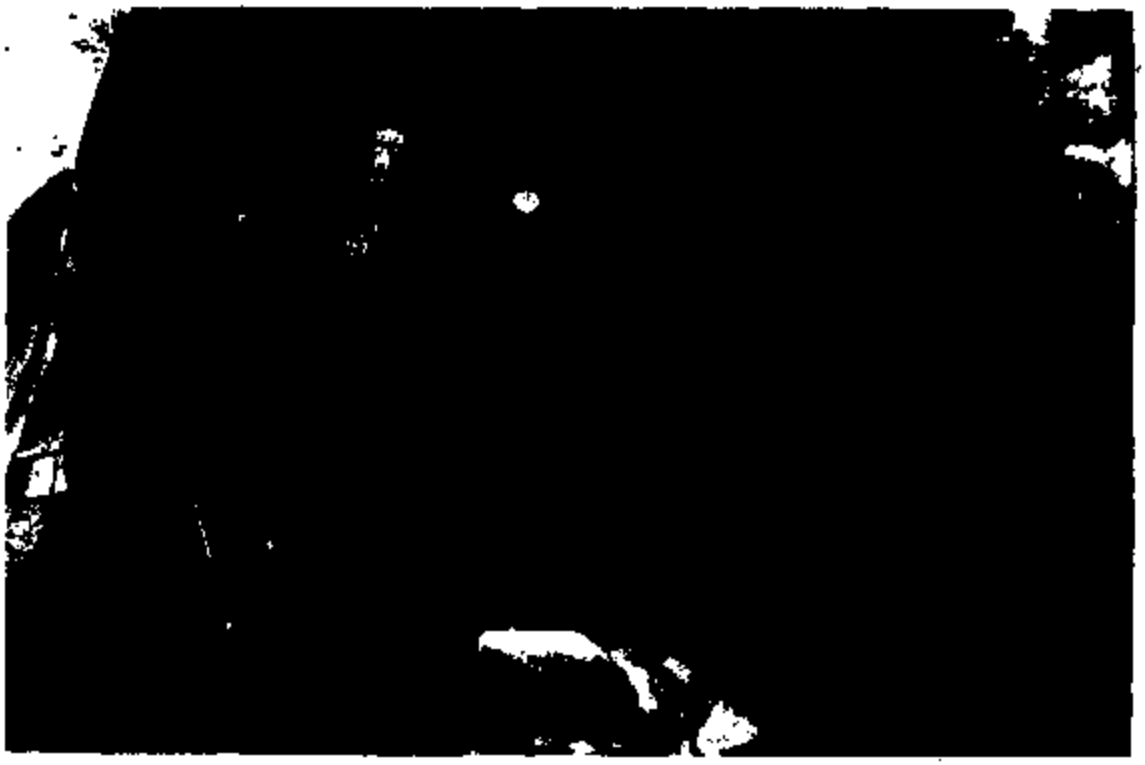

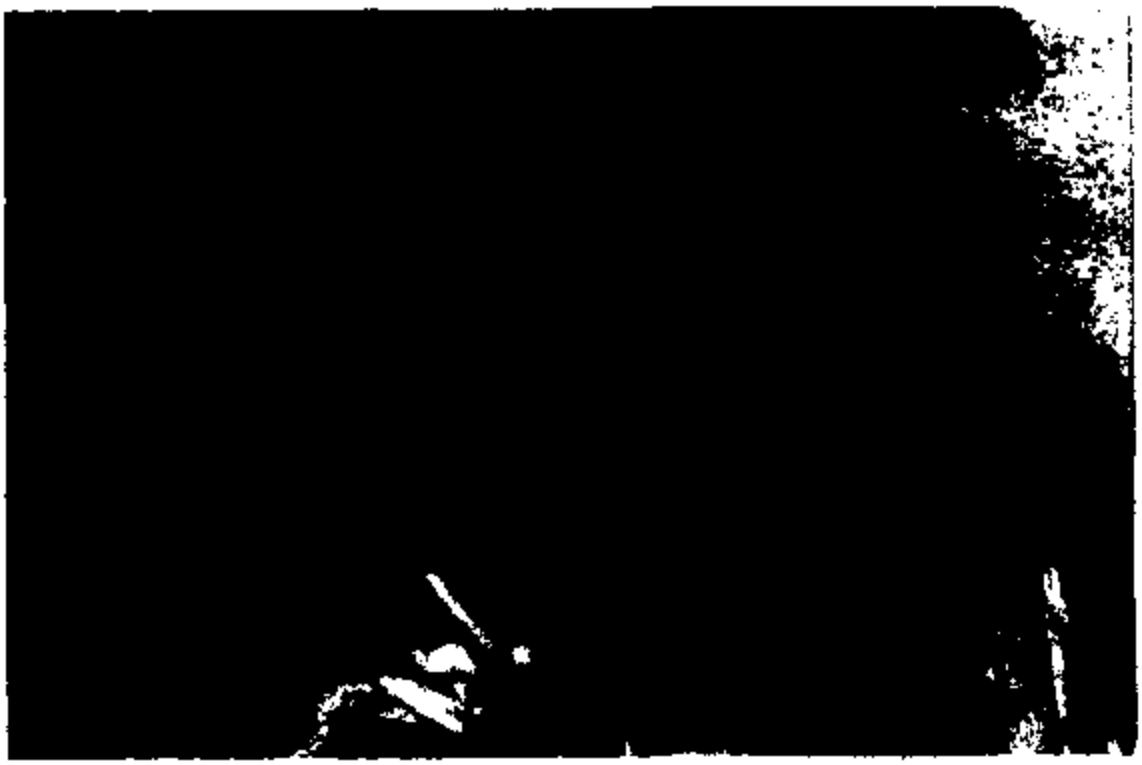

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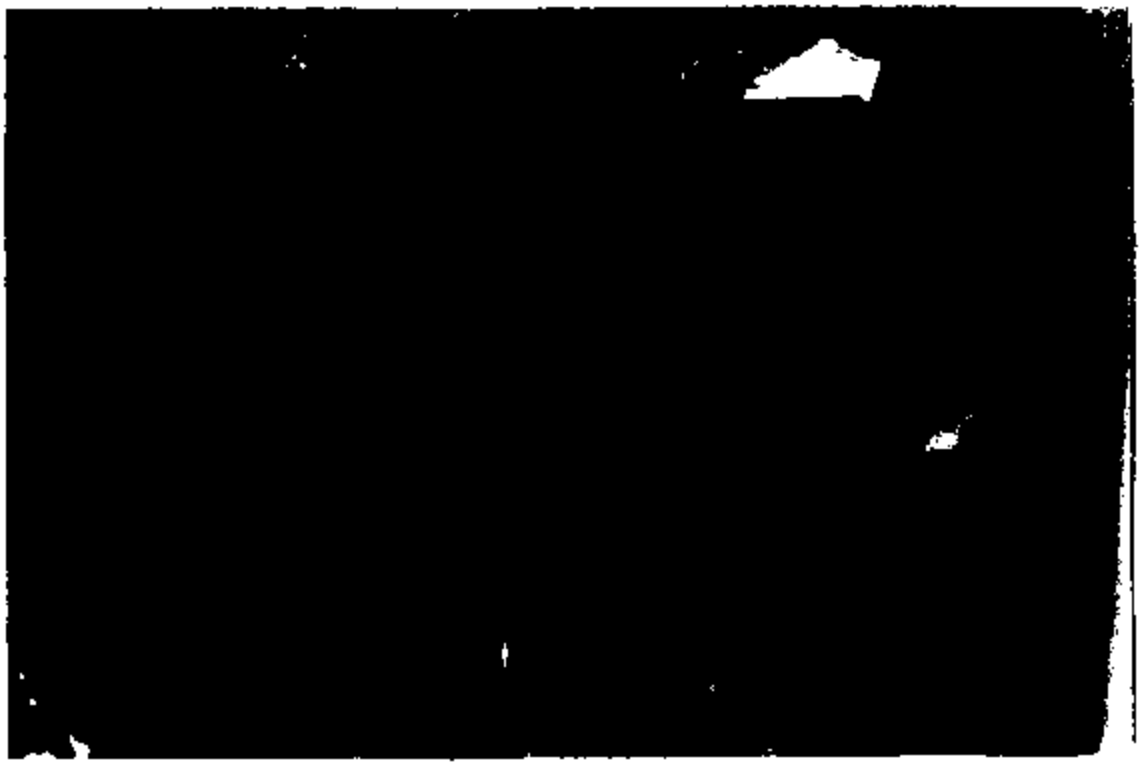

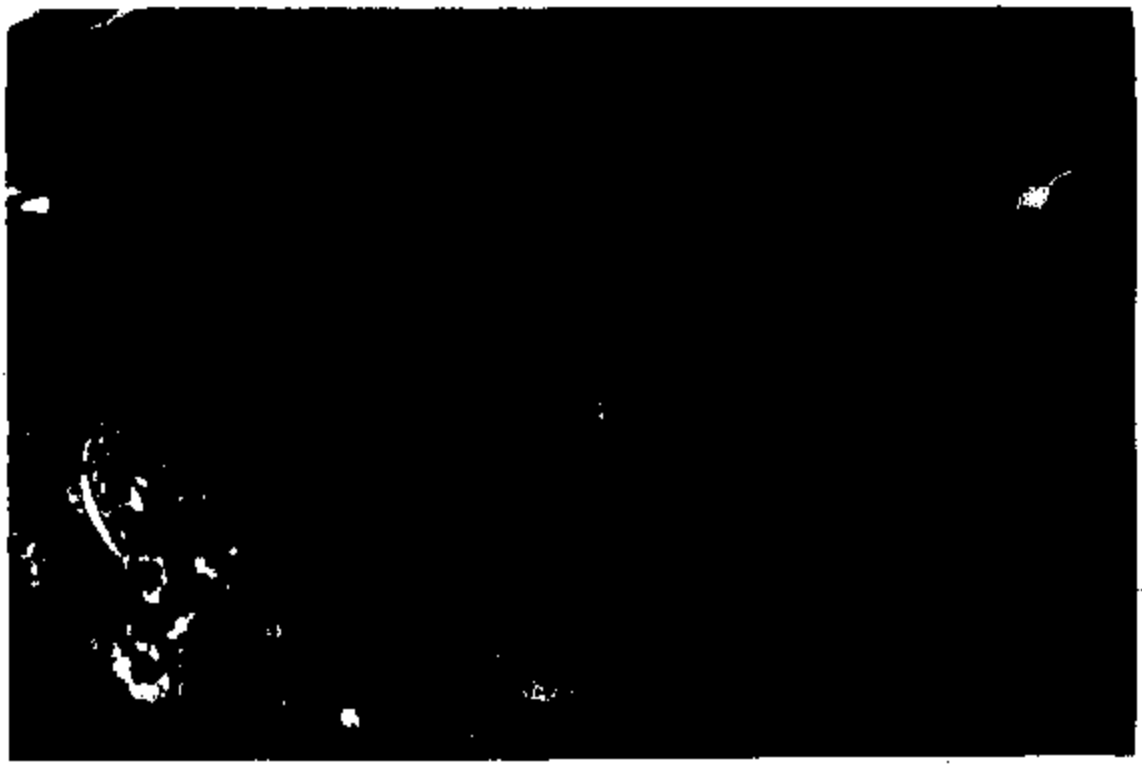

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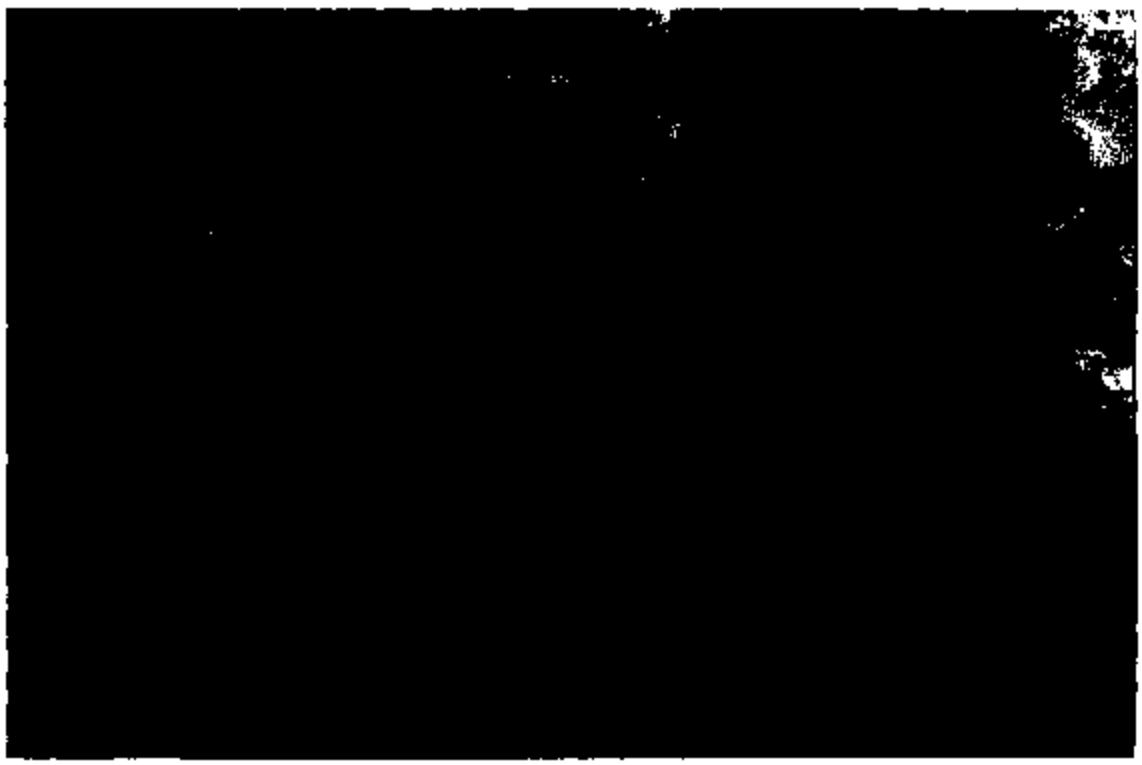

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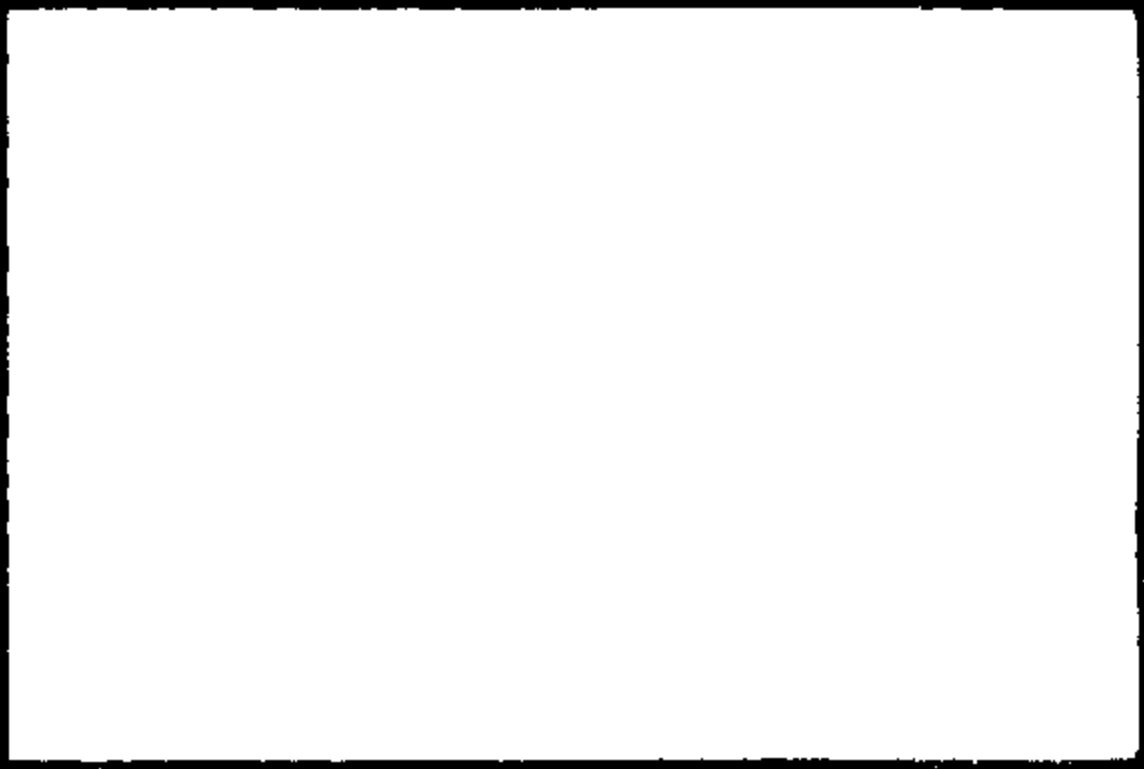

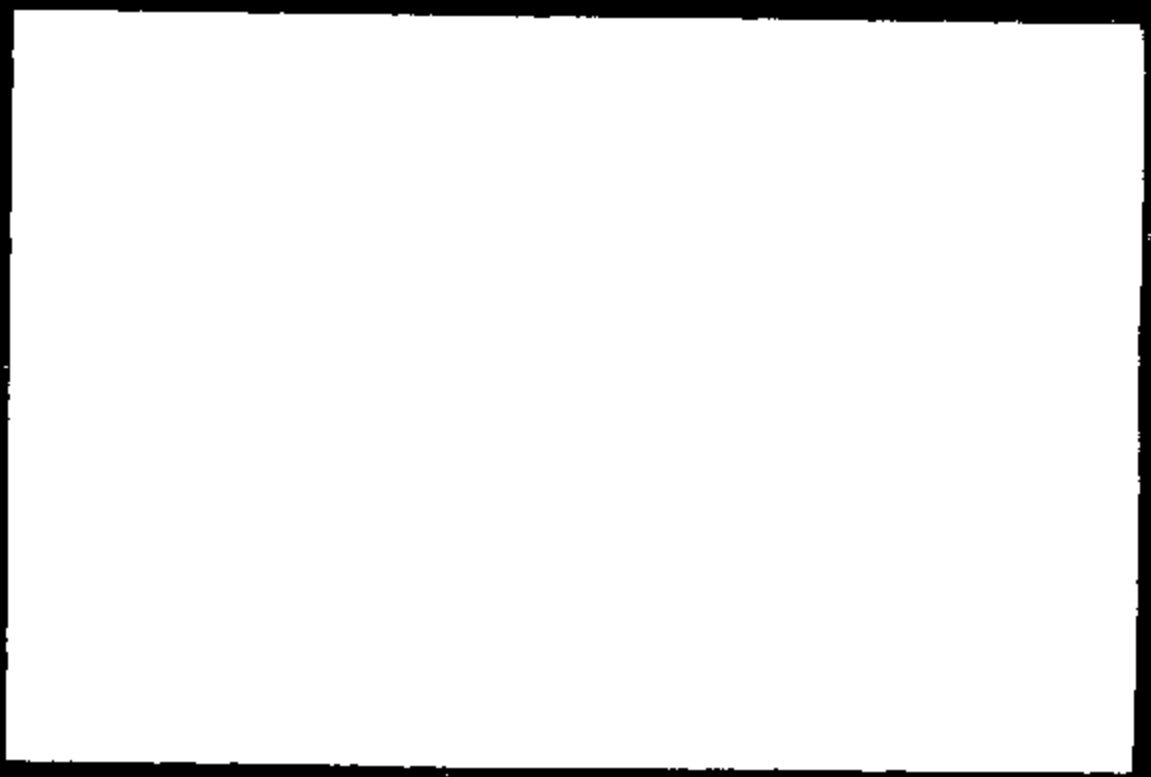

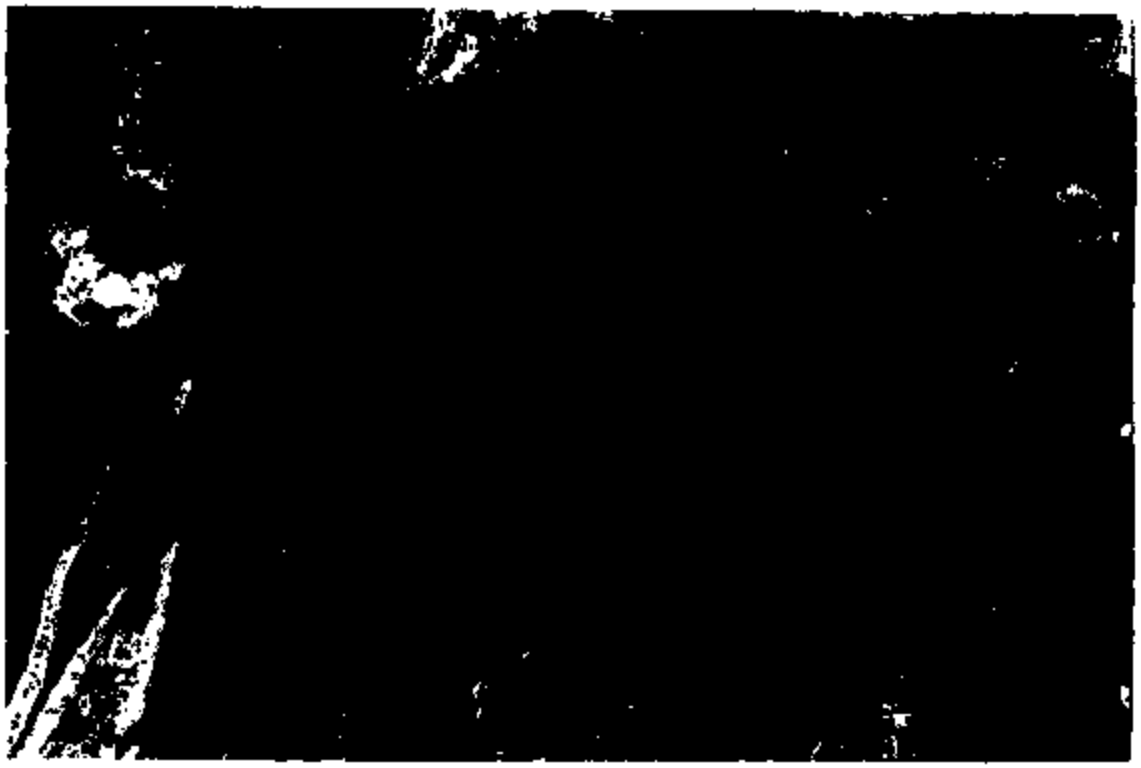

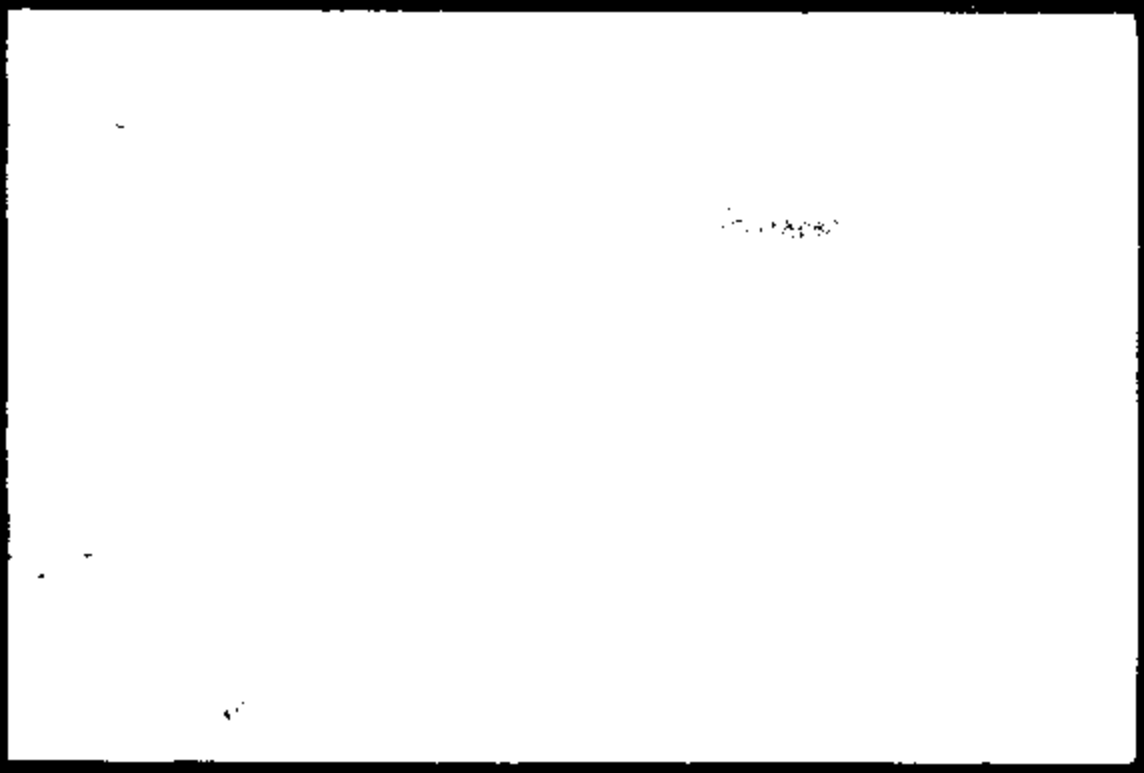

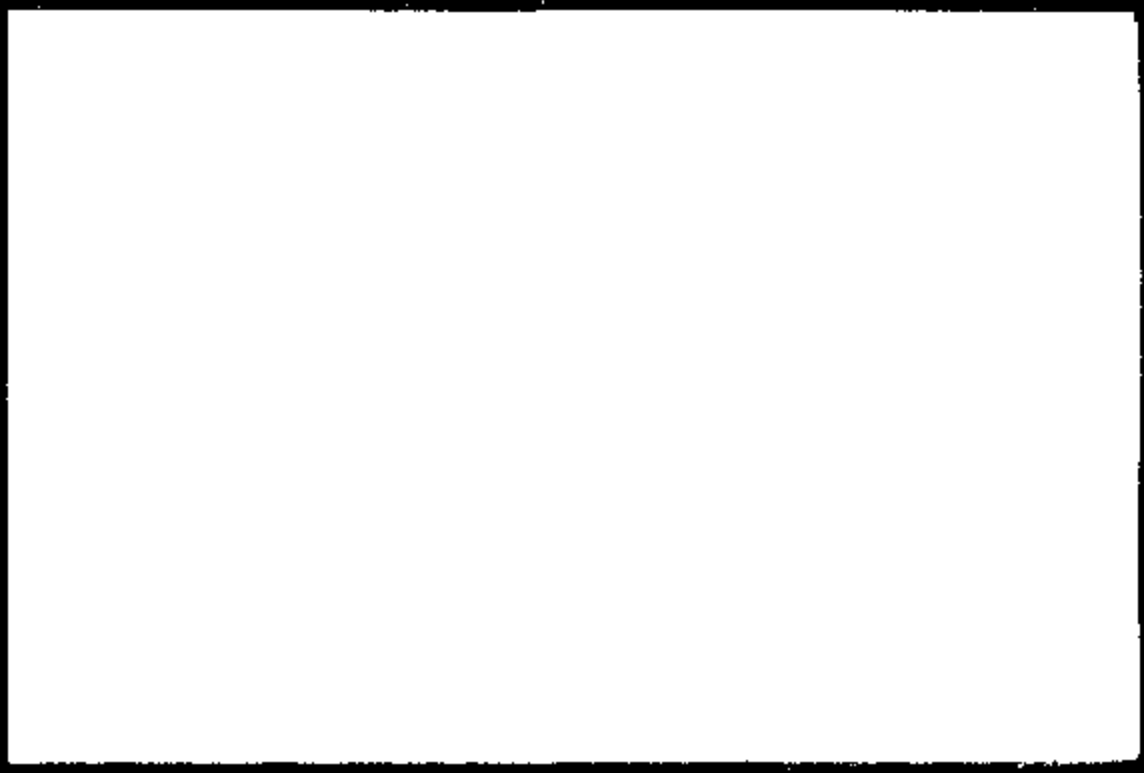

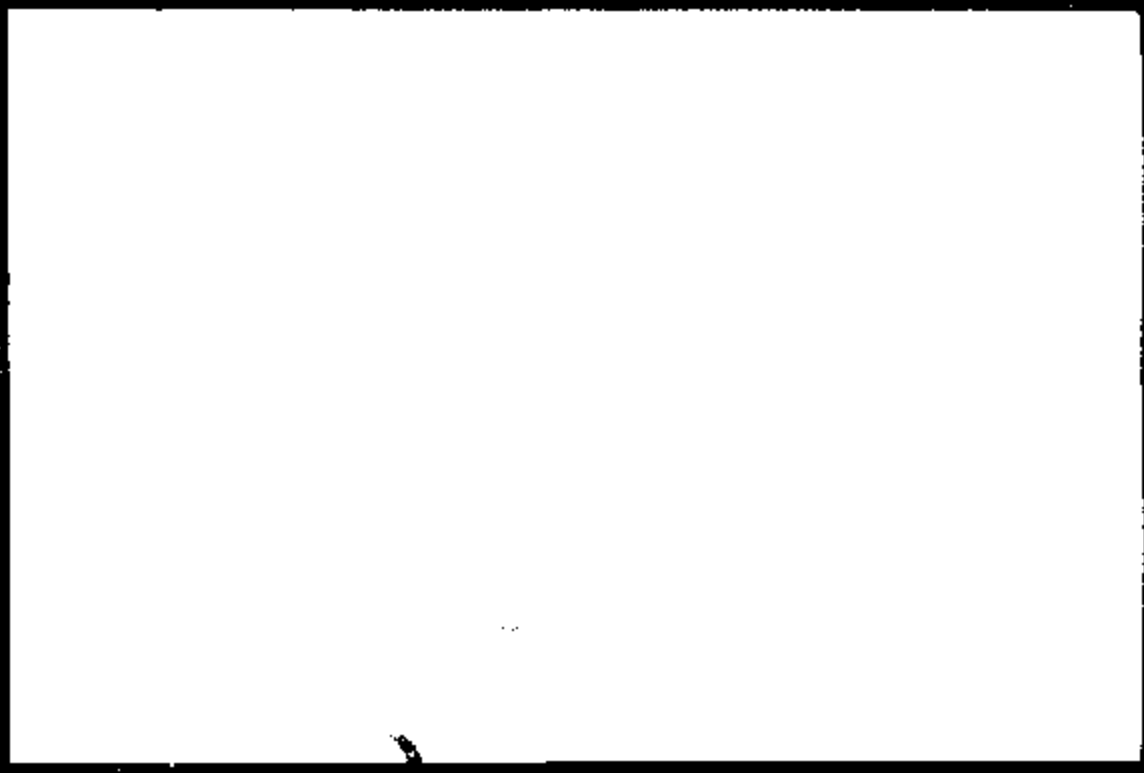

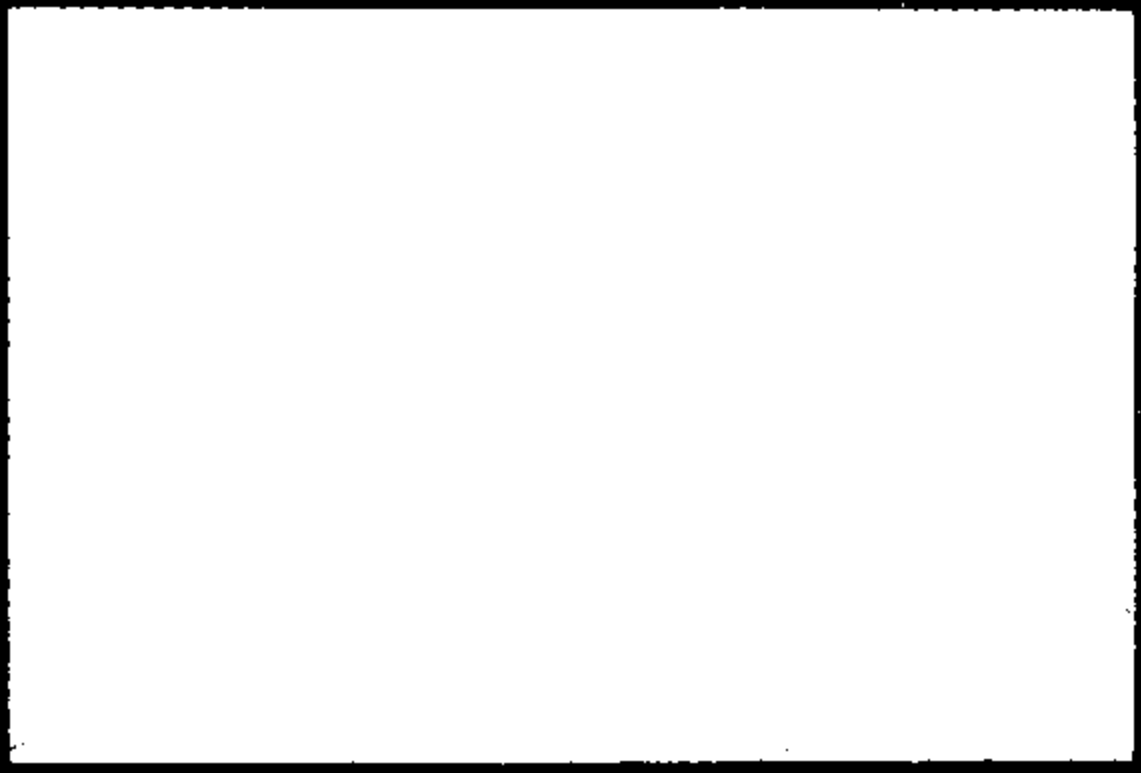

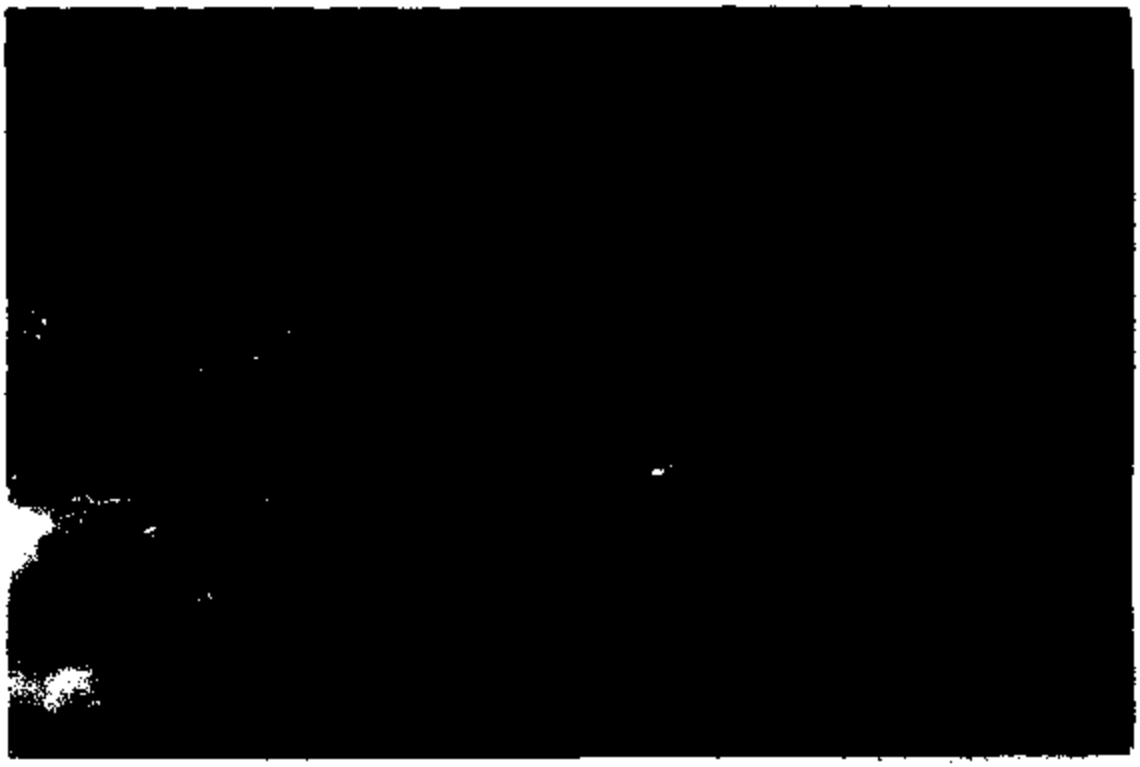

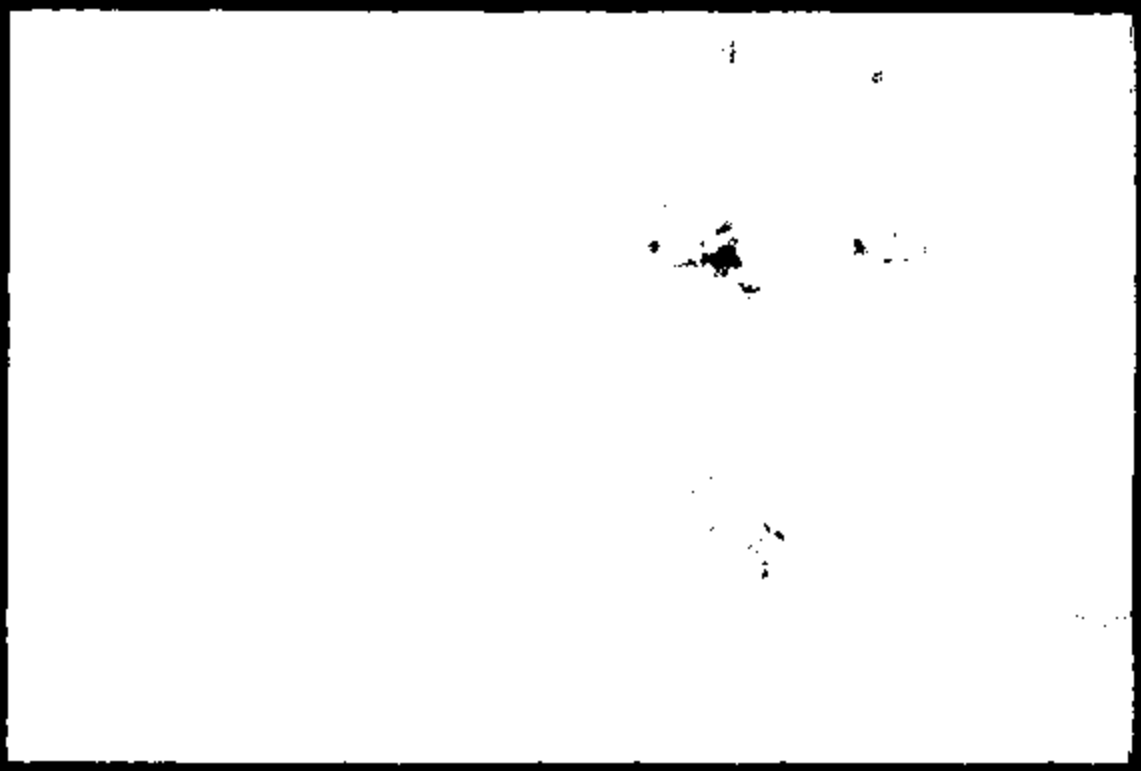

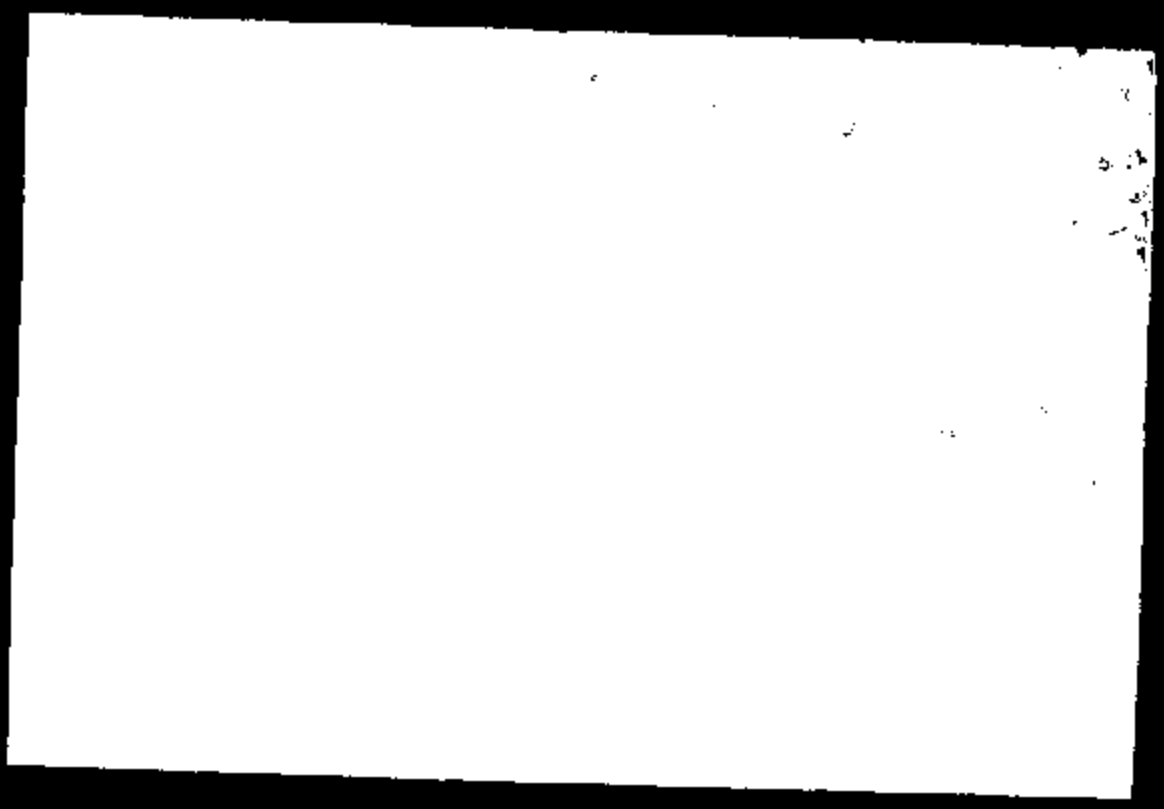

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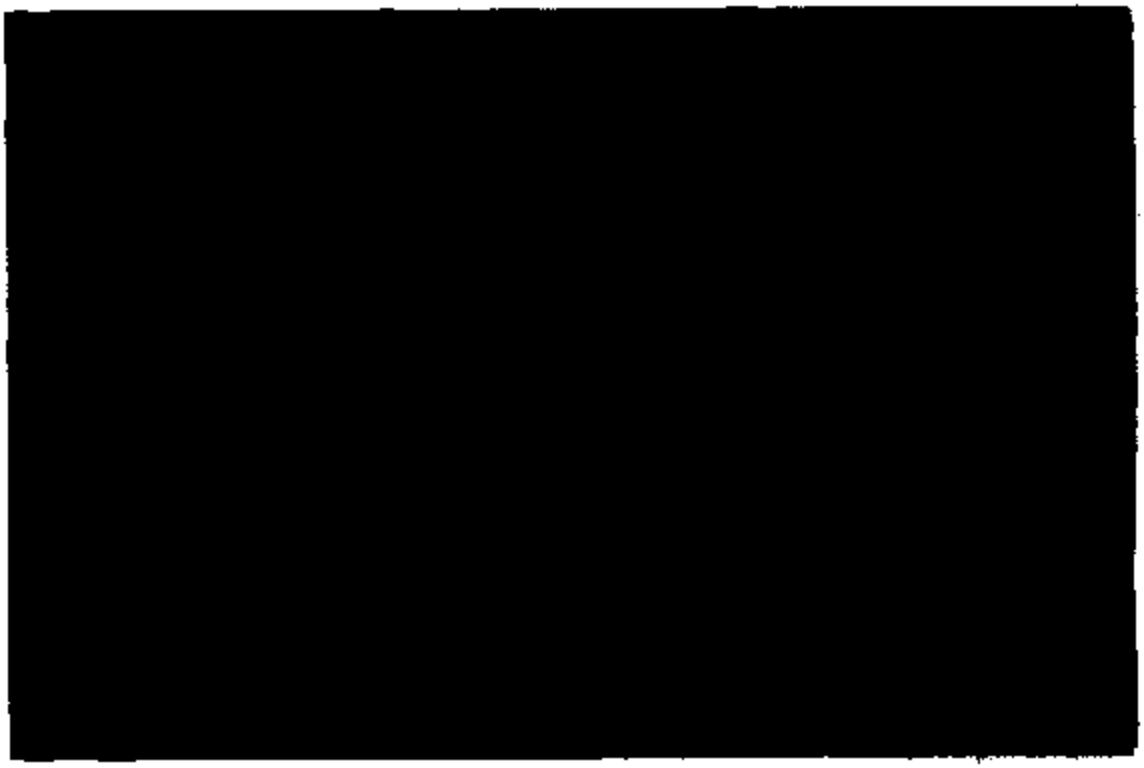

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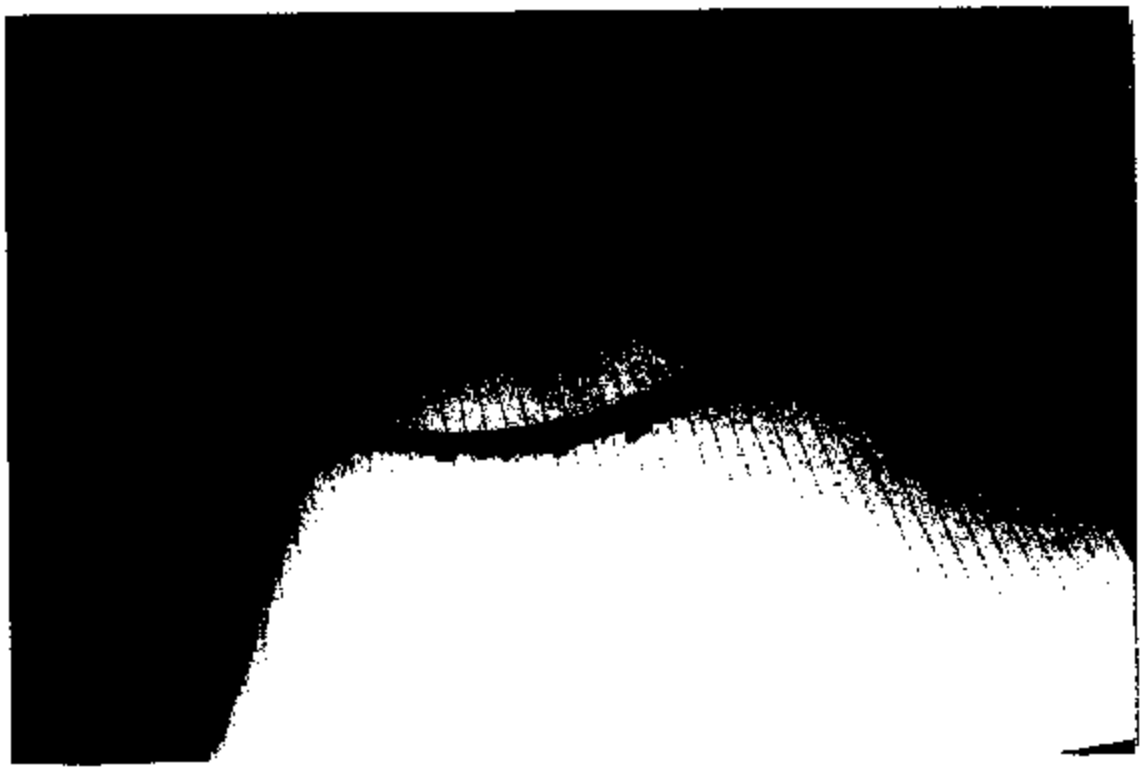

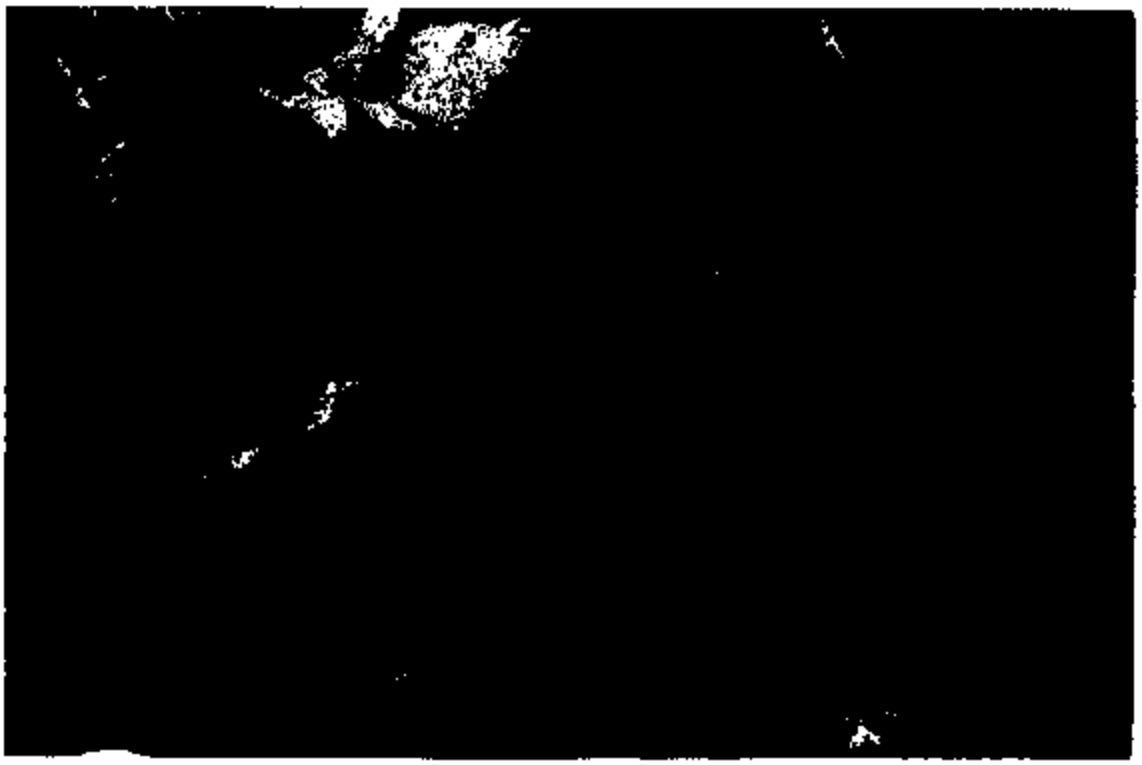

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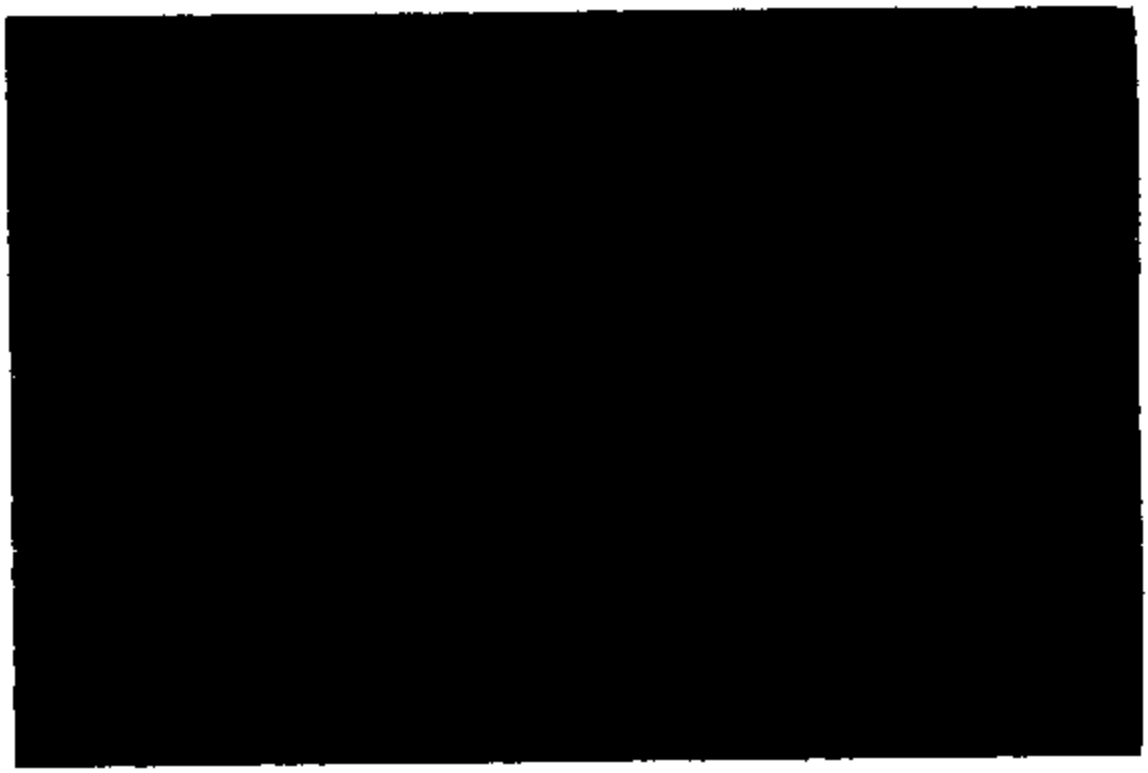

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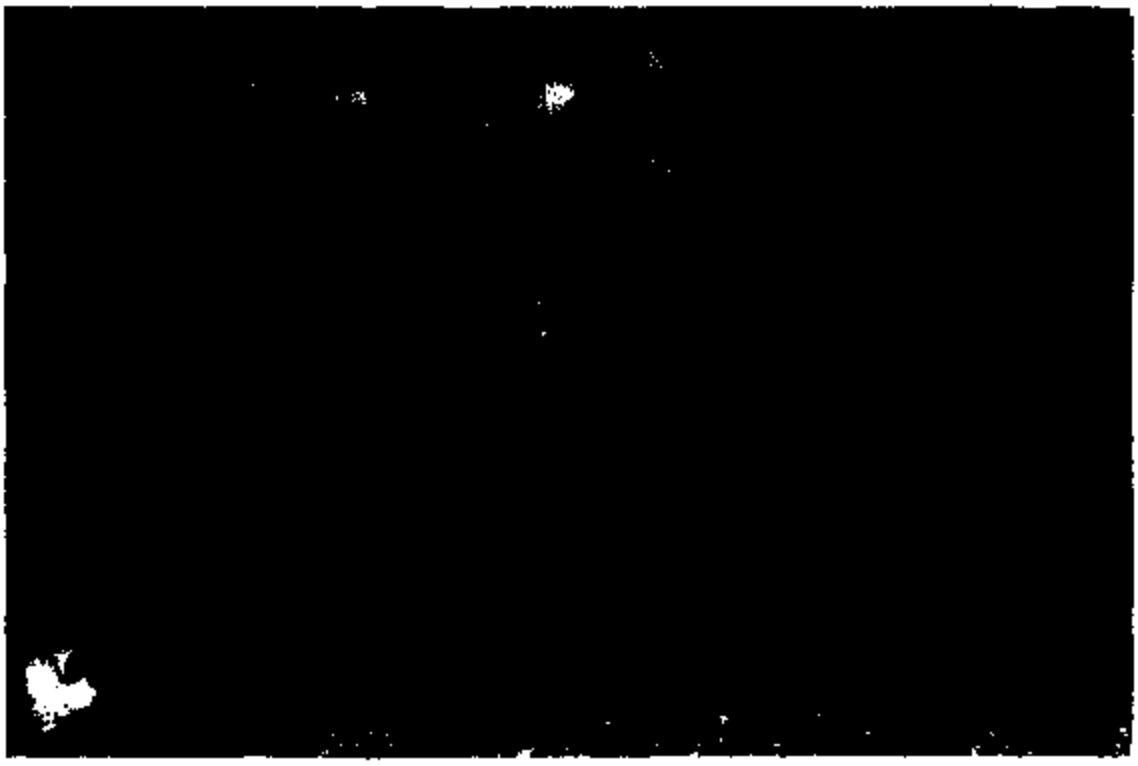

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NO MORE RECORDS AVAILABLE OGDB191

EM82-02E 36770

SFCHSVMA Vehicle List 07/14/99 17:13:05
==> _____ _____

Name: [redacted]
Address:
Address:
City: SULLIVAN
Zip/Postal: [redacted]

Home Phone: [redacted]
Day Phone:
State/Prov: IN
Country: USA

A C	VIN/ Owner Status	Year	Model/ Previous Owner	Sale Type/ Open Issues
	1LNFM83W8XY606179	1999	TOWN CAR	Individual Rtl
	ORIGINAL			
	1LNLM91V7VY698076	1997	MARK VIII	Individual Rtl
	ORIGINAL			
	2MECM75W1NX616160	1992	GRAND MARQUIS	Individual Rtl
	ORIGINAL			
	2MEBP93F0GX634377	1986	GRAND MARQUIS	Individual Rtl
	ORIGINAL			

F1=Help F2=IssueList F5=AddIssue F7=Prev F8=Next F9=ESP
F10=WarrHistory F11=Menu F12=Return F13=Recall/ONP F14=SpecialCoverage
NO MORE RECORDS AVAILABLE OGDB191

[redacted]

SPCHREMA Recall/CNP Information 07/14/99 17:13:50
==> _____

VIN: 2MECM75W1NX616160 Year: 1992 Model: GRAND MARQUIS
WSD: 05/02/91 Build Date: 04/12/91

A	Campaign				Status	Dealer
C	Number	Type	Description	Status	Date	Code
-	------	-	-----------	------------------	--------	------

F1-Help F7-Prev F8-Next F11-Menu F12-Return
NO DETAIL RECORDS FOUND OGDB191

```
CSCN150              CAMPAIGN VEHICLE INFORMATION              07/13/99 12:25:36
==> _____ _____________________________________________________

ENTER CAMPAIGN NUMBER==>          VIN==> 2MECM75W1NX616160  TYPE OF SEARCH: A
MODEL YEAR:    DEFECT:              BODY STYLE:
   NEW STATUS CODE:                                      CAMP DIV     :
   REPAIR INFORMATION:     TYPE CODE: _                  SUPP CODE    :
     REPAIR DATE: _____    DEALER P/A: _____             KIT CODE     :
     MICRO REF: _____ CLAIM NUM: _____                   OASIS DATE   :
   DELETE REASON:                                        VENDOR N/A INFORMATION:
   RESP DEALER INFORMATION:     NEW: _ __ __               IND:   MATCH CODE:
     CURRENT:          ASSIGNED:          SOURCE:          EXTRACT DATE:
****** STATUS INFORMATION: ******* ********** REPAIR INFORMATION: **********
CODE DESCRIPTION           DATE   TYPE  DATE    P/A    CLAIM#  MICRO#   CL SRC



DELETE REASON:
F1=INQUIRY  F2=G140  F3=EXIT  F5=G130  F7=FIRST  F8=NEXT  F9=MORE STATUS
F10=ADD STATUS  F11=REVISE  (ALL DATA FIELD DATES YY-MM-DD)
E807-END OF CAMPAIGNS FOR VEHICLE - CURRENT AND HISTORY DATABASES      OGDB191
```

```
CSCN130                    NOTIFICATION RECIPIENT HISTORY              07/13/99 12:25:45
===>

ENTER CAMPAIGN NBR ===>          VIN ===> 2MECM75W1NX616160
  DEFECT          : _____        BODY STYLE DESC: _____
  RESP DEALER     : _____              BEGINNING MAILED DATE: _____ YY-MM-DD
  RELEASE DESC    : _____              ENDING MAILED DATE   : _____ YY-MM-DD
  CAMPAIGN DIV    : _            FLEET CODE: _____  FLEET MGMT LOC CODE: ____
  LAST NAME       : _____________________________________ INITIALS: __
  STREET ADDR1    : _____________________________________
        ADDR2     : _____________________________________ ST/PRV: __
  CITY            : _____________________________________ CTRY: _____
  ZIP/POSTAL CODE: _____         N-A SOURCE:    N-A EFF DATE: _____ YY-MM-DD
**********************************************************************
  RESP DEALER     : _____              BEGINNING MAILED DATE: _____ YY-MM-DD
  RELEASE DESC    : _____              ENDING MAILED DATE   : _____ YY-MM-DD
  CAMPAIGN DIV    : _            FLEET CODE: _____  FLEET MGMT LOC CODE: ____
  LAST NAME       : _____________________________________ INITIALS: __
  STREET ADDR1    : _____________________________________
        ADDR2     : _____________________________________ ST/PRV: __
  CITY            : _____________________________________ CTRY: _____
  ZIP/POSTAL CODE: _____         N-A SOURCE:    N-A EFF DATE: _____ YY-MM-DD
F1=INQUIRY  F3=EXIT  F4=QUIT  F5=G150  F7=FIRST PAGE  F8=NEXT PAGE  F9=G140
E803-VIN NOT FOUND                                                 OGDB191

                                                                   EM02-025 38774
```

```
NVM9510                        NAVIS  Vehicle  Inquiry              07/13/99 12:29:36
-->
 VEHICLE ID: 2NNX616160 (WWYPRRRRRR) Vin: 2NECM75W1NX616160 Div: 3 Status: 800
Vehcle Line: CFP    Convy Deliv: 050291   Orig P-Lvl: 210  Selling Dlr: 46X625
Order Recpt: 032191 ShipTo Stat:          Curr P-Lvl: 210    Sale Date: 050291
 Orig Sched: 032591 Rls-To Stat: IN    Order Dlr/Reg: 46625/46 Demo Dt:
   Inv Prep: 040591 Orig Int St: 042391 Orig Rls Dlr: 46625 Deliv Type: 0
  Prod Date: 041291 Curr Int St: 042391  Rls Dlr P&A: 11592  Sales Prd: 091051
   Rls Date: 042291  Dlrfin Ext: 052591   Warr Start: 050291 Cancel Sl:
Memo Consgn:          P&C Ext: 052591    WarrS-Ind:      Sale Status: G
Orig Pltbus: 042291  Advert Ext: 052591                 -Date- -Dealer- -Region-
Curr Pltbus: 042291  Slspsn SS#:       4420  Shipped: 042591
T/Name: 4[redacted]                      Curr Stock: 042291  46X625     46
Addr: [redacted]                State: IN         1st-Prior:
City: SULLIVAN          N/A-Rept: 050691    2nd-Prior:
Zip: [redacted]      Warr-Ins-Ind:          3rd-Prior:
V.O.:1       2         3         4         5         6         7         8
12345234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234
M75NXY  2     J1 25C9293      LC S   T3 J3P9Q7  3 KH     B     46X625  1  DD
8    9         0         1         2         3         4         5         6
56789012345678901234567890123456789012345678901234567890123456789012345678901234567890
   HH3H  3  2 W2NEC1 2 2      172A59WT   8
F1=Help  F3=Exit F4=Primary Menu F5=Financial Screen F9=Screen #3
                                                                      OGDB191
```

EA02-025 36778

NVMP530 NAVIS Inquiry Screen #3 07/13/99 12:29:52
===>

VEHICLE ID: 2MNX616160 ([redacted]) Vin: 2MECM75W1NX616160 Div: 3 Status: 800

Ordering Name: [redacted]
Secondary Name:
Ordering FIN: Selling FIN:
Order-For FIN: Sold-To Fin:
Orig Ordr Type: 1

Distr Status: P
Last NAVIS St: 050791
Distr Stat Dt: 050291
Last Activity: 010992
Serialized Dte: 032191
Scheduled Dte: 032591
Mexico Status:

Component Data -
Dr Post/Calib: GAA Tire Brand: A4
Main Cntl Lbl: HAA HEC:
Engine Tag Cd: 2G802AB
Engine Serial: W
Driver Airbag: 1PUW088E10140
Psengr Airbag: Axle: GY

F1=Help F3=Exit F4=Primary Menu F5=Financial Screen F6=Screen #1

OG0B191

E982-825 35778

```
NVWP520                    NAVIS  Financial Screen          07/13/99 12:29:56
==>
 VEHICLE ID: 2NNX616160 (NNTPNNNNNN) VIN: 2NECM75W1NX616160 DIV: 3 STATUS: 800

Financial Data- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Orig Totl Inv:   20963.00  A-Plan Price:   19997.00  Predel Invoice:      .00
 Curr Totl Inv:   20963.00     Total Adj:       .00    Sched-A GST:       .00
  Base Vehicle:   16821.00      Base Adj:       .00        FOC GST:       .00
       Options:    3157.00    Option Adj:       .00  Price Protect:       .00
  Base Holdback:    594.00   Base Hb Adj:       .00  Chargeback Amt:
  Optn Holdback:    112.00 Option Hb Adj:       .00  30-Day FP Amt:       .00
   Misc Charges:       .50       Gas Amt:     14.50     Floor Plan:     87.34
 Finance Charge:    260.00    Sched-B Amt:    535.00     F&C Charge:     53.20
      FDAF/LMDA:    175.00  Mktng Contrib:       .00  Pre-Dlvry Amt:       .00
Financing Data- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Finance Source: 0000001     O-Purr Start: 050291      Release Date: 042291
 Orig Int St-Sw: N          Co Tag Number:           Transit Time: 14
  Bet Draft Ind:             Pre-del Date:          Rls Plus Trans: 050691
 Floor Pln Date: 052591    Prdlvty S.Code:               Ramp Code: 50
 Advt Comm Code: 1             Lease Code:          Method Shipped: 7
 Upfront FP Ind:           Invoice In-Proc:          Memo Cons Loc:

 F1=Help  F3=Exit  F4=Primary Menu  F6=Screen #1  F9=Screen #3
                                                              OGDB191
```

Vehicle Information Report

GENERAL VEHICLE INFORMATION:

(Related Claims)

VIN:	2MECM75W1NX616160	Veh Line:	C/FP - GRAND MARQ (EN53/EN114) [92-99]	Eng Serial No:	W
Model Year:	1992	Market Derivat:	C/M - L-M DIVISION DERIVATIVE	Body Shell:	*
Veh Type:	C	Drive Code:	C/B - 2 WHL L/H REAR DRIVE	Engine:	C/VN - R-M 4.6L SOHC EF
Inv. Dealer:	11592	Body Cab Style:	C/FA - 4 DOOR SEDAN-4 LITE	Transmission:	C/DC - 4 SPD AUTO TRA
		Version/Series:	C/AJ - LS VERSION		

BUILD INFORMATION:

Region: NA - [illegible] Plant: AW - ST. THOMAS PLANT BUILD
Country: CAN - [illegible] Prod Date: 12-APR-1991

SALE INFORMATION:

Region: NA - [illegible] Selling Dealer: 346628 - *
Country: USA - [illegible] Selling Dlr St/Prov: IN
Buyer St/Prov: IN

Arrival Date:	02-MAY-1991	Red Carpet Lease:	*	
Sale Date:	02-MAY-1991	Fleet/Retail/Co. Lease:	R	
Warranty Start Date:	02-MAY-1991	Modified Vehicle:	*	
Orig Warranty Date:	02-MAY-1991	Reacquired Vehicle:	*	Vehicle Export Flag: N

VOC/EOC:

---1---2---3---4---5---6---7---8---9---

[illegible]

[illegible]

EA02-028 38778

INSTALLED OPTION INFORMATION:

Air Conditioning:	C/B - MANUAL AIR CONDITIONER	GVW Code:	-
Alternator Amp Rating:	*	GVW Class Code	C
Audio Disk:	* - [N/A]	Instrumentation	* - [N/A]
Axle Ratio:	EGACC - 3.08 FINAL DRIVE RATIO	Mirror(Driver Side):	* - [N/A]
Axle Type:	EGHAC - LIMITED SLIP REAR AXLE	Mirror(Pssgr Side):	* - [N/A]
Battery Amp Rating:	HC	Paint:	PNDAD - MOCHA FROST C/C
Brake Code:	* - [N/A]	Power Antenna:	AE - POWER TELESCOPIC RADIO ANTENNA
Brake Code(Service):	* - [N/A]	Radio:	AR - ELECTRONIC AM/FM STRD/CASSETTE
Calibration Code:	31SAR00A	Sound System:	* - [N/A]
Color(Accent):	* - [N/A]	Single Tandem Axle:	* - [N/A]
Color(Trim):	* - [N/A]	Tire Brand:	AI - MICHELIN TIRE VENDOR
Delivery Type:	D	Tire Size:	DIGHF - P215/70R15 WSW
Driveshaft Code:	*	Traction Control:	AB - ANTI-SPIN TRACT BRAKES W/O TVD
Front Seat:	C/K - SEAT-SPLIT BENCH	Wheel Base:	* - [N/A]
Fuel Type:	* - [N/A]		

ESP INFORMATION: EMISSIONS INFORMATION:

ESP Code:	*	Emission Code:	C/B - C/B
ESP Coverage(Miles):	*	Emission Cert Type:	F
ESP Coverage(Time):	*	Emission Decal Suffix:	HAA
ESP Plan Year:	*	Engine Family:	NF0446VHEP8
ESP Signature Date:			

Any comments? You can contact

vehmaster@ouv-ford.com

Standard Claims List For Model Year 1992

Note: All Costs are in US Dollars

2MECM75W1NX616160	C/FP	C/M	C/FA	C/AJ	C/B	AW	C/DC	C/VN	12-APR-1991	02-MAY-1991	346625	USA	2	4

AWS Claim Key: 10996710 Trx Code: 1 Labor Hrs: .6 Labor Cost: 16.8 Material Cost: 0

Dlr Cd-Sub Cd: 11593-* Name: BOB WALTERS LINC-MERC INC Ph: 812-8974306 St: IN Ctry Cd: USA

Tech Comments: RATTLE RIGHT SIDE UNDERNEATH CAR--TEST DRIVE--RIGHT BRACKET AND INSULATOR LO

2MECM75W1NX616160	C/FP	C/M	C/FA	C/AJ	C/B	AW	C/DC	C/VN	12-APR-1991	02-MAY-1991	346625	USA	2	5

AWS Claim Key: 10996708 Trx Code: 1 Labor Hrs: .6 Labor Cost: 16.8 Material Cost: 0

Dlr Cd-Sub Cd: 11593-* Name: BOB WALTERS LINC-MERC INC Ph: 812-8974306 St: IN Ctry Cd: USA

Tech Comments: CUSTOMER COMPLAINS CAR PULLS TO RIGHT--CK ALIGNMENT--IS WITHIN SPECS

2MECM75W1NX616160	C/FP	C/M	C/FA	C/AJ	C/B	AW	C/DC	C/VN	12-APR-1991	02-MAY-1991	346625	USA	29	4

AWS Claim Key: 10996711 Trx Code: 1B4 Labor Hrs: .3 Labor Cost: 28.8 Material Cost: 125.38

Dlr Cd-Sub Cd: 04418-* Name: CLINTON FORD-MERCURY SALES INC Ph: 317-4923564 St: IN Ctry Cd: USA

Cust Comments: NOISY MUFFLER

Tech Comments: REPLACE CORRODED AND PITTED MUFFLER

Any comments? You can contact

webmaster@qpis-ford.com

E002-025 35780

Claim Detail Report

Note: All costs are in US dollars
Model Year = 1992; Claim Key = 10996710

Vehicle Information

Model Year:	1992
Market Derived:	C/M - L-M DIVISION DERIVATIVE
Body/Cab Type:	C/FA - 4 DOOR SEDAN-4 LITE
Version/Series:	C/AJ-LS VERSION
Drive Type:	C/B-2 WHL L/H REAR DRIVE
Vehicle Line:	C/FP-GRAND MARQ (EN53/EN114) [92-99]
Warranty Start Date:	02-MAY-1991
Production Date:	12-APR-1991
VIN:	2MECM75W1NX616160

Claim Information

Document Number:	203443
Repair Date:	25-JUN-1991
Distance:	642
TIS:	2

Dealer Information:

Dealer Name	BOB WALTERS LINC-MERC INC
Dealer Code:	11592 - *
Address:	ROUTE 4, BOX 163
City:	LINTON
State:	IN Zip Code:47441
Country:	USA Region Code: NA
Phone:	(812)430-4306

Expense Information

Customer Paid Amount:	0
Deductible Amount:	0
Dealer Paid Amount:	0
Labor Cost:	16.8
Misc. Expense Amount:	0
Part Markup Amount:	
Material Cost:	0
Total Cost Gross:	16.8

Cust. Concern Code: * -
Condition Code: * -
Technician Comment: RATTLE RIGHT SIDE UNDERNEATH CAR--TEST DRIVE--RIGHT BRACKET AND INSULATOR LO
Customer Comment:

Labor Op Code	Labor Op Description	Labor Op Cost
M		0

Causal Flag	Full Part Number PREF	BASE	SUFF	Part Description	CPSC	Part Quantity	Extended Amount
Y	*	5C263	*	BRKT&INS ASY MUFFLER	090303	0	0

Any comments? You can contact

webmaster@qvs-ford.com

Claim Detail Report

Note: All costs are in US dollars
Model Year = 1992; Claim Key = 10996709

Vehicle Information

Model Year:	1992
Market Derived:	C/M - L-M DIVISION DERIVATIVE
Body/Cab Type:	C/FA - 4 DOOR SEDAN-4 LITE
Version/Series:	C/AJ-LS VERSION
Drive Type:	C/B-2 WHL L/H REAR DRIVE
Vehicle Line:	C/FP-GRAND MARQ (EN53/EN114) [92-99]
Warranty Start Date:	02-MAY-1991
Production Date:	12-APR-1991
VIN:	2MECM75W1NX616160

Claim Information

Document Number:	203443
Repair Date:	25-JUN-1991
Distance:	642
TIS:	2

Dealer Information:

Dealer Name	BOB WALTERS LINC-MERC INC
Dealer Code:	11592 - *
Address:	ROUTE 4, BOX 163
City:	LINTON
State:	IN Zip Code:47441
Country:	USA Region Code: NA
Phone:	(812)430-4306

Expense Information

Customer Paid Amount:	0
Deductible Amount:	0
Dealer Paid Amount:	0
Labor Cost:	16.8
Misc. Expense Amount:	0
Part Markup Amount:	
Material Cost:	0
Total Cost Gross:	16.8

Cust. Concern Code: * -
Condition Code: * -
Technician Comment: CUSTOMER COMPLAINS CAR PULLS TO RIGHT--CK ALIGNMENT--IS WITHIN SPECS
Customer Comment:

Labor Op Code	Labor Op Description	Labor Op Cost
3001AF	CASTER, CAMBER, TOE-IN CHECK	0

Causal Flag	Full Part Number PREF	BASE	SUFF	Part Description	CPSC	Part Quantity	Extended Amount
Y	*	FRONT	*	FRONT END ALIGNMENT	040001	0	0

Any comments? You can contact

webmaster@aws-ford.com

Claim Detail Report

Note: All costs are in US dollars
Model Year = 1992; Claim Key = 10996711

Vehicle Information

Model Year:	1992
Market Derived:	C/M - L-M DIVISION DERIVATIVE
Body/Cab Type:	C/FA - 4 DOOR SEDAN-4 LITE
Version/Series:	C/AJ-LS VERSION
Drive Type:	C/B-2 WHL L/H REAR DRIVE
Vehicle Line:	C/FP-GRAND MARQ (EN53/EN114) [92-99]
Warranty Start Date:	02-MAY-1991
Production Date:	12-APR-1991
VIN:	2MECM75W1NX616160

Claim Information

Document Number:	010375
Repair Date:	14-SEP-1993
Distance:	29142
TIE:	29

Dealer Information:

Dealer Name	CLINTON FORD-MERCURY SALES INC
Dealer Code:	04618 - *
Address:	335 S THIRD ST
City:	CLINTON
State:	IN Zip Code:47842
Country:	USA Region Code: NA
Phone:	(317)356-3564

Expense Information

Customer Paid Amount:	0
Deductible Amount:	0
Dealer Paid Amount:	0
Labor Cost:	28.8
Misc. Expense Amount:	0
Part Markup Amount:	
Material Cost:	123.28
Total Cost Gross:	152.08

Cust. Concern Code:	N59 - OTHER SQUEAK/RATTLE (EXCLUDING WIND NOISE)
Condition Code:	08 - OTHER/UNKNOWN(NO APPROPRIATE COND. CODE)
Technician Comment:	REPLACE CORRODED AND PITTED MUFFLER
Customer Comment:	NOISY MUFFLER

Labor Op Code	Labor Op Description	Labor Op Cost
5230A	MUFFLER REPLACE	0

Causal Flag	Full Part Number PREF	BASE	SUFF	Part Description	CPSC	Part Quantity	Extended Amount
Y	F2AZ	5230	E	MUFFLER ASY	090101	1	0

Any comments? You can contact

webmaster@aces-ford.com