EA02-025

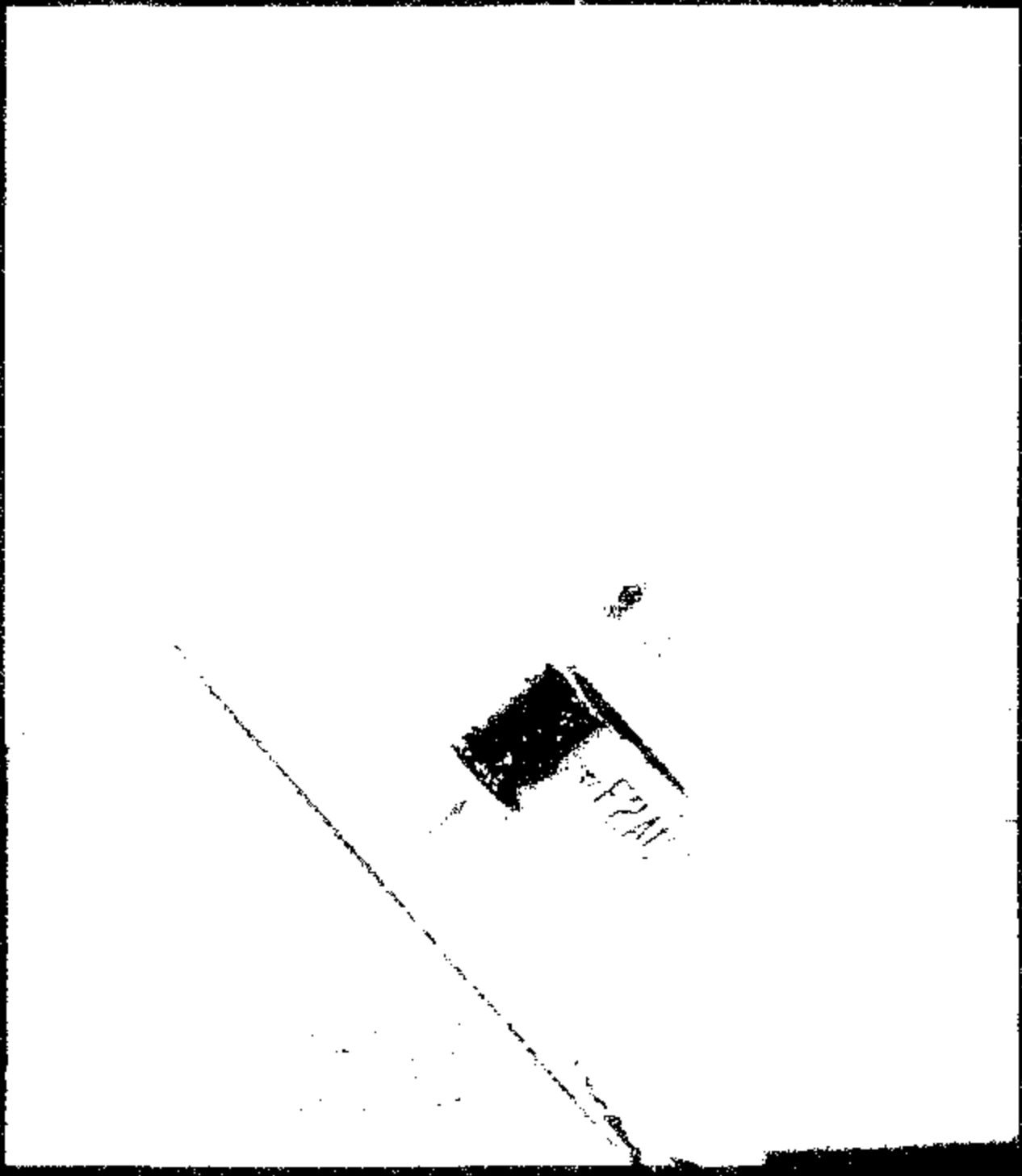
TEXAS INSTRUMENTS, INC.'S 9/10/03 ATTACHMENT

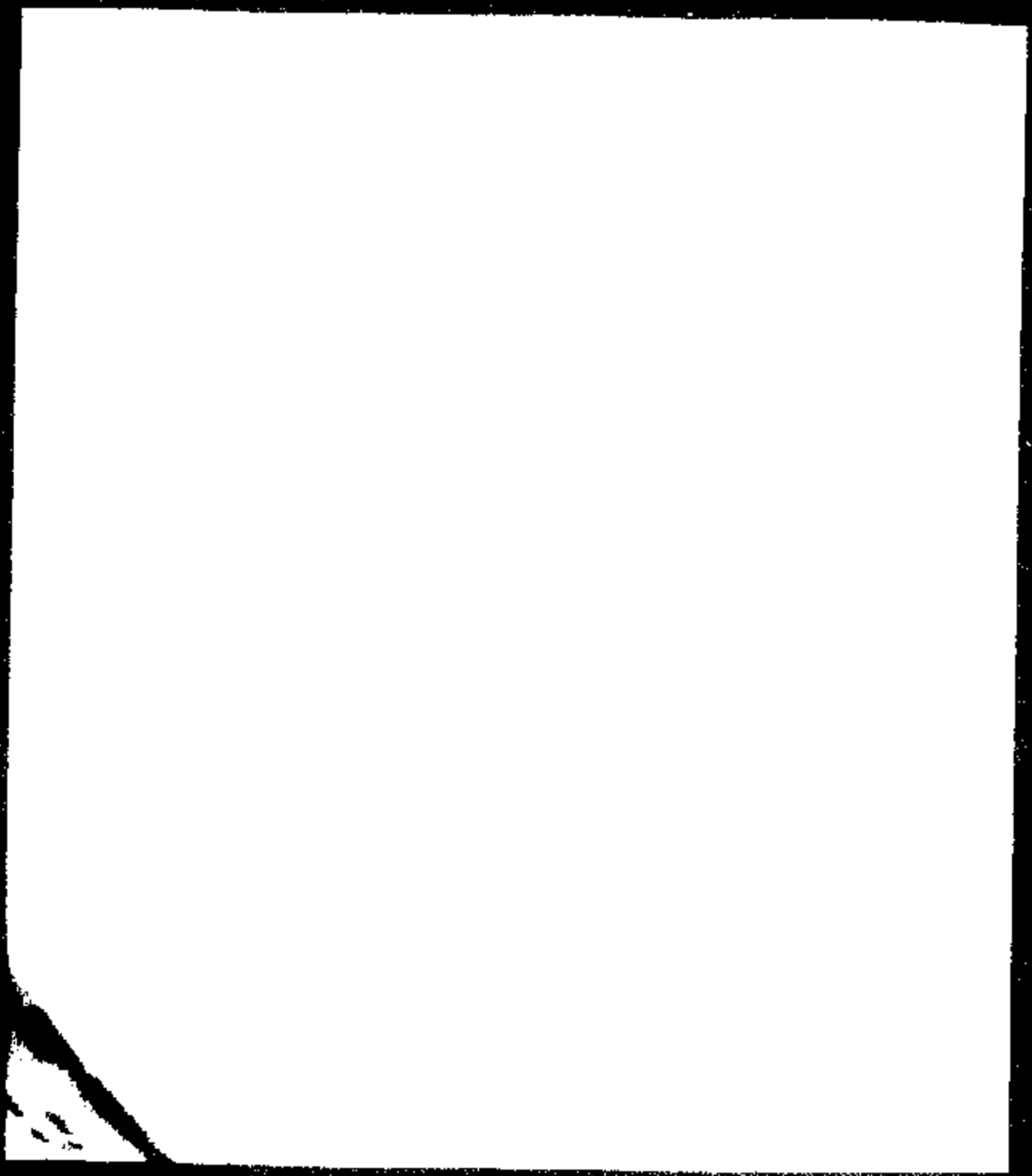
REQUEST NO. 7

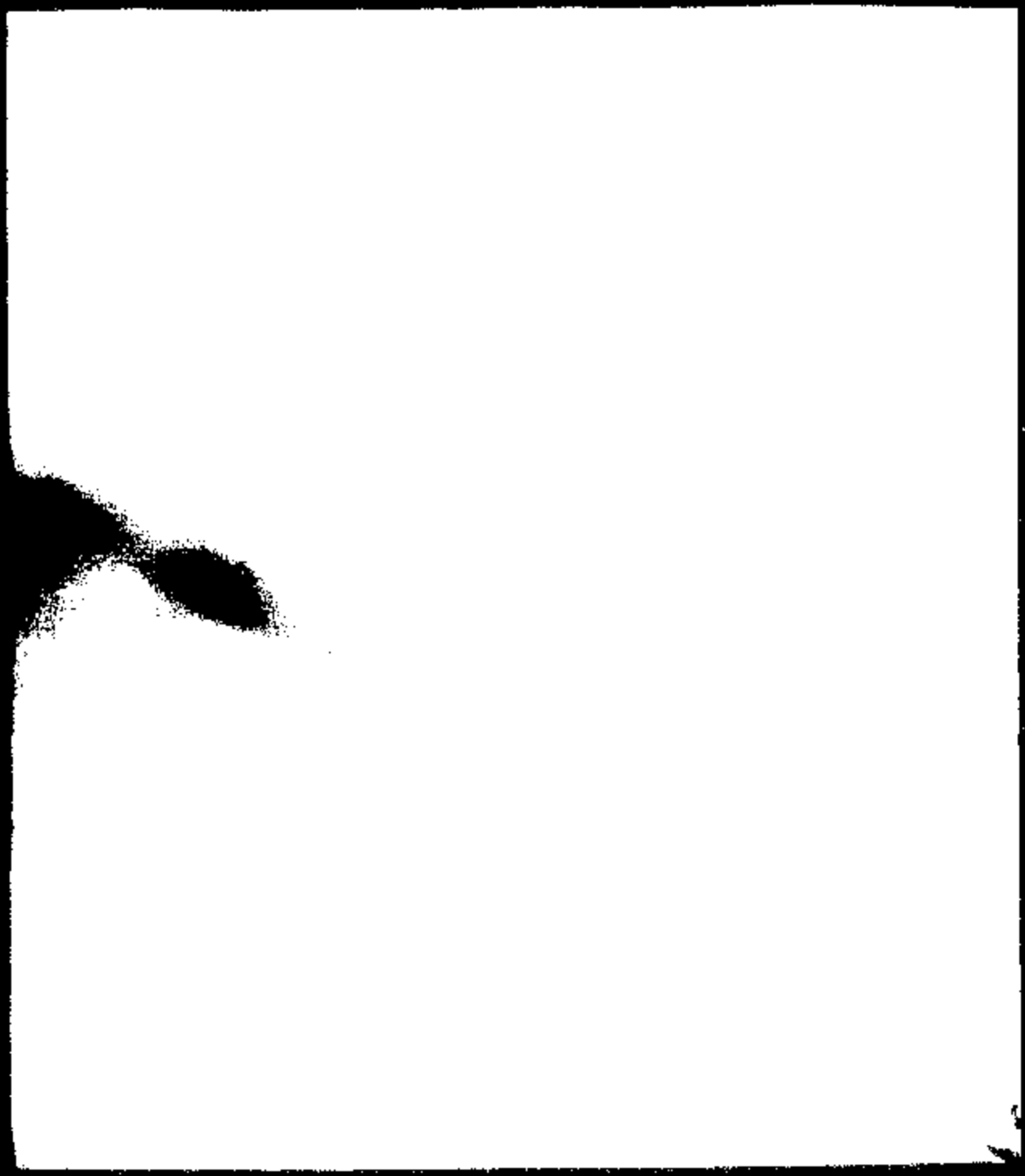
BOX 8

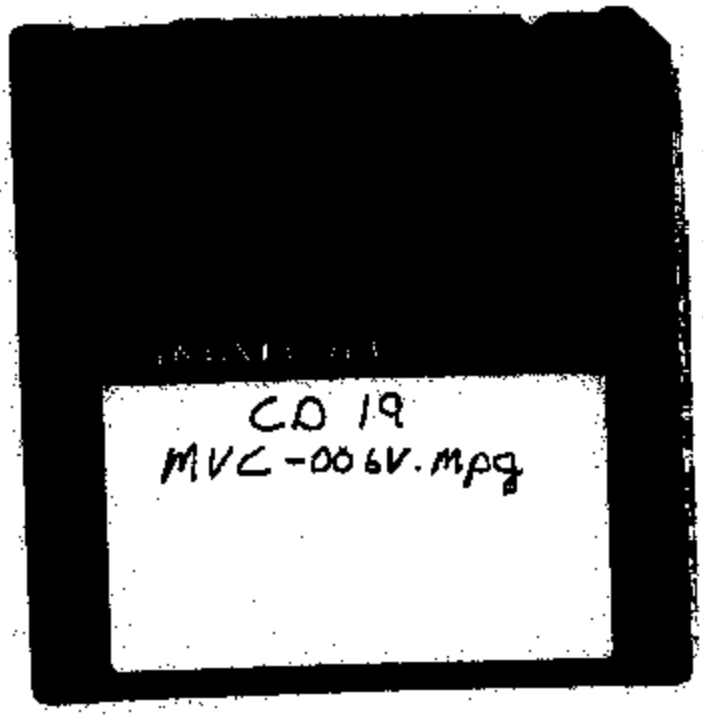
PART A-U

PART S





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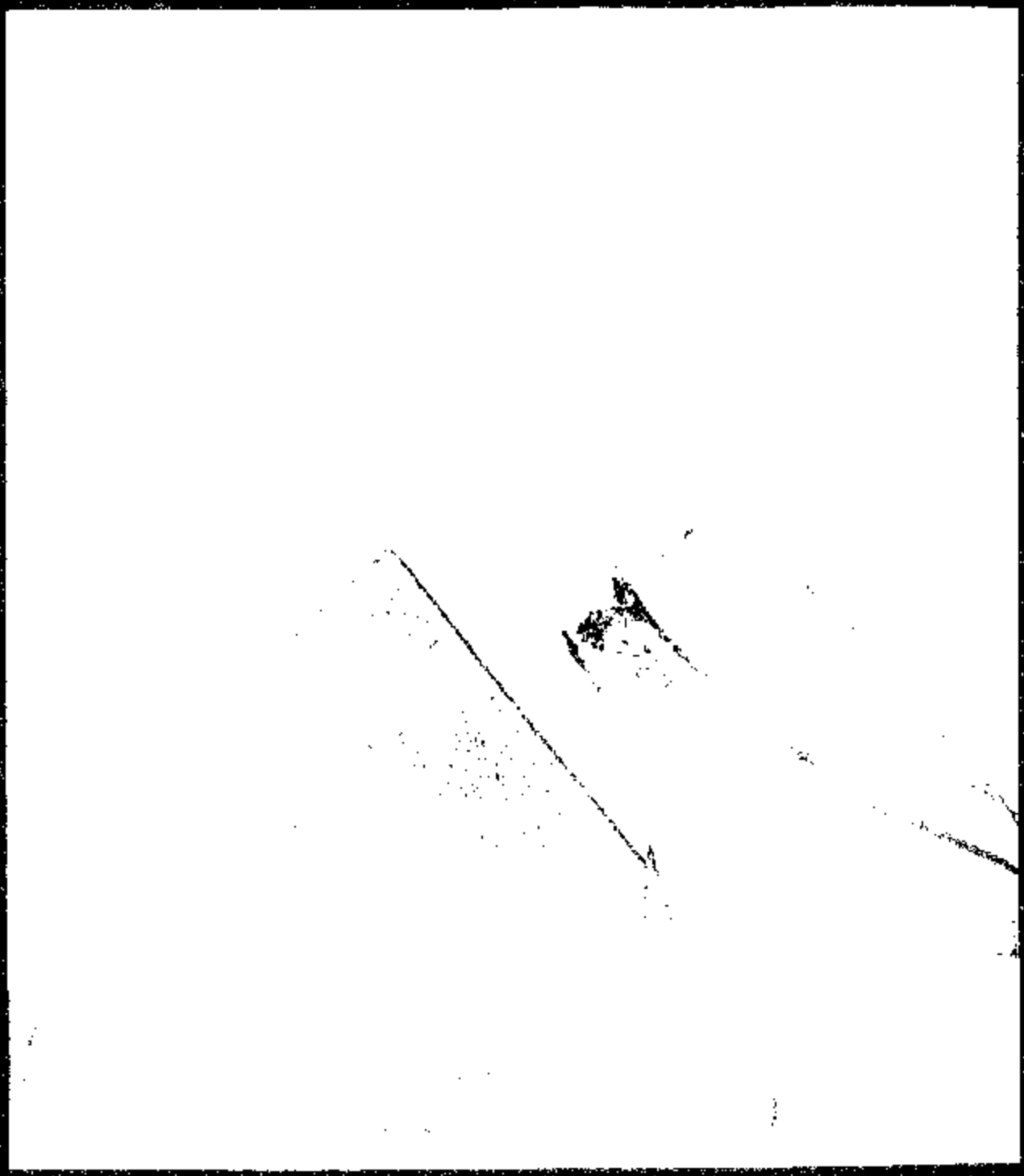

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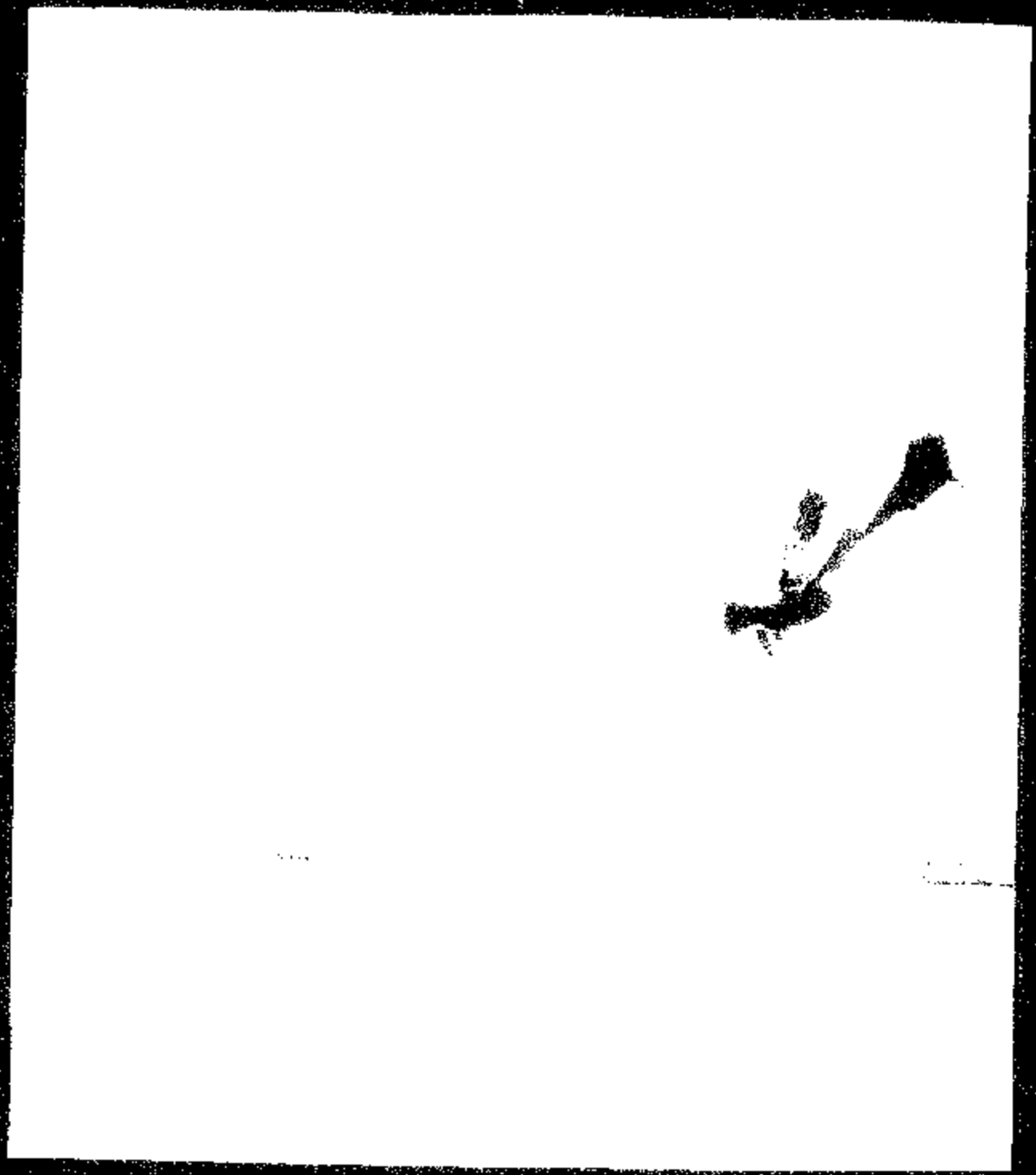

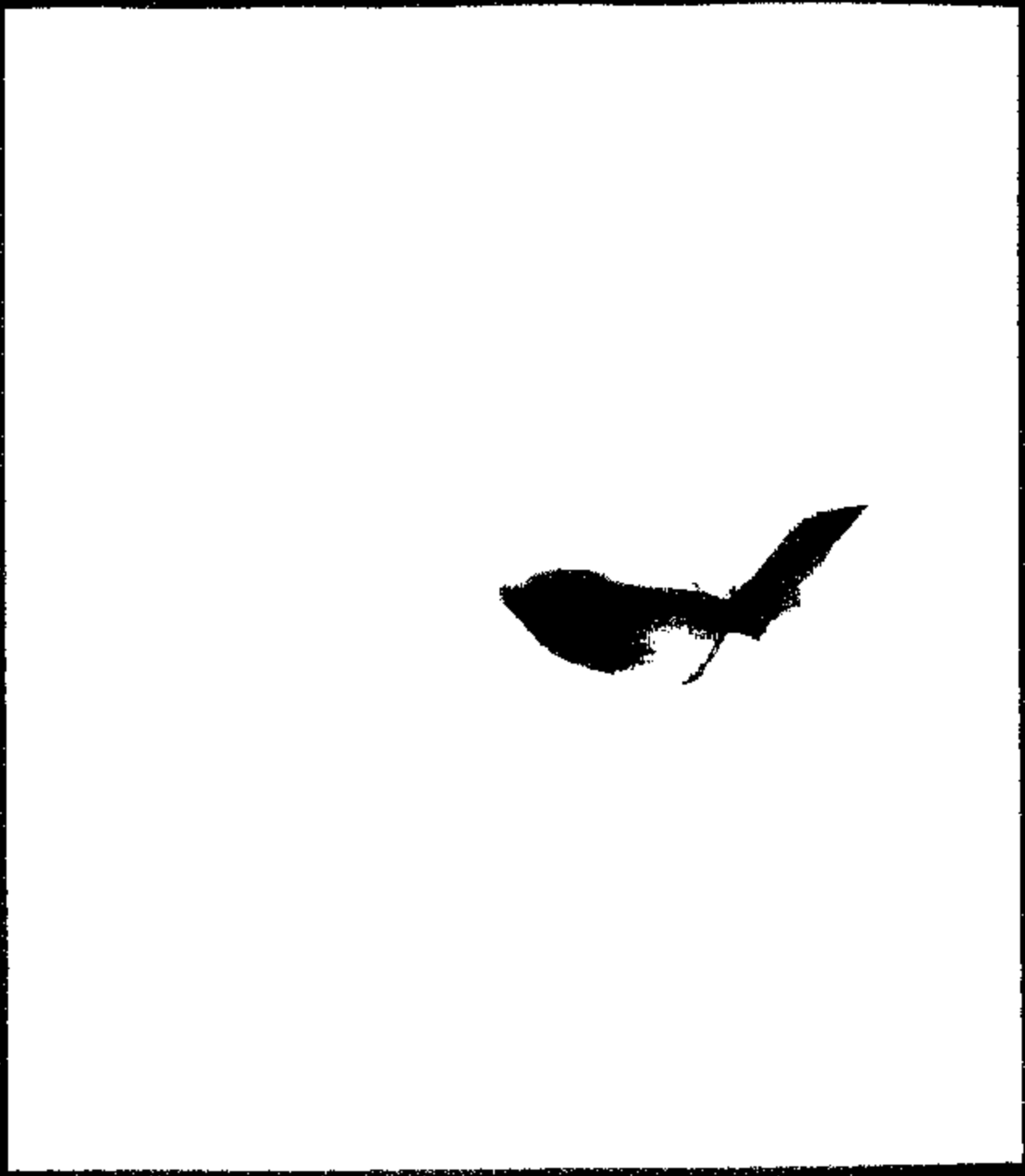

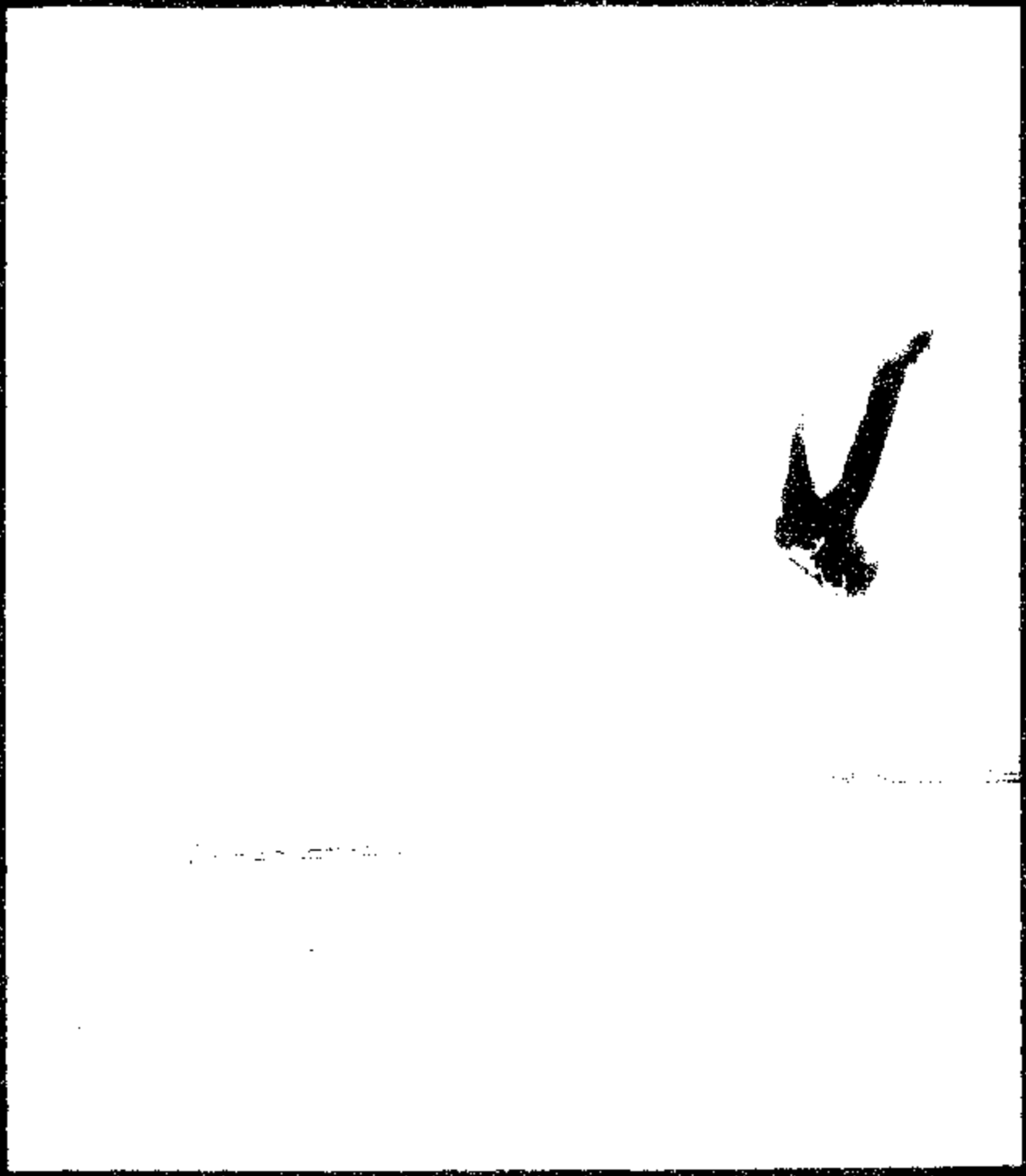

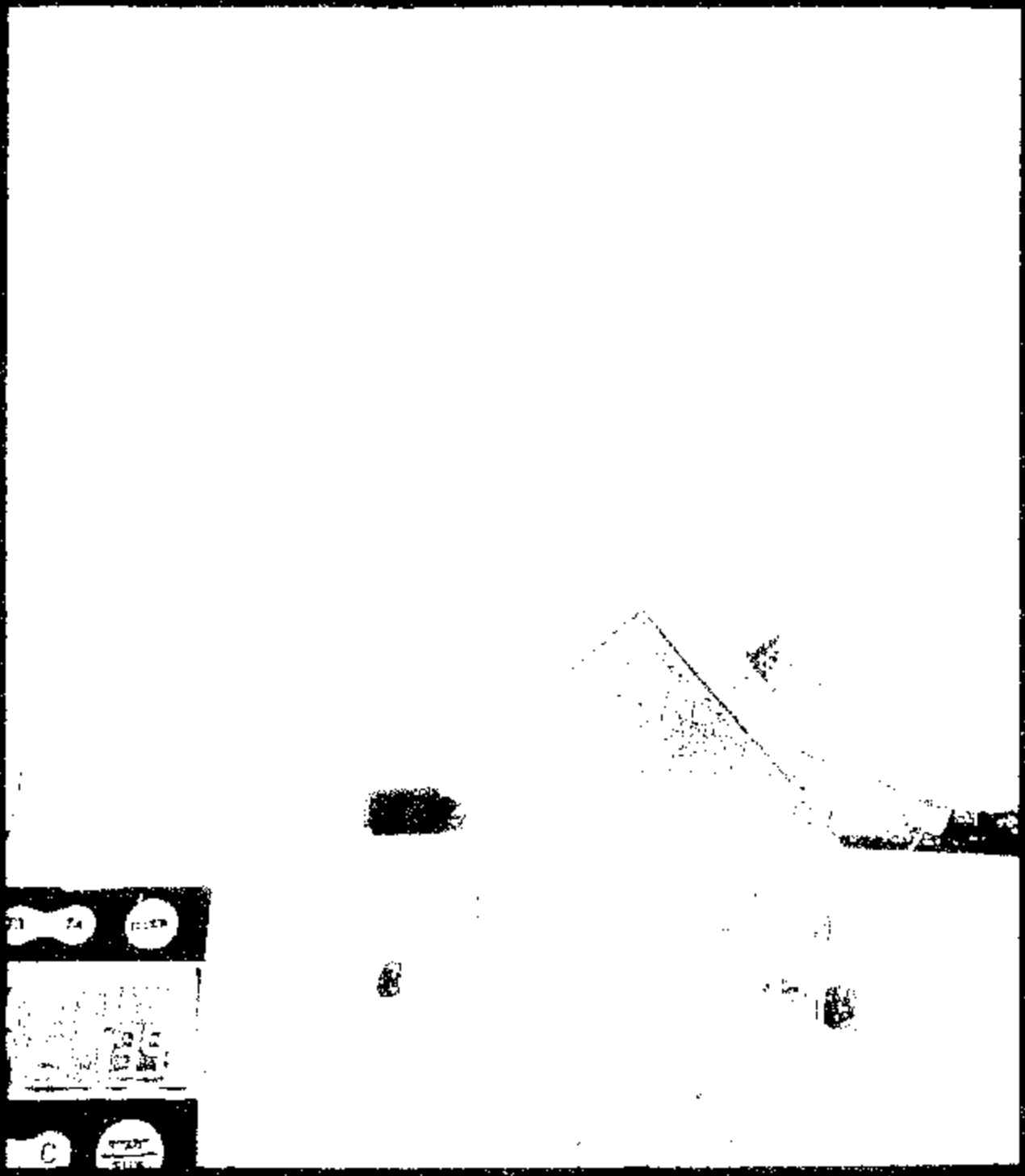

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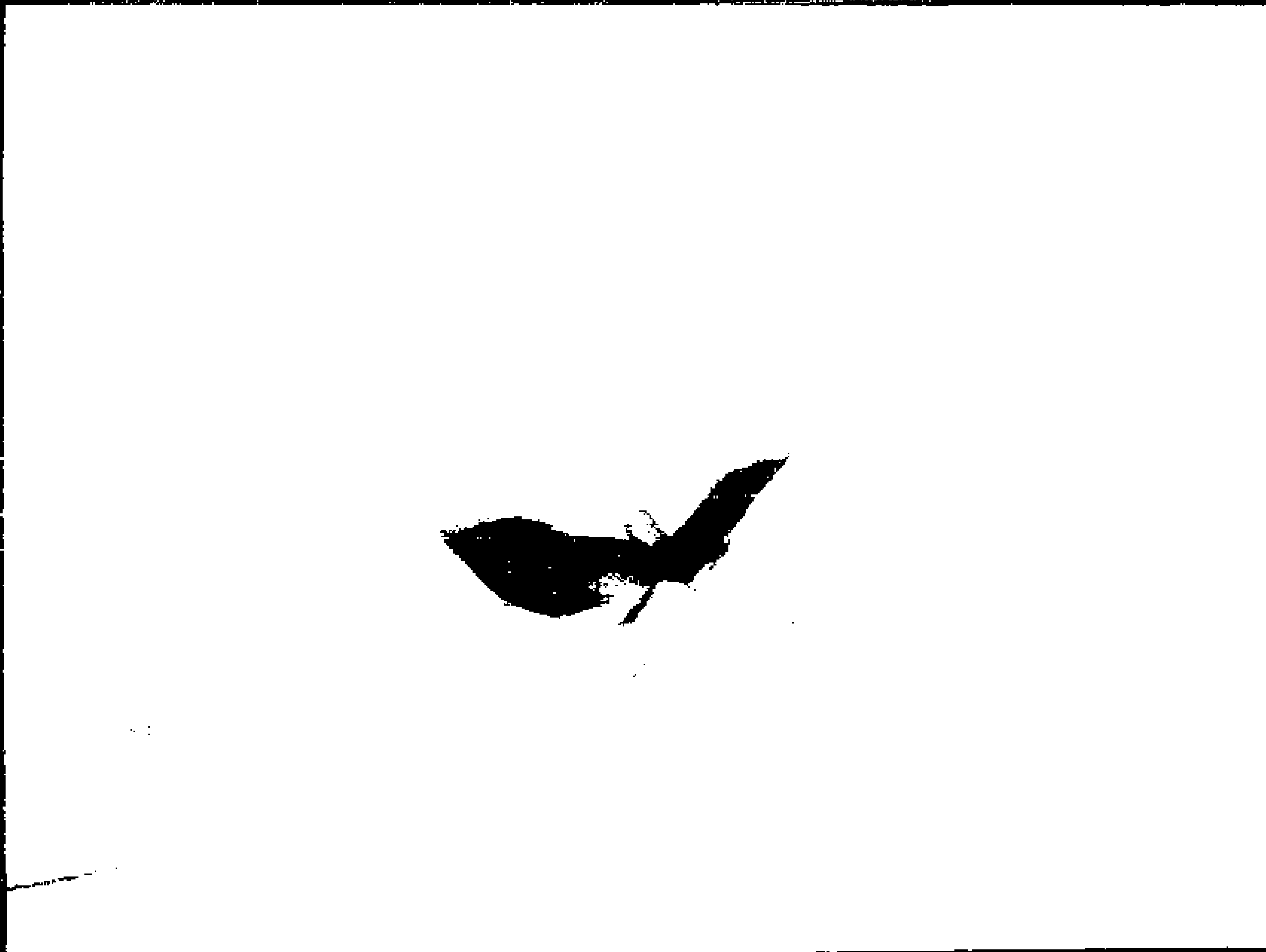

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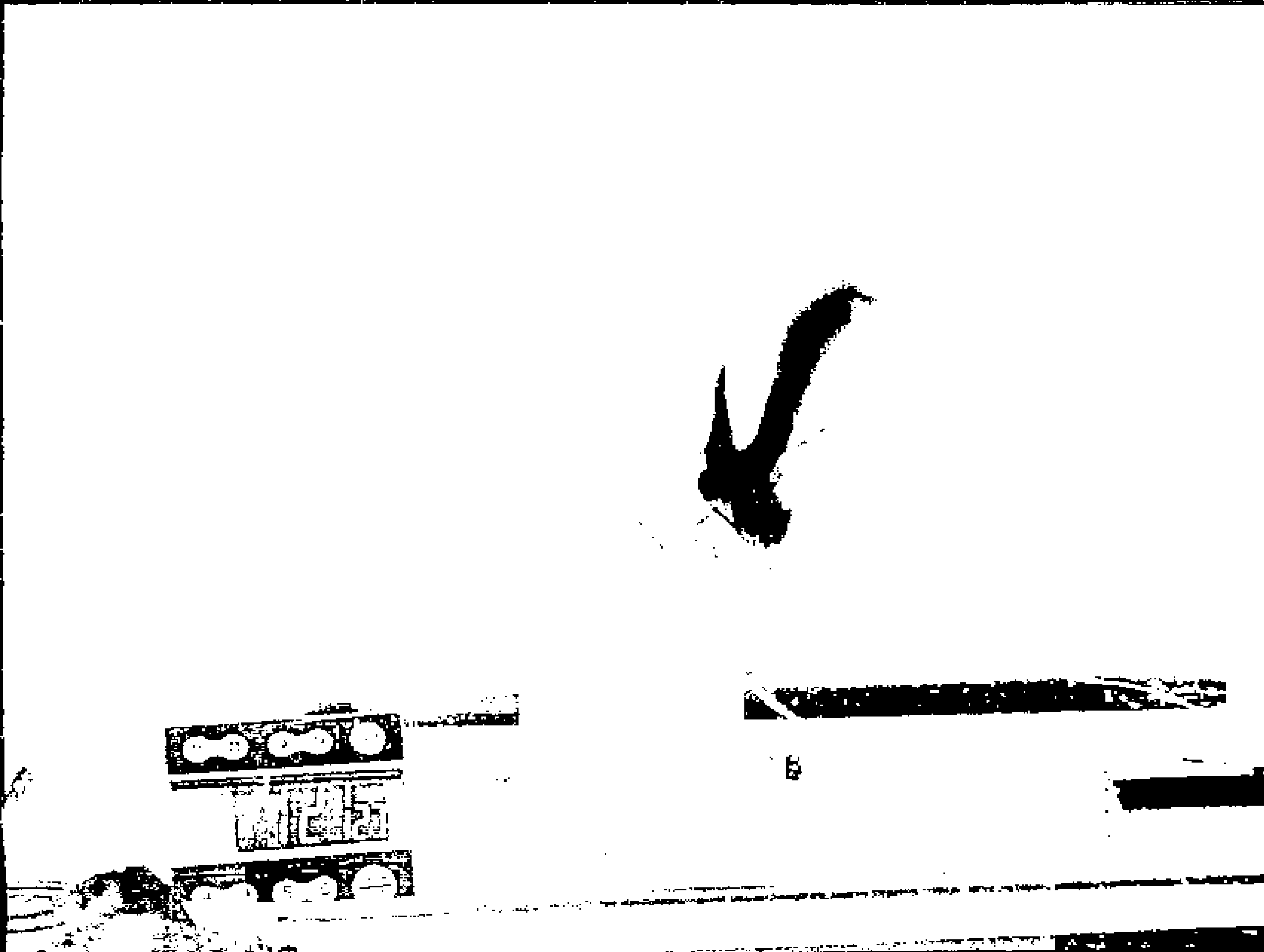
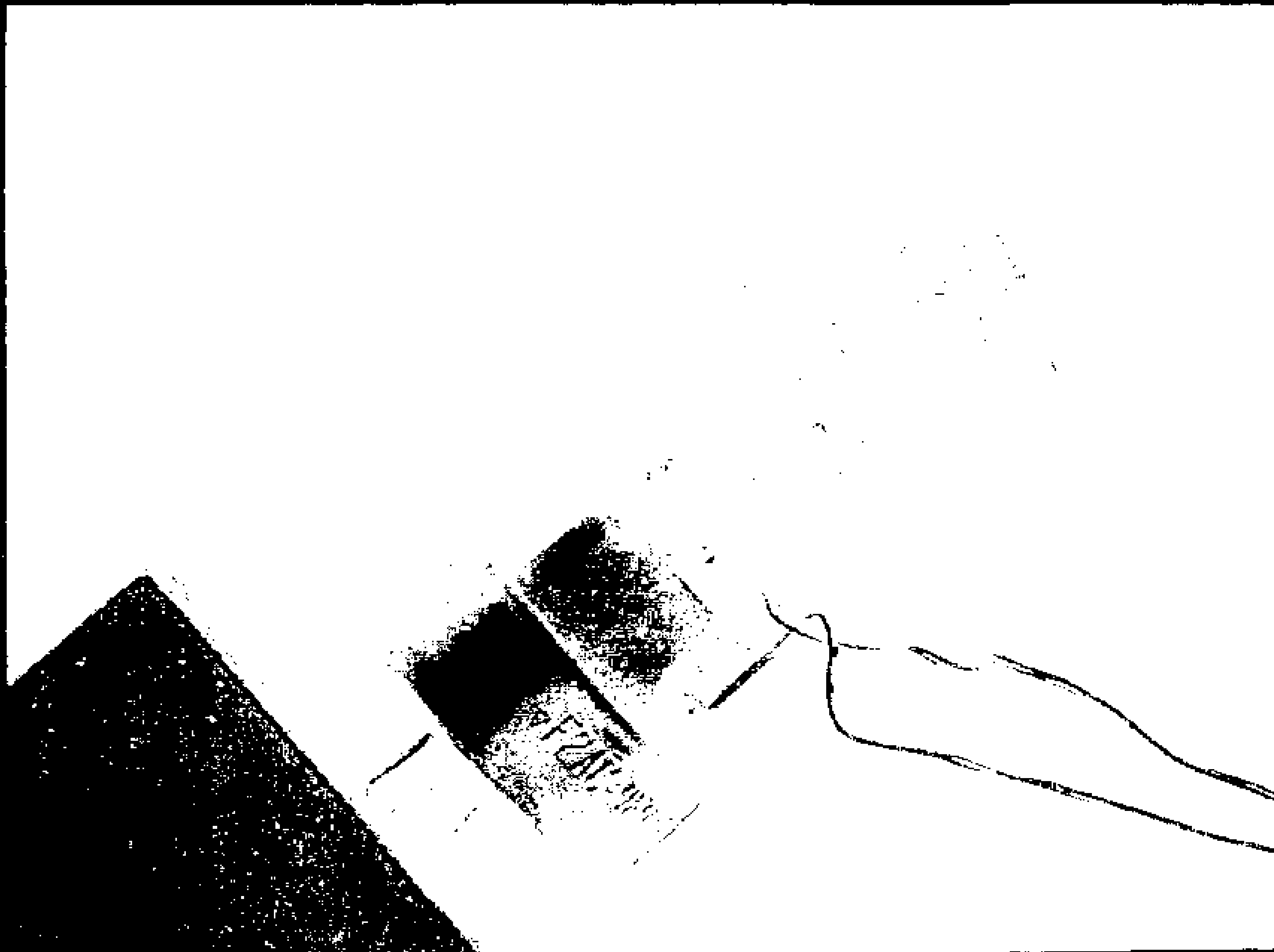




TI-NHT8A 013282

FORM 0399

TECHNICAL SERVICE LABS

TEST NO. 152762 LOG NO. 12800 TEST NO. 152762

PCC I.D.	127
REQUESTOR COST CENTER	357
PRODUCT CODE	099
REQUESTOR	S. Mulligan
EXTENSION	12-29
MSS ID	2535
DATE SUBMITTED	SEAM
DATE REQUIRED	03/23/99
NO. OF SAMPLES	(3)
COMPOSITION *	Used Brake Fluid

STATE YOUR PROBLEM/SAMPLE DESCRIPTION: "Metals and water in brake fluid" may effect switch performance

INFORMATION DESIRED:
(1) Water content
(2) Metal Content
Cu
Fe
Cr

REPORT OF RESULTS:

DATE RECEIVED 3.31.99 DATE OUT 4-6-99

TECHNICIAN	JL		
HOURS WORKED			
PROCEDURE USED	TSL-C-181, General TK pg. 109		

*PCC I.D.

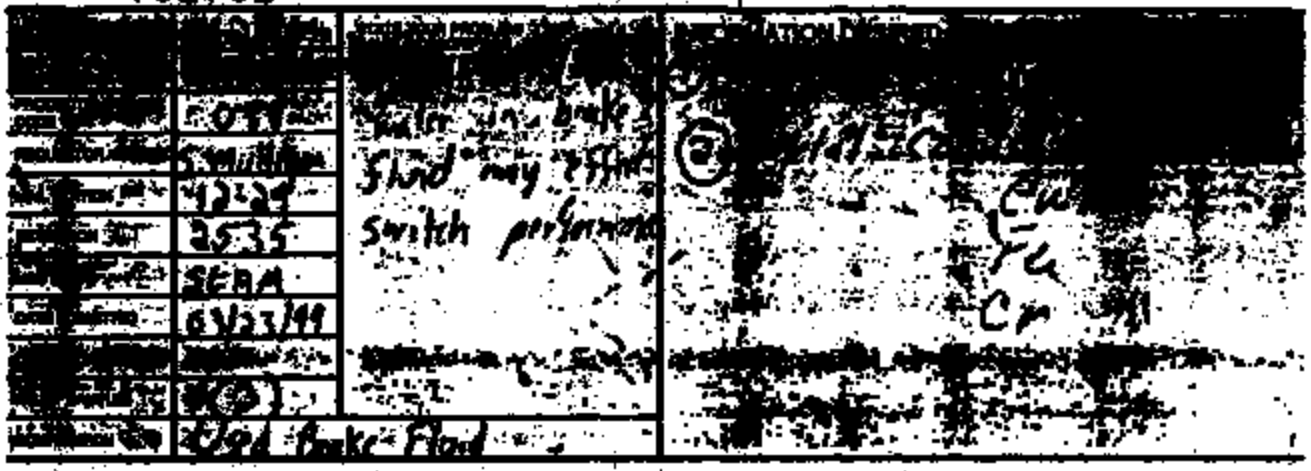
MC=325	TM=431	CLKE=122	FACIL=514
PC=127	WIRE=432	CAN=954	FACIL=521
VERS=169	EPD=621	AD DEV=256	FACIL=531
AFCC=483	PEP=622	EMCD=877	STAFF=885
IMD=430	CSD=635		

TEST NO. 152762

TECHNICAL SERVICE LABS

LOG NO. 12800

TEST NO. 152762



REPORT OF RESULTS:

DATE RECEIVED 3.11 DATE OUT 4.6.99

TECHNICIAN			
HOURS WORKED			
PROCEDURE USED	TSC-C-181, Jan 98 TK pg. 69		

PCC I.D.

MC=395	TM=431	CLKE=122	FACIL=614
PC=127	WIRE=432	CAN=654	FACIL=621
VERB=166	EPD=621	AD DEV=288	FACIL=631
APCC=483	PEP=622	EMCD=677	STAFF=666
MD=430	CSD=636		

Epstein, Sally

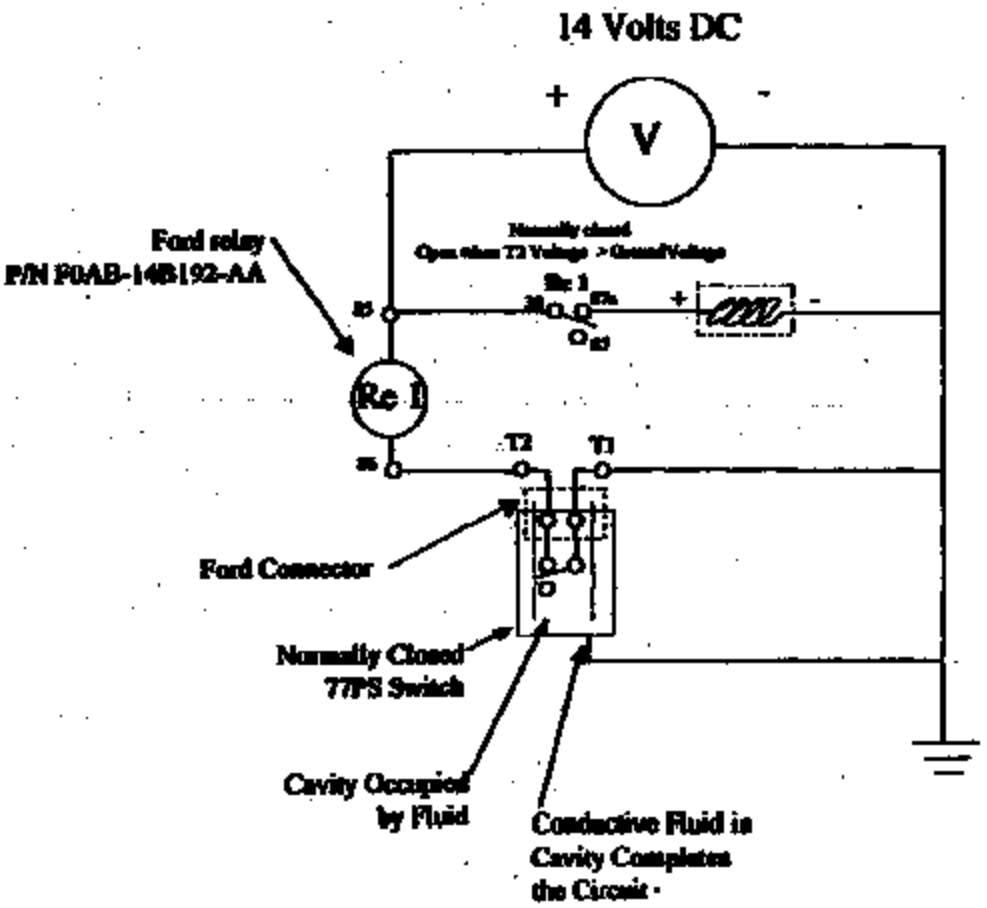
From: Mulligan, Sean [smulligan@email.mcd.com]
Sent: Wednesday, [illegible] 8:51 AM
To: Rahman, Aziz
Subject: Ford Relay


Hi Aziz,
Here are the proposed relay schematics.
relay.ppt shows the Ford application
relay_testsetup is our test setup.

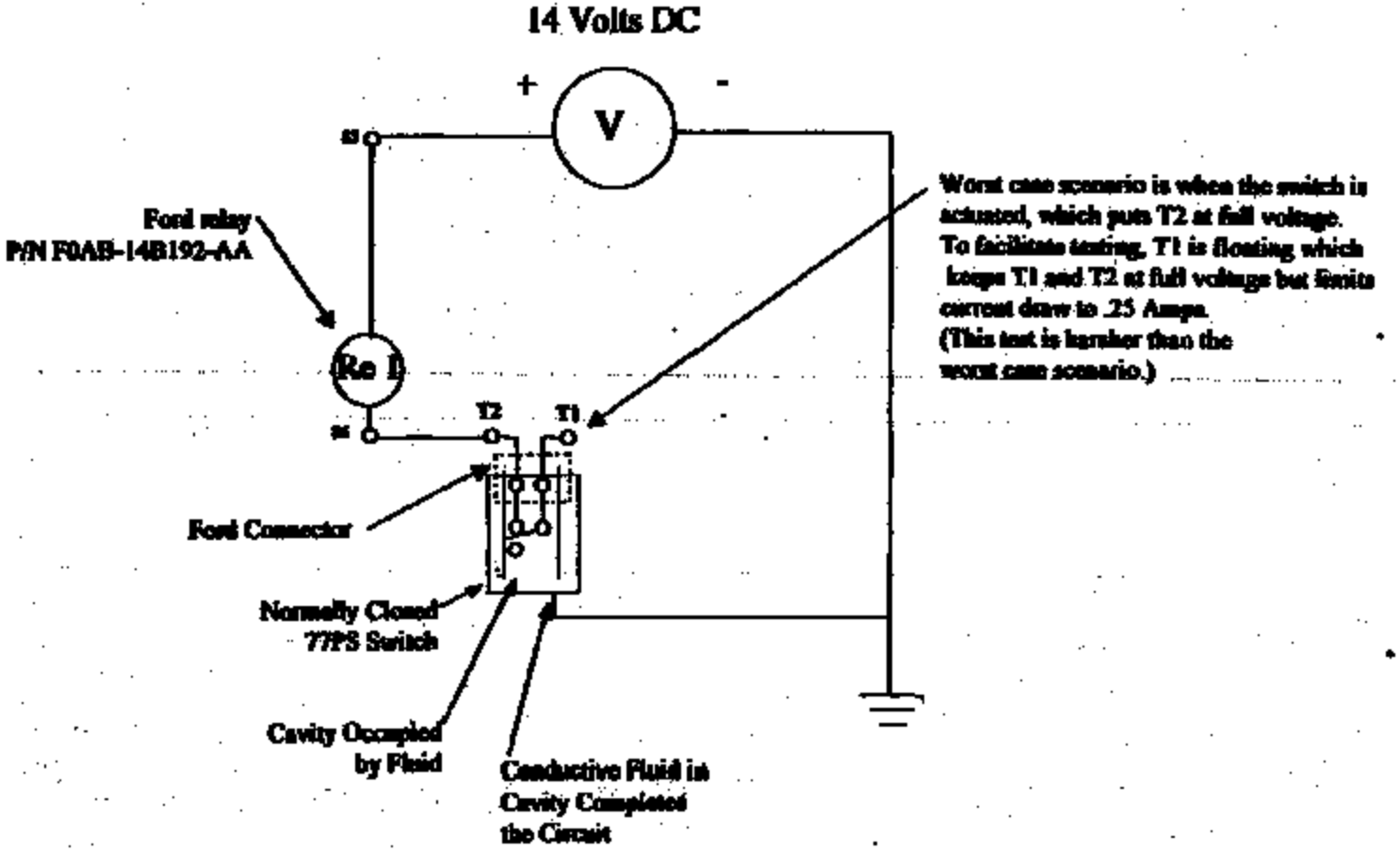
I am getting confirmation from Fred Porter that this is indeed the proposed setup. I will notify when I get results.

All the best,

Sean
<<relay.ppt>> <<relay_testsetup.ppt>>



TI Test Setup



Epstein, Sally

From: Roy, Norman [nroy@email.mc.ti.com]
Sent: Thursday, April 08, 1999 8:09 AM
To: McGuirk, Andy
Subject: FW: Materials Recommendations for Flammability issue

Andy,

Attached is the reply from Ticona regarding material pedigree with additional info regarding effect of colorants. The current runnerless system in the 46515 mold uses heat pipe technology that is not recommended for LCP materials. We are also getting an answer on its compatability with the Zytel material.

Regards,

Norm

From: Dunn, Kevin
Sent: Tuesday, April 06, 1999 9:52 AM
To: Roy, Norman
Subject: FW: Materials Recommendations for Flammability issue

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From: kprice@ticona.com[SMTP:kprice@ticona.com]
Sent: Tuesday, April 06, 1999 9:45 AM
To: kdunn@email.mc.ti.com
Cc: rfyurachek@ticona.com
Subject: RE: Materials Recommendations for Flammability issue

Mr. Dunn,

The samples sent to you labeled as Celanex 3316 were in fact Celanex 3316. A non-technical test, such as exposing a sample to a simple kitchen match under non-controlled conditions, will yield misleading results. The UL-94 flammability tests are very specific in nature. Items which must be carefully controlled include sample orientation (vertical or horizontal), sample size and thickness, burner size and regulator, type of gas used to supply burner, flame height, temperature and relative humidity. The time that the flame is applied and the relative orientation of the flame to the specimen are also carefully controlled.

I can send you a copy of the procedure, but in order to perform the test properly, you must have the right equipment. If you want a copy, please provide your fax number.

The tensile bar probably behaved better because it was thicker. Colorants can have an effect on the flammability. We have pre-colored materials which have been rated in the UL-94 test. For example, Celanex 3316 natural is rated V-0 down to 0.38 mm thickness, while all other colors are rated V-0 down to 0.75 mm thickness. The natural material is more robust in its flame retardancy.

Celanex 3316 has been successfully used in hot runner systems.

Ken Price

-----Original Message-----
From: Yurachek, Robert, TP/US
Sent: Tuesday, April 06, 1999 12:55 AM
To: Price, Kenneth, TP/US
Subject: FW: Materials Recommendations for Flammability issue
Importance: High

Ken:

Please contact Kevin and respond to his request. Thanks and please copy me.

Bob

-----Original Message-----
From: Dunn, Kevin [mailto:kdunn@email.mc.ti.com]
Sent: Monday, April 05, 1999 2:52 PM
To: rfyurachek@ticona.com
Subject: FW: Materials Recommendations for Flammability issue

Hi Bob, Would you please verify that the test bars were 3316 material. Also
please check for alternatives.

As you can see, things are getting more attention at the customer.

Kevin

From: Roy, Norman
Sent: Monday, April 05, 1999 9:00 AM
To: Dunn, Kevin
Subject: FW: Materials Recommendations for Flammability issue

Kevin,

Would you please follow-up with Ticona to insure the sample of Celanex 3316
was indeed that. Also would adding colorant reduce the V-0 flammability
rating of the sample Ticona submitted. Feedback from our customer is that
the 3316 was no better than the 4300 material when subjected to a
non-technical type of flammability test, i.e., "the kitchen match test".
However, it was reported that the tensile bars behaved better.

The customer is now getting input to move to a higher melt temperature
material such as an LCP that would, in addition to a V-0 rating, provide the
flammability resistance they need. Another material being suggested is
Dupont Zytel HTN FR52G30BL which is lower cost. Does Ticona have any
recommendations keeping in mind that the mold is equipped with a Kona hot
runner system?

Please get a response from Ticona on these questions ASAP.

Regards,

Norm

From: McGuirk, Andy
Sent: Thursday, April 01, 1999 5:44 PM
To: Porter, P.J.; 'Steve Reimers'
Cc: Roy, Norman; Dague, Bryan
Subject: RE: Materials Recommendations for Flammability issue

Steve, got your voice mail and did act upon it.

norm roy is our in-house plastic molding coordinator and has initiated considerations of various plastics. our first concern was 'knit line' integrity of the LCP which might create a mechanical weakness issue. alternates were being reviewed.

also, norm was going to review our celanex 3314 pedigree to assure it was what it should have been as it 'acted' too similar to 4300.

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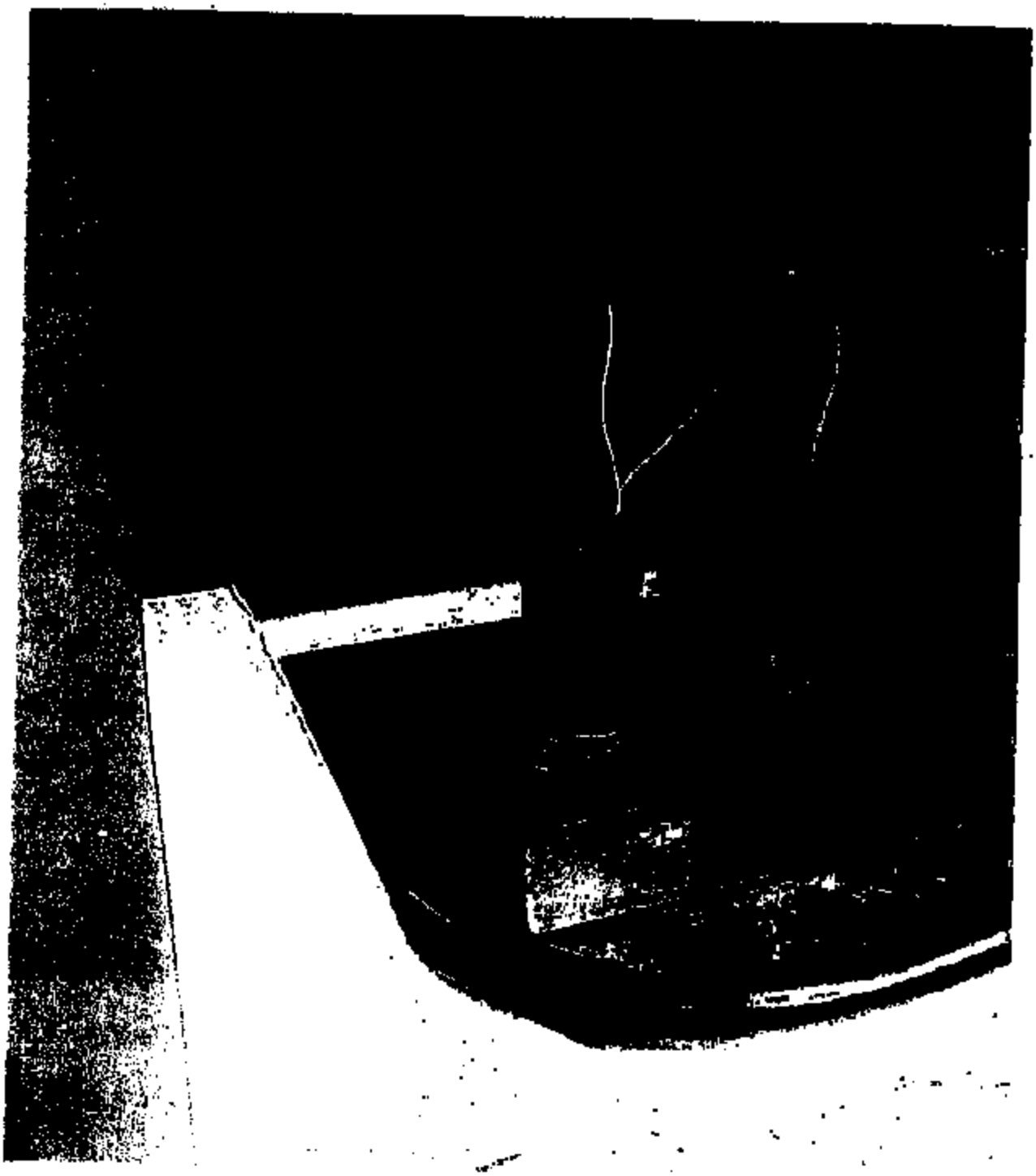

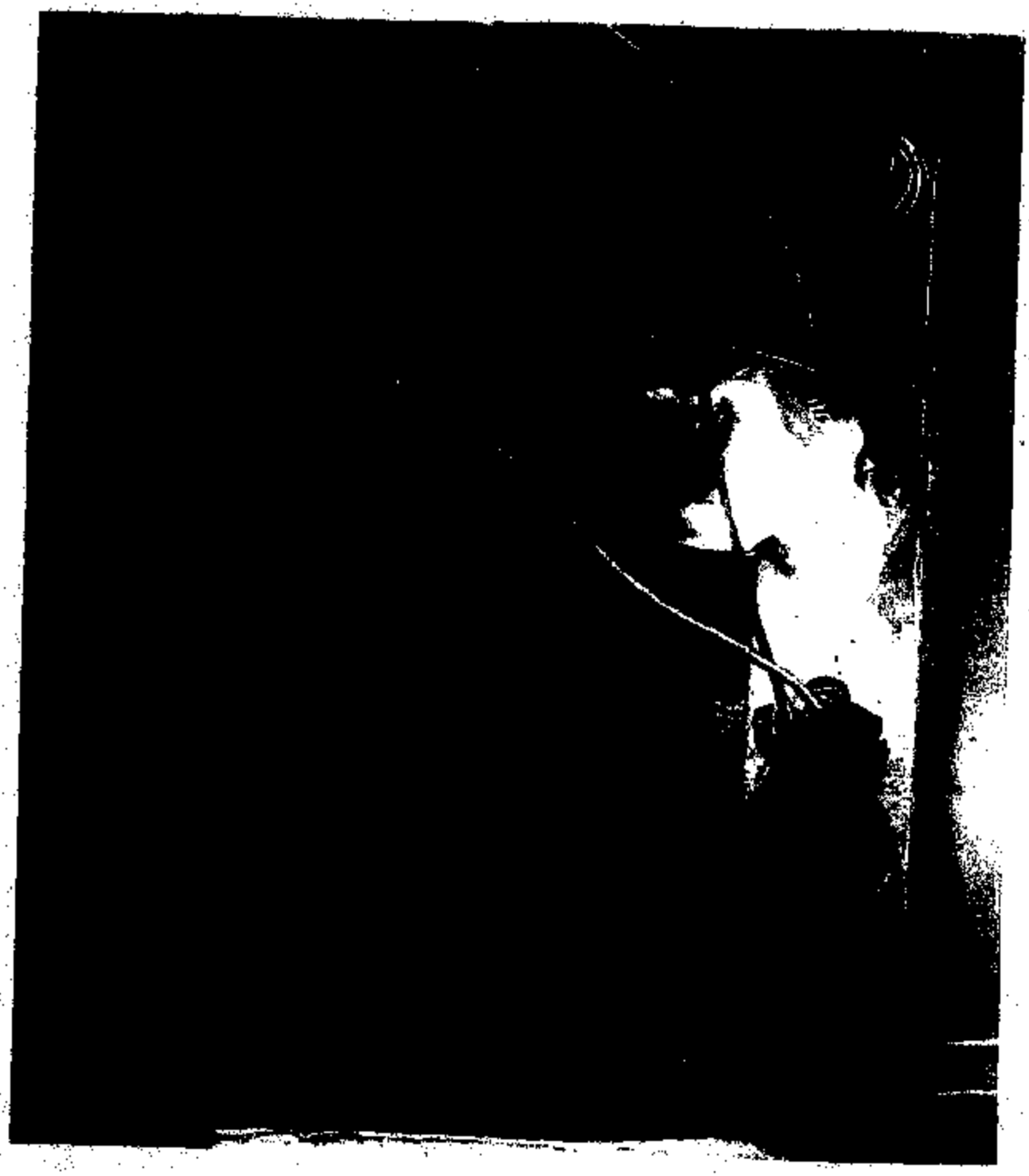

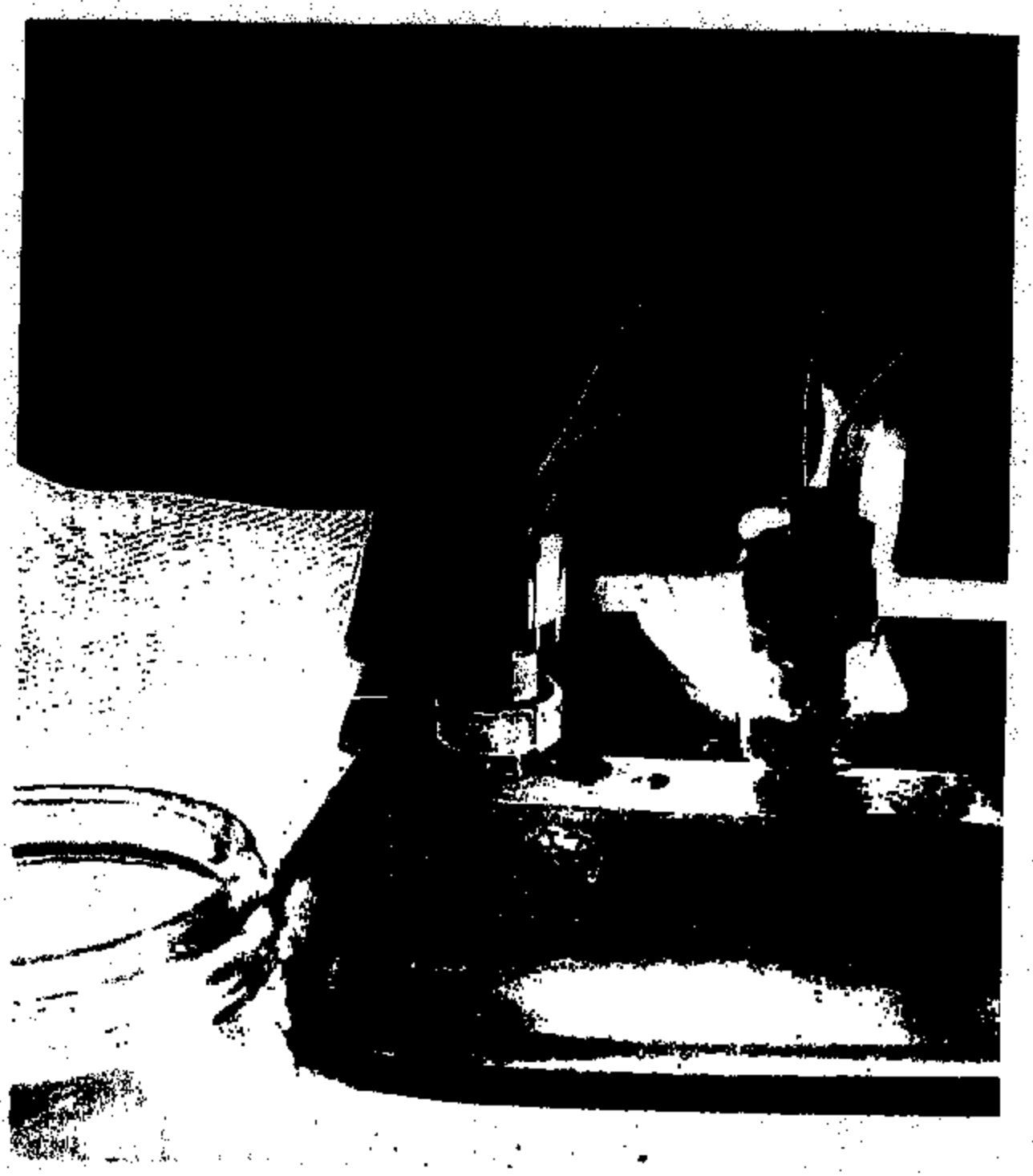

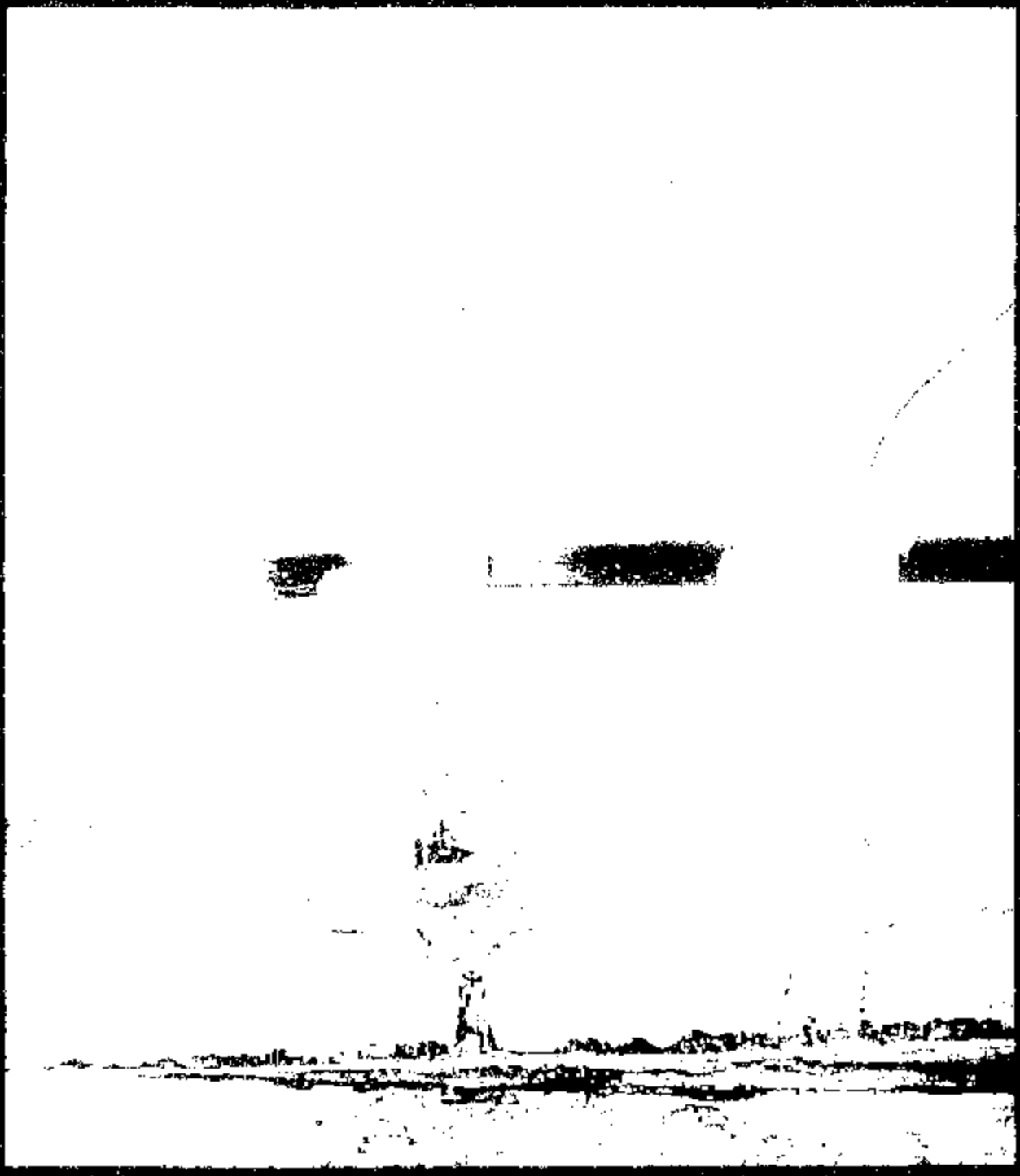

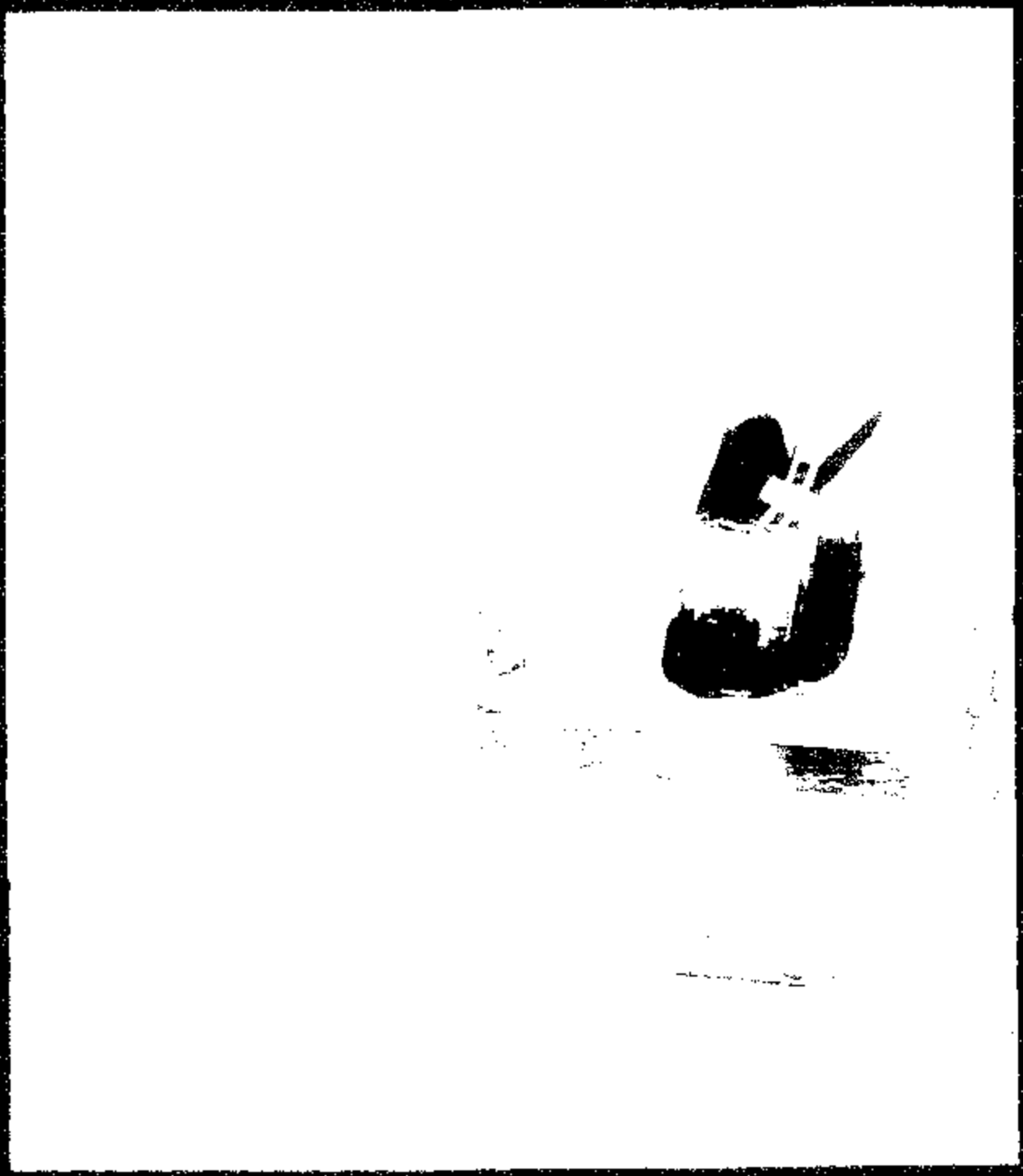

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Digital Mavica Images

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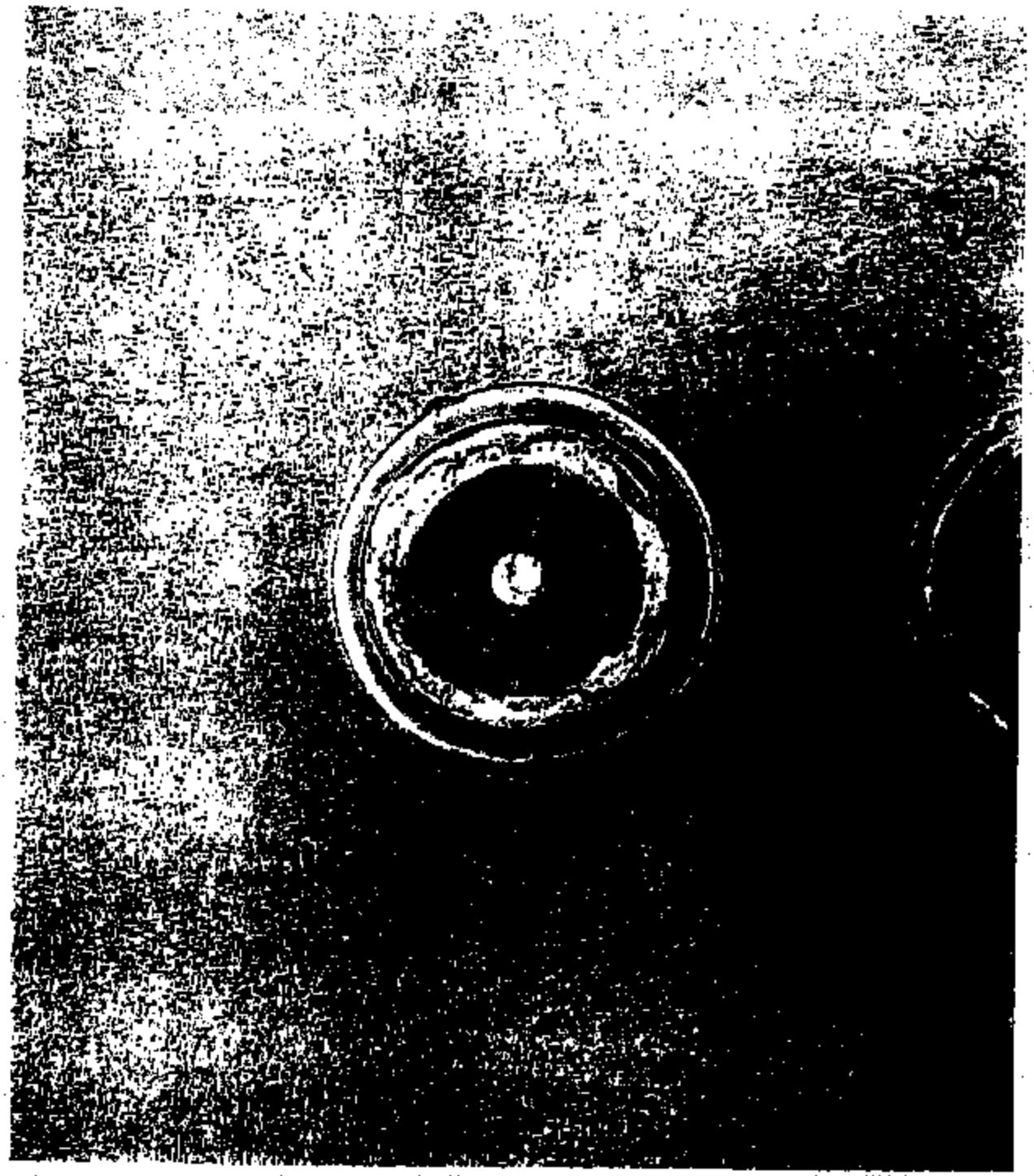

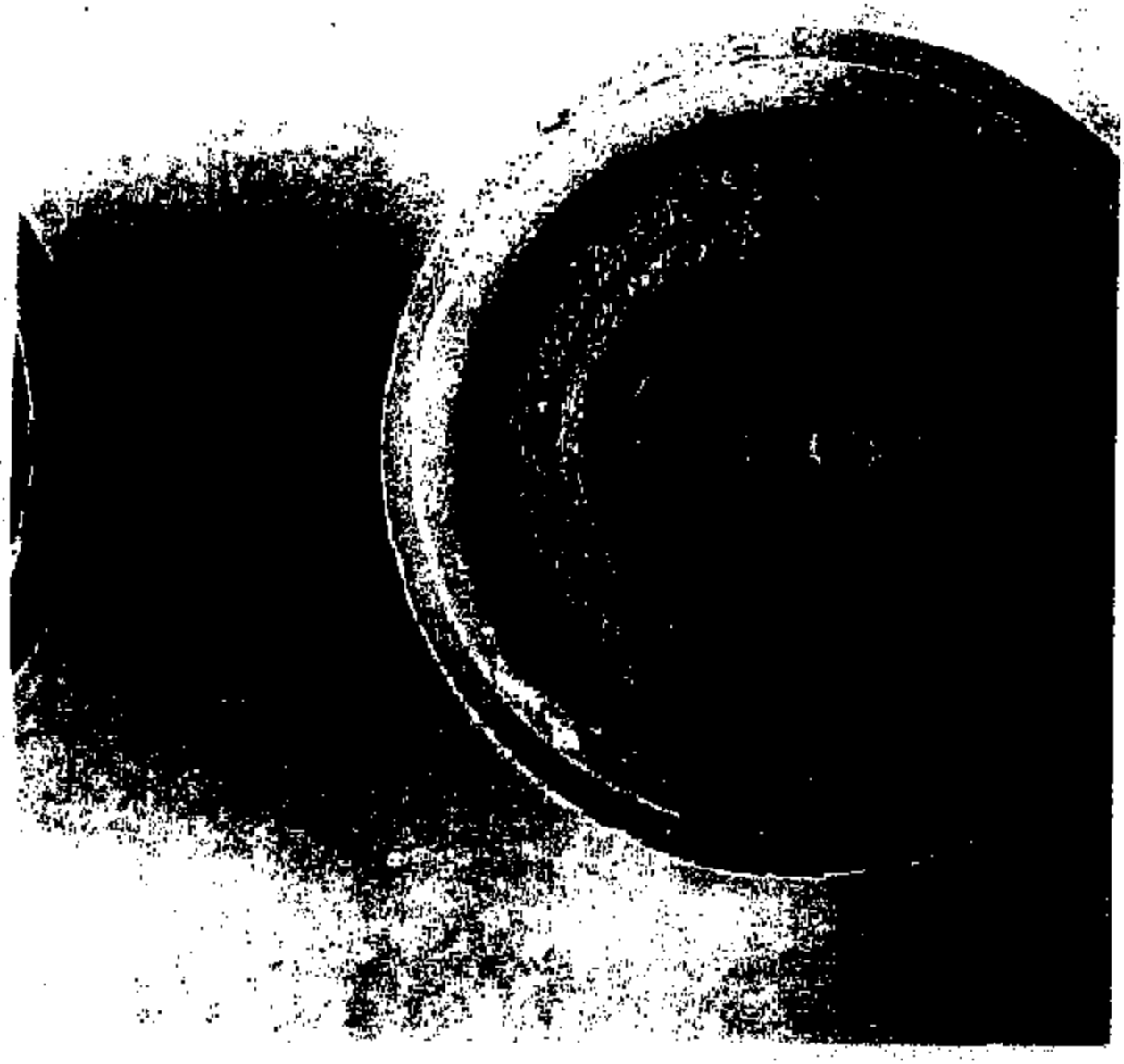

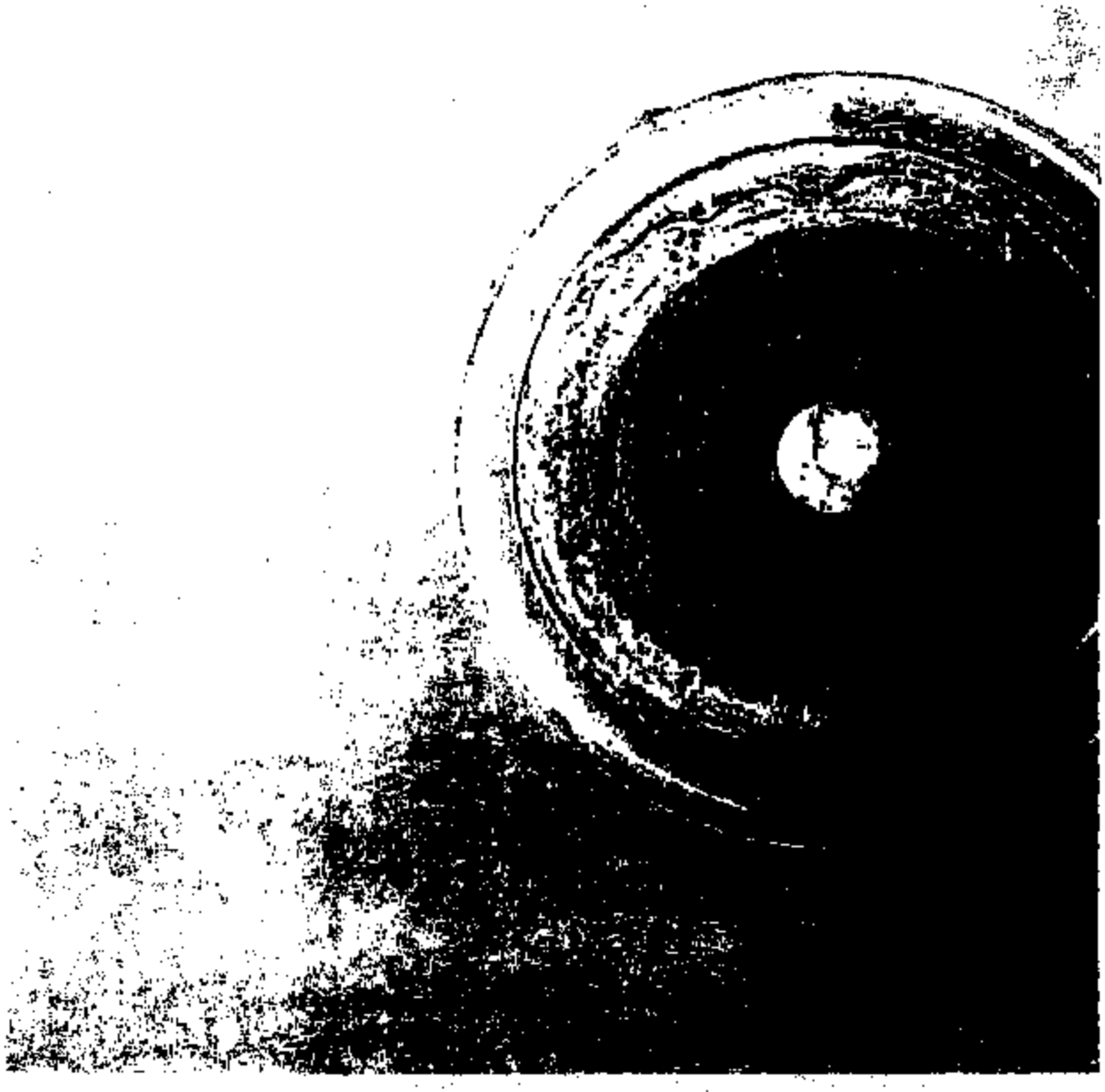

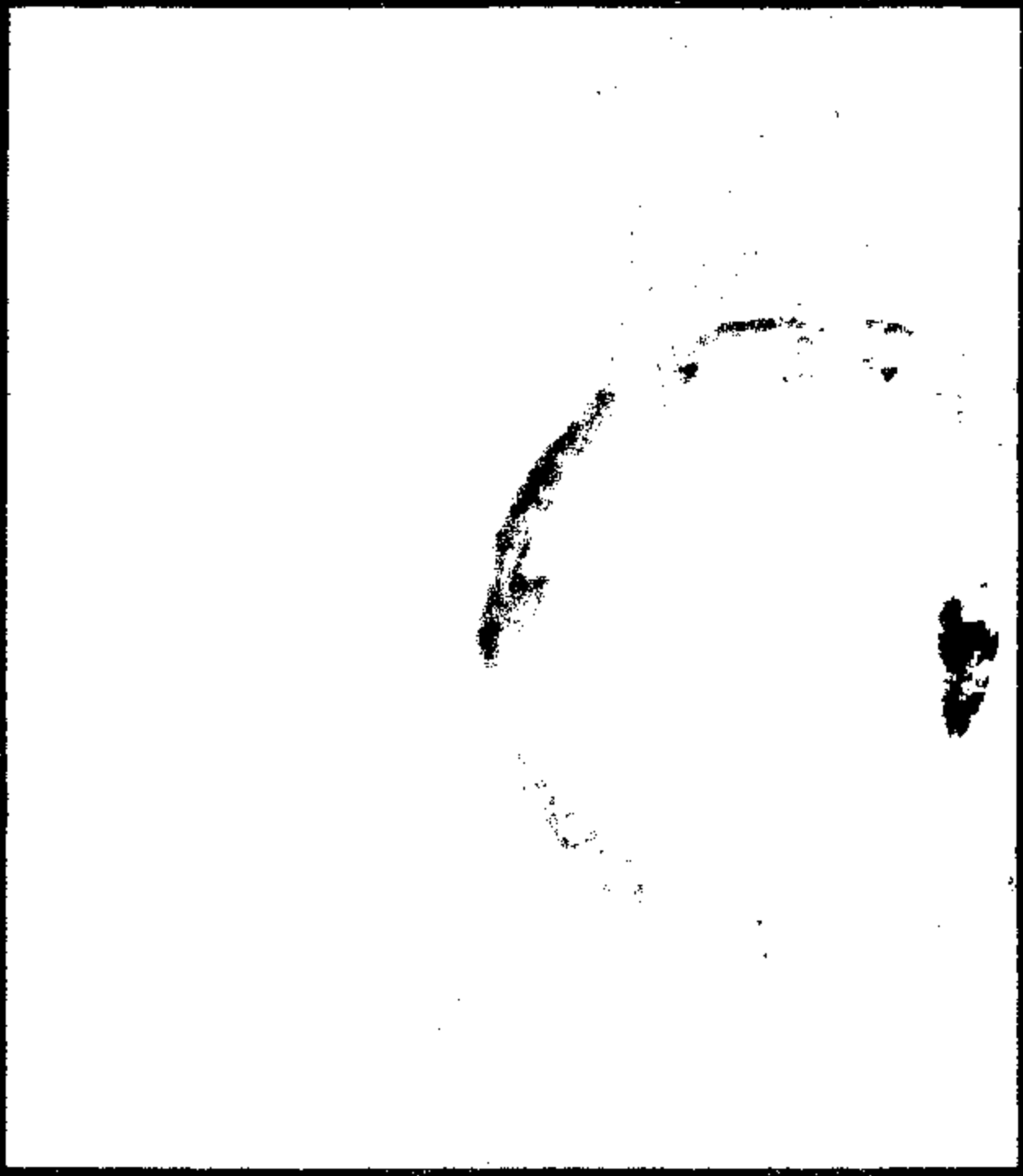

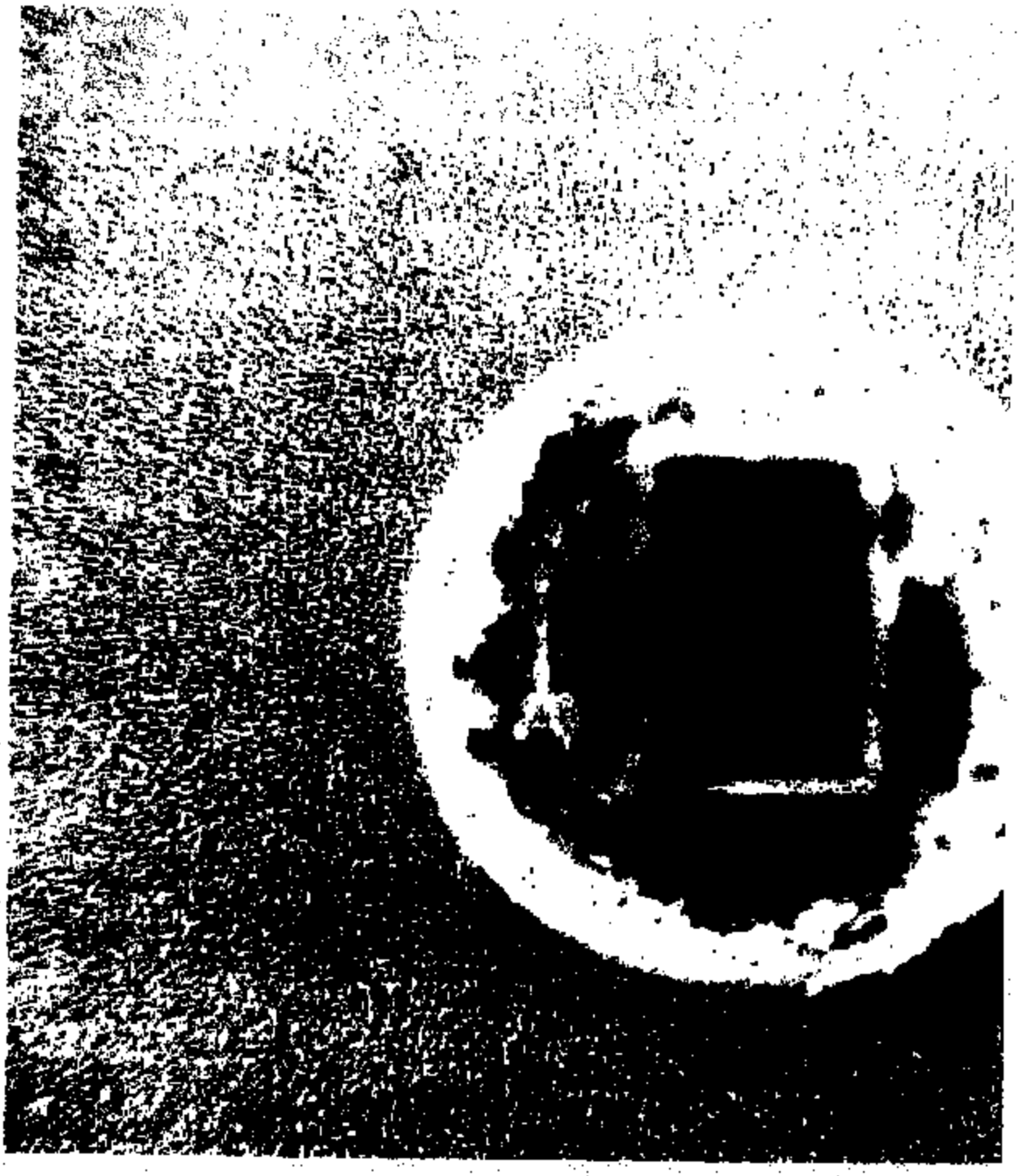

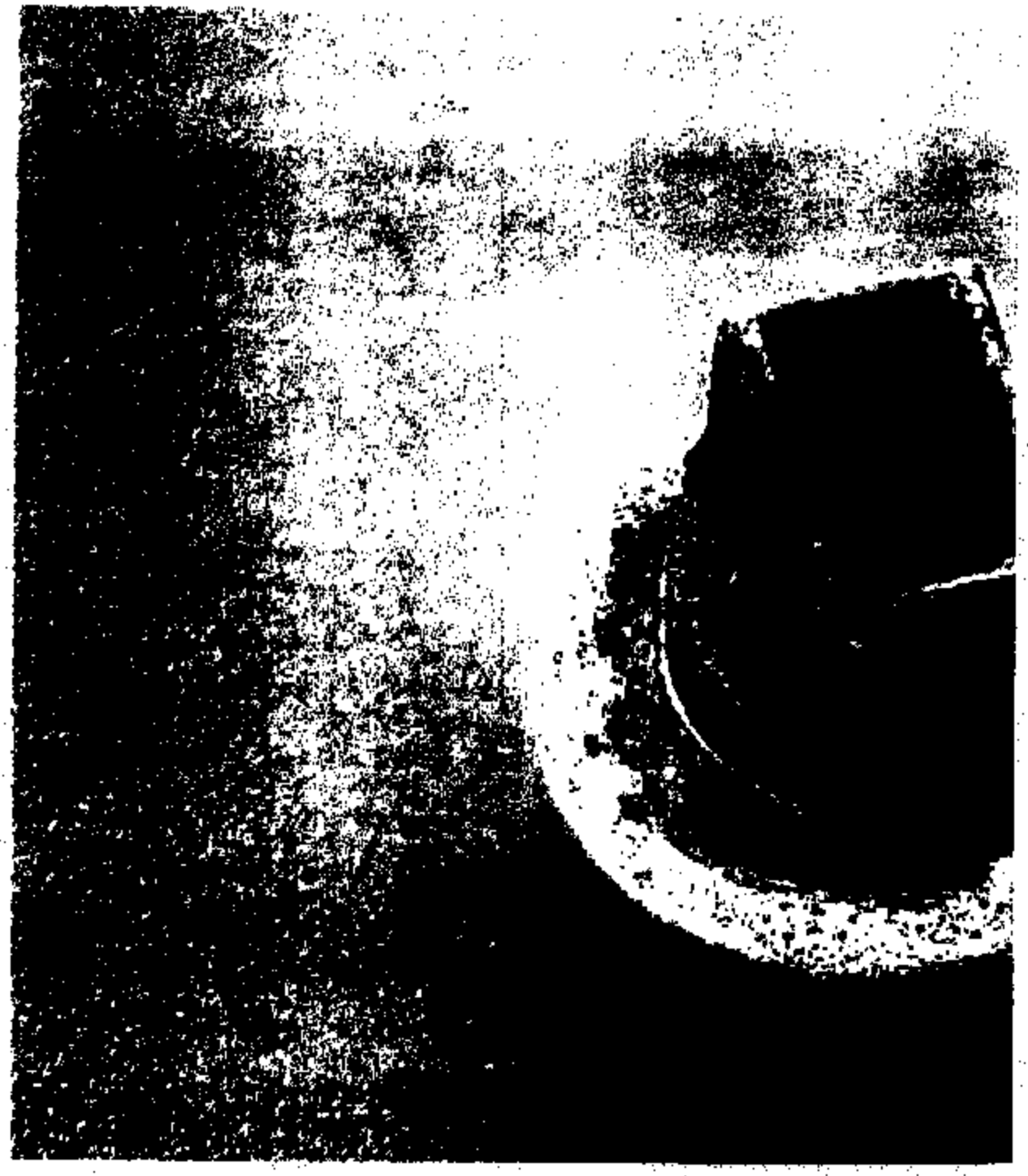

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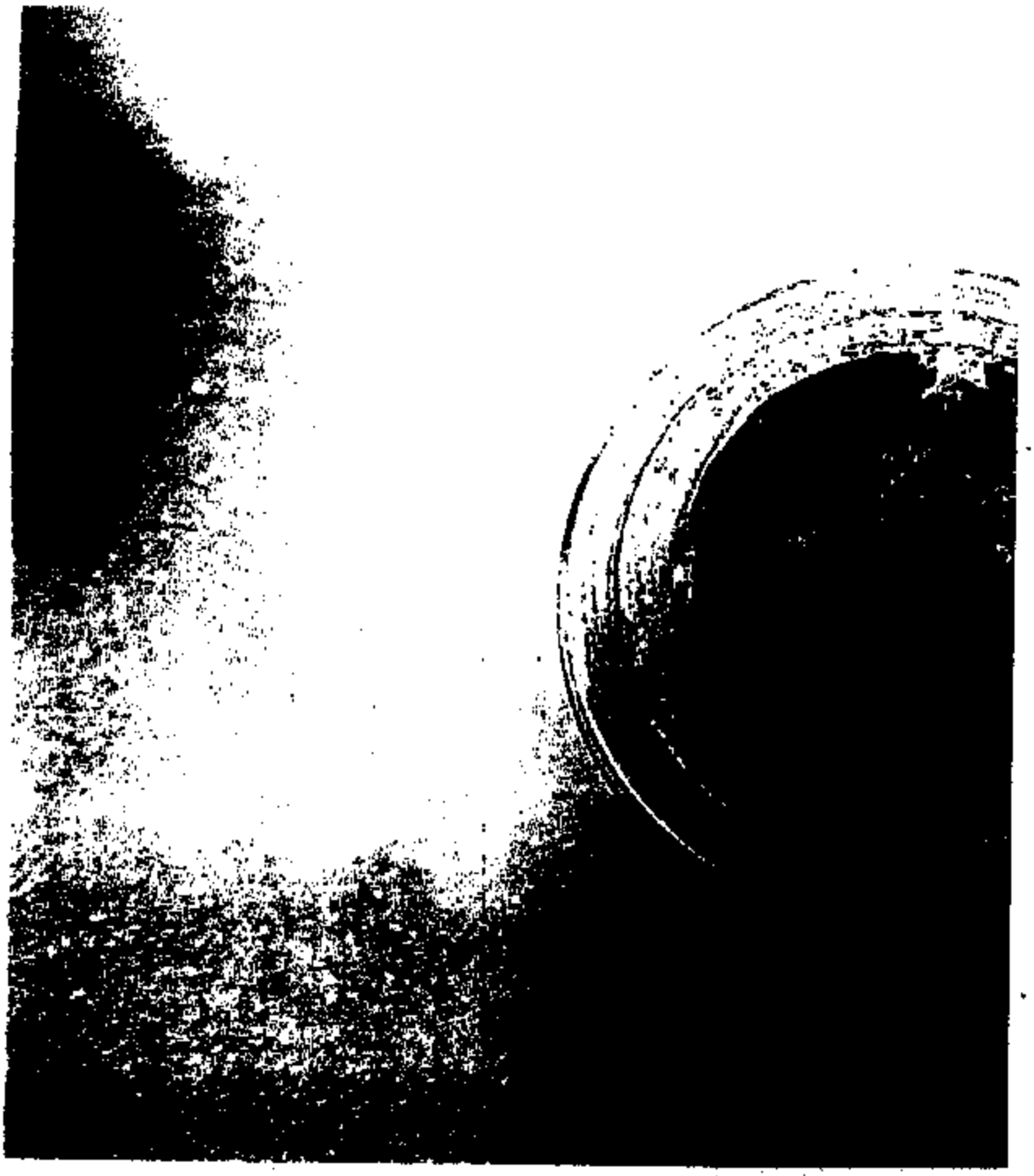

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TI-NHTSA 013295

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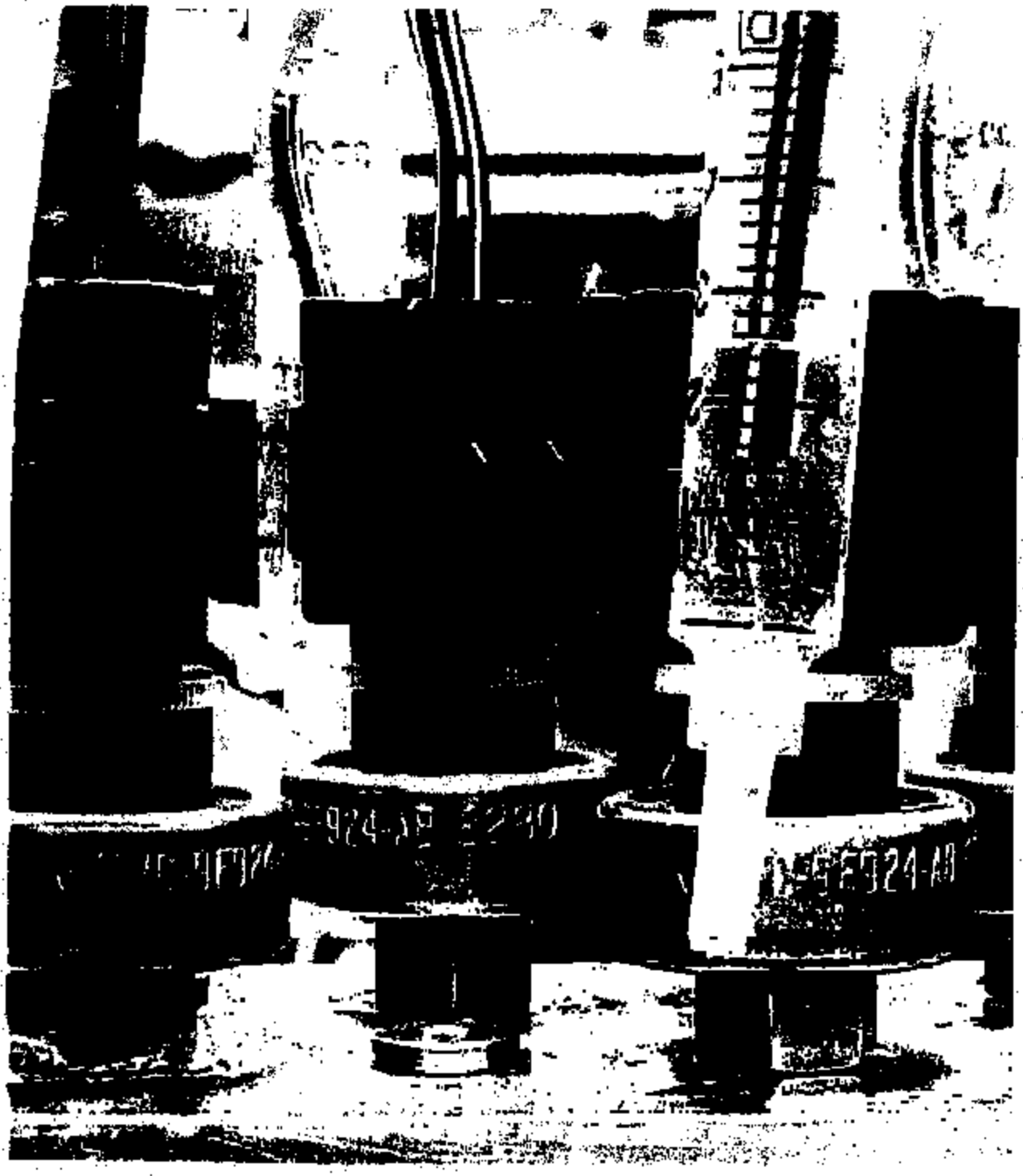

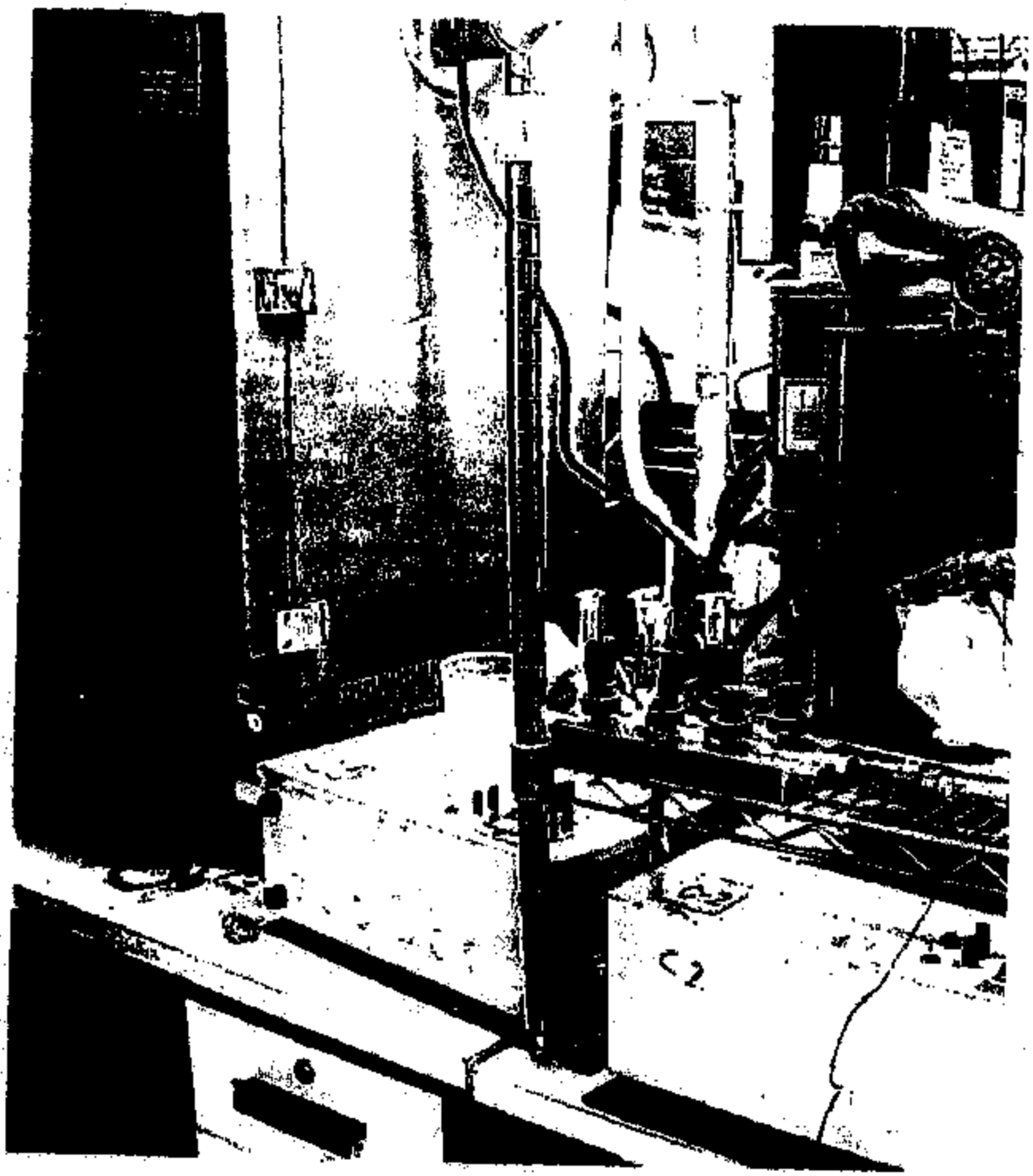

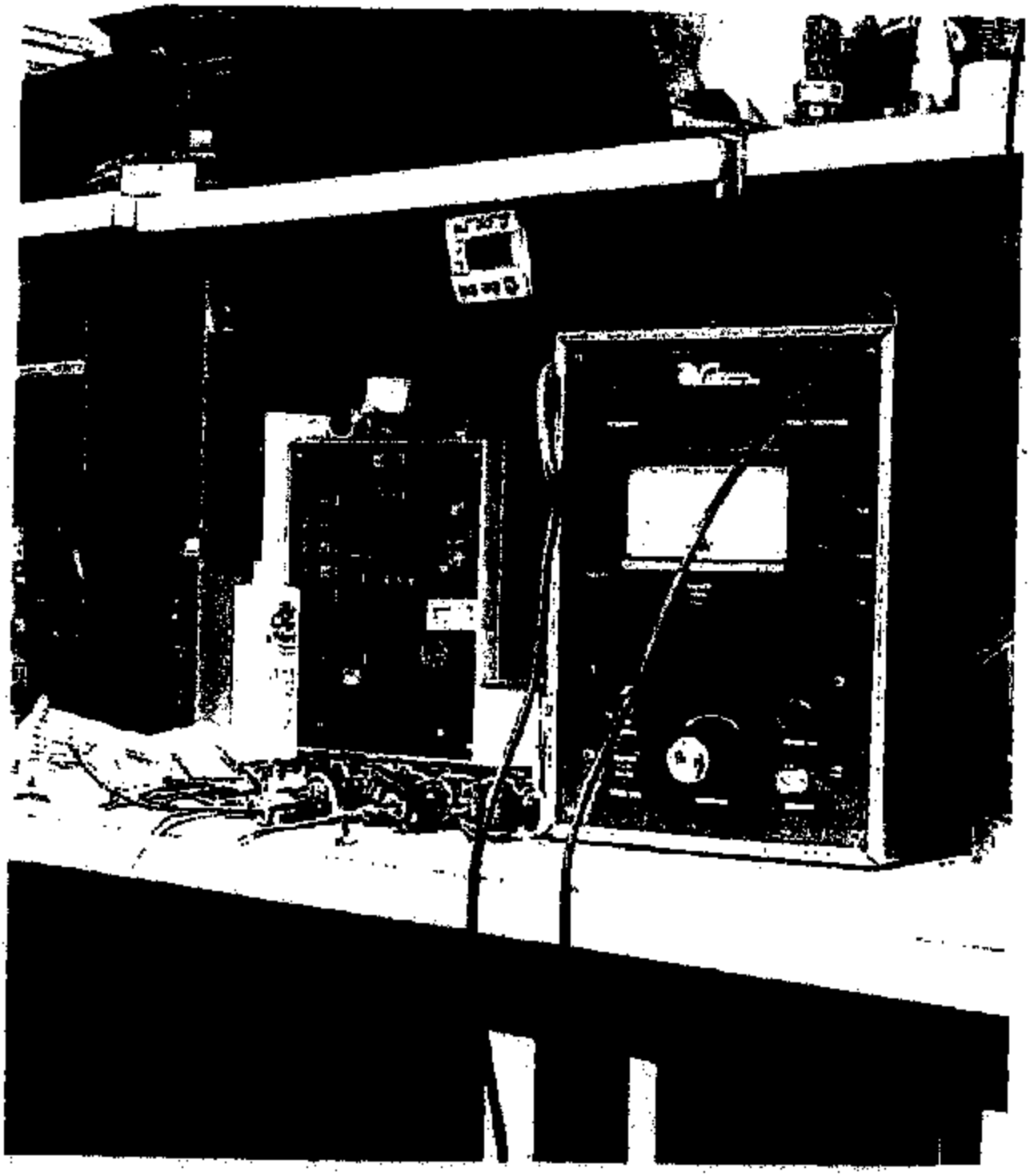

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TI-NHTSA 013300

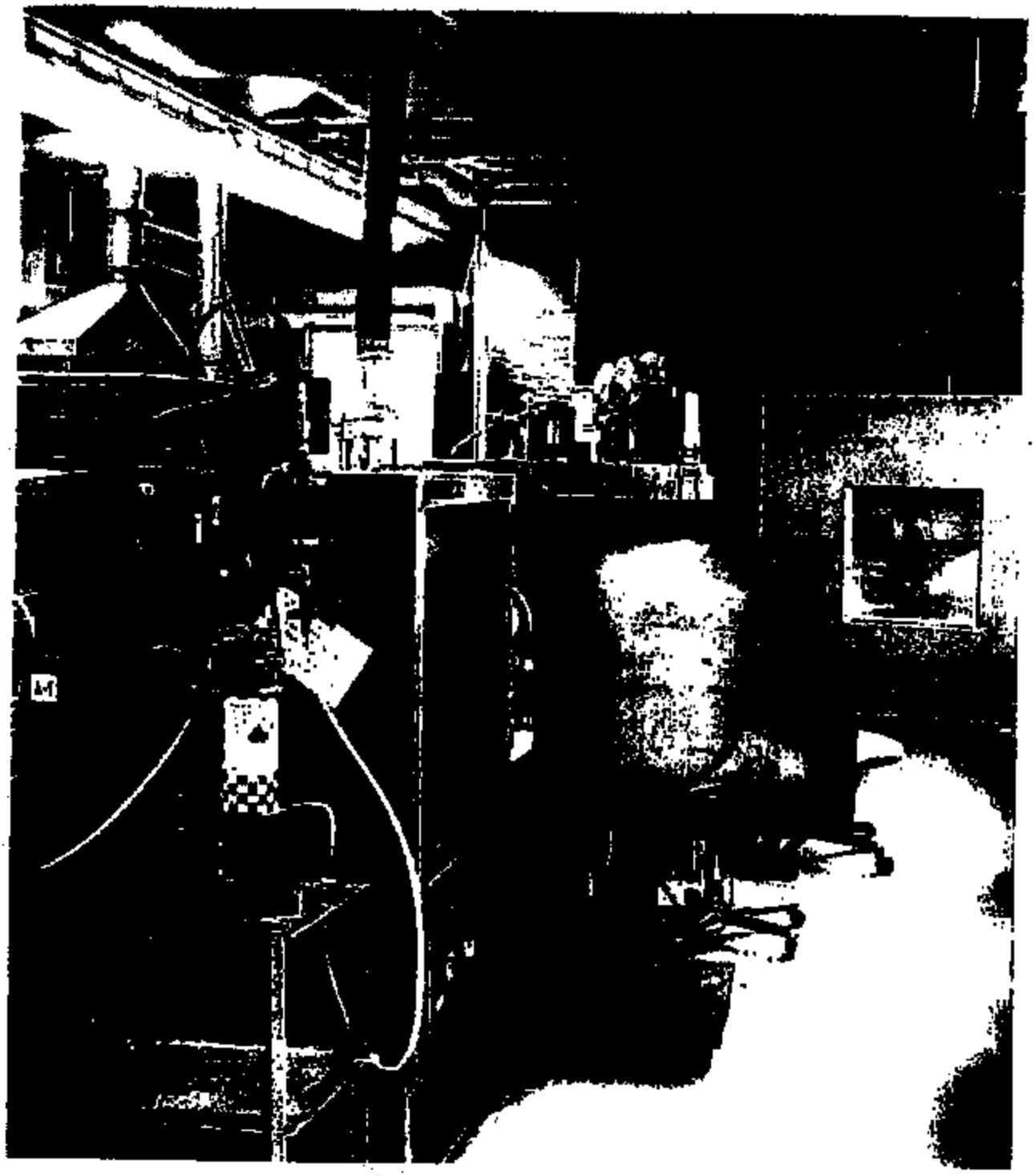
Thermal Cycle Fluid Ingress Test

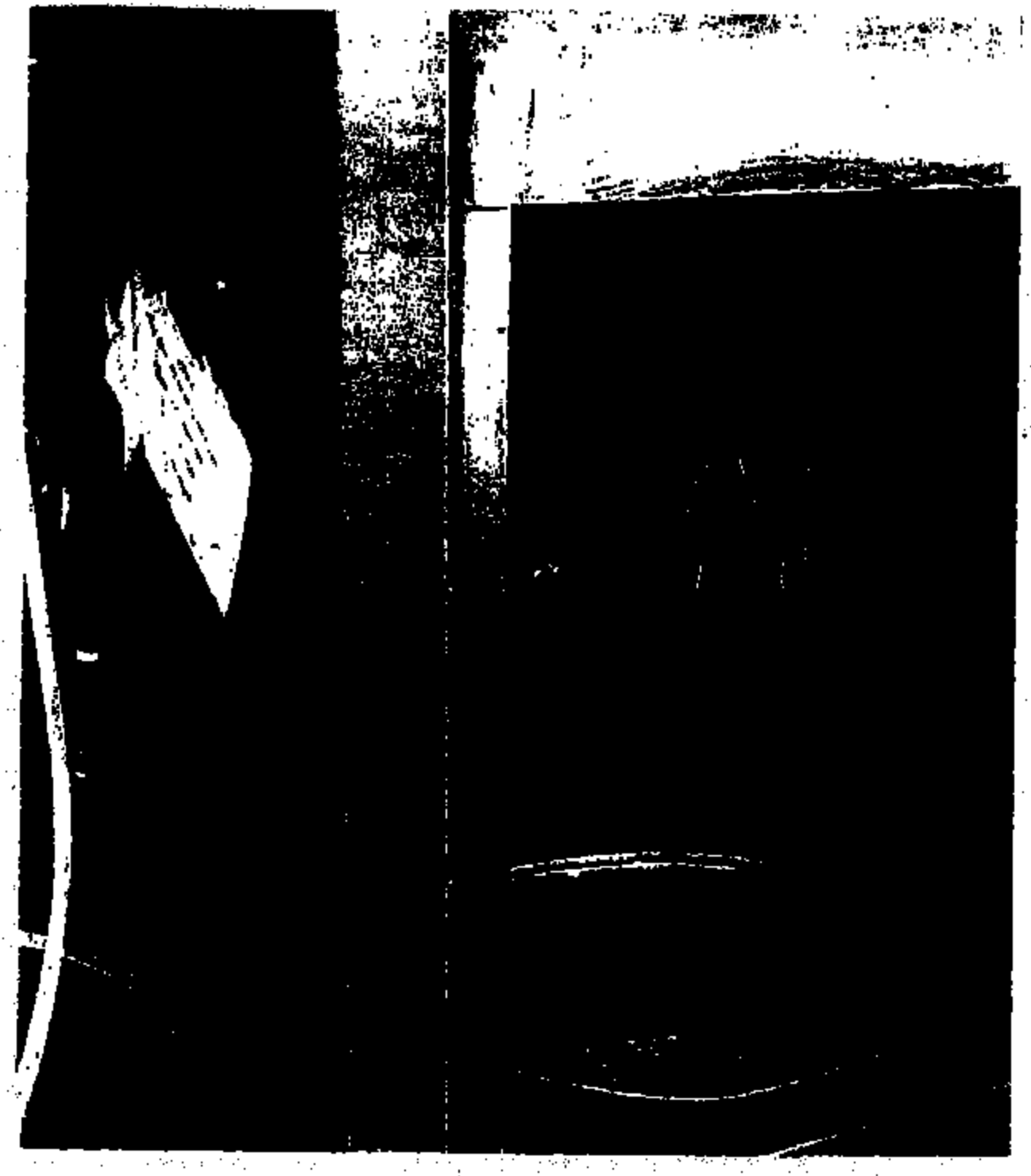
Purpose : To determine if fluid (water) will ingress into a sealed device after exposure to thermal cycling .

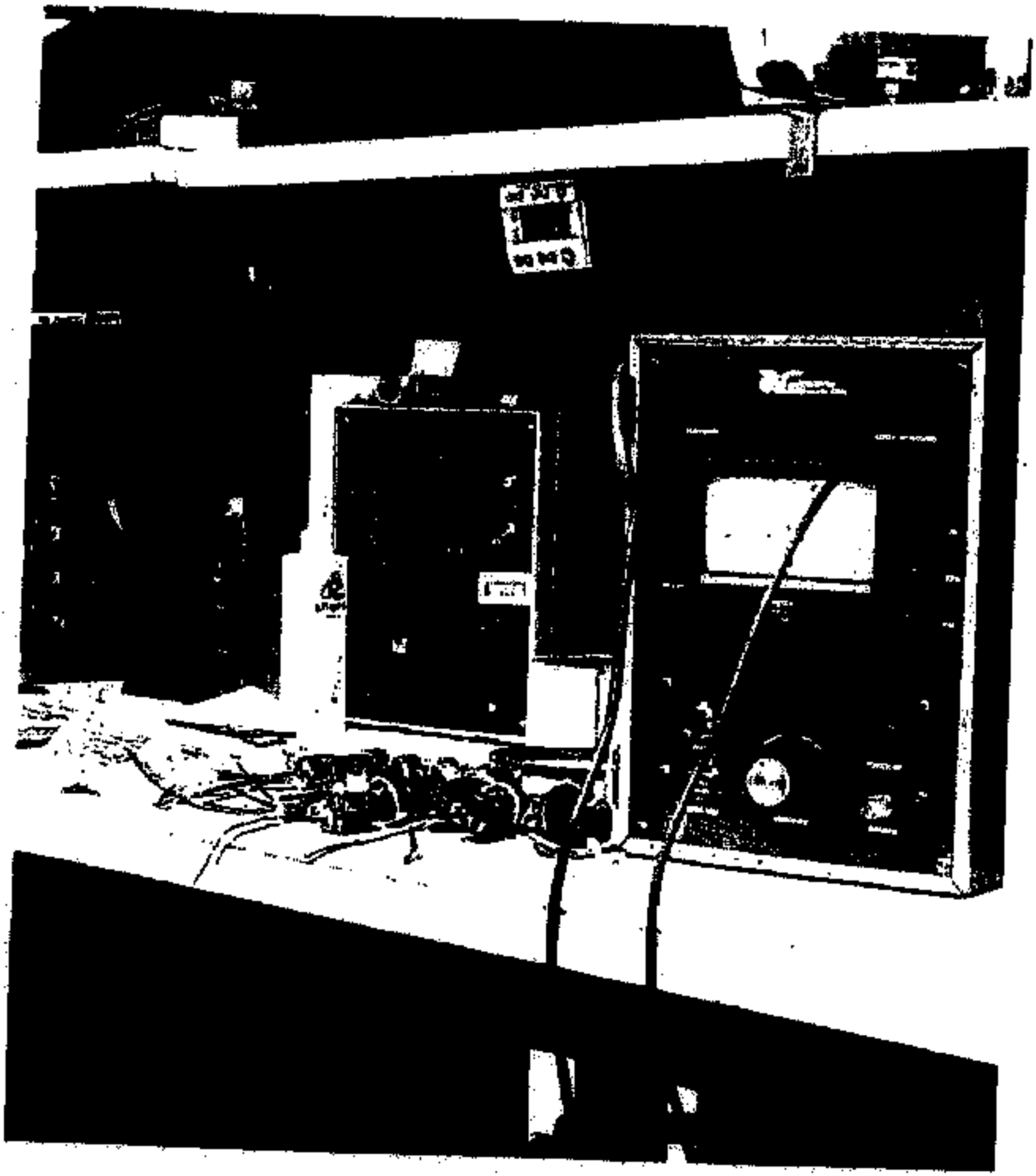
Test : Devices will undergo a 72hr thermal cycle with temperatures ranging from 125c to -40c . Each cycle will have a 4 hr soak at temp and a ½ hr . transition time between temperature excursions .

Post thermal cycling devices will be submitted to a soak of 125c and immersed into a cold water bath of 0c . A small percentage of salt will be added to the water for tracing purposes . Devices will be submerged to the top of the connector only and wires will remain exposed to the air . A 30 minute temperature soak and 5 minute immersion time will be considered 1 cycle . This will be repeated for 10 cycles and after all 10 cycles the device will be submitted to a high voltage current leak test from wire leads to ground . After a 24 hr set at room temperature .

Results : All ten samples passed current leak test at 1500 volts . No arcing or leakage to ground was observed .

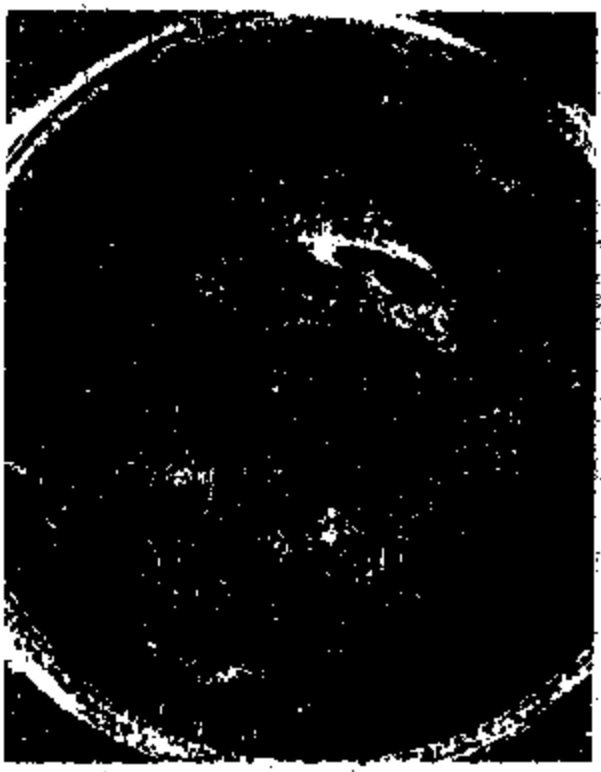


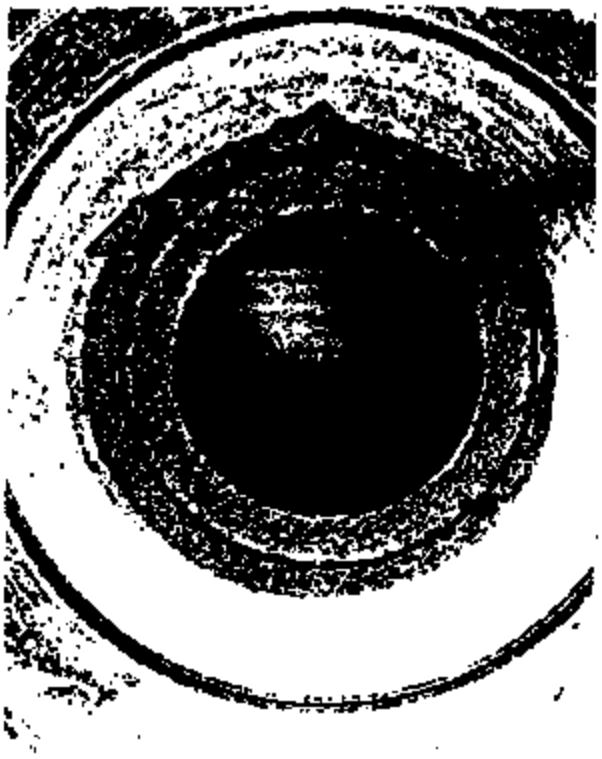




77PS Ford

Tests





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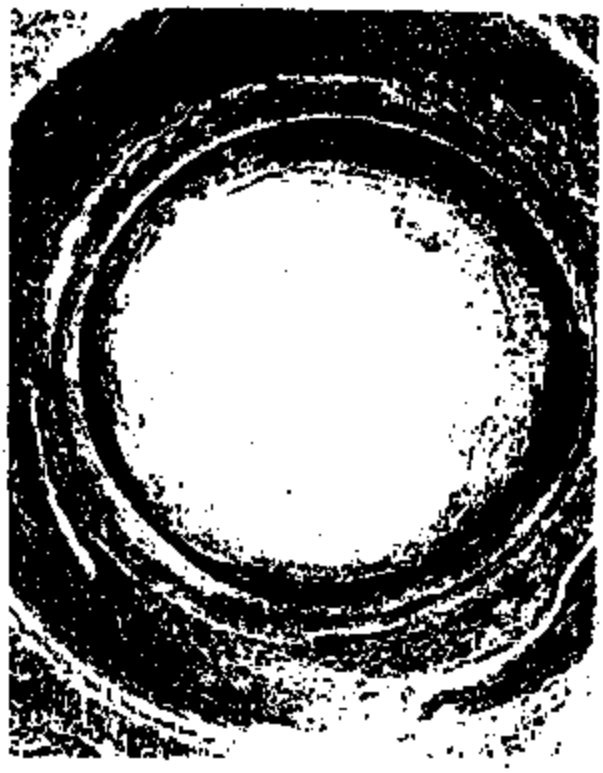

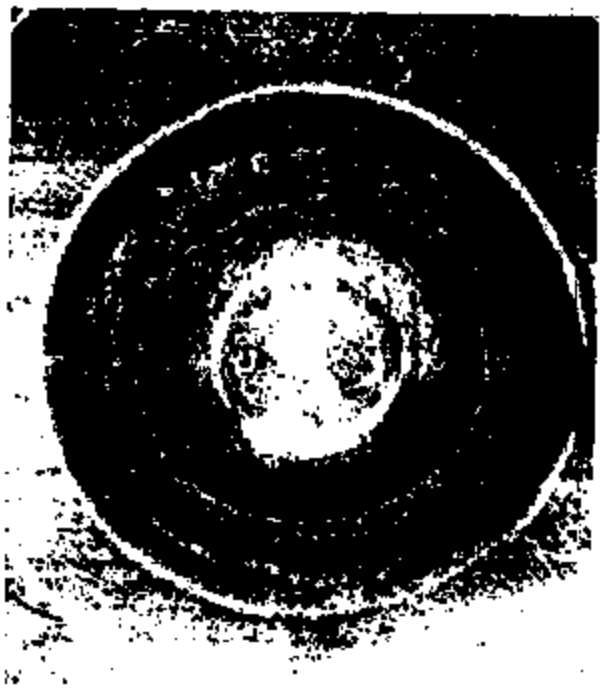

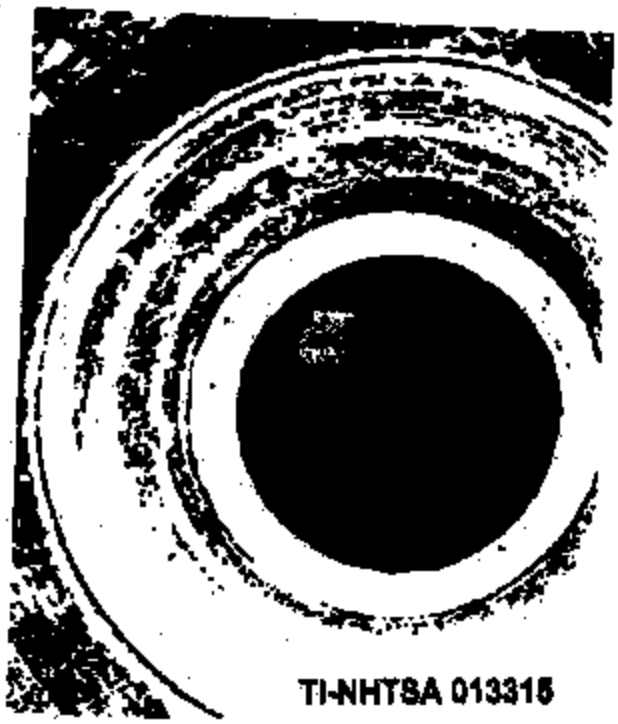

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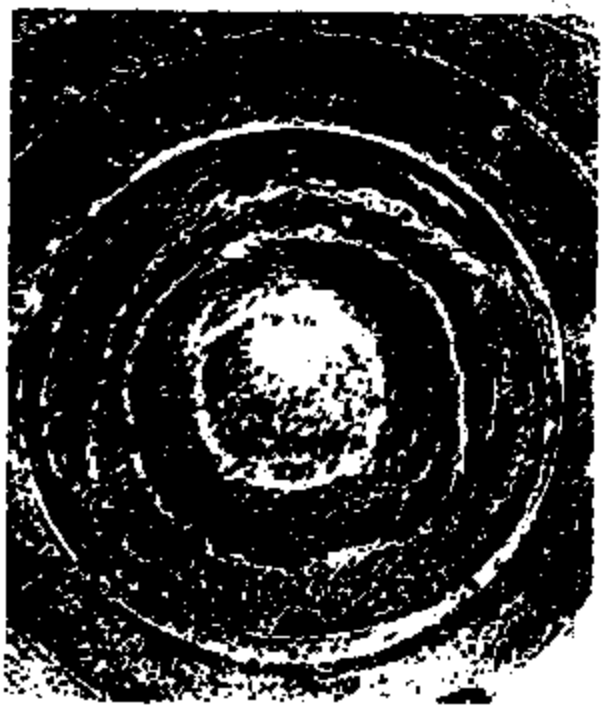

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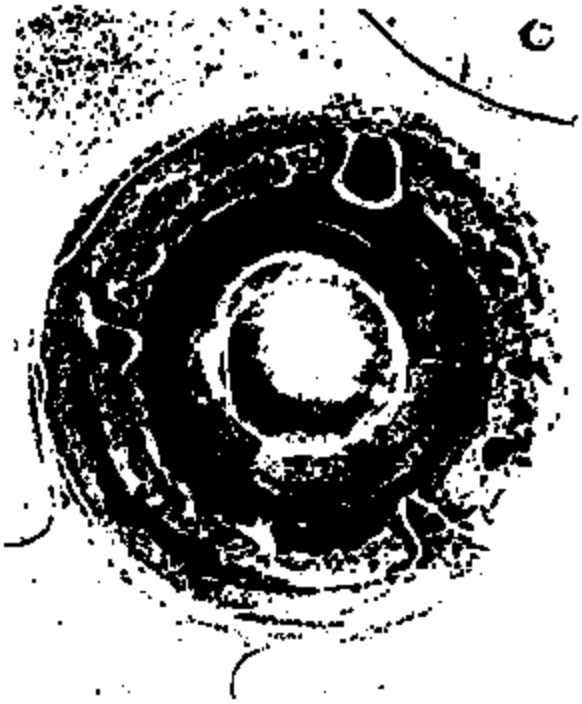

Brake Pressure Switch Test Log, Updated 4/20/99

Category	Test	Location	Test Parameters	Results Update
ab Simulation	1	TI	Vary water concentrations in 'new' Brake Fluid	250+ hours, Current draw in the 0.5mA to 5mA range
f Potential Ignition			14Vdc to one terminal, hexport grounded	Fluid has discolored.
n Switch			Water Conc: 4%, 8%, 10%, 75%	No Significant Temperature Rise. Test Suspended.
				Interval Analysis suspended.
	2	TI	New' Brake Fluid	260+ hours. Constant temperature.
			1 Amp through switch terminals	No significant temperature rise with time
			14Vdc to one terminal, hexport grounded	Test Suspended.
	3	AVT	new' Brake Fluid in Switch, 24 VDC to one	> 300 hours into test, max current 7mA
			terminal. Hexport Grounded	No significant change with time. Test ongoing
	4	AVT	new' Brake Fluid in Switch, 24 VDC to one	16 hours into test max current 5mA
			terminal. Hexport Grounded, Ambient at 100 C	No significant temperature rise with time. Test suspended.
	5	AVT	new' Brake Fluid in Switch, 16 Amps	Temperature rise of 20 C above room temp
			Through switch terminals	Delta T reached steady state at 20 C. Test suspended.
	5a	AVT	new' Brake Fluid in Switch approx. 60 Amps	Temperature rose to approx. 270 F. No smoke. No ignition
			through Switch Terminals	Test suspended.
	6	TI	Build heater elements into Switch.	2 tested. Smoke observed, ignition observed on part wheester
			Heat till failure, include sparking	See attachment
			With Fluid & Dry	Test complete
				Brake fluid is easily slows down heat build-up
				Smoke observed at 675 F, Base melts and falls off at 800 F
	6a	TI	Create heater by corroding spring arm	One out of 15 devices increased resistance to 5 ohms.
			Salt water solution, 14V between spring	Others either very low resistance or megaohms.
			and hexport	It took about 100 hours to reach the 5 ohm stage.
				The 5 ohm device ignited under conditions similar to test 6.
	6b	TI	Re-run ignition test to understand	Switch ignition with repeated 6% water solution into switch
			repeatability and current path.	Current path is through hexport.
				See plots and video.

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				Additional test include tap water, old BF, new BF and other.
	6a	TI	Pure 'new' brake fluid with metal shavings	Metal shavings do not contribute significantly to brake fluid conductivity
[redacted]				
ife Cycle Reliability	7	TI	0-1400 psig pressure pulses at 135C	First leak observed at 728,000 cycles.
f Pressure Switch			per E9	Test Completed. See attached Weibull Chart
[redacted]				
Diaphragm Wear	8	TI	0-1400 psig pressure pulses at 135C.	Parts withdrawn every 200k cycles, characterized for wear
[redacted]				
Field vs Lab Correlation	9	Central Labs	Field returns, from dealer lots, junkyards	Parts in Central Labs, see Ford spreadsheet
[redacted]				
Design Of Experiments (1)	10	TI	Vary water concentrations in 'new' Brake Fluid	Test Report being written investigation continues
Evaluating Factors			12 snap + 12 quiet switches w/ 0 % water in BF	Suspended at 1.3 million cycles with no leaks observed
Effecting Diaphragm Wear			12 snap + 12 quiet switches w/ 6 % water in BF	Snap samples suspended at 1.3 million cycles with 2 leaks
mpulse test				observed at 1.3M. Quiet samples suspended at 500k cycles to
[redacted]				assess fretting anomalies.
[redacted]				
On-Vehicle Characterization	11	AVT	Monitor Pressure and Temperature	Test at AVT.....see Ford charts...>600k in car?
f Pressure & Temperature			at Switch Location for ABS and non-ABS	
Profile in Town Car			braking events.	
[redacted]				
Brake fluid analysis	11a	TI	Analyze used brake fluid at the master cylinder	Test complete.
Used fluid at master cylinder.			(UMC), used brake fluid at the caliper (UCA)	UMC: Cu = 415 (ug/ml), Fe = 5.0 (ug/ml), Cr = 0.09 (ug/ml), 1.1 %H20.
			and new brake fluid (NEW) for metal and water	UCA: Cu = 682 (ug/ml), Fe = 5.5 (ug/ml), Cr = 1.9 (ug/ml), 1.1 %H20.
			content.	NEW: Cu = <0.01 (ug/ml), Fe = 0.92 (ug/ml), Cr = <.01 (ug/ml), 0.5 %H20.
[redacted]				
Spark Arc study	12	Central Labs	Determine if spark/arc forces in switch	Equipment set-up in progress at Central Labs.
			using slotish tools and high speed video.	TI Experimented with no 'significant' sparks observed
			Use dry switches as well as switches with	
			various brake fluid water slurys	
[redacted]				
Characterization of	13	Central Labs	Characterize statistical, mechanical	Data log and analysis procedure set up complete
switches retrieved from field			and electrical aspects of returned switches	Analysis of switches in progress
junkyards & other sources				
[redacted]				
Fluid Ingress Tests	13a	TI	Repeat ignition simulation with different fluids	Test complete
			(3) new tests	5% NaCl sample resulted in an ignition

			5% NaCl in tap water	All brake fluid samples drew less than 3 mAmps. No corrosion
			rain water	visible on brake fluid samples.
			(24) hour tests:	Rain water and tap water samples drew <10 mAmps and showed
			tap water	some signes of corrosion.
			used brake fluid	Chemical anlysis in process.
			used brake fluid w/ 5% H_2	
			new brake fluid	
			new brake fluid w/ 5% H_2O	
Design Of Experiments (2)	15b	TI	Very water concentrations in 'new' Brake Fluid	Test suspended. Analysis in process to assess test faliuring.
Repeat of test 10			10 snap + 20 quiet switches w/ 0 % water in BF	
			10 snap + 20 quiet switches w/ 5 % water in BF	
Compatibility of Kapton	14	DuPont	Characterize change in properties of Kapton	Report expected from Dupont by 5/3/99.
with Caustic Acid			with various % caustic acid in brake fluid.	
Evaluation of Plastic	16	TI	Assess properties and moldability of different	Test suspended.
Materials with Improved			grades of plastic resin with additives	Celanese and Noryl ignited 3/5 and 2/5 trials
Parameters			to improve plastic part performance	ZYTEL samples tested 1/5 ignitions
Long duration brake fluid	16a	TI	(4) samples with new brake fluid	Test in progress. (15) days to date.
migration test			(2) samples with used brake fluid	Used brake fluid current dropped off to <1/10 mAmp.
				New brake fluid hasport current remains low
Evaluation of Switch	16b	TI	Assess ignition sensitivity to switch orientation.	Test complete. Ignition is independent of switch orientation.
Orientation			Test vertical verses 45 degree.	simulated switch ignition can occur in vertical or 45 degree angle.
			Test rotational sensitivity in 45 deg. orientation.	Ignition appears not sensitive to switch rotational alignment.
Relay Circuit	18	TI	Repeat test 13a in Ford relay circuit for (48) hrs.	Test complete. No ignition. Corrosion rate drastically reduced.
Test			Bring switch to impending ignition in (16) Amp	Insufficient power in circuit to create or move toward ignition in lab
			circuit then place in relay circuit for (18) hrs.	Heater element was warm to the touch.
			Input max. circuit power into heater on switch.	