

REPORT NUMBER: 301-CAL-04-06

**SAFETY COMPLIANCE TESTING FOR FMVSS 301
FUEL SYSTEM INTEGRITY**

**DAIMLERCHRYSLER CORPORATION
2003 JEEP LIBERTY
SUV**

NHTSA NUMBER: C30302

GDAIS TEST NUMBER: 8655-F301-23

July 7, 2004

**GENERAL DYNAMICS
ADVANCED INFORMATION ENGINEERING SERVICES
P.O. BOX 400
BUFFALO, NEW YORK 14225**




FINAL REPORT

PREPARED FOR:

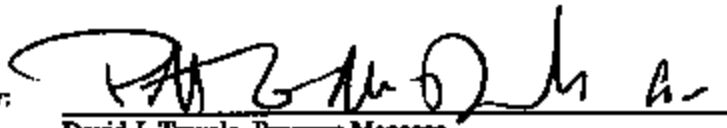
**U. S. Department of Transportation
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
400 Seventh Street, S. W.
Room No. 6111 (NVS-220)
Washington, DC 20590**

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16. Abstract Compliance tests were conducted on the subject 2003 Jeep Liberty SUV in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301-03 for the determination of FMVSS 301 compliance. For the purpose of acquiring information for applied research, two instrumented Anthropomorphic Test Devices (ATDs) were placed in the front occupant seating positions and various instrumentation was added to the test vehicle. Test failures identified were as follows: The test vehicle appeared to comply with all requirements of FMVSS 301 "Fuel System Integrity."					
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SECTION 1

PURPOSE OF COMPLIANCE TEST

This 30 mph rear moving barrier impact test is part of the Federal Motor Vehicle Safety Standard (FMVSS) 301 Compliance Test Program conducted for the National Highway Traffic Safety Administration (NHTSA) by Advanced Information Engineering Services under Contract No. DTNH22-01-C-01025. The purpose of this test was to determine if the subject vehicle, a 2003 Jeep Liberty SUV, meets the performance requirements of FMVSS No. 301, "Fuel System Integrity."

This compliance test was conducted using the requirements found in the OVSC Laboratory Test Procedure No. TP-301-03, dated February 28, 2003.

SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

A 2035.5 kg 2003 Jeep Liberty SUV was impacted from the rear by an 1797 kg moving barrier at a velocity of 46.83 kph (29.1 mph). The test was performed by Advanced Information Engineering Services on July 7, 2004.

The test vehicle was equipped with a 70 liter fuel tank which was filled to 92 percent capacity with standard fluid prior to impact. Additional ballast (111 kg) was secured in the left rear seating position and in the engine compartment. For the purpose of acquiring information for the Office of Vehicle Safety Research, one instrumented Part 572 E 50th percentile male Anthropomorphic Test Device (ATD) was placed in the P1 (driver) seating position and one instrumented Part 572 E 50th percentile male ATD was placed in the P3 (right rear) seating position. Various instruments were added to the test vehicle and the right front passenger seat was removed. Research data is presented in a separate report.

The crash event was recorded by ten high-speed cameras and one real-time camera. Camera locations and other pertinent camera information are found on pages 3-9 and 3-10 of this report. Pre- and post-test photographs of the vehicle can be found in Appendix A.

There was no fuel system fluid spillage following the impact or during any portion of the static rollover test. The average vehicle longitudinal crush was 157 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

SECTION 3
COMPLIANCE TEST DATA

DATA SHEET 1

TEST VEHICLE SPECIFICATIONS

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2003 Jeep Liberty SUV

NHTSA No.: C30302 ; Color: Red

Engine Data: 4 Cylinders; - CID; 2.4 Liters; - cc

Placement: X Longitudinal or In-Line; - Transverse or Lateral

Transmission Data: 5 Speeds; X Manual; - Automatic; - Overdrive

Final Drive: - Rear Wheel Drive; - Front Wheel Drive; X Four Wheel Drive

Major Options: X A/C; X Power Steering; X Power Brakes

X Power Windows; X Power Door Locks; X Tilt Wheel

Date Received: 1/19/2004 ; Odometer Reading 102 km

Selling Dealer: Ricart Chrysler, Plymouth, Jeep, Eagle

& Address: 465 South Hamilton Road, Columbus OH 43213

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: DaimlerChrysler Corporation

Date of Manufacture: 9-02

VIN: 1J4GL48183W539150

GVWR: 2359 kg; GAWR-FRONT: 1248 kg; GAWR-REAR: 1339 kg

DATA FROM VEHICLE'S TIRE LABEL:

Location of Placard on Vehicle: Driver Door

Recommended Tire Size: P215/75R16

* Recommended Cold Tire Pressure: FRONT: 227 kPa; REAR: 227 kPa

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P215/75R16 101S Manufacturer: Goodyear Wrangler

Tire Pressure with Maximum Capacity Vehicle Load: FRONT: 300 kPa; REAR: 300 kPa

Type of Spare Tire: P215/75R16 mounted on rear gate

VEHICLE CAPACITY DATA:

Type of Front Seats: X Bench; - Bucket; - Split Bench

Number of Occupants: 2 Front; 3 Rear; 5 Total

Vehicle Capacity Weight (VCW) = 601.5 kg

No. of Occupants x 68.04 kg = 340.2 kg

Rated Cargo/Luggage Weight (RCLW) = 261.3 kg **

*Tire pressure used for test

** Maximum of 136.1 kg used for target weight calculation.

DATA SHEET 2

PRE-TEST DATA

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with maximum fluids)= UDW:

Right Front	=	<u>444.5</u>	kg	Right Rear	=	<u>409.5</u>	kg
Left Front	=	<u>470.0</u>	kg	Left Rear	=	<u>433.5</u>	kg
TOTAL FRONT	=	<u>914.5</u>	kg	TOTAL REAR	=	<u>843.0</u>	kg
TOTAL DELIVERED WEIGHT	=	<u>1757.5</u>	kg				
% of Total Front of Vehicle Weight	=	<u>52.0%</u>		of Total Rear Weight	=	<u>48.0%</u>	

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight	=	<u>1757.5</u>	kg
Rated Cargo/Luggage Weight (RCLW)	=	<u>136.1</u>	kg
Weight of 2 p.572 Dummies, 74.4 kg	=	<u>148.8</u>	kg
TARGET TEST WEIGHT	=	<u>2042.4</u>	kg

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 129.2 KG OF CARGO WEIGHT:

Right Front	=	<u>520.0</u>	kg	Right Rear	=	<u>480.0</u>	kg
Left Front	=	<u>532.5</u>	kg	Left Rear	=	<u>503.0</u>	kg
TOTAL FRONT	=	<u>1052.5</u>	kg	TOTAL REAR	=	<u>983.0</u>	kg
TOTAL TEST WEIGHT	=	<u>2035.5</u>	kg				
% of Total Front of Vehicle Weight	=	<u>51.7%</u>		of Total Rear Weight	=	<u>48.3%</u>	

* Weight of Ballast Secured in Vehicle Trunk Area = 73 kg

Type of Ballast: Lead shot

Method of Securing Ballast: Left rear seat anchors, engine compartment firewall

Vehicle Components Removed for Weight Reduction: None

VEHICLE ATTITUDE (all dimension in millimeters):

AS DELIVERED:	RF	<u>834</u>	LF	<u>826</u>	RR	<u>844</u>	LR	<u>831</u>
AS TESTED:	RF	<u>803</u>	LF	<u>796</u>	RR	<u>816</u>	LR	<u>810</u>
Vehicle's Wheel Base:		<u>2640</u>	mm					
Location of Vehicle's C.G.:		<u>1275</u>	millimeters rearward of front wheel center.					

FUEL SYSTEM DATA:

Fuel System Capacity From Owner's Manual	=	<u>70.0</u>	liters
Usable Capacity Figure Furnished by COTR	=	<u>70.0</u>	liters
Test Volume Range (91 to 94% of Usable Capacity)	=	<u>63.7</u>	to <u>65.8</u> liters
ACTUAL TEST VOLUME	=	<u>64.35</u>	liters (with entire fuel system filled)

* Ballast weight includes the RCLW, the weight of drained vehicle fluids and the weight of any removed vehicle components less the weight of onboard instrumentation, cameras, and hardware.

DATA SHEET 2 (continued)

PRE-TEST DATA

FUEL SYSTEM DATA (continued):

Test Fluid Type:	Stoddard Solution	
Test Fluid Specific Gravity:	0.764	
Test Fluid Kinematic Viscosity:	0.96	centistokes
Test Fluid Color:	Orange	("red" is preferred)
Type of Vehicle Fuel Pump:	Electric	
Electric Fuel Pump Operation with Ignition Switch ON and Engine OFF -		
Fuel pump operated.		
Details of Fuel System: Fuel filler is located on the left rear quarter panel aft of the rear axle; Fuel tank is		
located on the vehicle underbody rear of the rear axle; Fuel lines are routed along the left side of the vehicle		
underbody.		
Comments:	None	

DATA SHEET 3

MOVING BARRIER DATA

WEIGHT OF MOVING BARRIER:

Right Front	=	<u>504.9</u>	kg	Right Rear	=	<u>393.7</u>	kg
Left Front	=	<u>499.9</u>	kg	Left Rear	=	<u>398.3</u>	kg
TOTAL FRONT	=	<u>1004.8</u>	kg	TOTAL REAR	=	<u>792.0</u>	kg
TOTAL BARRIER WEIGHT	=	<u>1796.8</u>	kg				

MOVING BARRIER DIMENSIONS:

Barrier Face Height: 1524 mm

Barrier Face Width: 1981 mm

Barrier Face Ground Clearance: 127 mm

Tread Width: 1511 mm

Wheel Base: 3048 mm

Location of C.G.:

X: 1344 mm rearward of front wheel center.

Y: 0 mm from longitudinal-vertical plane of symmetry.

Z: 414 mm above ground.

MOVING BARRIER TIRES:

Manufacturer: Dunlop

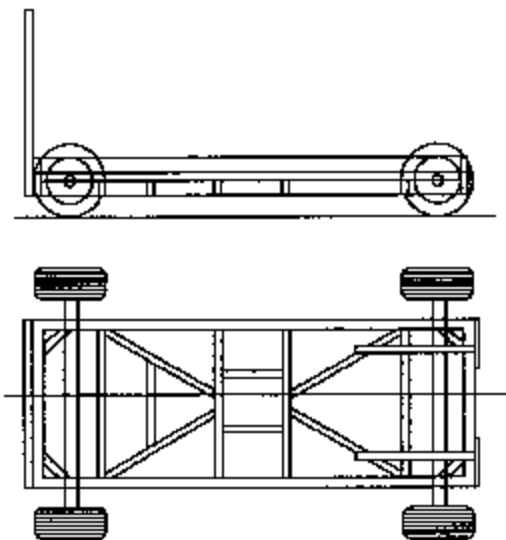
Model: AT Radial Rover

Size: P205/75R15

Recommended Max Pressure: 240 kPa:

MOVING BARRIER ABORT SYSTEM:

Type: Trailing cable



DATA SHEET 4
POST TEST DATA

TYPE OF TEST:

Type of Test: Rear Barrier Impact Angle: 0°
Test Date: July 7, 2004 Time: 10:30 Temperature: 21.1 °C
Vehicle NHTSA No.: C30302 VIN: 1J4GL48183W539150
Required Impact Velocity Range: 46.51 to 48.12 kph

BARRIER IMPACT VELOCITY: (Speed traps within 5 feet of impact plane.)

Trap No. 1 = 46.83 kph; Trap No. 2 = 46.83 kph
Average Impact Speed = 46.83 kph

VEHICLE STATIC CRUSH:

Vehicle Length:

Pre-Test	Left =	<u>4188</u>	; C/L =	<u>4444</u>	Right =	<u>4188</u>
Post-Test	Left =	<u>4090</u>	; C/L =	<u>4165</u>	Right =	<u>4095</u>
Crush	Left =	<u>98</u>	; C/L =	<u>279</u>	Right =	<u>93</u>
AVERAGE	=	<u>157</u>	millimeters			

DATA SHEET 4 (continued)

POST TEST DATA

TEST VEHICLE NHTSA NO.: C30302 TEST DATE: July 7, 2004Vehicle Mfg./Make/Model: 2003 Jeep Liberty SUV

Test vehicle fuel tank filled to 91% to 94% of manufacturer's "usable" capacity and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

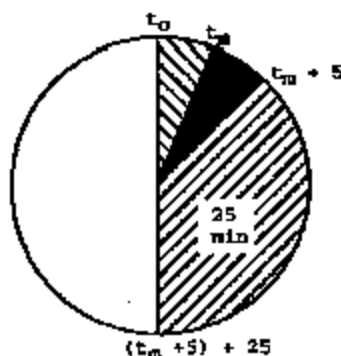
TEST VEHICLE IMPACT TYPE:

- Frontal (42.28 kph target velocity)

- Oblique (42.28 kph target velocity) with ° barrier face first contacting (driver/passenger) side

X Rear Moving Barrier (42.28 kph target velocity)

- Lateral Moving Barrier (32.19 kph target velocity)

FUEL SPILLAGE MEASUREMENT:

1. From impact until vehicle motion ceases
2. For five minute period after vehicle motion ceases
3. For next 25 minutes

ACTUAL	MAX ALLOWED
0	28 g
0	28 g.
0	28 g/min.

SOLVENT SPILLAGE DETAILS:

None

DATA SHEET 5

STATIC ROLLOVER TEST DATA

Table 7 FMVSS NO. 301 - STATIC ROLLOVER DATA SHEET

Vehicle: 2003 Jeep Liberty SUV

NHTSA No.: C30302



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Stage	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	1	minutes	12	seconds	5	minutes	6	minutes	12	seconds	7	minutes
90° - 180°	1	minutes	5	seconds	5	minutes	6	minutes	5	seconds	7	minutes
180°-270°	1	minutes	6	seconds	5	minutes	6	minutes	6	seconds	7	minutes
270°-360°	1	minutes	11	seconds	5	minutes	6	minutes	11	seconds	7	minutes

II. FMVSS 301 REQUIREMENTS: (Maximum allowable solvent spillage):

First 5 minutes from onset of rotation	6th min.	7th min.	8th min. (if required)
142 g	28 g	28 g	28 g

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

Rollover Stage	First 5 minutes from onset of rotation (g)	6th min. (g)	7th min. (g)	8th min. (if required) (g)
0° - 90°	0	0	0	-
90° - 180°	0	0	0	-
180°-270°	0	0	0	-
270°-360°	0	0	0	-

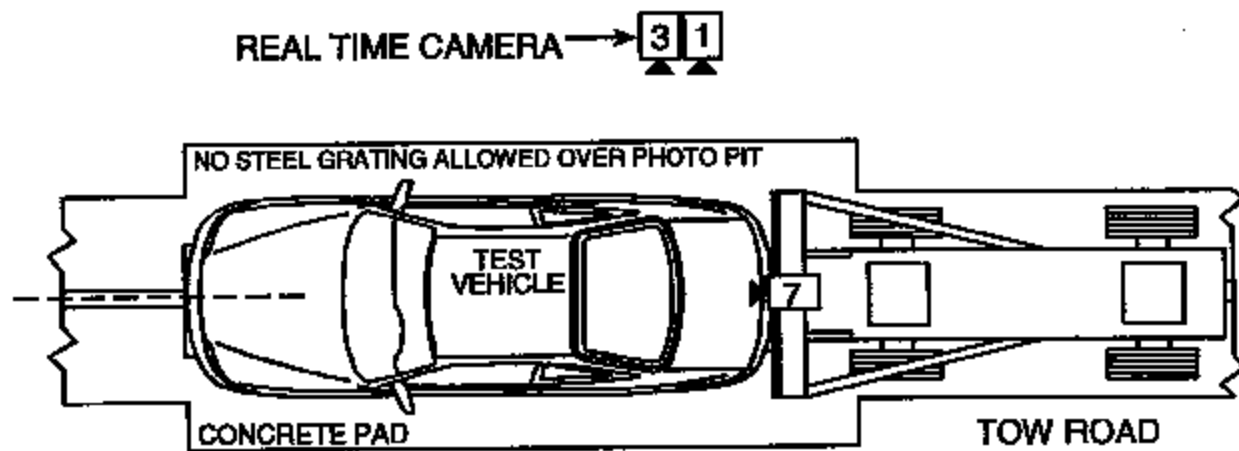
Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

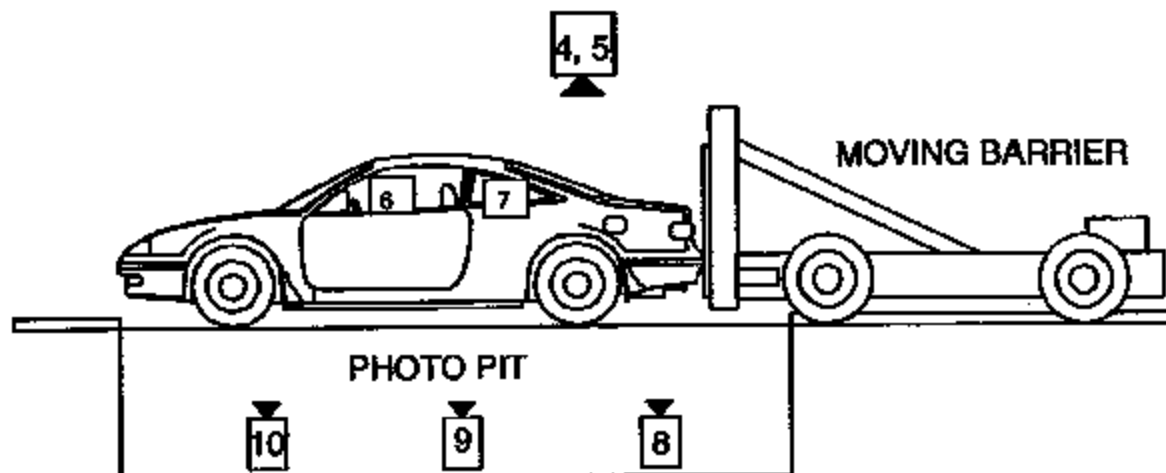
Rollover Stage	Spillage Location
0° - 90°	None
90° - 180°	None
180°-270°	None
270°-360°	None

DATA SHEET 6

HIGH SPEED CAMERA LOCATIONS



TOP VIEW



LEFT SIDE VIEW

DATA SHEET 6 (continued)

HIGH SPEED CAMERA LOCATIONS

NHTSA No. : C30302Vehicle : 2003 Jeep Liberty SUV

CAMERA NO.	VIEW	CAMERA POSITIONS (mm)*			ANGLE** (degrees)	LENS (mm)	SPEED (fps)
		X	Y	Z			
1	Real-Time Camera	-	-	-	-	-	24
2†	Left Side View	17665	3450	1110	0.0	35	View not available‡
3	Right Side View	-17840	405	1108	1.0	35	1000
4	Overhead Overall View	0	508	9804	-90	13	1000
5	Overhead Close View	0	508	9804	-105	25	Timing not available
6†	Onboard Driver View	-964	2355	1208	-10.0	8	1010
7†	Onboard Passenger View	1015	1590	1205	-10.0	8	1000
8	Vehicle Rear Underbody View	0	1080	-1956	90	13	1030
9	Vehicle Mid-Section Underbody View	0	2390	-1956	90	13	1000
10	Vehicle Front Underbody View	0	3790	-1956	90	13	1005

* X = film plane to monorail centerline (+ to left of rail)

Y = film plane to impact location (+ ahead of impact location)

Z = film plane to ground (+ above ground)

** = referenced to horizontal plane

† Research cameras - X distance is measured to the reference target plane.

‡ Film broke, view not available.

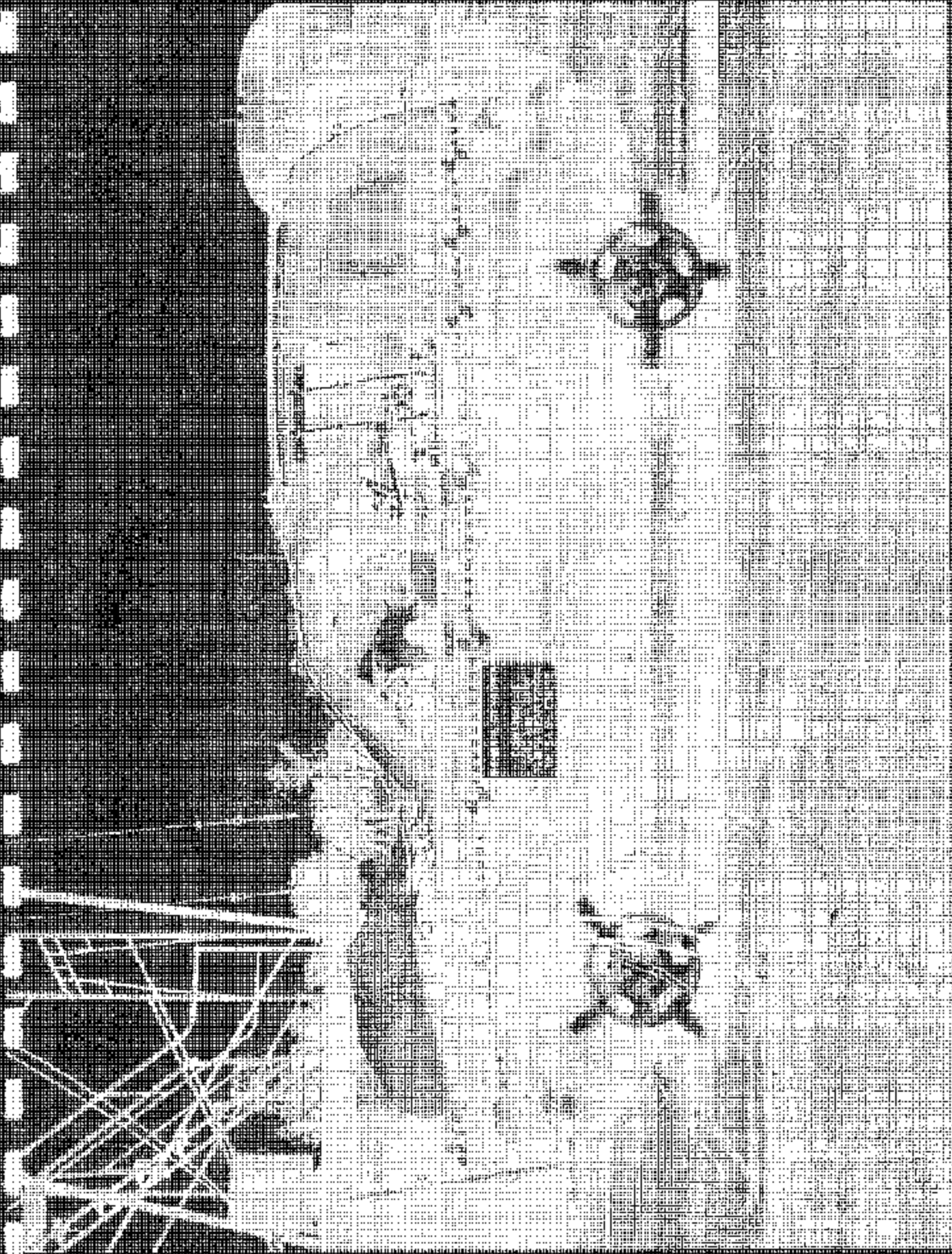
Appendix A
PHOTOGRAPHS

LIST OF PHOTOGRAPHS

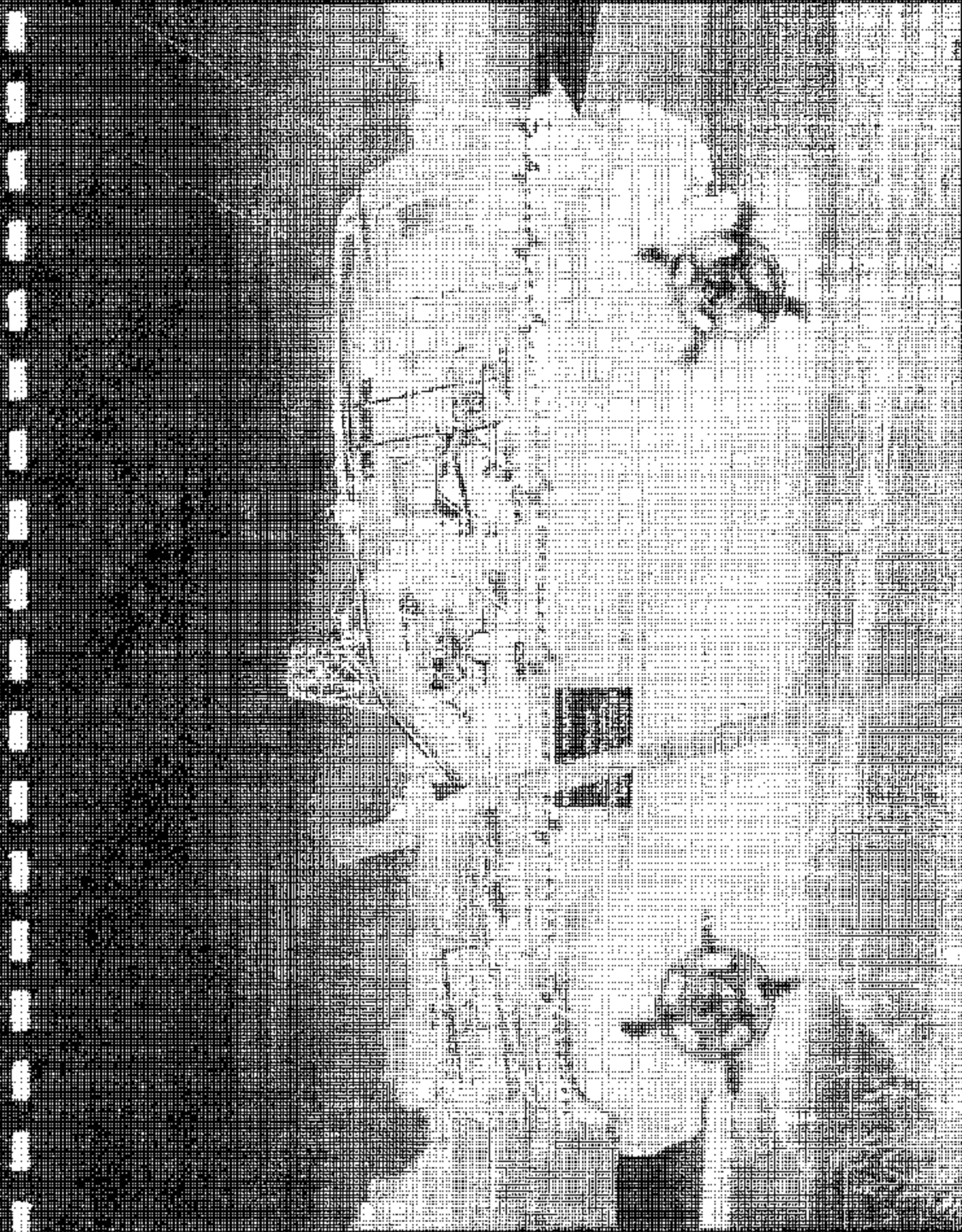
<u>Figure</u>	<u>Photograph Title</u>	<u>Page</u>
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ALAN LINDEN/REUTERS/GETTY IMAGES



ADDITIONAL INFORMATION



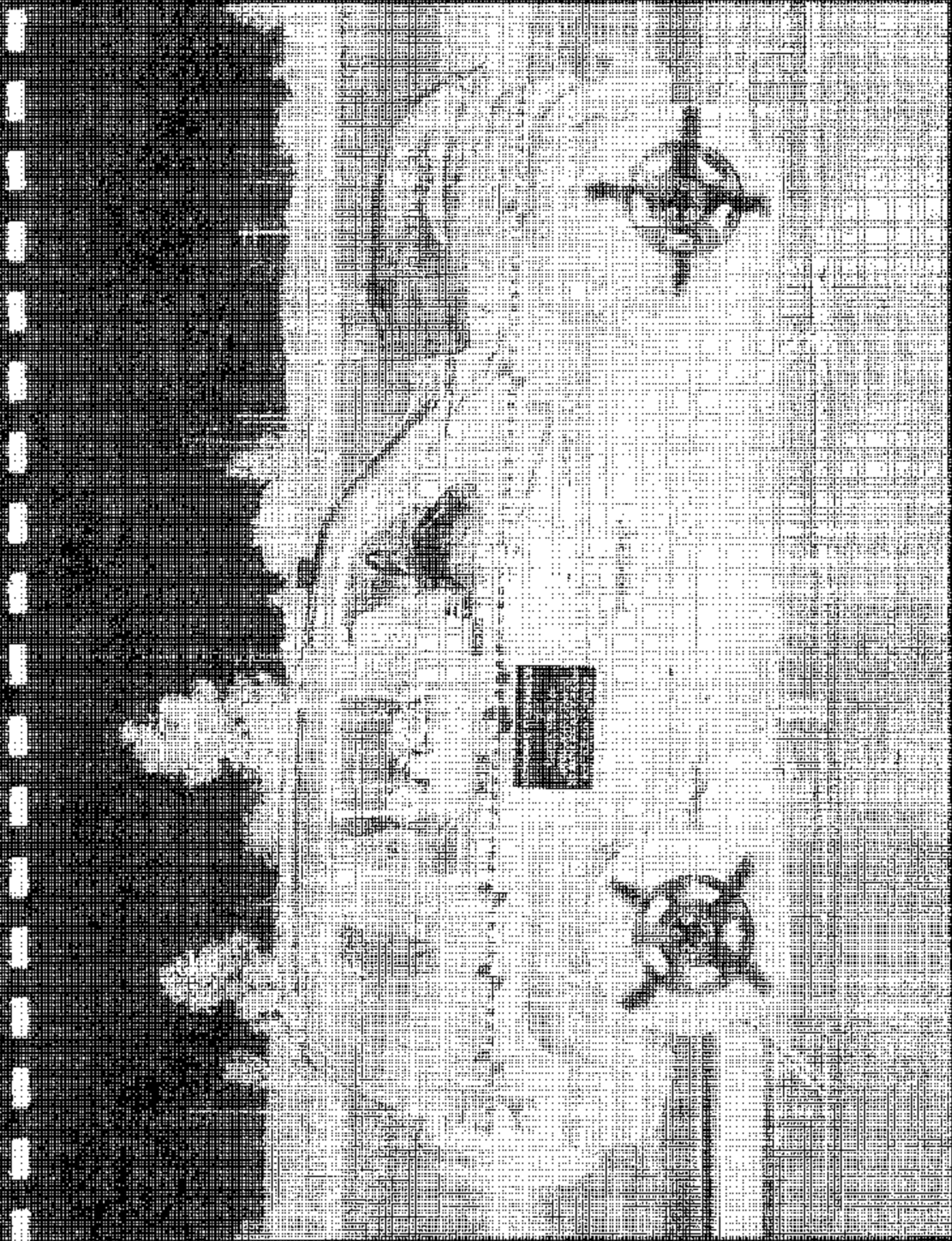


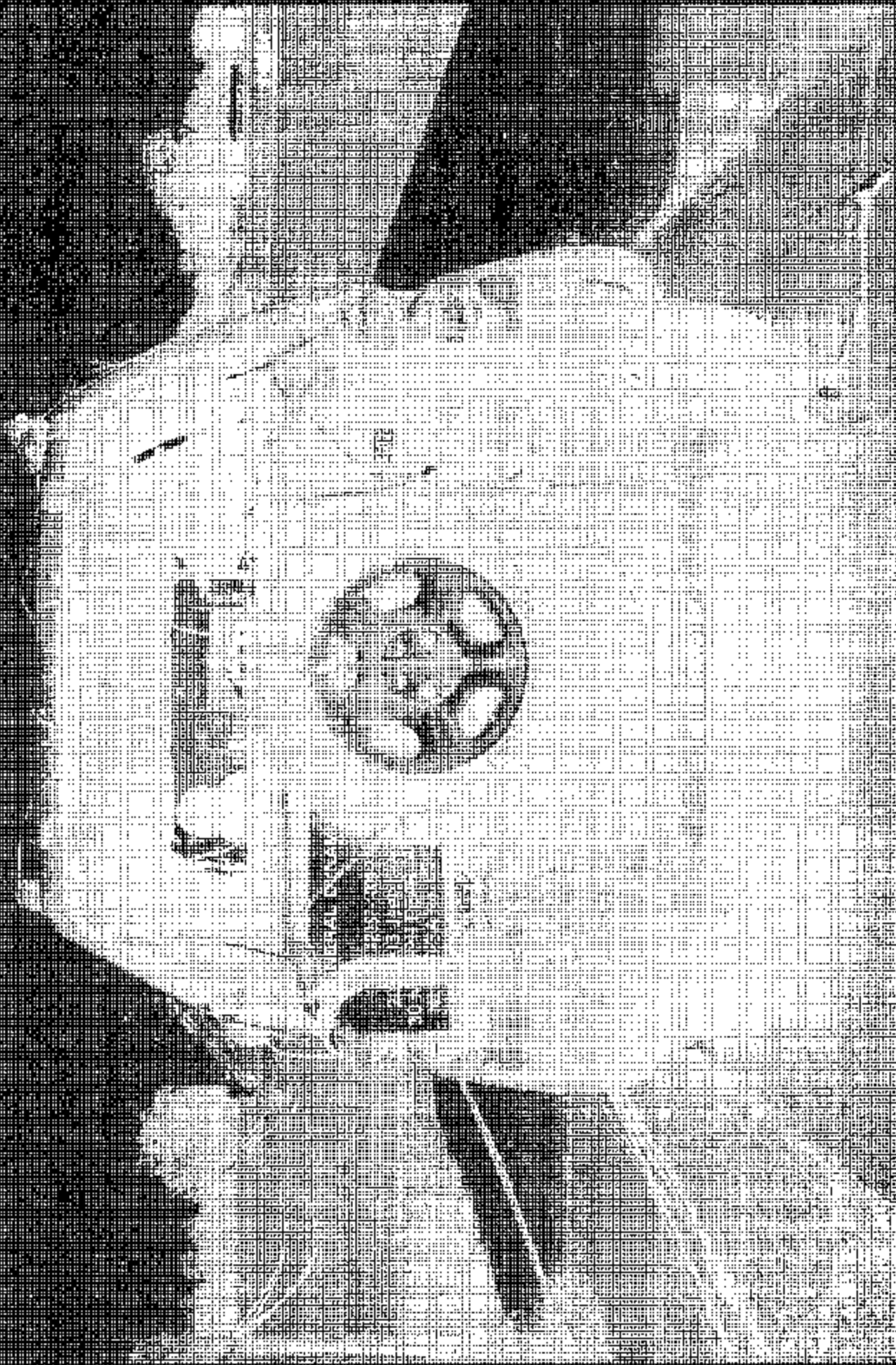
Figure 4-1 PRE-TEST HIGH SIDE VIEW



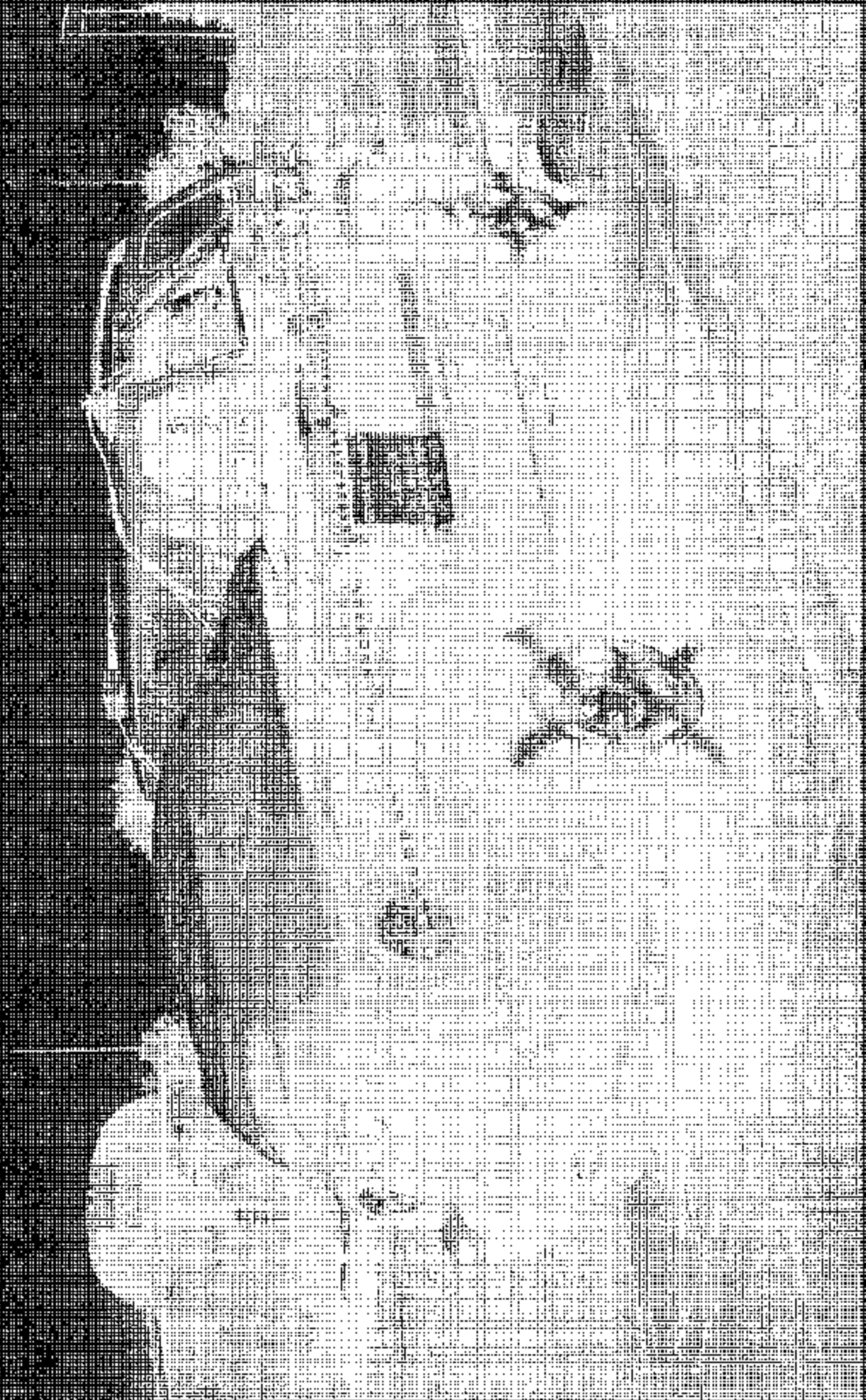
FIGURE 1-6 FINEST RIGHT SIDE VIEW



FIGURE 1-7 PRE-TEST REAR VIEW



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MAN IN SUIT, FRONT VIEW, PRESENTED IN FRONT VIEW

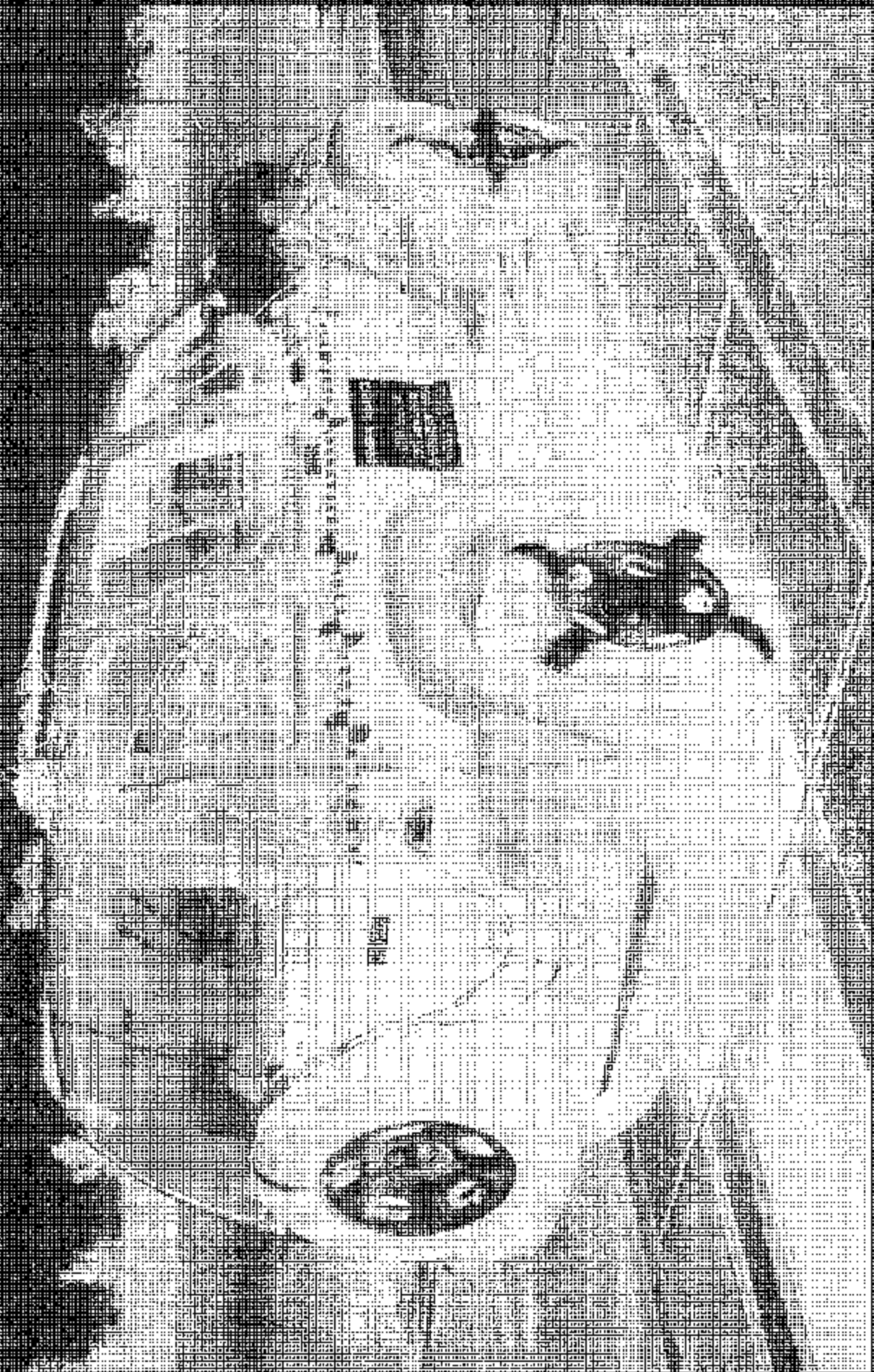


FIGURE 1: THE TEST SUBJECT'S REAR THREE-QUARTER VIEW

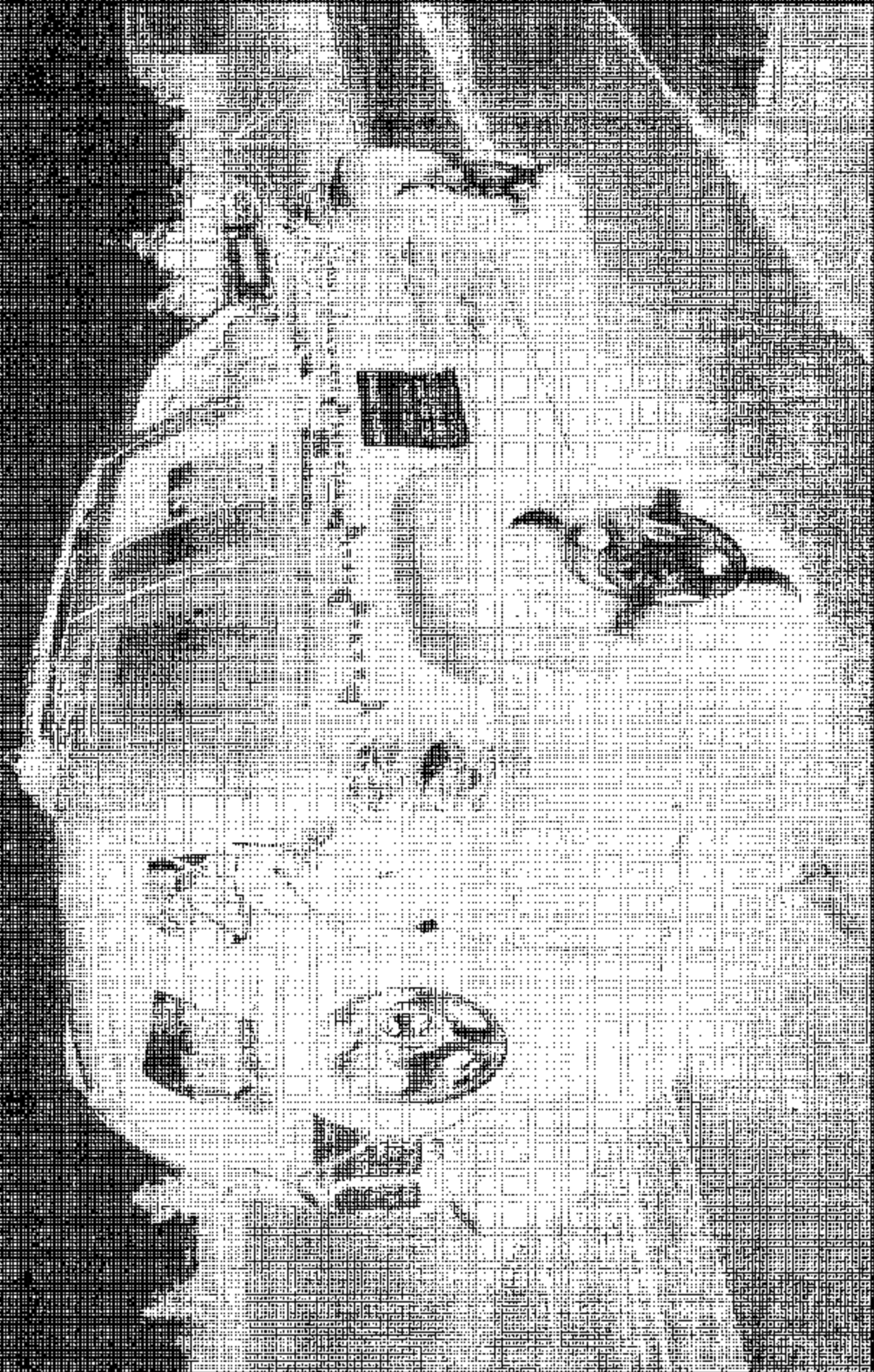


Figure 12. A photograph of a rock specimen, showing a large, light-colored, irregularly shaped object with several dark, rectangular and oval-shaped features embedded within it.



FIGURE 11-11 PISTON, FRONT (UNDEFORMED) VIEW

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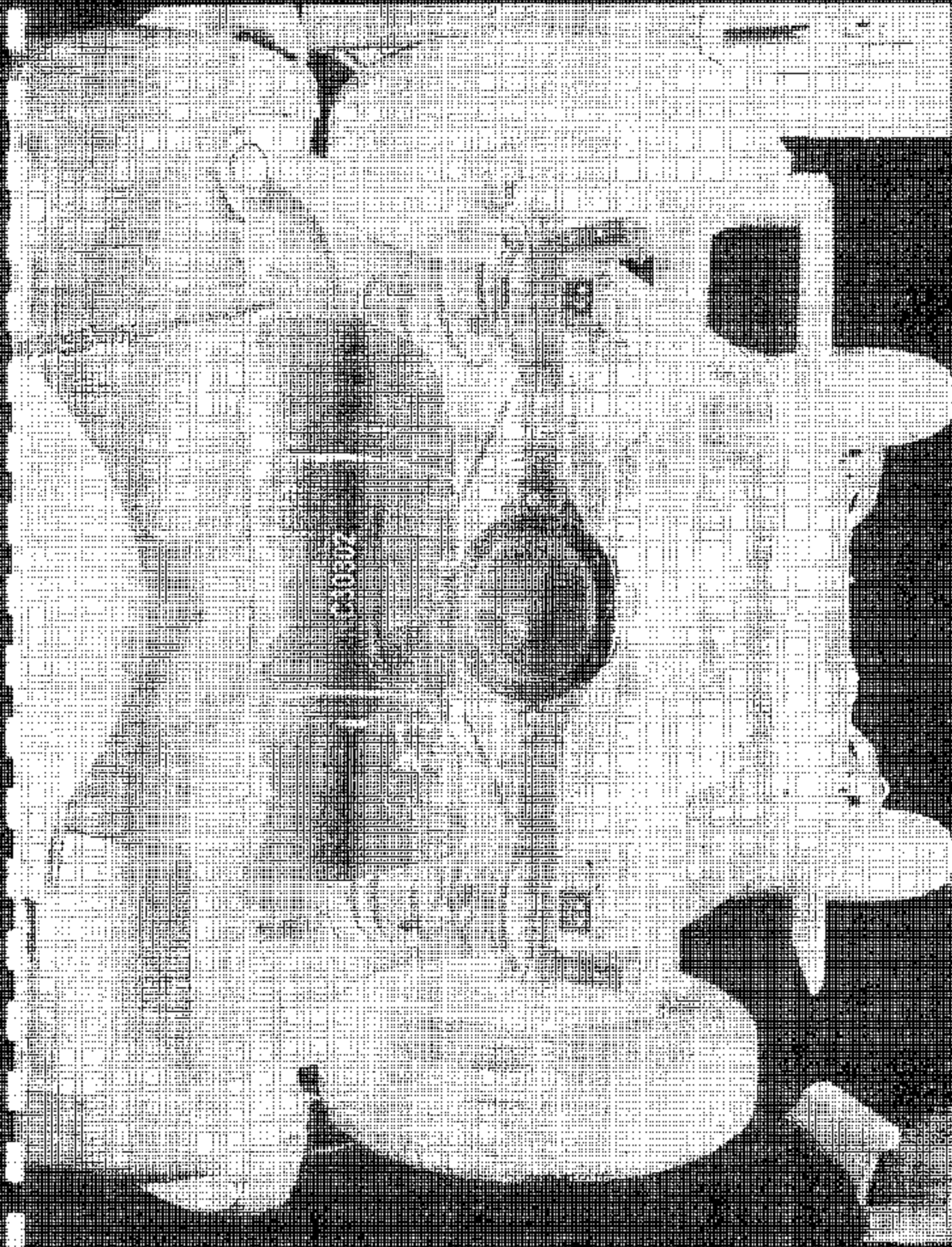


FIGURE 10-11: HEAD AND SHOULDERS, FRONT VIEW

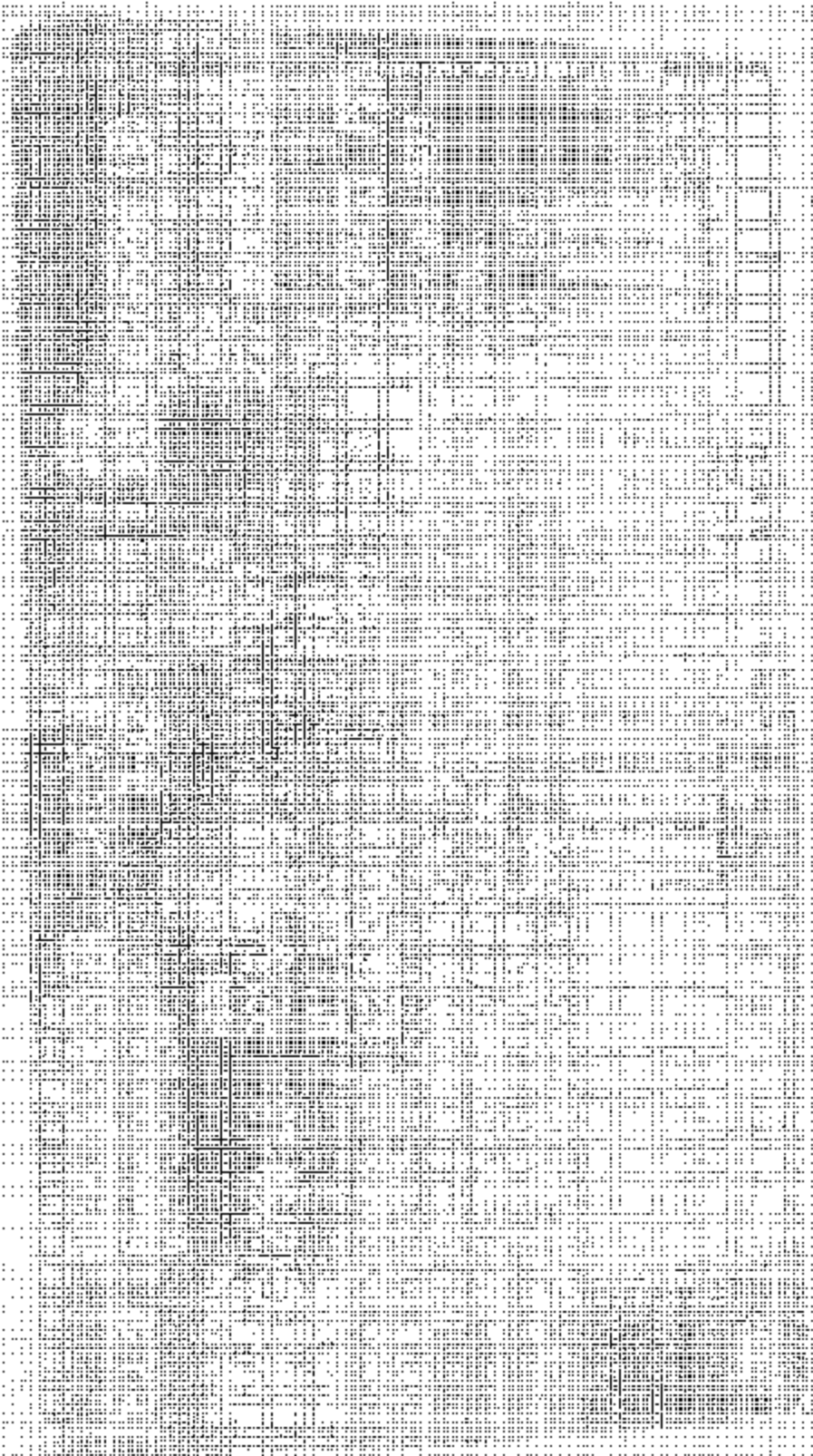
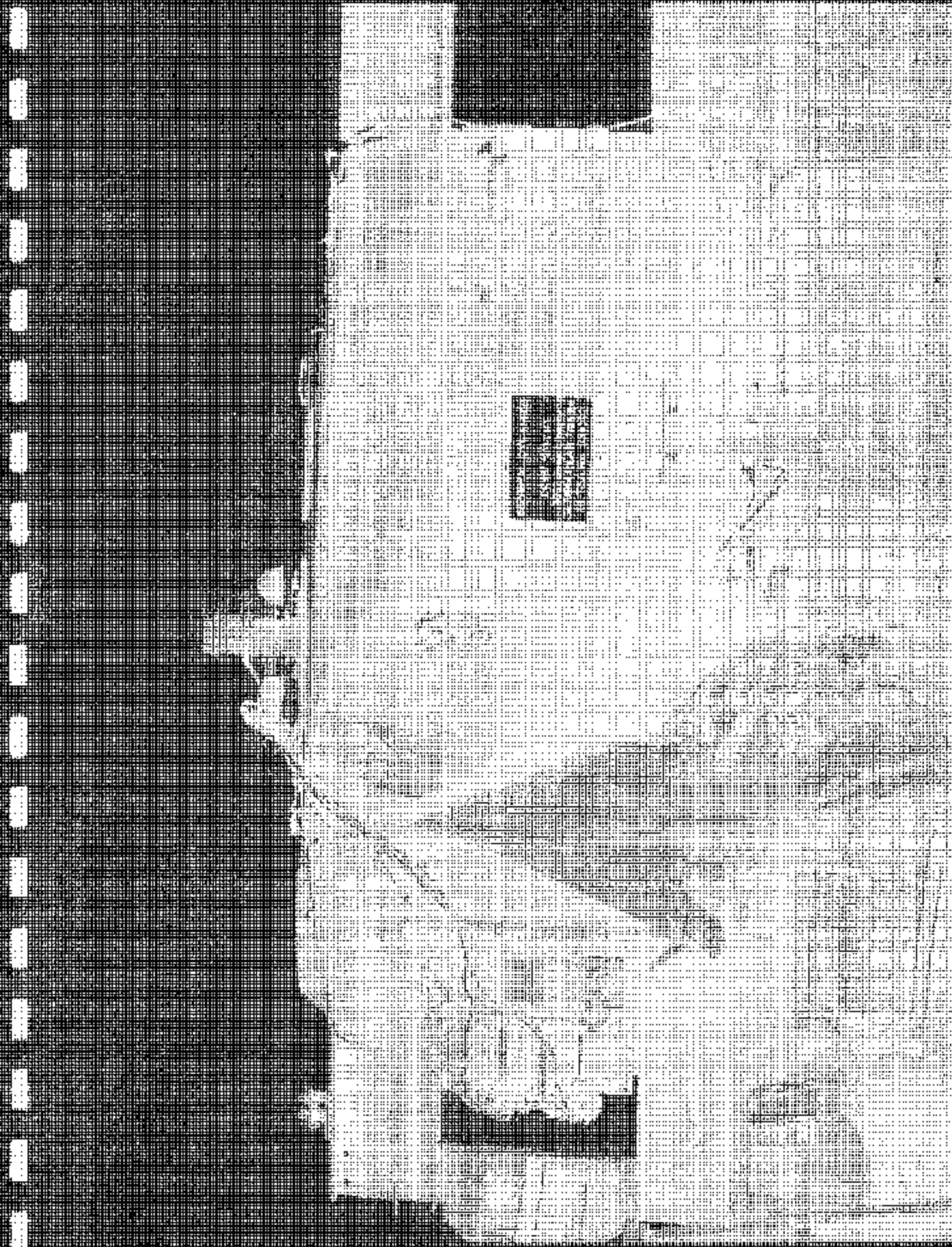


FIG. 1. PERSPECTIVE PLACARD



Figure 11. HPS-11-ACAD



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PHI REACTION OF A MATH



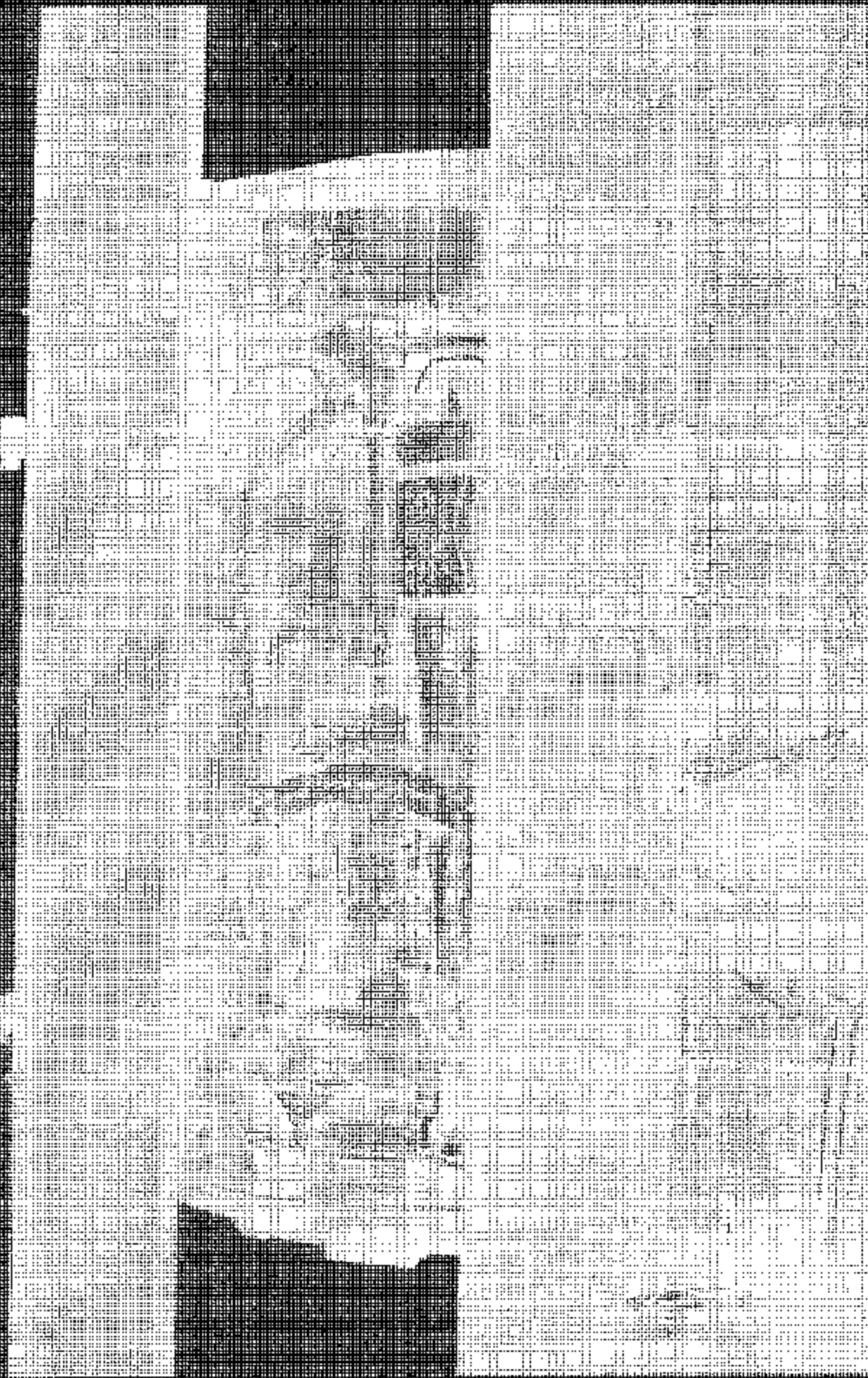


Figure A-2: ROLL OVER 279

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