GPU Nuclear

TECHNICAL DATA REPORT

TDR NO. 198	REVISION NO. 0
PROJECT NO. 3739	PAGE 1 OF 22

PROJECT: TMI-2 Containment Assessment

DEPARTMENT/SECTION Engineering Management

RELEASE DATE 10/24/80 **REVISION DATE**

DOCUMENT TITLE: Three Mile Island Unit 2 Reactor Building Entry Program Summary

ORIGINATOR SIGNATURE	DATE	APPROVAL(S) SIGNATURE	DATE
James W. Langenbach	10/17/80	R F Wilson	10/24/80
		APPROVAL FOR EXTERNAL DISTRIBUTION	**DATE**
		R F Wilson	10/24/80

*** DISTRIBUTION**

C.Adams
J.J. Barton
W.H. Behrle
M.L. Benson
J. Brasher
J.C. DeVine
F. Grice
R.W. Heward
G.K. Hovey
J.W. Langenbach
S. Levin
R. McGoey
T.C. Menzel
M.P. Morrell
J. Renshaw
R.F. Wilson
External

T. Fritz - Bechtel/TMI
R. Rider - Bechtel
J. Tate - GAI
E. Walker - Bechtel

ABSTRACT:

In May of 1979 following the March 28, 1979 accident at Three Mile Island Unit 2 (TMI-2), Metropolitan Edison Company (Met-Ed) established the Containment Assessment Task Force (CATF). The overall goal and object of the Containment Assessment Task Force was to establish, using external measurements, the reentry environment inside the Reactor Building. The specific function of the Assessment Task Force was to gather data as necessary to ensure that containment atmosphere cleanup could be accomplished, that an initial entry into the building could be accomplished, and that planning for Reactor Building decontamination and recovery could proceed. The cleanup of the containment atmosphere and the initial entry were considered to be the initial vital steps in beginning the recovery of the TMI-2 Reactor Building. Entry was required to gather data by visual inspection and radiological survey to support planning for the decontamination of the Reactor Building.

To accomplish the assigned duties, the Containment Assessment Task Force established a number of experiments and measurements which could be run without benefit of building entry. These experiments were designed to determine as much as possible what the airborne contamination, contamination plated out on the various surfaces of the containment, and contamination contained in the water in the basement of the Reactor Building were. The experiments and measurements were specifically designed to obtain detailed technical data on the magnitude, identity, distribution, and chemical forms of the existing airborne, surface, and sump water activity and the resulting radiation levels. The final step of the Containment Assessment Task Force would be

*COVER PAGE ONLY

A000 0030 9·80

the initial building entry to take direct radiation surveys, obtain material for decontamination studies and perform a preliminary visual assessment of damage within the building.

The ten tasks[1] established by the CATF leading up to entry into the Reactor Building are:

<u>Task</u>

CA-1 Containment Air Sample[2]

CA-2 Alternate Containment Air Sample[2]

CA-3 Equipment Hatch Gamm Scan[4]

CA-4 Containment Sump Radiation Measurement[3,5]

CA-5 Hydrogen Recombiner Piping Plateout[6]

CA-6 Personnel Air Lock Air Sample[9]

CA-7 Dose Rate Mapping of Personnel Air Lock[9]

CA-8 Determine Availability of Reactor Building Lighting and Power[12]

CA-9 Containment Remote Instrumentation[10]

CA-10 Containment Building Purge[13,14]

The results of these experiments established upper bounds on the radiological environment inside the TMI-2 Reactor Building. Additional experiments[25] through penetration R626 established the levels of oxygen and hydrogen inside the Reactor Building and concluded that there were no toxic gases present in concentrations that could be considered hazardous.

Entry Number One

On July 23, 1980 the initial entry into the Reactor Building was accomplished. During the initial entry 29 photographs and six 100 cm^2 swipes were taken while a general area beta and gamma survey was performed. In addition, a 5 gallon plastic bucket was removed from the building for analysis.

The general area gamma readings on the 305' (grade) elevation were in the range of 400-600 mR/hour near the air lock where entry was made into the building. The gamma readings increased to 700 mR/hour in the area near the other air lock at the equipment hatch. The gamma readings were 3 R/hour in the enclosed stairwell, 10 R/hour over the metal deck for the covered floor hatch, 4 R/hour at the edge of the metal covered floor hatch, 1.4 R/hour at the air coolers and 18 R/hour at the top of the open stairwell. The gamma readings against the D-ring and liner were approximately 400 mR/hour while the floor drains ranged from 2-5 R/hour and the core flood piping, seal injection piping and elevator door all read 3 R/hour on contact.

The general area floor and wall beta readings ranged from 1 to 2 Rad/hour.

The whole body exposure to the personnel for the 20 minutes in the building was approximately 190 mRem with the maximum extremity exposure of approximately 220 mRem. There was no beta skin exposure measured.

The pictorial survey showed no significant structural damage and only the door to the stairwell showed visible damage. There were deposits of rust and dirt on the floor with obvious water marks, most likely from the operation of the building spray system.

The floor swipes indicated concentrations of activity of Cs-134 and Cs-137 ranging from 3×10^{-2} to $1 \times 10^{-1} \mu Ci/cm^2$. Lesser levels of Cs-134 and CS-137 ranging from 2×10^{-5} to $4 \times 10^{-4} \mu Ci/cm^2$ were found on the walls.

Cerium, Cobalt, Antimony and Niobium were found on the vertical wall swipes in concentrations of 1×10^{-7} to $1 \times 10^{-6} \mu Ci/cm^2$. These isotopes were also most likely present in the floor swipes but were not detectable due to the levels of the Cesium present.

Entry Number Two

On August 15, 1980 the second entry was completed. During the second entry into the Unit 2 Reactor Building, the following tasks were accomplished.

1. Turned on the lights on El. 305' & El. 347' -6".

2. Obtained general area surveys on El. 305', El. 347' -6" and in the enclosed stairwell.

3. A total of 67 pictures were taken on both elevations.

4. 12 swipes and 2 scrape samples were obtained.

5. HP-R-211, a piece of glass, a steel plate, 2 metal covers, a funnel, and 4 plastic ties were recovered from containment.

6. A protective covering experiment and a directional dose experiment, both using TLD's, were also taken into containment and brought out again.

7. A decontamination test using a smear & masilin wipe was also performed.

Survey results from El. 305' in areas not surveyed during the first entry were 2 R/hr gamma behind (North) of the open stairwell, 40-45 R/hr gamma at 5-7 ft. from the water in the basement (teletoctor extended down the open stairwell), and a floor drain near the "A" Core Flood Tank was 3 R/hr gamma and 10 Rad/hr beta.

Surveys taken while proceeding up the enclosed stairwell showed readings of 3-5 R/hr gamma at the 305' elevation with a fairly linear decrease to a reading of 180 mR/hr gamma at El. 347'-6".

Surveys done on El. 347' -6" showed general area readings of 200-300 mR/hr gamma on the diamond plate decking outside the enclosed stairwell and 100-200 mR/hr gamma along the south wall of containment. The general area readings increased to 200-400 mR/hr gamma to the South East of the head storage stand then decreased to approximately 150 mR/hr gamma South of the open stairwell. A measurement taken over the open stairwell was 550 mR/hr gamma while a contact reading on the D-ring wall was 100 mR/hr gamma. Readings taken in the fuel pool area were 100-400 mR/hr gamma under the fuel handling bridge and 120-150 mR/hr gamma towards the reactor head and stud bolts at a distance of approximately 12-15 ft. Other readings were 2.5 R/hr gamma on contact with the pressurizer spray line, 200 mR/hr gamma on contact with the fuel handling bridge, 250-300 mR/hr gamma over both core flood tanks, 400-500 mR/hr gamma on contact with the base of the head storage stand and 50 mR/hr gamma behind the enclosed stairwell.

The pictorial survey on El. 305' in general showed more details of items identified from the first entry while the pictures from El. 347' -6" showed the general areas and structures of the operating deck, the fuel handling bridges, the D-rings, the seal table, and the vessel head.

No significant structural damage was seen although there was evidence of localized high temperatures from a partially melted telephone, and some melted rad rope. Also several barrels had been crushed, presumably by a pressure differential created due to temperature changes in containment. Some unpainted or zinc coated metal surfaces were rusted, probably due to the NaOH spray, and the concrete floor areas had rust deposits on them. Painted metal surfaces and diamond plate decking conditions were similar to those found on El. 305'. One object of interest is sections of cable and what appears to be cable insulation lying on the floor from the enclosed stairwell to the west D-ring, which may have fallen off the polar crane.

The whole body exposure to the entry team varied somewhat due to the tasks each was performing and the early exit of 2 members of the team. The whole body exposure and maximum extremely dose are listed below:

	Whole Body (mR)	Max Extremity (mR)
Cooper*	140	210
Behrle*++	260	320
Benson++	300	420
Griffith	165	270

*Early Exit - ++Worked near open stairwell - higher dose area. No skin beta skin dose was measured.

The 2 floor swipes taken from El. 305' indicated concentrations of Cs-134 and Cs-137 ranging from 6.6E-2 and 40.7E-2μCi/cm^2 under HP-R-211 to 3.8E-4 and 2.3E-3 μCi/cm^2 in front of the air coolers respectively. The two scrape samples showed concentrations of Cs-134 and Cs-137 ranging from 8.8E-3 and 5.25E-2μCi/cm^2 for the scrape near the open stairwell to 2.6E-2 and 16.1E-2μCi/cm^2 for the scrape near the air coolers respectively.

The floor swipes taken on El. 347'-6" for Cs-134 and Cs-137 averaged around 9.0E-3 and 5.6E-2μCi/cm^2 while the wall swipes averaged around 2.5E-5 and 1.5E-4μCi/cm^2 respectively.

Strontium - 90 was also found on both walls and floors in concentrations of approximately 3.1E-5μCi/cm^2 and 2.0E-3μCi/cm^2 or less respectvely.

Conclusions

The results of the entries revealed the inherent conservatism in analysis which always assumes the "worst case" and is demonstrated by the fact that the radiation levels are 100 to 1000 times less than the original estimates (see Table 1 Appendix A) and 2 to 3 times less than estimates based on physical data gathered through remote experimentation.

The gamma radiation levels on the grade (305') elevation of 500-700 millirem/hour, and 100 to 200 millirem/hour on the operating level (347'6"), are low enough to allow further entries for additional data acquisition and limited maintenance.

The gamma levels of 100 to 200 millirem/hour on the 347'6" elevation are a direct result of the plateout on the floor and walls. The data indicates that gross decontamination of the contamination on the floors can reduce the dose rate levels by a factor of 10 to 100.

The radiation levels of 500 to 700 millirem/hour on the 305' elevation are a combination of the gamma radiation from the sump and plateout on the floor. It is reasonable to assume that the dose rate contribution from the plateout on 305' elevation floor and walls is similar to that on the 347'6" elevation. Comparatively, the gamma dose rate contribution from the sump is most likely 300 to 600 millirem/hour and gross decontamination on the 305' elevation floor may reduce the radiation levels a factor of .15 to .4 with the water still in the building sump. Shielding, tents and other conventional techniques can further reduce the radiation levels on the 305' elevation to the point where access to the 347'6" elevation could be made for gross decontamination or other work on a limited basis with a minimum of additional exposure to personnel. Further tests and analysis will confirm this assumption.

THREE MILE ISLAND UNIT 2

REACTOR BUILDING ENTRY PROGRAM

SUMMARY

Table of Contents

Table of Contents - (Cont'd)

1.0 Introduction

A comprehensive technical summary of the total effort involved with the planning and implementation of the initial entries into the Three Mile Island Unit 2 (TMI-2) Reactor Building is presented herein. In addition, this document provides a technical and historical compilation of the information gathered during the initial two entries into the TMI-2 Reactor Building. The entry program logic as initially conceived is shown on Figure 1, Appendix B and in Appendix E.

The planning, selection of equipment, and implementation of these entries is based upon the criteria that "entry be accomplished in accordance with existing industry standards, in the safest manner practicable, with existing or commercially available equipment and facilities." The entry program, as implemented, complied with the intent of the criteria. The design and construction of the contamination control envelope and the selection and procurement of the entry equipment was accomplished utilizing commercially available "off the shelf" equipment.

The selection, screening and training of the entry personnel was done utilizing existing company programs, facilities and personnel wherever possible.

The experiments performed as part of the containment assessment task force are discussed briefly and the results described herein.

The planning and efforts of the following individuals insured the successful completion of the initial entry into the Unit 2 reactor building.

Jim Langenbach	GPUSC
Tom Menzel	GPUSC
Mike Morrell	GPUSC
Ron Mays	Bechtel
Tim Fritz	Bechtel
Ed Walker	Bechtel
Jackie Tate	GAI
Ralph Jacobs	Rad Services
Mike Pavelek	Rad Services
Bob Hornbeck	NSS
Chet Kuki	NSS
Darrell Osden	NSS
Barry York	NSS
Sam Griffith	NSS
and especially	
Mike Benson	Met-Ed
Bill Behrle	Met-Ed
Fred Grice	Met-Ed
Chuck Adams	Met-Ed

There were many others unnamed who were involved and without whom the program would not have been successful.

2.0 Chronology

In May of 1979 the Containment Assessment Task Force (CATF) was established to address the need to gather data from the Reactor Building to assess the consequences of the March 28, 1979 accident at the Metropolitan Edison Company Three Mile Island Unit 2 (TMI-2) Nuclear Generating Station and to prepare for entry into the TMI-2 Reactor Building.

In September of 1979 GPUSC proposed to the NRC that the TMI-2 Reactor Building be entered in December of 1979[15] as shown in Figures 2 and 3 Appendix B.

Concurrent with this proposal, efforts commenced to evaluate and select the equipment and facilities to be utilized for entry into the TMI-2 Reactor Building. Specifically, communications, lighting, respiratory protection, protective clothing, video equipment, dosimetry, and radiation measurement equipment were evaluated. In addition, the area outside the Reactor Building personnel air lock Number 2 was modified to accommodate access to and egress from the Reactor Building. Work also proceeded on completion of the containment access tasks.

On November 6, 1979, Met-Ed and Babcock & Wilcox (B&W) successfully cut through the stainless steel flange in penetration R626 gaining direct access into containment.

On November 10, 1979, the first video inspection of the Reactor Building was completed through penetration R626.

On December 6, 1979, Met-Ed submitted the procedure to the NRC for opening the outer door of the Number 2 personnel air lock and advised the NRC of their intent to enter the air lock for surveillance on January 31, 1980, after completion of the modifications to the service building ventilation system.

Construction of the facility outside the Number 2 personnel air lock was completed January 15, 1980 in preparation for opening the air lock outer door.

On January 30, 1980, the NRC directed Met-Ed not to open the number 2 personnel air lock outer door because of their concerns associated with the release of about forty millicuries of Kr-85 from the air lock.

Meetings were held in February and March of 1980 to apprise the NRC of the Reactor Building entry plans. See Appendix G.

The NRC finally approved opening the number 2 air lock outer door on March 4, 1980.

On March 13, 1980 the outer door of the Number 2 personnel air lock was opened after a 72 hour purge of the air lock.

On March 14, 1980 a Ge(Li) gamma scan of the inner air lock door was performed.

On March 21, 1980 the Metropolitan Edison Company[16] formally requested permission from the NRC to enter the Unit 2 Reactor Building without purge of the Kr-85.

On March 25, 1980[17] the NRC denied Met-Ed's request to enter the Reactor Building, stating the need for more information concerning presence of toxic gases and the oxygen deficient atmosphere.

Met-Ed completed some of the testing requested by the NRC on April 8, 1980 and submitted that information to the NRC[18]. The rest of the NRC requested information was submitted on April 15, 1980[19] along with a request to enter the Unit 2 Reactor Building on April 24, 1980.

On April 23, 1980 Met-Ed Company was notified verbally by (NIOSH) National Institute of Occupational Safety and Health that the Bio Marine, Bio Pac 60, self contained breathing apparatus (SCBA), which had been planned for use during the initial entry, had been modified by the manufacturer and that the modification violated the approval certification because it had been done without proper notification to, and approval by, NIOSH. Based on this notification, the Met-Ed Company postponed the planned entry pending resolution of the apparent problem between NIOSH and Bio Marine.

On April 30, 1980[20] the Metropolitan Edison Company notified the NRC of its plans to reschedule the entry to May 20, 1980 and to have an alternate SCBA, MSA Model 401, available for entry.

On May 6, 1980[21] the NRC notified the Metropolitan Edison Company of the NIOSH "Stop-sales-and-recall" of the Bio Pac 60.

On May 16, 1980[22] the NRC approved Met-Ed Company's plans to enter the Unit 2 Reactor Building on May 20, 1980.

Entry into the Unit 2 Reactor Building was attempted at 2000 hours May 20, 1980, but all attempts to open the reactor building inner air lock door failed and at 2020 hours, the mission was scrubbed.

Subsequent testing of the air lock inner door on May 23 and May 30, 1980 indicated that the pressure differential interlock to the door was corroded in the lock position.

Subsequent to the aborted entry attempt, the NRC on June 12, 1980[13] issued approval to vent the TMI-2 Reactor Building and it was decided by Met-Ed that the entry into the Reactor Building would be delayed until after the Reactor Building purge was completed. Work then proceeded in parallel with purge efforts to gain access to the Reactor Building. The Reactor Building purge commenced on June 28, 1980.

On July 1, 1980 a hole was drilled through the 1 1/4 inch steel bulkhead and the pressure differential interlock pin was pryed free and the door opening mechanism was operated to verify its functional ability.

On July 11, 1980 purging of the Unit 2 Reactor Building was completed.

On July 15, 1980[23] Met-Ed Company requested NRC approval for entry into the TMI-2 Reactor Building on July 23, 1980.

On July 16, 1980 the inner air lock door to the Reactor Building was successfully opened in preparation for entry into the Reactor Building.

NRC approval for entry into the TMI-2 Reactor Building was received on July 22, 1980[24].

On July 23, 1980 William Behrle and Michael Benson of the Met-Ed Company successfully entered the Three Mile Island Unit 2 Reactor Building, 15 months, 24 days after the March 28, 1979 accident.

A second entry was made into the Reactor Building on August 15, 1980 by William Behrle, Michael Benson, and Marty Cooper of Met-Ed Company and Sam Griffith of Nuclear Support Services.

3.0 Experiments

The following experiments were performed to establish the containment environment prior to entry.

1. Weekly containment building airborne samples. These samples were analyzed for particulates, gases, iodine and gross beta.[2]

2. Gamma radiation readings through the equipment hatch, using a Ge(Li) detector. The purpose of

these measurements was to determine the isotopic identity and magnitude of plateout on the 305' elevation.[4]

3. Gamma radiation readings through the inner flange of penetration R605 (approximately 2 feet above the sump water level, near the basement of the Reactor Building) using a Ge(Li) detector and a teletector. The purpose of this measurement was to determine sump level and specific activity on the contamination in the sump.[3,5]

4. A sump water sample. To perform this sampling, a hole was cut in the inner flange of penetration R401 (approximately 2 feet above the sump water level) and water was drawn into a sample bomb for analysis. The water was sent to Oak Ridge in order to accomplish a detailed activity analysis of the water.[7] Subsequently, several larger samples were drawn for further analysis.

5. Gamma radiation readings through the inner metal flange of penetration R626 (at the 347' elevation approximately 11 feet above the Reactor Building operating floor) using a NaI(Tl) detector and teletector. The purpose of this measurement was to determine general area radiation levels and to determine the isotopic identity and magnitude of plate-out on the 347' elevation operating floor.[8]

6. Radiation mapping of the number 2 personnel air lock. The experiment consisted of taking air samples from the personnel air lock and placing probes into the air lock to determine airborne activity radiation level inside the air lock.[9]

7. Analysis of the hydrogen recombiner inlet spool piece.[6] This experiment consisted of removal of the spool piece to the recombiner and shipment of the spool piece to Oak Ridge for analysis. The purpose of the experiment was to determine what plateout existed on the spool piece as a result of the several days of flow through the hydrogen recombiner which occurred within the first three weeks after the accident.

8. Remote TV camera and radiation survey through penetration R626. The purpose of this equipment was to obtain an initial visual assessment of the

damage that may have been done by the accident and to obtain the first direct radiation measurement readings inside the building.[10]

9. Air lock entry. This experiment consisted of opening the outer door and entering the air lock to take detailed swipe surveys, radiation surveys and Ge(Li) scans through the inner door of the air lock.[11] The purpose of this experiment was to obtain better information on the 305' elevation radiation levels and the 305' elevation plateout source. The experiment also afforded some view through the inner door viewport of the 305' elevation.

With the exception of the sump sample, the above experiments were all taken by the Containment Assessment Task Force as part of the initial entry program. The sump sample was actually taken to better define activity levels in the sump to plan for the initial engineering of a sump water cleanup system. Results of the above experiments are presented in this TDR.

3.1 Weekly Air Sample Program

Samples of the Reactor Building atmosphere were taken and analyzed routinely since the March 28th incident. Initially, airborne activity samples were difficult to obtain due to the high radiation levels of the gases and also due to the fact that the normal sample panel was in the auxiliary building, where high general area radiation levels existed. As a result, very few samples were taken in March or April. In May, a weekly sampling program was established and the samples were taken weekly from then on. These samples were taken through the normal sample panel known as HPR-227. This sample system only had the capability to take samples from one location in the Reactor Building. The sample point was from the dome area of the Reactor Building, and the piping to the sample panel was several hundred feet long. The exact location was also in doubt due to the fact that a drain valve off the sample line inside the building is thought to be open such that part of a sample comes from the dome area and part of the sample comes from the area just inside the containment sample penetration. As a result of this inability to know exactly what location in the Reactor Building was being sampled, Metropolitan Edison decided to pursue other sample points. A separate sample point was used just inside the Reactor Building near the 347' elevation. This second location also used the sample panel of HPR-227. Additionally, two other sample locations were available. The penetration R401, which was used to draw the sump sample, was also modified (but never actually used) to take an airborne sample just above the water in the basement and Penetration R626 near the operating floor was used to draw other samples.

Metropolitan Edison had difficult in getting consistent samples from the Reactor Building due to longer runs of piping inherent in the design of HPR-227, procedural difficulties and analytical difficulties. Eventually, however, the sampling program showed that the major isotope of concern reamining in he Reactor Building after the short half-life radioisotopes had decayed was Krypton 85. Initially, large concentrations of Xenon 133, Xenon 131m, and Iodine 131 were also detected. After several months, however, all these items had decayed away such that essentially the only nuclide above its restricted area MPC was Krypton 85. Selected representative air samples are shown in Table 2 Appendix A.

3.2 Equipment Hatch Gamma Scan

The dose reading results from the equipment hatch gamma scan, are shown on Figure 4 Appendix B. The major results of this experiment are as follows: The estimated plateout activity on the 305' elevation ranges from 6.3 to 17.3 microcuries per square centimeter. The lower estimate assumes that all of the activity detected in the measurements is from plateout on the vertical surface of the hatch. The upper estimate assumes that the activity is based on plateout on the 305' elevation floor. The dose rate on the 305' elevation due to this plateout ranges from 177 to 457 mr/hr. The lower and upper dose rate numbers make the same assumptions as those described for the surface activity numbers above. The major activities found at the 305' elevation are from Cesium and Lanthanum. Iodine 131 was also determined in significant amounts at the time of the measurement, however, essentially all of this Iodine 131 has since decayed.

3.3 Radiation Survey Through the R605 Penetration

To determine radiation and contamination levels in the basement area of the Containment Building, measurements were taken in penetration R605 which is approximately 2' above the water level in the Containment Building. This experiment was performed by removing the outer flange of an existing spare penetration and inserting a high range gamma survey instrument (teletector) into the penetration. Additionally, a photon spectrum from the water was measured through the penetration using a Ge(Li) detector.

The maximum dose rate measured inside the penetration was 31 R/hr. The 31 R/hr was extrapolated using analytical methods to determine that the dose rate at the surface of the water is approximately 123 R/hr.

From the Ge(Li) readings, it was determined that the major activity contributor in the water is Cesium 137 and the Cesium 137 in the sump water is present in amounts of approximately 366 microcuries per cubic centimeter. The radiation levels measured in the experiment are shown in Table 3 Appendix A. The energy levels measured through penetration R605 are shown in Table 4 Appendix A. The estimate of sump inventory resulting from the measurements is shown in Table 5 Appendix A.

3.4 Sump Water Sample

To plan and engineer a water cleanup system to treat the water remaining in the sump of the Three Mile Island Reactor Containment Building, a sample was taken from the water. To take this sample, the outer flange of penetration R401 was removed and a hole was drilled into the inner flange of that penetration. R401 is located approximately 2 feet above the water. Figure 5 Appendix B shows a cutaway view of the Reactor Building and the location of pen R401. A sample probe was then droppedinto the sump water and samples drawn from the top, middle and bottom of the approximately 7 feet of water existinginside the building. The sump sample was analyzed at Oak Ridge National Laboratory and it was determined that the sump water contains approximately 270 microcuries per millileter activity. The major constituents are Cesium 137, Cesium 134 and Strontium 89/90. The sample from the bottom of the water in the building also showed a greenish precipitate which was determined to be mainly Copper. Table 6 Appendix A shows the raiochemical analyses of the solutions and of the precipitate which was separated from the samples. Table 7 Appendix A shows the amounts of Uranium and Plutonium found in each of the samples.

In addition to drawing a sample through penetration R401, the 4" diameter painted steel plug cut from the inner flange of the penetration was removed and also sent to Oak Ridge for analysis. Activity present on the painted steel plug was found to be mostly Tellurium, with appreciable amounts of Cesium and Niobium also present. Table 8 Appendix A shows the results of the isotopic analysis of activity on the painted steel plug.

3.5 Gamma Scan Through Penetration R626

Prior to cutting the inner flange of penetration R626 (to insert a camera into the Reactor Building), gamma readings and sodium iodide detector readings were taken through the penetration (See Figure 5). The major purpose of this experiment was to obtain an estimate of plateout activity on the operating floor 347' elevation.

The gamma survey readings showed maximum dose rates inside the penetration of 50 mr/hr. Table 9 Appendix A shows the dose rates measured in the penetration. Using the information from this Table, it has been calculated that the dose rate at the 347' elevation is approximately 297 mr/hr.

The sodium iodide scan showed mostly Cesium and Barium/Lanthanum gamma peaks. The major energies detected by the sodium iodide detector are shown in Table 10 Appendix A. Using the energy levels determined by the sodium iodide measurements, estimates of the dose rates and plateout activity on the 347' elevation were made and these are also shown in Table 10. Cesium 134 was determined to be in the largest concentration and Cesium 137 was also found plated out in large amounts.

3.6 Radiation Mapping of the Number 2 Personnel Air Lock

Since the initial entry into the Reactor Building was to be performed through personnel air lock number 2, experiments were performed to determine the airborne activity, plateout activity and dose rates inside the air lock. The initial experiments consisted of taking an air sample through the air lock vent valve and by inserting radiation probes through a hole provided by removing a pressure gauge from the outside air lock wall. Plateout activity swipe samples will not be performed until an airlock entry is performed.

To perform air activity measurements an Eberline Ping-2A air monitor was attached to the air lock vent valve. This monitor was used to measure noble gas iodine and particulate activity in the air lock atmosphere. Additionally, a Marinelli gas sample bottle was inserted in the radiation monitor flow path to obtain a direct sample for independent verification of the activity measured by the Eberline Monitor. The air lock air sample showed detectable levels of Krypton 85, Iodine 131, and Xenon 131M. Krypton 85 in the air lock was found to be 2×10^{-3} microcuries per cubic centimeter. Iodine 131 was found to be present at approximately 1.5×10^{-8} microcuries per cubic centimeter. Zenon 131M was found to be present at approximately 8×10^{-6} microcuries per cubic centimeter. All these activities, i.e., Krypton 85, Xenon 131M and Iodine 131 are above their restricted area MPC. They are, however, several orders of magnitude lower than the activities for those isotopes inside the Reactor Building. These air sample results show that the inner air lock door seal is not perfectly tight and that some activity from the Reactor Building has found its way into the air lock, most likely due to diffusion.

To take the radiation survey readings inside the air lock, measurements with a gamma probe and with TLD chips were taken. The gamma probe was mounted on the end of a 3/8" diameter metal tube which could be inserted into the air lock all the way to the inner door. The calcium fluoride TLD chips were similarly mounted on a tube such that the probe could be inserted all the way to the inner door. The gamma probe readings were made by an Eberline PRM-3 dose rate meter. The readings taken inside the air lock showed that the maximum dose rate was about 100 mr/hr. Table 11 Appendix A shows the direct results of the readings and Figure 6 Appendix B shows the points in the air lock at which each reading was taken.

3.7 Hydrogen Recombiner Spool Piece Analysis

As one part of the experiment program to determine airborne activity and plateout contribution in the Reactor Building, Metropolitan Edison decided to remove the inlet spool piece to the hydrogen recombiner to determine what isotopes plated out during the operation of the recombiner. The recombiner operated for several days during the first two weeks to one month of the accident and as a result, it was thought to have contained plateout representative of that which occurs in the early stages of such an accident and also which may be representative of plateout that currently exists in the Reactor Building. The spool piece was removed and shipped to Oak Ridge National Laboratory for analysis. The analysis requested included gamma spectrum measurements on the spool piece, cutting the spool piece into two pieces and then performing beta/gamma spectrum measurements and elemental and compound analyses on the plateout on one of the pieces. The second piece is stored in TMI archives. The results from the analysis performed on the spool piece indicate the principle surface contamination is Cs-134/137 and Sr-89/90, surface contamination on unpainted carbon steel surfaces may be difficult to remove, and an upper bound estimate of the long term average surface concentration (above the sump exclusive of the primary system) is about $.5 \mu Ci/Cm^2$. This corresponds to a total activity in the reactor building of approximately 140 curies. The results of the analysis are shown on Table 12 Appendix A.

3.8 Remote Camera and Radiation Measurements Through Penetration R626

To obtain the first direct radiation measurements inside the building and the first remote viewing of the containment, Metropolitan Edison removed the outer flange and cut a hole in the inner flange of penetration R626.

The initial experiments planned through penetration R626 included camera insertion, radiation monitor insertion, including beta probes and gamma probes, a direct air sample, humidity reading, temperature reading and swipes taken off the Reactor Building wall and off the flange of the penetration. Subsequent experiments included insertion of various other radiation monitors into the penetration and insertion of a frame which had TLD's, film badges and dosimeters mounted at various locations throughout the frame. This frame was also used to determine the beta shielding effectiveness of several types of materials being contemplated for the suit to be worn by initial entry team members.

The camera inspection of the building showed no damage, showed some dust or dirt on the floor, and showed some condensation which resulted in rain in the Reactor Building. Difficulty in obtaining accurate and consistent gamma and beta radiation measurements was experienced. Part of the problem was the interference of Krypton 85 in the operation of the instruments used. The range of gamma and beta radiation measurements in the penetration is shown in Table 13. Swipes taken in penetration R626 showed mostly Cesium 137 and Cesium 134. Table 14 summarizes the results of these swipes. Air samples taken inside penetration R626 confirmed that Krypton 85 was the major isotope present inthe Reactor Building air. Further experiments were also performed as needed through penetration R626 to support the initial entry into the Reactor Building.

3.9 Air Lock Entry and Gamma Scan

The first step in the actual entry into the Reactor Building was entry into the number 2 personnel air lock. This entry consisted of opening the outer air lock door while leaving the inner door shut. This entry allowed swipe surveys inside the air lock, Ge(Li) scans through the inner air lock door[26] and viewing of the 305' elevation through the port hole on the inner air lock door. This entry also afforded the opportunity to inspect the outer door seals to determine if deterioration had occurred since the accident.

Prior to the entry, airborne activity in the air lock was removed by running the sample system hooked up to the air lock vent valve and discharging the activity into the plant ventilation system and through the plant stack.

When the air lock was entered, no smearable activity was found. The seals to the outer air lock door showed no damage due to radiation exposure and the visual inspection through the view port showed no indication of any structural damage. It should be noted that the view port glass was significantly discolored due to the effects of the radiation exposure.

The results of the Ge(Li) and NAI scans through the air lock door looking into the building and through the floor. Only three gamma energy levels were detected with sufficient counts to allow meaningful analysis using the

Ge(Li) detector. These were the 514 keV from ^{85}Kr, the 796 keV from ^{134}Cs and the 662 keV from ^{137}Cs. Table 15 Appendix A shows the counts per second observed for these gamma rays and the associated gamma ray flux.

With the NAI detector looking into the sump water and using spectral stripping to obtain the number of counts under the observed peaks at 514, 604, 795, 1365 and 661 keV, Kr85, Cs134 and Cs137 are indicated. The resulting counts per second and the associated fluxes are given in Table 16 Appendix A.

3.10 Additional Experiments

Additional experiments were performed to determine the suitability of protective clothing, telemetered dosimetry, and dose rate instruments. In addition, the reactor building atmosphere was analyzed for hazardous and toxic gases.[25]

The results of these additional experiments aided in the selection of the Zetex telemetered dosimetry, RO-7 and teletector as the dose rate instruments,[27] the Viking dry suit for protective clothing, [28] and the Bio Marine Bio Pac 60 for respiratory protection initially.

The results of the hazardous gas analysis are shown in table 17, Appendix A.

3.11 Summary

The Containment Assessment Program has produced valuable information which was absolutely necessary in planning the Reactor Building purge and entry. The results of the experiments have shown that the radiological environment inside the building is less hazardous than originally contemplated shortly after the accident. The results showed that manned entry into the Reactor Building was feasible and that manned entry could be accomplished with or without Reactor Building purge.

The information obtained from these experiments is also being utilized in planning the initial steps of the Reactor Building decontamination.

Accomplishment of the initial experiments contributed to an increased level of confidence that the Reactor Building environment could be determined through the conscientious use of a well thought out assessment program. This confidence allowed the use of the techniques learned to conduct further experiments as deemed appropriate and necessary to support the Reactor Building recovery. The

Containment Assessment Program was successful and provided the initial step toward the recovery of the Three Mile Island Unit 2 Generating Station.

4.0 Containment Entry Equipment

The equipment used by personnel for the first two Reactor Building entries consisted of lighting, respiratory equipment, protective clothing, communications, dosimetry and radiation instrumentation equipment. This section describes that type of equipment used and the rationale for its selection for use in the Reactor Building entries.

4.1 Lighting

For the Reactor Building entries it was determined that portable lighting was required because the Reactor Building lighting would not be energized for the initial entry. For subsequent entries, portable lighting was also determined to be a requirement if the Reactor Building lighting could not be energized or the Reactor Building lighting failed, after it was energized. The following types of portable lighting was selected:

1. Personnel lamps rated at 2 hours, Model 11759 by Rally Hardhat Throwaway Lights. The primary considerations for this application were weight, beam intensity and the time rating of operation for the light. The Rally light was selected for use because it provided an adequate beam and rating and was low in cost and disposable.

2. For floor lighting, a hand auxiliary flood lamp by Teledyne, rated for 5 hours of operation was selected. This piece of equipment was replaced by a Model 1095 Clear Modular Superlite by Ikelite Underwater Systems when it was determined by testing in the Unit 1 reactor building that the beam of the Teledyne lamp was too dim for use. In addition, the Superlite was designed for underwater use which facilitates decontamination if necessary. The Super lite had a two hour rating and was rechargeable.

4.2 Respiratory Equipment

Respiratory protection for the initial containment entry was to be provided by a Bio-Pac 60 manufactured by Bio Marine. This unit is a self contained closed circuit breathing apparatus for use in contaminated or oxygen deficient atmosphere because of the positive gas pressure in the face plate. In addition, this unit recirculates the major portion of the users exhaled gas, thus permitting the unit to be small, light weight and provide a 60 minute supply of breathing air. It was determined that a 60 minute air supply was desirable, even though the initial containment entry required less time, because of the increased air consumption by personnel working in adverse environments.

Prior to the first entry, a switch was made from the Bio Marine equipment to an MSA 401 unit. The reason for this switch in equipment was due to problems in NIOSH certification of the Bio Marine and the preference of the entry team members for the MSA 401 unit. The reason for this preference was that the MSA units were more comfortable because of the cool air supplied to the face on a one shot basis rather than the warm rebreathed air from the Bio Marine units. Although the MSA units have s smaller air supply than the Bio Marine Units (30 minutes vs 60 minutes) this was not considered to be a problem due to the short planned entry time of the first entry (15 minutes).

For the second entry, breathing air was no longer necessary because the krypton 85 in the atmosphere had been reduced to MPC level The only respiratory protection required for the second entry was a positive pressure battery operated filtered breathing air mask with a protection factor for particulate of 1000.

4.3 Protective Clothing

4.3.1 Initial Entry Attempt

For the initial Reactor Building entry attempt, where krypton-85 was present at a concentration of 0.80 μCi/cc, the primary means of protection for the whole body was an underwater heavy duty dry suit manufactured by Viking. This suit has the capacity to be maintained at positive pressure to prevent inleakage of radioactive material. Also, this suit was the only available off the shelf equipment which would provide sufficient density (250 mg/cm^2) to attenuate the anticipated beta radiation. In addition to the dry suit, a rain suit was used over the dry suit to provide a protective shield to prevent direct contamination of the dry suit.

For protection of the extremities from beta radiation, multiple pairs of standard rubber gloves and rubber fireman's boots were used.

The fireman's boots also provided anti skid protection for personnel.

4.3.2 Subsequent Entries

After the purge of krypton-85 from the reactor building, the need for whole body protection against beta radiation was reduced. Therefore, the dry suit was no longer required. For the next two entries whole body protection consisted of paper overalls, cotton overalls followed by a fireman's suit. For foot protection cloth shoe covers, three pairs of plastic disposable shoe covers followed by fireman's boots were used. Hand protection consisted of cotton surgeons gloves, latex glove taped to the paper coveralls, neopreme yellow gloves taped to the cotton overalls, neopreme yellow gloves taped to the fireman's jacket followed by lineman's gloves. For the head, a cotton surgeon's cap, respiratory mask, a cotton hood followed by a rain suit hood was used.

4.4 Communications

Communications for the Reactor Building entry consisted of Motorola MX 350 portable radios for use by each member of the entry team, as well as for use by each member of the standby team, a Micor Base/Repeater to be located outside the Reactor Building, a T1617M remote control console to be located in the control area and an antenna arrangement. The portable radio method was selected for use because it permitted more freedom of movement and depth of entry for the team members versus a system utilizing the existing plant communication system which would require each team member to be linked by cable to the communications system. Further, the use of this type of system would not permit the inner door of the personnel airlock to be closed.

The portable radios utilize Set-Com push-to-talk elbow switches. The head sets initially utilized bone conduction cranial mirophones and ear receivers. This system was selected to be compatible with the head gear and respiratory equipment to be worn by the team members.

For the second Reactor Building entry, a microphone was placed on the speaking diagram of the mask. This sytem provided clearer communications between the entry team members and the command center.

The transmitter power of the portable radio was five watts with a battery life of eight hours based on 10% talking time, 10% listening time and no conversation 80% of the time. The base station Micro Base/Repeater has a transmitter power of 75 watts. It is linked by cable to the antenna system and to the remote control console in the command center.

The communication system uses two channel transmission with the capability of using either channel. If one channel fails, the second channel can be used. The system operates in the 450MHz band of frequencies as approved by the FCC.

Since the radio signals can not penetrate the Containment Building, an antenna was inserted through penetration R-626 located at elevation 347'. This antenna enabled radio signals to be transmitted to/from the Reactor Building. There were no signal transmission difficulties encountered between the 305' and 347' elevation floor because of the grating in the floors.

To provide radio communication in the personnel air lock #2, an antenna was clamped to the portal of the outer door of the air lock. A cable linked the two antennas to the Micor Base/Repeater.

The control console was equipped for use with either one or two operators. The operator has the flexibility of using the control console as a base station or as a repeater to permit the team members to communicate with each other.

Prior to use for the entries, the system was tested inside the Unit 1 Reactor Building.

4.5 Dosimetry

Personnel dosimetry for the entry team members was provided in the form of telemetered dosimetry, self reading digital dosimeters and thermoluminescent detectors/film badges.

Telemetered dosimetry was provided by a Xetex Model S03 Telemetry System. This sytem consisted of two central receiver units, five portable dosimeter/transmitter units per central receiver and their associated antenna systems. A dosimeter/transmitter unit is carried by each member in the Reactor Building. Each 1 millirem unit of dose accumulated activates the coded transmitter in the unit. This signal is received at the central station, decoded to identify the unit and recorded on a digital counter.

Self reading digital dosimeters were also provided for each entry team member. During the entries, each entry team member was required by the control area to call out his accumulated dose. These units are similar to the telemetered units described above but have an LED readout instead of a transmitter.

To determine the radiation dose received to any part of the whole body and extremities, multiple TLD's were used. This provided a means of identifying directionality of the radiation fields and monitoring the radiation doses to extremities which would come in contact with radiative surfaces. TLD locations are shown on figure 7 Appendix B.

4.6 Instrumentation

Two types of radiation detection instrumentation were used for the Reactor Building entries, an Eberline Model 6112 Teletector gamma dose rate meter and an Eberline RO-7 high range Beta survey meter. The Teletector was selected because it possessess the ability to have its probe extended thirteen feet from he person using this radiation detector thus permitting the identification of radiation fields ahead of the entry team personnel. This radiation meter also possesses the ability to detect gamma radiation very accurately. The RO-7 survey meter was used primarily for high range Beta ray measurements. This type of radiation instrument was found to be an accurate instrument for the measurement of beta radiation. This was a prototype instrument developed by Eberline for use at TMI.

4.7 Video

To provide a visual record of the Reactor Building entries, a 35 mm camera was used. The camera system used consisted of a Nikonos III underwater camera using a 35 mm lens, an automatic flash unit and color print film. The Nikonos III was selected because it is a sealed unit designed for underwater use which would facilitate decontamination and previous experience with this camera under radiation conditions in the TMI-II Auxiliary Building. The automatic flash unit is required due to the low light intensity in the Reactor Building. A 35 mm lens was selected for use because it offers greater depth of field, a wider picture area and requires less light for a given condition. Kodacolor-2 (ASA-100) color print film was selected for use. To prevent film fogging, the film was overexposured by 1 f-stop.

Color Video cameras were considered for use in the initial entries but were ruled out due to weight considerations.

4.8 Control Envelope

The No. 2 Personnel Air Lock Contamination Control Facility consists of temporary barrier partition walls and ceiling near the No. 2 personnel air lock to provide a controlled access path and to prevent the spread of radioactive contmination when the containment is entered via the lock. The facility was provided with supporting services including ventilation, electrical power, and lighting required to perform its function.

Temporary barrier walls and ceiling were added to divide the area near the No. 2 personnel air lock into contamination control areas. The barriers were constructed of gypsum panels on steel channel framing to provide rigid, nonflammable partitions. The new barrier partitions were coated with an epoxy painting system to permit ease of decontamination if the need arises, as are the permanent walls, floor, and ceiling in the area. All seams, joints and penetrations in the facility structure are sealed to prevent the uncontrolled flow of contaminated air. The arrangement of the area is shown on figure 8 Appendix B.

The facility was ventilated by the existing HVAC system in the area, which was rebalanced to provide a positive flow of air from clean areas to areas of progressively higher contamination within the facility.

4.9 Summary

The equipment selected provided more than adequate personnel protection and performed reasonably well. As with all systems which are prototypes, there were deficiencies which should be corrected, as discussed below.

Communications: there is a need for a NIOSH approved SCBA with an integral microphone which can be adapted to conventional two way radio communication systems. For the initial entries we had to adapt conventional equipment to meet our needs.

Protective Clothing: The Viking Dry suit is not suitable for use in warm environments. There is a need for a self-contained, self-cooled light weight system which could be worn in contaminated environments.

Overall all equipment worked well with the exceptions noted above. The equipment is adequate for future reconnaissance and limited maintenance. Purging of the Reactor Building atmsophere greatly reduced the protective clothing requirements and went a long way toward easing the problems with the protective clothing by eliminating the need to wear the Viking Dry Suit.

5.0 Training

Training for the initial entry into the TMI-2 Reactor Building consisted of over one hundred hours of classroom training and fifty hours of hands-on training inside the Unit 1 Reactor Building and the Unit 2 Auxiliary Buildings.

An outline of the training program is shown in Table 18, Appendix A.

In addition to the classroom and hands-on familiarization training, with equipment and inside the Unit 1 Reactor Building with the lights out, the initial entry personnel were given extensive pre-entry and post-entry physical exams at Hershey Medical Center.

For the second entry, 2 hours of model review and 2 hours of task plan review and equipment familiarization along with standard RWP training were all the training required. The physical examinations for performing work in a radiation area were deemed sufficient for the second entry.

The survey result of the initial entry into the Reactor Building indicated that the radiological environment was equivalent to that inside the Unit 2 Auxiliary Building and therefore the extensive training and physical examinations were no longer required.

6.0 Entry

On July 16, 1980, the inner air lock door to the Reactor Building was successfully opened in preparation for entry into the Reactor Building. During the door opening exercise preliminary radiation measurements were taken just inside the building. Gamma radiation levels ranged from 300mR/hr over the access ramp to 700 mR/hr adjacent to the elevator shaft.

On July 23, 1980, William Behrle and Michael Benson of the Metropolitan Edison Company successfully entered the Three Mile Island Unit 2 Reactor Building, 15 months 24 days after the March 28, 1979 accident. During the twenty minute stay inside the reactor building the two men were able to take twenty-nine photographs, six one hundred square centimeter smears, perform a general area beta/gamma survey and the removal of a five gallon plastic bucket from the reactor building.

A preliminary analysis of the smears taken was performed and the results are included in Table 19 Appendix A. The smear samples, bucket and shoe covers worn by he entry personnel were sent to the Department of Energy in Idaho for analysis.

The general area survey indicated gamma radiation levels of 500 to 700 mR/hr and beta radiation levels of 1 Rad/hr.

Each individual received a whole body gamma exposure of approximately 220 millirem with no beta skin exposure. Table 20 Appendix A shows the personnel exposure to each of the entry personnel.

The transcript of the communications from this entry is in Appendix C.

A second entry was made into the Reactor Building on August 15, 1980, by William Behrle, Michael Benson, Marty Cooper of Metropolitan Edison Company and Sam Griffith of Nuclear Support Services.

Bill Behrle and Marty Cooper spent twenty-three minutes in the building and Mike Benson and Sam Griffith spent thirty-eight minutes in the building. During the stay in the building the entry personnel removed radiation monitor HP-R211, took sixty-seven photographs, twelve one hundred square centimeter surface smears, two scrape samples and deposits on the grade (305') elevation floor, removed one twelve inch by sixteen inch painted plate, two pieces of reflective insulation (1C-1B-05 and 1C-2B-02), a carbon steel funnel and a sample of discolored glass from the Reactor Building.

In addition, two experiments were performed along with the general area survey. The first experiment was performed to determine the amount of loose contamination which could be removed using a maslin cloth swipe and the second experiment measured the beta to gamma ratios at floor level and again at three feet off the floor.

The general area survey on the operating elevation 347' 6" indicated a gamma radiation level of one hundred to two hundred millirem/hour and a beta level of two hundred and fifty millirads per hour to one rad per hour.

The preliminary results of the smear samples are shown on Table 21 Appendix A.

During the entire entry the highest whole body exposure to the entry personnel was less than four hundred millirem. A detailed summary of the exposures is shown on table 22 Appendix A.

The transcript of the conversations from this entry are part of Appendix C.

A comprehensive radiation survey map incorporating the survey results from the first two entries is shown on Figures 9 and 10 Appendix B, and Tables 23 and 24 Appendix A.

In addition to this figures 11 and 12 of Appendix B and Tables 19 and 21 of Appendix A show the locations of the smears and samples removed from the Reactor Building.

Photographs taken during the entries are shown in Appendix D. Appendix F is the procedure used for entries into the reactor building.

7.0 Conclusion

The entries into the TMI-2 Reactor Building concluded the responsibilities of the TMI-2 Containment Assessment Task force. The most significant achievements of this accomplishment have been to break down the psycological barrier of the unknown environment inside the Unit 2 Reactor Building and to demonstrate that the clean up of the TMI-2 accident is well within the existing technology of the Nuclear Power Industry.

Given timely rate relief or another source of funds and swift, prudent decision making by the regulatory agencies, TMI-2 can be defueled, decontaminated and recommissioned. The cost and time frame for the clean up at TMI can be greatly reduced if the above action is taken.

8.0 References

1. GPU Service Corp. Memo, R. F. Wilson to R. C. Arnold, dated 5 June 1980.

2. TDR-112 Revision 0, "Post Accident Sampling and Analysis of the TMI-2 Reactor Building Atmosphere", dated 5 May 1980.

3. TDR-069 Revision 0, "Containment Water Activity from Gross Gamma Measurement in Penetration R-605", dated 13 September 1979.

4. TDR-133 Revision 0, "Equipment Hatch Radiation Measurements", dated 25 July 1979.

5. TDR-120 Revision 0, "Theoretical Estimate of Cs-137 Concentration in the Sump Water based on Measurements thru Penetration R-605", dated January 1980.

6. TDR-072 Revision 0, "Post Accident Radioactive Plate-out Measurements of the Hydrogen Recombiner Spool Piece", dated 30 September 1980.

7. Oak Ridge National Laboratory Letter to Dr. Ben Rusche Metropolitan Edison Company at TMI from R. E. Brooksbank ORNL, "Reactor Building Sump Water Analysis", dated 12 September 1979.

8. TDR-073 Revision 0, dated 4 February 1980, "Deposition Activity at the 347'6" Elevation based on Gamma Measurements in Penetration R-626."

9. TDR-072 Revision 0, "Preliminary Measurements of Radiological Conditions inside Personnel Airlock No. 2", dated 19 October 1979.

10. Babcock & Wilcox Task 26 - Containment Access TMI-2 in Containment Surveillance Program BAW-1614, dated February 1980.

11. "Gamma Ray Measurements through the inner door of the Personnel Air Lock No. 2" by C. D. Thomas SAI, T. Fritz Bechtel Power Corp., Inc. and J. Tate GAI on March 14, 1980.

12. GPU Service Corp. Memo G. T. Steuerwald to J. W. Langenbach "Reactor Building Lighting Status", dated 12 October 1979.

13. NRC Order CLI-80-25 dated 12 June 1980, Approval to purge TMI-2 Reactor Building.

14. Metropolitan Edison Company Letter GQL 1416, R. C. Arnold to R. Vollmer NRC dated 13 November 1979 Requesting Permission to Purge TMI-2 Reactor Building Atmosphere of Kr-85 gas.

15. GPUSC - J. Langenbach Presentation to the NRC September 1979 Stating Met-Ed Plan to enter Reactor Building.

16. Met-Ed letter TCC 123, dated 21 March 1980, R. F. Wilson to J. T. Collins.

17. NRC Letter NRC/TMI-80-048, dated 25 March 1980, J. T. Collins to R. C. Arnold.

18. Metropolitan Edison Company letter TLL 166, dated April 8, 1980, G. K. Hovey to J. T. Collins.

19. Metropolitan Edison Company letter TLL 185, dated April 15, 1980, G. K. Hovey to J. T. Collins

20. Metropolitan Edison Company letter TLL 210, dated April 30, 1980, G. K. Hovey to J. T. Collins

21. NRC letter enclosing IE Information Notice 80-19, dated May 6, 1980.

22. NRC letter NRC/TMI-80-088, dated May 16, 1980, J. T. Collins to R. C. Arnold

23. Metropolitan Edison Company letter TLL 343, dated July 15, 1980, G. K. Hovey to J. T. Collins

24. NRC letter NRC/TMI-80-113, dated July 22, 1980, J. T. Collins to R. C. Arnold

25. TDR 162, "Post Accident Sampling and Hazardous Gas Analysis of TMI-2 Reactor Building Atmosphere for Support of Reactor Building Entry", dated September 24, 1980.

26. Gamma Ray Measurements through the Inner door of the Personnel Airlock, by Jim Cline, SAI, Tim Fritz Bechtel, Jackie Tate GAI.

27. TDR 163, "Krypton Response of the Containment Entry suit and Breathing Air system utilizing Penetration R-626", dated September 8, 1980.

28. Metropolitan Edison Company Memo TMI-II-R-12300 dated May 19, 1980, P. Ruhter to Distribution.

9.0 TABLES

APPENDIX A

TABLE 1

THREE MILE ISLAND
UNIT 2
REACTOR BUILDING RADIATION LEVELS

	REFERENCES	ESTIMATED LEVELS mR/hr gamma — 7/79 BECHTEL REPORT (1) Projected to 12/1/79	BECHTEL REPORT UPDATE (9/79) (1) Projected to 12/1/79	PENETRATION EXPERIMENTS (1) 12/79	INITIAL ENTRY (2) 7/23/80
LOCATION	Operating Level 347'6" El.	320,000 to 2,400,000	760 to 160,000	2,400	100 to 150
	Entry Level 305' El.	7,000 to 46,000	3,100 to 6,800	1,300	500 to 700
	Basement 286'6"	160,000	160,000	125,000	90,000

(1) Water in sump - Kr-85 not removed.

(2) Water in sump - Kr-85 removed. Max γ contribution from Kr-85 300 mR/hr 347' elevation and 100 mR/hr 305' elevation.

TABLE 2

GROUP 2 REACTOR BUILDING GAS GRAB SAMPLE DATA
FROM MODIFIED SYSTEM WITH NO CHANGE IN ANALYTICAL METHOD

		KRYPTON-85 CONCENTRATION (uCi/cc)	
		Sample Point Elevation	
Sample No.	Date	469'	354'
18648	9/8/79	7.8×10^{-1}	
19709	9/18/79	9.6×10^{-1}	
20503	9/26/79	7.8×10^{-1}	
20504	9/26/79	7.1×10^{-1}	
20498	9/26/79	8.4×10^{-1}	
20582	9/26/79	5.2×10^{-1}	
21299	10/3/79	9.9×10^{-1}	
23825	10/31/79	9.1×10^{-1}	
24455	11/8/79		7.1×10^{-1}
24458	11/8/79	6.8×10^{-1}	
24967	11/14/79		8.3×10^{-1}
24970	11/14/79	7.9×10^{-1}	
26113	11/28/79		9.3×10^{-1}
26692	12/5/79		6.3×10^{-1}
26695	12/5/79	1.5×10^{0}	
27883	12/20/79	9.1×10^{-1}	
28814	1/3/80		6.1×10^{-1}
28816	1/3/80	8.2×10^{-1}	
29292	1/9/80	8.2×10^{-1}	
29293	1/9/80		6.1×10^{-1}

AVERAGE VALUE	0.86	0.72
STANDARD DEVIATION	0.22	0.12

AVERAGE VALUE OF DATA FOR BOTH SAMPLE POINTS 0.82

STANDARD DEVIATION OF DATA FOR BOTH SAMPLE POINTS 0.20

Table 3

PENETRATION R605 RADIATION SURVEY RESULTS

POSITION	DOSE RATE (R/hr)
1	27
2	30
3	31
4	16
5	3
6	.800
7	.490
8	.300
9	.220
10	.180
11	.130
12	.100
13	.080
14	.060
15	.085

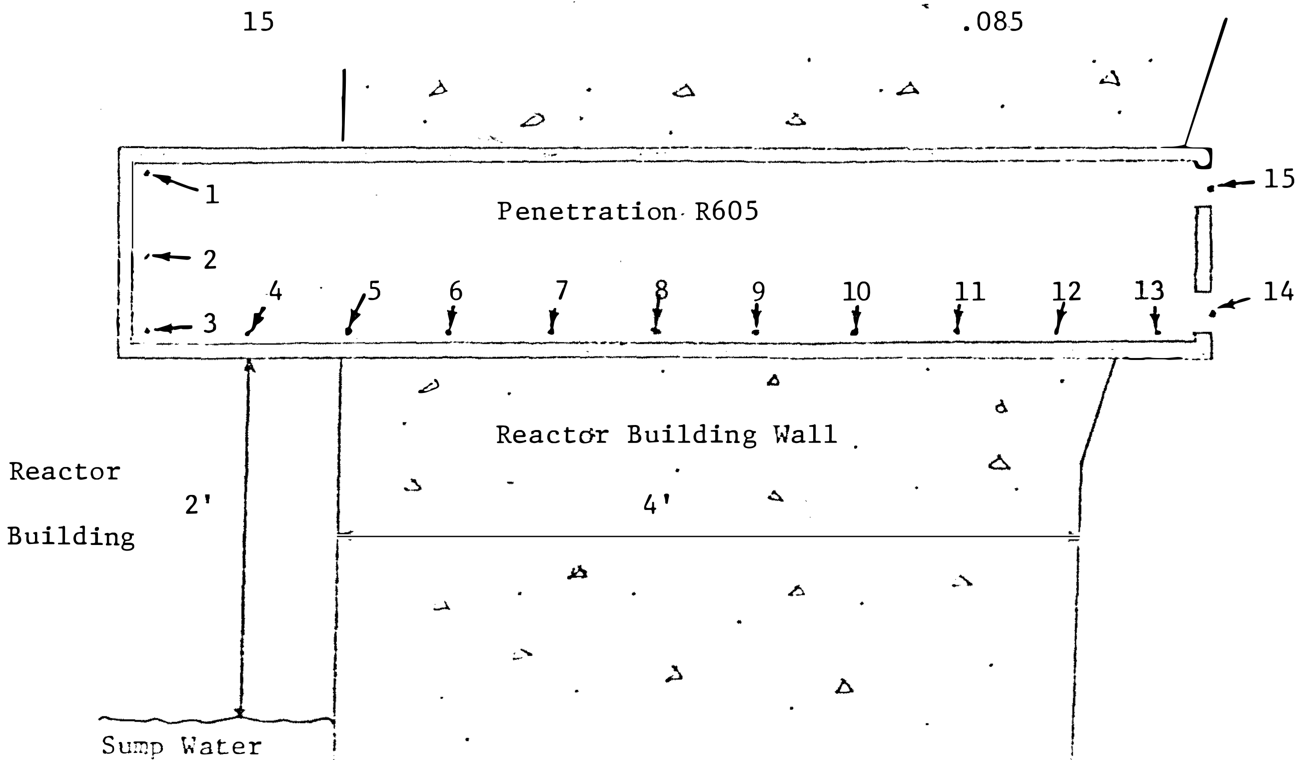


Table 4

FLUXES OBSERVED THROUGH THE R605 PENETRATION

Energy (keV)	(γ/cm^2/sec)
131-I	
364.5	51.
636.0	7.
134-Cs	
563.2	74.
569.3	161.
604.7	1214.
795.8	1454.
801.8	88.
1038.4	24.
1167.8	54.
1365.2	135.
136-Cs	
340.6	10.
818.5	5.
1048.1	24.
1235.3	27.
140-La	
328.8	35.
487.0	114.
537.4	29.
752.0	13.
815.9	3.
868.0	24.
919.6	9.
925.2	26.
1596.5	1228.
2348.1	17.
2521.7	82.
2547.5	2.
137-Cs	
661.6	4809.
85-Kr	
514	

Table 5

PREDICTED SUMP INVENTORY JUNE 20, 1979

ISOTOPE*	ACTIVITIES (μCi/cm^3)
XE-131M	7.64E-01
XE-133M	4.74E-15
XE-133	1.09E-10
I-129	5.93E-05
I-131	2.51E+01
I-132	1.74E-05
I-133	1.20E-22
SR-89	2.97E+02
SR-90	9.37E+00
TE-129M	2.40E+00
TE-129	1.54E+00
TE-131M	7.91E-18
TE-131	1.44E-18
TE-132	1.69E-05
BA-137	1.45E+02
BA-140	6.17E+00
RU-103	5.68E+01
RU-106	9.21E+00
LA-140	7.10E+00
CE-141	6.95E+01
CE-143	4.92E-15
CE-144	6.75E+01
PR-143	1.51E+01
PR-144	6.75E+01
EU-155	1.78E-01
EU-156	5.31E-01
ND-147	4.22E+00
NB-95M	2.78E+00
NB-95	1.02E+02
MO/TC99	3.06E-06
Y-89M	2.67E-02
Y-90	9.37E+00
Y-91	2.86E+01
CS-134	4.70E+01
CS-135	5.52E-01
CS-136	1.91E+00
CS-137	1.54E+02
ZR-95	1.28E+02
AG-110	5.77E-02
TOTALS	1.26E+03

*Tritium (H-3) activity in the sump is estimated at 0.5 to 1.5 μCi/cm^3 based on normalization to the 6-19-79 RCS sample using Cs-137 as a queing isotope.

Table 6

RADIOCHEMICAL ANALYSES OF THREE SOLUTIONS

(μCi/ml at 0800, 8/28/79)

Location of Sample

Isotope	Top	Middle	Bottom
^{137}Cs	176	179	174
^{134}Cs	40	40	39.6
^{140}La	0.09	0.078	0.14
$^{89+90}Sr$	46.3	43.5	44.9
^{3}H	1.03	1.05	1.01
^{129}I	0.79[a]	0.080[a]	0.076[a]
^{131}I	0.012	0.012	0.013
^{90}Sr	2.70	2.90	2.83
Activity in scavenging precipitation with $Pr(OH)_3$			
^{95}Zr	-----	0.0030	0.0025
^{95}Nb	0.0021	0.0030	0.0099
^{103}Ru	0.005	0.0050	0.0071
^{106}Ru	0.0039	0.0072	0.0099
^{113}Sn*	-----	-----	0.0016
^{125}Sb	0.012	0.015	0.017
^{129}Te	-----	-----	0.035
^{134}Cs	0.0066	0.0059	0.0042
^{137}Cs	0.029	0.028	0.0175
^{141}Ce	-----	0.00047	0.0019
^{144}Ce	-----	0.0046	0.0080
^{140}La	0.036	0.028	0.052
^{140}Ba	-----	0.0038	-----
Gross a	3.4 ± 1.6[b]	1.2 ± 1.3[b]	5.4 ± 2[b]

[a]Units are μg/ml [b]Units are dpm/ml *Tentative identification

Table 7

SOLUTION ISOTOPIC ANALYSIS

Sample	Top	Middle	Bottom
U, ppb	7	13	28
234, %	0.021	0.014	0.021
235, %	1.98	1.34	2.04
236, %	0.058	0.036	0.066
Pu, ppb	0.010	0.011	0.033
239, %	89.1	89.4	89.8
240, %	8.5	8.4	8.1
241, %	2.3	2.1	2.0
242, %	-----	-----	Assume 0.1

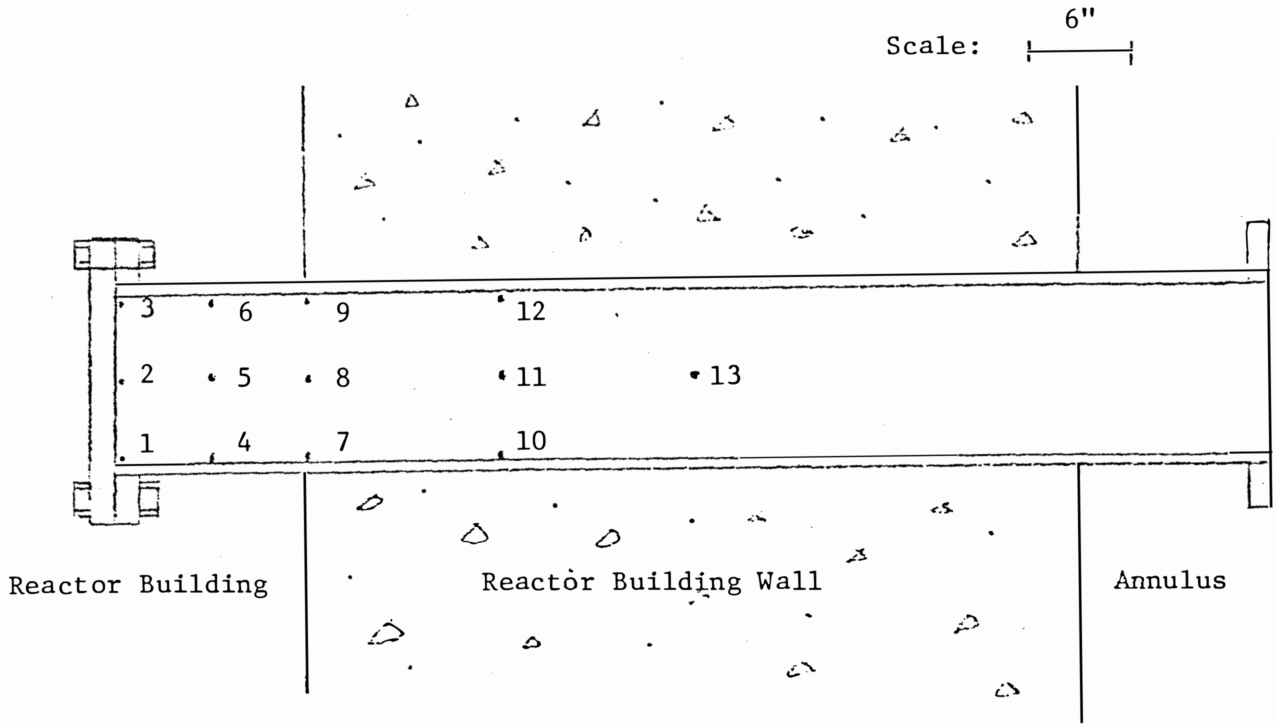
Table 8

PAINTED STEEL PLUG (μCi TOTAL AT 0800, 8/29/79)

Isotope	μCi
^{58}Co	0.032
^{60}Co	0.01
^{95}Zr	0.09
^{95}Nb	1.7
^{103}Ru	0.58
^{106}Ru	0.42
^{110m}Ag	0.080
^{113}Sn	0.24
^{124}Sb	0.005
^{125}Sb	0.45
^{127m}Te	7.8
^{129m}Te	23.6
^{125m}Te	0.5
^{131}I	0.33
^{134}Cs	0.47
^{137}Cs	2.07
^{140}Ba	-----
^{140}La	0.019
^{141}Ce	0.057
^{144}Ce	0.24

Table 9

PENETRATION R626 GAMMA DOSE RATE SURVEY RESULTS



Position	Dose Rate (mR/hr) Sept. 9, 1979	Dose Rate (mR/hr) Oct. 4, 1979
1	30	27
2	35	35
3	35	32
4	40	45
5	50	50
6	45	47
7	15	35
8	25	40
9	15	32
10	1.5	3
11	1	3
12	1	3
13	0.6	-

Dose Rates Measured Using Teletector

9/9/79 - Recorded by John Shoemaker, Frank Nichols (Rad Services), and Ed Walker (Bechtel).

10/4/79 - Recorded by Ed Walker (Bechtel).

Table 10

SURFACE ACTIVITY AT ELEVATION 347

E_γ (keV)	Isotope	D_{di} (mR/hr)	σ_i (μCi/cm^2)
514	Kr-85	0.008	
563 569 604	Cs-134	0.035	1.53
662	Cs-137	0.139	5.76
796 801	Cs-134	0.071	2.15
1168	Cs-134	0.019	17
1368	Cs-134	0.027	11
1596	Ba/La-140	0.013	0.14

D_d = 0.312 mR/hr σ = 37.58 μCi/cm^2

Table 11

AIRLOCK GAMMA SURVEY DATA

POSITION[d]	DISTANCE FROM FRONT BULKHEAD (ft)	GM/PRM-2 (mR/hr)	CaF2 - TLD[e] 0° (mR/hr)	90°	180°	270°
1	0	30	52.8	40.6	29.2	41.0
2	0.5	60	60.2	71.2	61.0	56.9
3	1.0	80	80.5	(b)	82.1	75.2
4	1.5	60				
5	2.0	-	80.0	-	71.1	-
6	2.5	50				
7	3.0	-	100.9	-	120.5	-
8	3.5	40				
9	4.0	-	60.7	-	74.2	-
10	4.5	20				
11	5.0	-	58.0	-	66.6	-
12	5.5	19				
13	6.0	-	54.1	-	51.6	-
14	6.5	15				
15	7.5	-	84.1	-	(c)	-
16	7.5	9				
17	8.5	8				
18	9.5	9				
19	10.5	8				
20	0.0	60				
21	0.0	50				
22	0.0	40				
23	~1.0	100				
24	~2.5	100				

(b) TLD chip was broken upon removal from airlock.

(c) TLD chip was lost upon removal from airlock.

(d) See Figure for location of dose points.

(e) Tip of the TLD rod touching front bulkhead during measurement time.

TABLE 12
Gamma-Ray Spectral Analysis Of Spool Piece Sections
1B, 2B and 3B As Of 28 January 1980

Radionuclide	Activity[a] (uCi)	Concentration (uCi/cm^2)
	Section 1B (90 cm^2)	
Nb-95	0.023	2.5×10^{-4}
Cs-134	5.5	0.061
Cs-137	27.5	0.30
	Section 2B (90 cm^2)	
Nb-95	0.011	1.2×10^{-4}
Cs-134	4.1	0.046
Cs-137	21.	0.23
	Section 3B (130 cm^2)	
Nb-95	0.026	2.0×10^{-4}
Cs-134	6.50	0.050
Cs-137	32.	0.25

[a]Uncertainties Are 6% For Cs-134/137 And 20% For Nb-95 Values

Gamma-Ray Spectral Analysis Of The Open Ends
Of The "As Received" Spool Piece And Of The
Spool Piece Gasket As Of 28 January 1980

Radionuclide	End With 1.75cm Flange (uCi)	End With 2.0cm Flange (uCi)	Gasket From 1.75cm Flange (uCi)
Nb-95	0.05	0.04	0.001
Cs-134[a]	7.5	8.5	0.63
Cs-137[a]	36.	43.	3.2
Ru-103	0.05	(No Value)	0.001

[a]Uncertainties Range From 6 To 30% For The CS-134/137 Values

TABLE 12
Special Analysis Of Leach Solutions Used
To Decontaminate Spool Piece Section 1B
As Of 28 January 1980

Radionuclide	Activity Measured In Leaching Solutions: 50% HNO_3 (uCi)	50% HCl (uCi)	3:1 $HCl:HNO_3$ (uCi)	Activity Leached (uCi)	Concentration Leached (uCi/cm^2)
Sr-89	7.8	3.4	2.8	14.0	0.156
Sr-90	6.1	2.6	2.2	10.9	0.121
Cs-134	0.81	2.4	2.2	5.41	0.060
Cs-137	4.1	12.0	11.0	27.1	0.301
Te-127/129	0.081	0.32	0.093	0.494	0.006
Totals	18.9	20.7	18.3	57.9	0.643
Percentage Of Total Surface Activity	32.6	35.8	31.6	100.0	

Special Analysis Of 1-1/4 Grams Of Rust
Removed From 60 cm^2 Of Spool Piece Section 1B
As Of 28 January 1980

Radionuclide	Activity (uCi)	Concentration (uCi/cm^2)
Sr-89	6.3	0.11
Sr-90	4.9	0.086
Cs-134	0.36	0.0063
Cs-137	1.8	0.032
Te-127/129	0.53	0.0093
Co-60	8.0×10^{-4}	1.4×10^{-5}
Zr-95	3.6×10^{-3}	6.5×10^{-5}
Nb-95	8.2×10^{-3}	1.4×10^{-4}
Ru-103	8.2×10^{-3}	1.5×10^{-4}
Ru-106	7.3×10^{-2}	1.2×10^{-3}
Sb-125	9.8×10^{-3}	1.7×10^{-4}
Ce-144	2.4×10^{-2}	4.3×10^{-4}

Table 13

DIRECT RADIATION MEASUREMENT RESULTS (PENETRATION R626)

GAMMA READINGS

TELETECTOR: Gamma Dose Rate = 300 mR/hr

EBERLINE RMS-2: Gamma Dose Rate = 350 mR/hr

SELF-READING DOSIMETER: Gamma Dose Rate = 375-525 mR/hr

FILM BADGE: Gamma Dose Rate = 350-950 mR/hr

TLD: Gamma Dose Rate = 600-925 mR/hr

BETA READINGS

PARALLEL PLATE IC: Beta Dose Rate = 390 Rads/hr

FILM BADGE: Beta Readings = 21-33 Rads/hr

TLD: Beta Readings = 20-44 Rads/hr

BETA DOSE CALCULATIONS: Based on TLD/Film Badge Readings = 100-350 Rads/hr

Battelle Method = 160 Rads/hr
NCRP-44 Method = 205 Rads/hr
NRC Reg. Guide Method = 290 Rads/hr

Table 14

PLATEOUT SWIPE ISOTOPIC ANALYSIS

Cesium 137	$2 \times 10^{-1} \rightarrow 4 \times 10^{-1}$ μCi/swipe
Cesium 137	$4 \times 10^{-2} \rightarrow 7 \times 10^{-2}$ μCi/swipe
*Strontium 89	$1 \times 10^{-1} \rightarrow 7 \times 10^{-2}$ μCi/swipe
*Strontium 90	$3 \times 10^{-2} \rightarrow 8 \times 10^{-2}$ μCi/swipe
Niobium 95	$9 \times 10^{-4} \rightarrow 3 \times 10^{-3}$ μCi/swipe
**Cobalt 58	$9 \times 10^{-5} \rightarrow 2 \times 10^{-4}$ μCi/swipe
Cobalt 60	$9 \times 10^{-5} \rightarrow 2 \times 10^{-4}$ μCi/swipe

*Not detected on wall or penetration flange swipes.

**Not detected on floor swipes.

Table 15

RESULTS OF Ge(Li) SCANS

Detector Position Counter Clockwise Angle From Straight In	^{137}Cs (662 keV)		^{85}Kr (514 keV)		^{134}Cs (795 keV)	
	Count Rate (c/s)	Flux $\gamma/cm^2/sec$	Count Rate (c/s)	Flux $\gamma/cm^2/sec$	Count Rate (c/s)	Flux $\gamma/cm^2/sec$
0.	0.16±0.16	2.2±2.2	3.6±0.16	45±2.0	0.12±0.10	2.7±2.2
18.	3.76±0.49	52.±6.7	4.9±0.51	61.±6.3	0.12±0.25	2.8±5.4
20.	7.36±0.62	102.±8.6	9.3±0.62	115.±7.7	2.05±0.03	45.±7.3
22.5	11.84±0.72	164.±9.9	9.9±0.64	123.±8.0	2.38±0.36	52.±7.9
25.	5.60±0.55	78.±7.6	5.9±0.53	74.±6.6	1.06±0.30	23.4±6.5
27.	5.16±0.54	72.±7.6	6.8±0.53	84.±6.5	1.27±0.30	28.1±6.5
30.	3.76±0.19	52.±2.6	3.8±0.16	48.±2.0	0.68±0.11	15.1±2.4
60.	0.14±0.36	1.9±5.0	0.30±0.30	3.8±3.8	--	--
Looking Straight Up	0.574±0.16	7.98±2.2	4.49±0.16	56±2.0		

Table 16

RESULTS OF NaI OBSERVATION OF SUMP WATER

Energy (keV)	Nuclide	Detection Efficiency (c/s)/(γ/cm^2/sec)	Count Rate (c/s)	Flux (γ/cm^2/sec)
514	^{85}Kr	0.50	59.6	236.
604	^{134}Cs	0.45	211.3	934.
795	^{134}Cs	0.38	197.5	1034.
1365	^{134}Cs	0.29	22.4	154.
661	^{137}Cs	0.43	637.8	2990

APPENDIX A

TABLE 17

GPU SERVICE CORPORATION

Industrial Hygiene Field Sampling Record

Plant: Met-Ed, TMI, Unit #2 — Date: 4-3 and 4-80

Area or Unit: Reactor Building, Containment — By: R. L. Witzke

Material(s): Carbon Monoxide, Ozone, Hydrogen Sulfide, Carbon Monoxide

Operating Comditions: -0.5 psig — Instrument: Bendix/Gastec Detector Tubes, MSA Detector Tubes

Sample No.	Time	Description	Concentration
			Carbon Dioxide %
	4-3-80		
CO_2-1	13:41	Inside R-626 glove box. Direct sample of continment	N.D. to 0.013
			~~Ozone ppm~~
O_3-1	14:08	Same as above	N.D. to 0.1
			Hydrogen Sulfide ppm
H_2S-1	14:26	Same as above	N.D. to 2.5
			Carbon Monoxide ppm
CO-1	13:58	Same as above	Void*
CO-2	14:35	Same as above	Void*
	4/14/80		Carbon Monoxide ppm
CO-3	16:17	Same as above	N.D.**
CO-4	16:34	Same as above	N.D.**

N.D. = Not Detected
*Hydrogen interference with the indicator media for the Bendix, carbon monoxide detector tube.

**MSA, Part No. 47134 carbon monoxide detector tube.

APPENDIX A

TABLE 17

GPU SERVICE CORPORATION

Industrial Hygiene Field Sampling Record

Plant: Met-Ed, TMI, Unit #2 Date: 4-3-80

Area or Unit: Reactor Building, Containment By: R. L. Witzke

Material(s): Oxygen

Operating Conditions: Instruemnt: Edmont-Wilson Model 60-400

Sample No	Time	Description	Concentration Oxygen %
O_2-1	13:54	Inside R-626 glove box. Direct sample of containment air	12.9*
O_2-2	13:56	Same as above	12.6*
O_2-3	14:13	Same as above	12.9*
O_2-4	14:27	Same as above	13.0
O_2-5	15:10	Same as above	12.8
			Hydrogen %
H_2-1	13:54		.7%*
H_2-2	13:56		.7%*
H_2-3	14:13		.7%*
H_2-4	14:27		.7%*
H_2-5	15:10		.5%
H_2-6	15:13		.6%
		*Corrected for relative humidity at 90% = 36 mm Hg as sampled.	

Appendix A
Table 17

Metropolitan Edison Company Three Mile Island Unit 2			
Sample No.	Time/Date	Description	Results μCi/ml
37669	1907 4/15/80	Penetration R-626 Reactor Building Particulate Sample	Cs-134 $6.45E^{-10}$ Cs-137 $4.75E^{-9}$ Gross α $1.97E^{-10}$ Gross βγ $1.13E^{-8}$
36652	1715 4/3/80	Penetration R-626 Reactor Building Particulate Sample	Cs-137 $1.24E^{-8}$ Gross α $4.02E^{-11}$ Gross βγ $6.69E^{-9}$
36620	1519 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $9.45E^{-1}$ Cs-137 $1.05E^{-5}$*
36615	1332 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $5.5E^{-1}$ Cs-137 $1.11E^{-5}$*
36616	1345 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $6.25E^{-1}$ Cs-137 $1.37E^{-5}$*
36617	1400 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $8.86E^{-1}$
36618	1420 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $6.58E^{-1}$
36619	1448 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $8.9E^{-1}$

*Sample vial contaminated.

TABLE 18

CONTAINMENT REENTRY TRAINING OUTLINE

	SUBJECT
1	Candidate Knowledge Evaluation
2	Radiation Effects/Risks Limits
3	Radiation Interaction With Matter And Detection Theory
4	Theory And Use Of Radiation Dosimetry And Bioassay
5a	Work Definition General Scope Of Entry Plan, Tour Control Envelope Entry Facility, Review Model 1. Objectives Of Entry 2. Model Familiarization 3. Unit 1 Containment Familiarization
5b	Radiation Data 1. Expected Sources On Map 2. Anticipated Nuclides 3. Anticipated Biological Effects From Nuclides 4. Anticipated Types Of Radiation Hazard Point Line Submerged 5. Review Tapes From 626 Penetration
5c	Casualty Consideration 1. Basic Casualty Considerations a. Communications b. Lighting c. Protective Clothing d. Installed Containment Equipment e. Radiological
6	Psychiological Consideration
7	Task Procedure Review Workshop
8	Use Of Radiation Instrumentation
9a	Breathing Apparatus Familiarization
9b	Other Equipment Familiarization
9c	Hands On Classroom Instrumentation
9d	Hands On Classroom Instrumentation - Swipe Technique

TABLE 18

SUBJECT

10	Auxiliary Building Tour/Briefing (Use currently existing protective clothing, stress ALARA considerations in a radiological environment)
11	Protective Clothing/Communication Familiarization (communication equipment and breathing apparatus must be available)
12	1. Task Walk Through - No Equipment 2. Task Walk Through Critique
13	1. Task Walk Through No Lights With Communication Equipment 2. Task Walk Through Critique
14	Psyiological Briefing
15	Casualty Review Walk Through
16	Time-Motion Task Discipline Classroom Exercise
17	Task Walk Through Real Time - Unit 1, No Lights, With Communication and Skelton Command Post (This training is for the R. B. Reentry Team and the command support organization) Critique Walk Through
18a	Casualty Drills Real Time - Dark With Communication and Skelton Command Post
18b	Critique
19	Casualty Drills Real Time - Dark With Communication and Skelton Command Post
20	Suit/Communication Familiarization Classroom Dress/Undress Casualties Critique Repeat 11 Through 12
21	Readiness Evaluation Critique - Refresher Planning
22	Final Rehearsal Real Time - Dark Communication (This training is for the R. B. Reentry Team and the command support organization)
23	Operational Turnover Entry

TABLE 19

PRELIMINARY ANALYSIS RESULTS OF SWIPES TAKEN DURING INITIAL REACTOR BUILDING ENTRY OF 23 JULY 1980

ACTIVITY DETECTED (μCi)

Swipe/ Specimen	Sample Number	Swipe Location	Co-60	Nb-95	Sb-125	Cs-134	Cs-137	Ce-144	Gross B γ	Gross α	Remarks
1	46279	Reactor Bldg. Liner next to South Wall of Airlock				3.91E-4	2.25E-3		2.54E-3	<1.75E-7	
2	46280	Painted Portion of North Wall of Elevator				1.51E-3	9.81E-3		6.59E-3	<2.76E-7	
3	46281	Reactor Bldg. Floor at base of the entrance ramp		1.97E-3		5.78E-1	3.48E+0				
4	46282	D-Ring wall opposite entrance ramp		1.56E-5		8.33E-4	4.70E-3		4.78E-3	<1.75E-7	
5	46283	Reactor Bldg. floor between equipment hatch & stairwell				1.98E+0	1.20E+1				Swipe may have been cross-contaminated in airlock
6	46284	D-Ring adjacent to open stairwell	1.92E-5		3.29E-4	2.31E-3	1.60E-2	1.81E-4	1.43E-2	<2.76E-7	Swipe may have been cross-contaminated in airlock
10	46288	Sample recovered from 16 July 1980 inner door opening				4.12E+0	2.50E+1				Unknown location and area

Note: All activity total. All wipes approximately 100 cm^2 except #10.

TABLE 20

ENTRY TEAM MEMBER: BEHRLE, WILLIAM H.

TLD Position	TLD No.	TLD Reading mr	mr	mr	mr
Chest Area	112	149	141	134	126
Cord Around Neck	115	234	187	158	152
	102	206	168	159	147
Base Of The Back Of Neck	134	139	143	134	123
6" Above Left Knee	148	182	189	170	184
6" Above Right Knee	126	190	176	166	154
6" Below Left Knee	12336	190	184	189	185
6" Below Right Knee	137	198	201	191	176
Right Wrist	145	149	153	150	150
Left Wrist	146	172	169	171	176
Right Ankle	104	189	155	155	173
Left Ankle	2359	170	177	174	177
Respiratory (Inside)	108	182	177	164	161

ENTRY TEAM MEMBER: BENSON, MICHAEL L.

TLD Position	TLD No.	TLD READING mr	mr	mr	mr
Chest Area	141	151	131	134	144
Cord Around Neck	12302	182	154	150	147
	123	159	154	168	167
Base Of The Back Of Neck	101	123	115	124	126
6" Above Left Knee	118	185	179	161	160
6" Above Right Knee	2382	171	165	165	170
6" Below Left Knee	121	160	160	159	148
6" Below Right Knee	103	142	151	128	143
Right Wrist	106	173	164	161	154
Left Wrist	119	173	156	152	155
Right Ankle	0140	194	188	174	165
Respirator (Inside)	2415	167	169	166	167
Left Ankle	143	174	148	173	171

TABLE 21

TMI-2 REACTOR BUILDING PRELIMINARY BETA GAMMA SCAN WIPE/SPECIMENS 15 AUGUST 1980

Swipe/ Specimen	Sample Number	Sample Location	Gross α μCi	Gross β μCi	Cs-134 μCi	Cs-137 μCi	Sr-90 μCi	Co-60 μCi	Nb-95 μCi	Cs137/Sr90 Ratio
Floor Scrape A	47846	305' el. floor crud at open stairwell	-	-	8.80-1	5.25				-
Floor Scrape B	47845	305' el. floor crud at hatch cover	-	-	2.654	16.05				-
DF #1	47862	305' el. floor decon test initial wipe	-	-	1.13	6.95	5.3-1			8.85
DF#2	47861	305' el. floor decon test final wipe	-	-	1.18-1	7.15-1	6.98-2			9.37
Wipe #1	47847	305' el. floor under HPR-211	-	-	6.61	40.7	2.63			12.4
Wipe #2	47848	305' el. floor in front of air cooler	-	-	3.75-2	2.22-1	2.94-2		9.26-4	5.78
Wipe #3	47849	Elevator stairwell floor, top landing	-	-	8.16-1	5.10	2.4-1		2.19-3	19.0
Wipe #4	47850	347' el. floor behind elevaror shaft	-	-	8.60-1	5.40	1.6-1		2.44-3	23.8
Wipe #5	47851	Fuel handling bridge	-	-	6.80-1	4.25	4.76-1	*9.70-4	2.62-3	8.89
Wipe #6	47852	347' el. liner southwall	<4.88-7	1.30-2	2.46-3	1.52-2	2.3-3			5.22
Wipe #7	47853	347' el. liner southwall	<4.88-7	9.22-3	2.87-3	1.91-2	1.15-3			7.83
Wiep #8	47854	347; el. floor head stand area	-	-	9.41-1	5.80	1.97-1			29.4
Wipe #9	47855	Cable tray by NE corner of canal	-	-	3.95-2	2.57-1	5.55-2			4.11
Wipe #10	47856	Not Used								
Wipe #11	47857	Not Used								
Wipe #12	47858	347' el. tool chest	-	-	2.54-1	1.58	9.00-2			16.7
Wipe #13	47859	347' el. liner - EMT wall	< 5.0-7	5.10-3	1.03-3	9.86-3	6.99-4			5.65
Wipe #14	47860	347' el. east "D" Ring wall	1.29-6	2.57-2	5.32-3	3.10-2	3.12-3			8.72

TABLE 21

TMI-2 REACTOR BUILDING PRELIMINARY BETA GAMMA SCAN WIPE/SPECIMENS 15 AUGUST 1980

Swipe/ Specimen	Sample Number	Sample Location	Gross α µCi	Gross β µCi	Cs-134 µCi	Cs-137 µCi	Sr-90 µCi	Co-69 µCi	Nb-95 µCi	Cs137/Sr90 Ratio
Glass Sample	47870	305' el. floor near equip. hatch			1.73	10.7				-
HPR-211	47910	305' el. elevator shaft wall	3.60-6	1.26-1	1.99-2	1.55-1	3.1-3			52.9
12"x16" steel plate	47911	305' el. east "D" Ring wall	3.00-6	2.27-1	3.64-2	2.19-1	3.98-2			6.28
1C-1B-05 Cover	47912	347' el. floor near east "D" Ring	9.01-7	7.65-2	1.06-2	6.40-2	1.6-2			3.10
1C-2B-02	47913	347' el. floor near east "D" Ring	2.00-6	-	3.30-1	1.97	6.1-2			33.8
Funnel	47915	305' el. near floor hatch to 282 el.	<4.66-7	2.34-2	5.09-3	2.92-2	1.6-3			20.4

*Cr51 = 1.08-2; Ce144 = 1.41-2

Note: All activities total. All wipes approximately 100 cm^2.

TABLE 22

Date 8-15-80 Team Member COOPER Entry #2

TLD Location	Type of TLD*	γ (m Rem)				β (m Rem)
Chest Area	H		110			--
	P	99.8	98.1	110	114	
6 inches above right knee	H		170			--
	P	186	154	162	184	
6 inches above left knee	H		170			--
	P	159	159	167	166	
Back Area	H		120			--
	P	119	108	118	126	
Forehead	H		130			--
	P	148	122	136	135	
Finger Ring - Right Hand	H					
Finger Ring - Left Hand	H					
Card Under Right Foot	H		200			--
Card Under Left Foot	H		210			--
Chest Area - outside of Fireman's Suit	H		130			--
	P	149	121	125	121	
	P	156	114	133	133	
Respirator - underneath battery pack	H		110			40
	P	152	125	131	131	
	P	138	120	115	112	

* H= Hartshaw P= Panasonic

TABLE 22

Date 8-15-80 Team Member BENSON Entry #2

TLD Location	Type of TLD*	γ (m Rem)				β (m Rem)
Chest Area	H		240			--
	P	219	214	266	271	
6 inches above right knee	H		370			--
	P	335	296	342	337	
6 inches above left knee	H		330			--
	P	298	289	297	331	
Back Area	H		240			--
	P	189	174	197	226	
Forehead	H		320			--
	P	394	326	308	288	
Finger Ring - Right Hand	H					
Finger Ring - Left Hand	H					
Card Under Right Foot	H		420			--
Card Under Left Foot	H		390			--
Chest Area - outside of Fireman's Suit	H		290			--
	P	335	339	302	288	
	P	344	257	258	255	
Respirator - underneath battery pack	H		270			130
	P	373	289	313	309	
	P	323	293	301	305	

* H = Hartshaw P = Panasonic

TABLE 22

Date 8-15-80 Team Member BEHRLE, W. Entry #2

TLD Location	Type of TLD*	γ (m Rem)				β (m Rem)
Chest Area	H		240			--
	P	221	216	204	202	
6 inches above right knee	H		250			--
	P	228	216	225	236	
6 inches above left knee	H		270			--
	P	256	228	258	273	
Back Area	H		190			
	P	203	181	172	188	
Forehead	H		340			
	P	314	301	317	342	
Finger Ring - Right Hand	H					
Finger Ring - Left Hand	H					
Card Under Right Foot	H		310			--
Card Under Left Foot	H		320			--
Chest Area - outside of Fireman's Suit	H		280			--
	P	296	245	270	262	
	P	315	279	265	277	
Respirator - underneath battery pack	H		250			--
	P	297	236	241	234	
	P	334	249	232	237	

* H = Hartshaw P = Panasonic

TABLE 22

Date 8-15-80 Team Member GRIFFITH Entry #2

TLD Location	Type of TLD*	γ (m Rem)				β (m Rem)
Chest Area	H		150			--
	P	103	87.3	141	148	
6 inches above right knee	H		190			
	P	174	169	182	185	
6 inches above left knee	H		170			--
	P	158	147	154	170	
Back Area	H		140			--
	P	116	115	119	124	
Forehead	H		170			--
	P	147	148	180	175	
Finger Ring - Right Hand	H					
Finger Ring - Left Hand	H					
Card Under Right Foot	H		270			--
Card Under Left Foot	h		260			--
Chest Area - outside of Fireman's Suit	H		160			--
	P	184	142	154	140	
	P	165	147	163	148	
Respirator - underneath battery pack	H		190			--
	P	221	161	173	174	
	P	227	165	190	174	

* H = Hartshaw P = Panasonic

TABLE 23
TMI-2 305'El.
Radiation Survey Summary Description
July 23, Aug. 15, 1980

Location Number	Instrument	Gamma Dose Rate	Beta Dose Rate	Location
1	T	400 mR/hr	-	6 feet inside airlock door, head high .
2	T/R-7	200 mR/hr	1600 mRad/hr	Liner, adjacent to airlock No. 2, contact.
3	T/R-7	2 R/hr	~ 0	Northeast wall of elevator shaft, contact.
4	R-7	*(500 mR/hr)	2 Rad/hr	Floor at base of ramp, contact.
5	R-7	*(500 mR/hr)	2 Rad/hr	D-Ring wall opposite airlock No. 2, contact.
6	T	5 R/hr	-	Floor drain near ramp, contact.
7	T	3 R/hr	-	High pressure injection line on D-Ring wall, contact.
8	T	300 mR/hr	-	D-Ring wall opposite elevator shaft, contact.
9	R-7	*(500 mR/hr)	7 Rad/hr	Floor ~8 ft. north of ramp, contact.
10	T/R-7	500 mR/hr	1 Rad/hr	Column R-14, General area.
11	R-2	3 R/hr	10 Rad/hr	Floor drain near column R-12, contact.
12	R-2	3 R/hr	10 Rad/hr	Floor drain near column R-13, contact.
13	T	3 R/hr	-	Elevator door, contact.
14	T	2 R/hr	-	Floor drain near floor equipment hatch, contact.
15	T	400 mR/hr	-	Stairwell door.
16	T/R-7	3 R/hr	2 Rad/hr	Landing inside stairwell - 305' el.
17	T	10 R/hr	-	Center of floor equipment hatch.
18	T	4 R/hr	-	Edge of floor equipment hatch.
19	T	3 R/hr	-	Core flood line, contact.
20	R-2	3.5 R/hr	-	Floor penetration R-251, CRD cable chase (assume: all gamm
21	T	1400 mR/hr	-	Air coolers.
22	T	700 mR/hr	-	Area above pressurizer drain tank, general area.
23	T	400 mR/hr	-	D-ring opposite equipment hatch, contact.
24	T	8 R/hr	-	Floor drain near open stairwell, contact.
25	T	2 R/hr	-	Behind open stairwell.
26	T	45 R/hr	-	Water in basement, 5-7 ft. from surface in stairwell.

*Nos. in () are estimated of gamma portion of beta/gamma reading based upon adjacent area gamma readings.
All radiation dose rates are corrected for Instrument
Instruments: T = Teletector R-2 = RO-2A R-7 = RO-7

TABLE 24
TMI-2 347'El.
Radiation Survey Summary Description
Aug. 15, 1980

Location Number	Instrument	Gamma Dose Rate	Beta Dose Rate	Location
27	T/R-2	2 R/hr	4 Rad/hr	Closed stairwell, 1st landing - 312' el.
28	T	1 R/hr	-	Closed stairwell, 2nd landing - 319' el.
29	T/R-2	800 mR/hr	-	Closed stairwell, 3rd landing - 326' el.
30	T/R-2	500 mR/hr	-	Closed stairwell, 4th landing - 333' el.
31	T/R-2	300 mR/hr	-	Closed stairwell, 5th landing - 340' el.
32	T/R-2	180 mR/hr	-	Closed stairwell, 6th landing - 347' el.
33	T	250 mR/hr	-	Stairwell doorway.
34	R-2	100 mR/hr	-	Elevator wall, waist level.
35	R-2	600 mR/hr	-	Diamond plate decking, outside stairwell door.
36	T/R-2	50 mR/hr	-	Behind closed stairwell.
37	T	150 mR/hr	-	Between indexing fixture and liner.
38	R-2	30 mR/hr	-	Indexing fixture, contact.
39	T	100 mR/hr	-	South containment wall area.
40	T	400 mR/hr	-	Between coolant motor stand and head storage stand, general area.
41	R-2	300 mR/hr	-	Underneath head storage stand.
42	R-2	450 mR/hr	6.2 Rad/hr	Steel base of head storage stand, contact.
43	T	150 mR/hr	-	Between head storage stand and open stairwell.
44	T	550 mR/hr	-	Over open stairwell.
45	T/R-2	100 mR/hr	-	D-Ring wall opposite head storage stand.
46	R-2	2.5 R/hr	-	Pressurizer spray line at elbow, contact.
47	T	250 mR/hr	-	Grating over core flood tank "A".
48	T/R-2	170 mR/hr	0.9 Rad/hr	Over reactor cavity, under bridge.
49	T	150 mR/hr	-	12 feet from reactor head studs.
50	R-2	*200 mR/hr	5.2 Rad/hr	Fuel handling bridge, contact.
51	T/R-2	125 mR/hr	-	Over reactor cavity.
52	R-2	300 mR/hr	10.8 Rad/hr	Grating over core flood tank B.

*Estimated
Instrument - T = Teletector, R-2 = RO2A

10.0 FIGURES

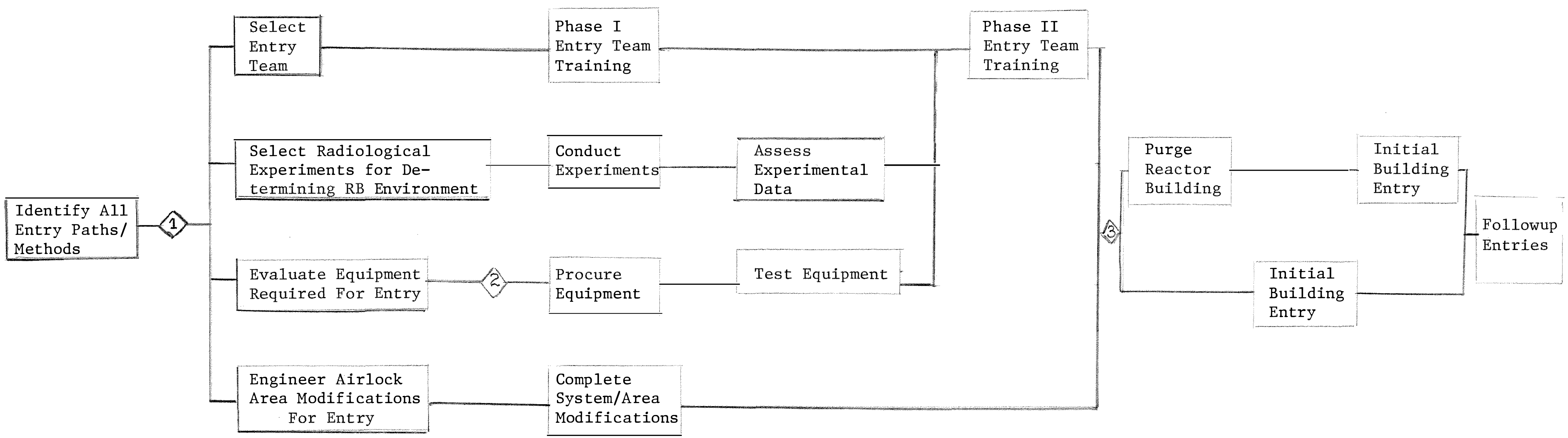
APPENDIX B

Appendix B

Figure 1

Reactor Building Entry

Program Logic

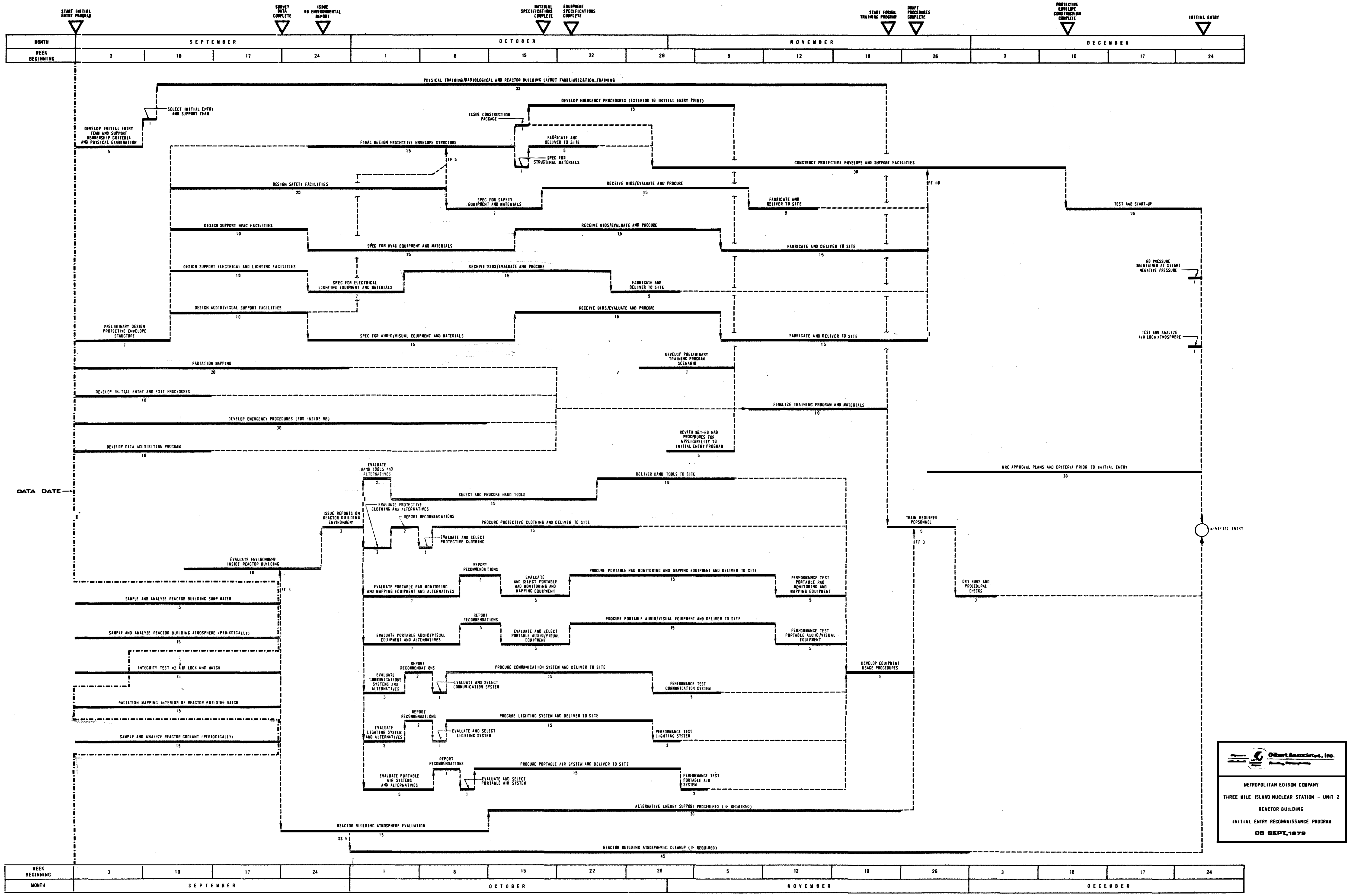


1 Select air lock to be used for entry.

2 Select communications equipment, camera, clothing, breathing equipment, lighting and radiation/dose monitors.

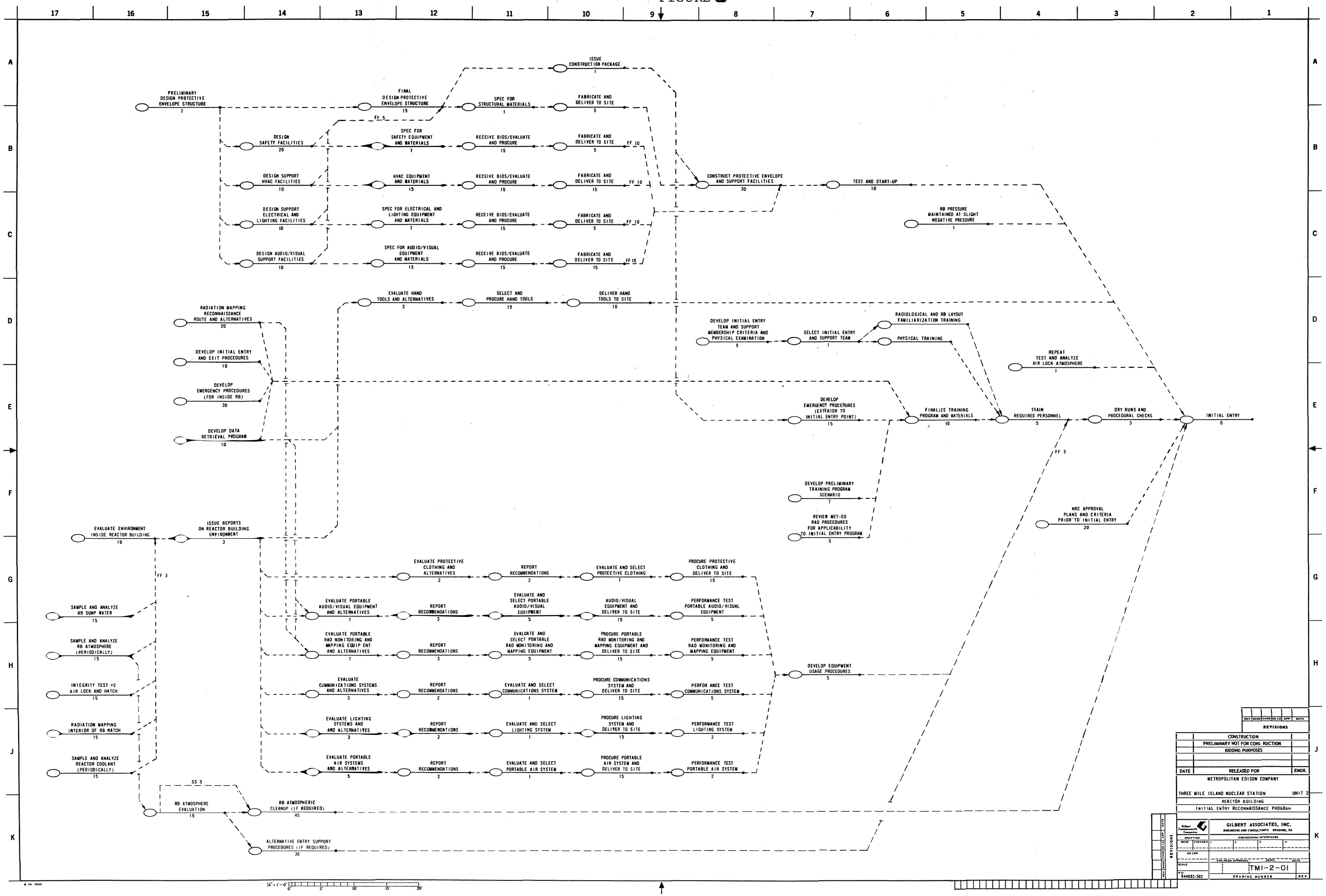
3 Determine feasibility of building entry prior to purge and likelihood of obtaining permission to perform the purge in the near future.

FIGURE 2

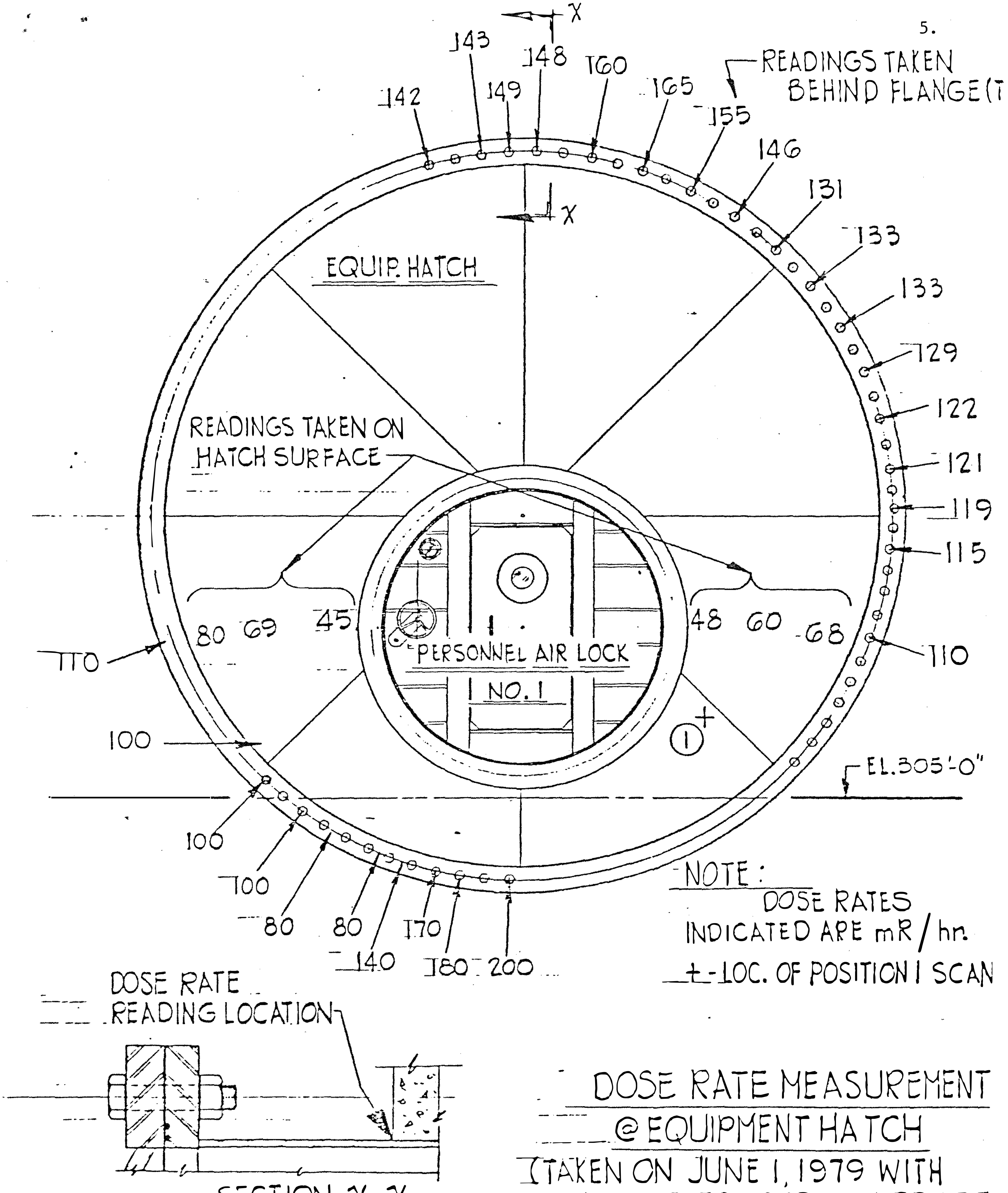


START INITIAL ENTRY PROGRAM
SURVEY DATA COMPLETE
ISSUE RB ENVIRONMENTAL REPORT
MATERIAL SPECIFICATIONS COMPLETE
EQUIPMENT SPECIFICATIONS COMPLETE
START FORMAL TRAINING PROGRAM
DRAFT PROCEDURES COMPLETE
PROTECTIVE ENVELOPE CONSTRUCTION COMPLETE
INITIAL ENTRY
MONTH
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
WEEK BEGINNING
3
10
17
24
1
8
15
22
29
5
12
19
26
3
10
17
24
PHYSICAL TRAINING/RADIOLOGICAL AND REACTOR BUILDING LAYOUT FAMILIARIZATION TRAINING
SELECT INITIAL ENTRY AND SUPPORT TEAM
DEVELOP INITIAL ENTRY TEAM AND SUPPORT MEMBERSHIP CRITERIA AND PHYSICAL EXAMINATION
DEVELOP EMERGENCY PROCEDURES (EXTERIOR TO INITIAL ENTRY POINT)
ISSUE CONSTRUCTION PACKAGE
FABRICATE AND DELIVER TO SITE
FINAL DESIGN PROTECTIVE ENVELOPE STRUCTURE
SPEC FOR STRUCTURAL MATERIALS
CONSTRUCT PROTECTIVE ENVELOPE AND SUPPORT FACILITIES
DESIGN SAFETY FACILITIES
SPEC FOR SAFETY EQUIPMENT AND MATERIALS
RECEIVE BIDS/EVALUATE AND PROCURE
TEST AND START-UP
DESIGN SUPPORT HVAC FACILITIES
SPEC FOR HVAC EQUIPMENT AND MATERIALS
FABRICATE AND DELIVER TO SITE
DESIGN SUPPORT ELECTRICAL AND LIGHTING FACILITIES
SPEC FOR ELECTRICAL LIGHTING EQUIPMENT AND MATERIALS
RB PRESSURE MAINTAINED AT SLIGHT NEGATIVE PRESSURE
DESIGN AUDIO/VISUAL SUPPORT FACILITIES
PRELIMINARY DESIGN PROTECTIVE ENVELOPE STRUCTURE
SPEC FOR AUDIO/VISUAL EQUIPMENT AND MATERIALS
TEST AND ANALYZE AIR LOCK ATMOSPHERE
RADIATION MAPPING
DEVELOP PRELIMINARY TRAINING PROGRAM SCENARIO
DEVELOP INITIAL ENTRY AND EXIT PROCEDURES
FINALIZE TRAINING PROGRAM AND MATERIALS
DEVELOP EMERGENCY PROCEDURES (FOR INSIDE RB)
REVIEW MET-ED RAD PROCEDURES FOR APPLICABILITY TO INITIAL ENTRY PROGRAM
DEVELOP DATA ACQUISITION PROGRAM
NRC APPROVAL PLANS AND CRITERIA PRIOR TO INITIAL ENTRY
EVALUATE HAND TOOLS AND ALTERNATIVES
DELIVER HAND TOOLS TO SITE
DATA DATE
SELECT AND PROCURE HAND TOOLS
ISSUE REPORTS ON REACTOR BUILDING ENVIRONMENT
EVALUATE PROTECTIVE CLOTHING AND ALTERNATIVES
REPORT RECOMMENDATIONS
PROCURE PROTECTIVE CLOTHING AND DELIVER TO SITE
TRAIN REQUIRED PERSONNEL
EVALUATE AND SELECT PROTECTIVE CLOTHING
EVALUATE ENVIRONMENT INSIDE REACTOR BUILDING
EVALUATE AND SELECT PORTABLE RAD MONITORING AND MAPPING EQUIPMENT
PROCURE PORTABLE RAD MONITORING AND MAPPING EQUIPMENT AND DELIVER TO SITE
EVALUATE PORTABLE RAD MONITORING AND MAPPING EQUIPMENT AND ALTERNATIVES
PERFORMANCE TEST PORTABLE RAD MONITORING AND MAPPING EQUIPMENT
DRY RUNS AND PROCEDURAL CHECKS
SAMPLE AND ANALYZE REACTOR BUILDING SUMP WATER
SAMPLE AND ANALYZE REACTOR BUILDING ATMOSPHERE (PERIODICALLY)
PROCURE PORTABLE AUDIO/VISUAL EQUIPMENT AND DELIVER TO SITE
EVALUATE PORTABLE AUDIO/VISUAL EQUIPMENT AND ALTERNATIVES
EVALUATE AND SELECT PORTABLE AUDIO/VISUAL EQUIPMENT
PERFORMANCE TEST PORTABLE AUDIO/VISUAL EQUIPMENT
INTEGRITY TEST #2 AIR LOCK AND HATCH
PROCURE COMMUNICATION SYSTEM AND DELIVER TO SITE
DEVELOP EQUIPMENT USAGE PROCEDURES
EVALUATE COMMUNICATIONS SYSTEMS AND ALTERNATIVES
EVALUATE AND SELECT COMMUNICATION SYSTEM
PERFORMANCE TEST COMMUNICATION SYSTEM
RADIATION MAPPING INTERIOR OF REACTOR BUILDING HATCH
PROCURE LIGHTING SYSTEM AND DELIVER TO SITE
SAMPLE AND ANALYZE REACTOR COOLANT (PERIODICALLY)
EVALUATE LIGHTING SYSTEM AND ALTERNATIVES
EVALUATE AND SELECT LIGHTING SYSTEM
PERFORMANCE TEST LIGHTING SYSTEM
PROCURE PORTABLE AIR SYSTEM AND DELIVER TO SITE
EVALUATE PORTABLE AIR SYSTEMS AND ALTERNATIVES
EVALUATE AND SELECT PORTABLE AIR SYSTEM
PERFORMANCE TEST PORTABLE AIR SYSTEM
ALTERNATIVE ENERGY SUPPORT PROCEDURES (IF REQUIRED)
REACTOR BUILDING ATMOSPHERE EVALUATION
REACTOR BUILDING ATMOSPHERIC CLEANUP (IF REQUIRED)
Gilbert Associates, Inc.
METROPOLITAN EDISON COMPANY
THREE MILE ISLAND NUCLEAR STATION - UNIT 2
REACTOR BUILDING
INITIAL ENTRY RECONNAISSANCE PROGRAM
06 SEPT, 1979

FIGURE 3



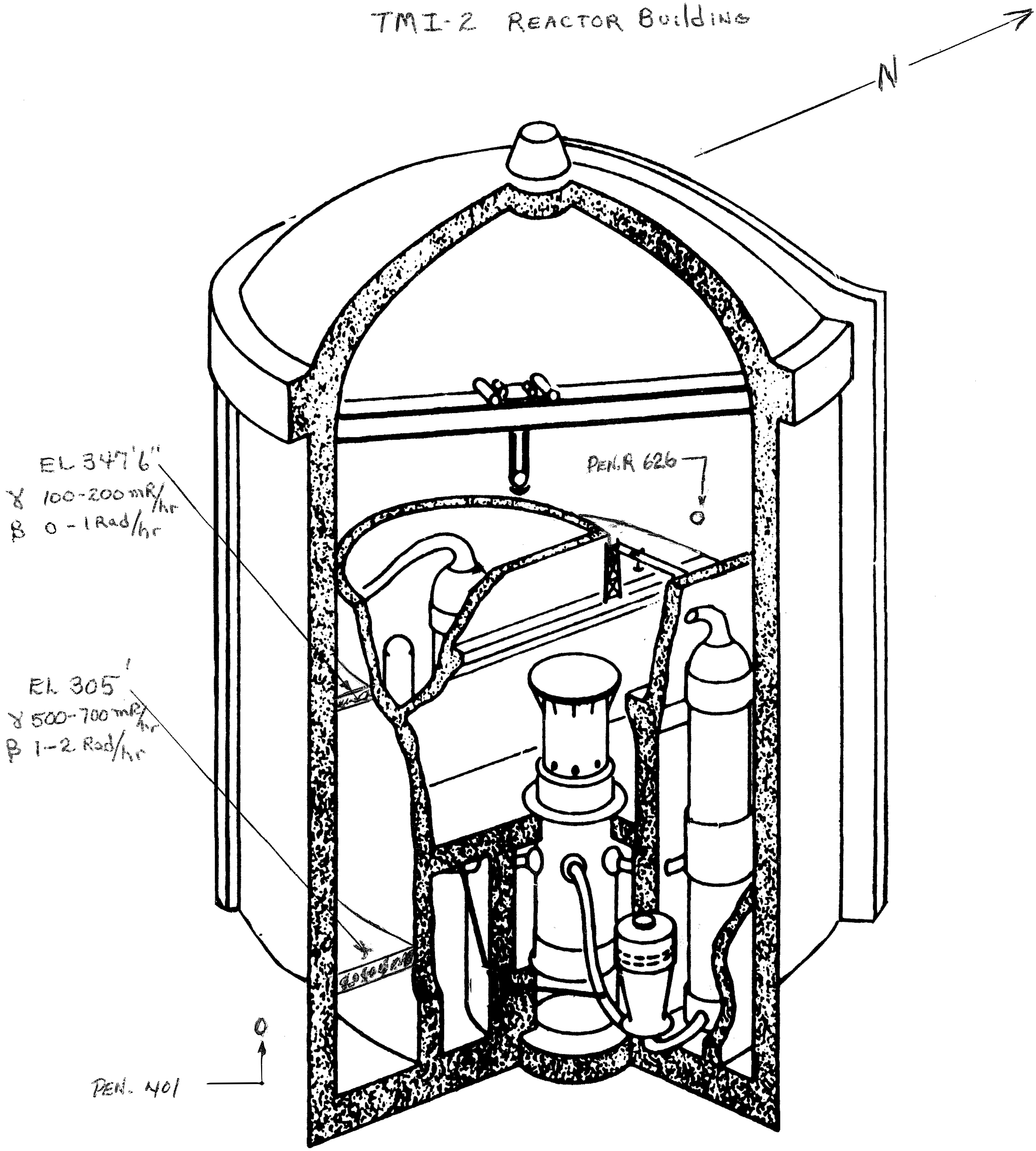
ISSUE CONSTRUCTION PACKAGE 1
PRELIMINARY DESIGN PROTECTIVE ENVELOPE STRUCTURE 7
FINAL DESIGN PROTECTIVE ENVELOPE STRUCTURE 15
SPEC FOR STRUCTURAL MATERIALS 1
FABRICATE AND DELIVER TO SITE 5
FS 5
DESIGN SAFETY FACILITIES 20
SPEC FOR SAFETY EQUIPMENT AND MATERIALS 7
RECEIVE BIDS/EVALUATE AND PROCURE 15
FABRICATE AND DELIVER TO SITE 5
FF 10
DESIGN SUPPORT HVAC FACILITIES 10
HVAC EQUIPMENT AND MATERIALS 15
RECEIVE BIDS/EVALUATE AND PROCURE 15
FABRICATE AND DELIVER TO SITE 15
FF 10
CONSTRUCT PROTECTIVE ENVELOPE AND SUPPORT FACILITIES 30
TEST AND START-UP 10
DESIGN SUPPORT ELECTRICAL AND LIGHTING FACILITIES 10
SPEC FOR ELECTRICAL AND LIGHTING EQUIPMENT AND MATERIALS 7
RECEIVE BIDS/EVALUATE AND PROCURE 15
FABRICATE AND DELIVER TO SITE 5
FF 10
RB PRESSURE MAINTAINED AT SLIGHT NEGATIVE PRESSURE 1
DESIGN AUDIO/VISUAL SUPPORT FACILITIES 10
SPEC FOR AUDIO/VISUAL EQUIPMENT AND MATERIALS 15
RECEIVE BIDS/EVALUATE AND PROCURE 15
FABRICATE AND DELIVER TO SITE 15
FF 10
EVALUATE HAND TOOLS AND ALTERNATIVES 2
SELECT AND PROCURE HAND TOOLS 15
DELIVER HAND TOOLS TO SITE 10
RADIATION MAPPING RECONNAISSANCE ROUTE AND ALTERNATIVES 20
DEVELOP INITIAL ENTRY TEAM AND SUPPORT MEMBERSHIP CRITERIA AND PHYSICAL EXAMINATION 5
SELECT INITIAL ENTRY AND SUPPORT TEAM 1
RADIOLOGICAL AND RB LAYOUT FAMILIARIZATION TRAINING
PHYSICAL TRAINING
DEVELOP INITIAL ENTRY AND EXIT PROCEDURES 10
REPEAT TEST AND ANALYZE AIR LOCK ATMOSPHERE 1
DEVELOP EMERGENCY PROCEDURES (FOR INSIDE RB) 30
DEVELOP EMERGENCY PROCEDURES (EXTERIOR TO INITIAL ENTRY POINT) 15
FINALIZE TRAINING PROGRAM AND MATERIALS 10
TRAIN REQUIRED PERSONNEL 5
DRY RUNS AND PROCEDURAL CHECKS 3
INITIAL ENTRY 0
DEVELOP DATA RETRIEVAL PROGRAM 10
FF 3
DEVELOP PRELIMINARY TRAINING PROGRAM SCENARIO 7
NRC APPROVAL PLANS AND CRITERIA PRIOR TO INITIAL ENTRY 20
REVIEW MET-ED RAD PROCEDURES FOR APPLICABILITY TO INITIAL ENTRY PROGRAM 5
EVALUATE ENVIRONMENT INSIDE REACTOR BUILDING 10
ISSUE REPORTS ON REACTOR BUILDING ENVIRONMENT 3
FF 3
EVALUATE PROTECTIVE CLOTHING AND ALTERNATIVES 2
REPORT RECOMMENDATIONS 2
EVALUATE AND SELECT PROTECTIVE CLOTHING 1
PROCURE PROTECTIVE CLOTHING AND DELIVER TO SITE 15
SAMPLE AND ANALYZE RB SUMP WATER 15
EVALUATE PORTABLE AUDIO/VISUAL EQUIPMENT AND ALTERNATIVES 7
REPORT RECOMMENDATIONS 3
EVALUATE AND SELECT PORTABLE AUDIO/VISUAL EQUIPMENT 5
AUDIO/VISUAL EQUIPMENT AND DELIVER TO SITE 15
PERFORMANCE TEST PORTABLE AUDIO/VISUAL EQUIPMENT 5
SAMPLE AND ANALYZE RB ATMOSPHERE (PERIODICALLY) 15
EVALUATE PORTABLE RAD MONITORING AND MAPPING EQUIP ENT AND ALTERNATIVES 7
REPORT RECOMMENDATIONS 3
EVALUATE AND SELECT PORTABLE RAD MONITORING AND MAPPING EQUIPMENT 5
PROCURE PORTABLE RAD MONITORING AND MAPPING EQUIPMENT AND DELIVER TO SITE 15
PERFORMANCE TEST RAD MONITORING AND MAPPING EQUIPMENT 5
DEVELOP EQUIPMENT USAGE PROCEDURES 5
INTEGRITY TEST #2 AIR LOCK AND HATCH 15
EVALUATE COMMUNICATIONS SYSTEMS AND ALTERNATIVES 3
REPORT RECOMMENDATIONS 2
EVALUATE AND SELECT COMMUNICATIONS SYSTEM 1
PROCURE COMMUNICATIONS SYSTEM AND DELIVER TO SITE 15
PERFOR ANCE TEST COMMUNICATIONS SYSTEM 5
RADIATION MAPPING INTERIOR OF RB HATCH 15
EVALUATE LIGHTING SYSTEMS AND AND ALTERNATIVES 3
REPORT RECOMMENDATIONS 2
EVALUATE AND SELECT LIGHTING SYSTEM 1
PROCURE LIGHTING SYSTEM AND DELIVER TO SITE 15
PERFORMANCE TEST LIGHTING SYSTEM 2
SAMPLE AND ANALYZE REACTOR COOLANT (PERIODICALLY) 15
EVALUATE PORTABLE AIR SYSTEMS AND ALTERNATIVES 5
REPORT RECOMMENDATIONS 2
EVALUATE AND SELECT PORTABLE AIR SYSTEM 1
PROCURE PORTABLE AIR SYSTEM AND DELIVER TO SITE 15
PERFORMANCE TEST PORTABLE AIR SYSTEM 2
SS 5
RB ATMOSPHERE EVALUATION 15
RB ATMOSPHERIC CLEANUP (IF REQUIRED) 45
ALTERNATIVE ENTRY SUPPORT PROCEDURES (IF REQUIRED) 30
REVISIONS
CONSTRUCTION
PRELIMINARY NOT FOR CONSTRUCTION
BIDDING PURPOSES
DATE
RELEASED FOR
ENGR.
METROPOLITAN EDISON COMPANY
THREE MILE ISLAND NUCLEAR STATION UNIT 2
REACTOR BUILDING
INITIAL ENTRY RECONNAISSANCE PROGRAM
GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS READING, PA
TMI-2-01
DRAWING NUMBER
REV

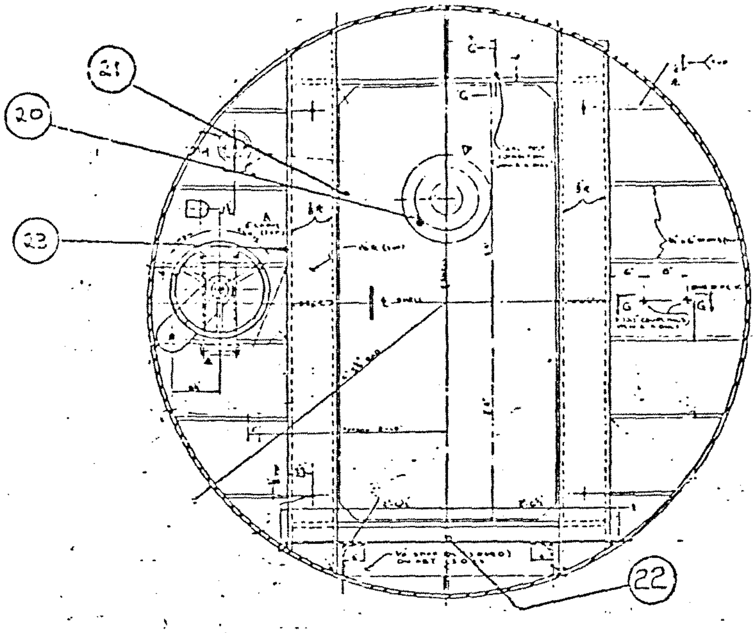


DOSE RATE MEASUREMENT
@ EQUIPMENT HATCH
(TAKEN ON JUNE 1, 1979 WITH
EBERLINE E-520 STD. GM PROBE

FIG. 4 APPENDIX B

Figure 5
TMI-2 Reactor Building





VIEW A-A

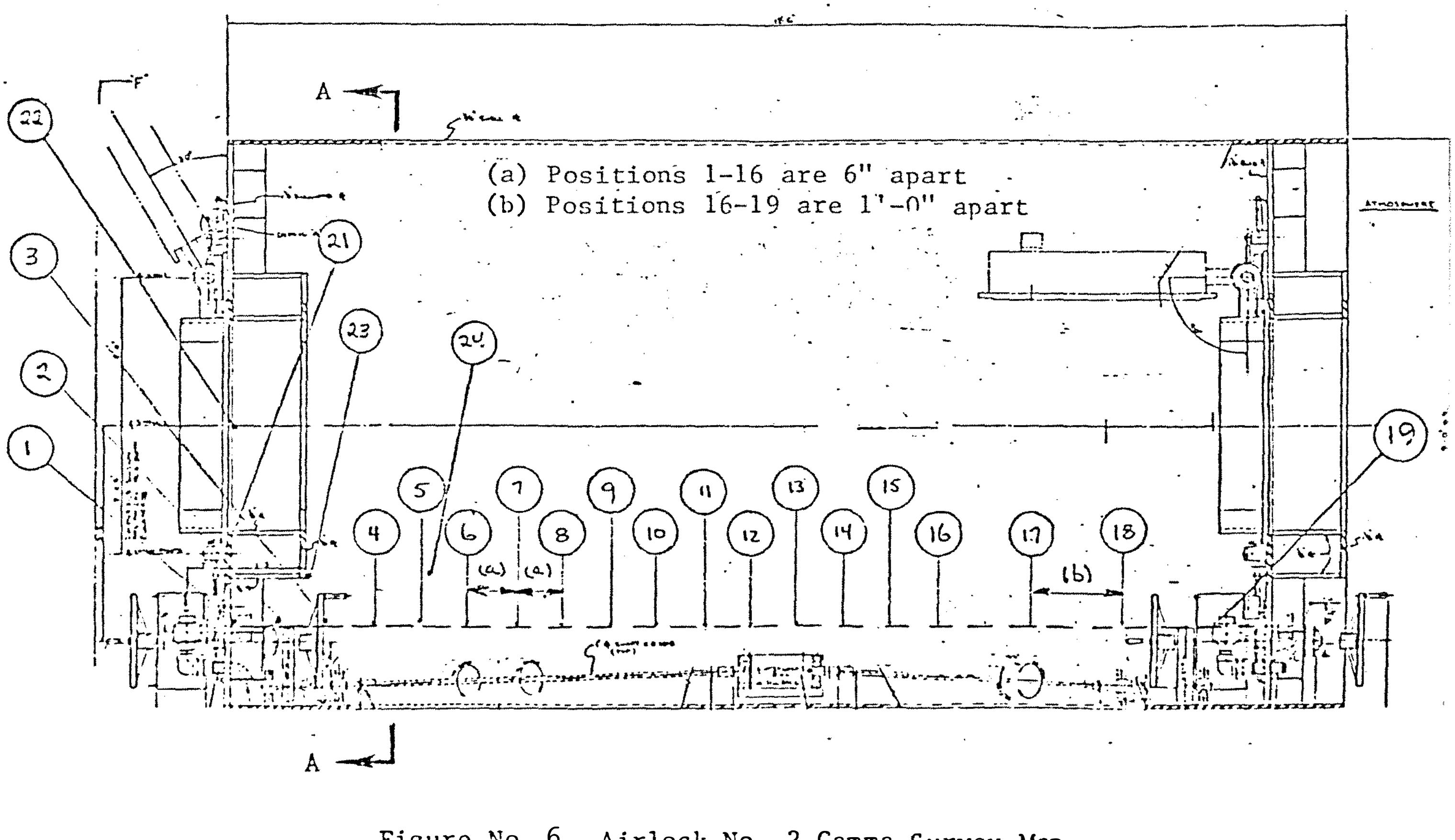


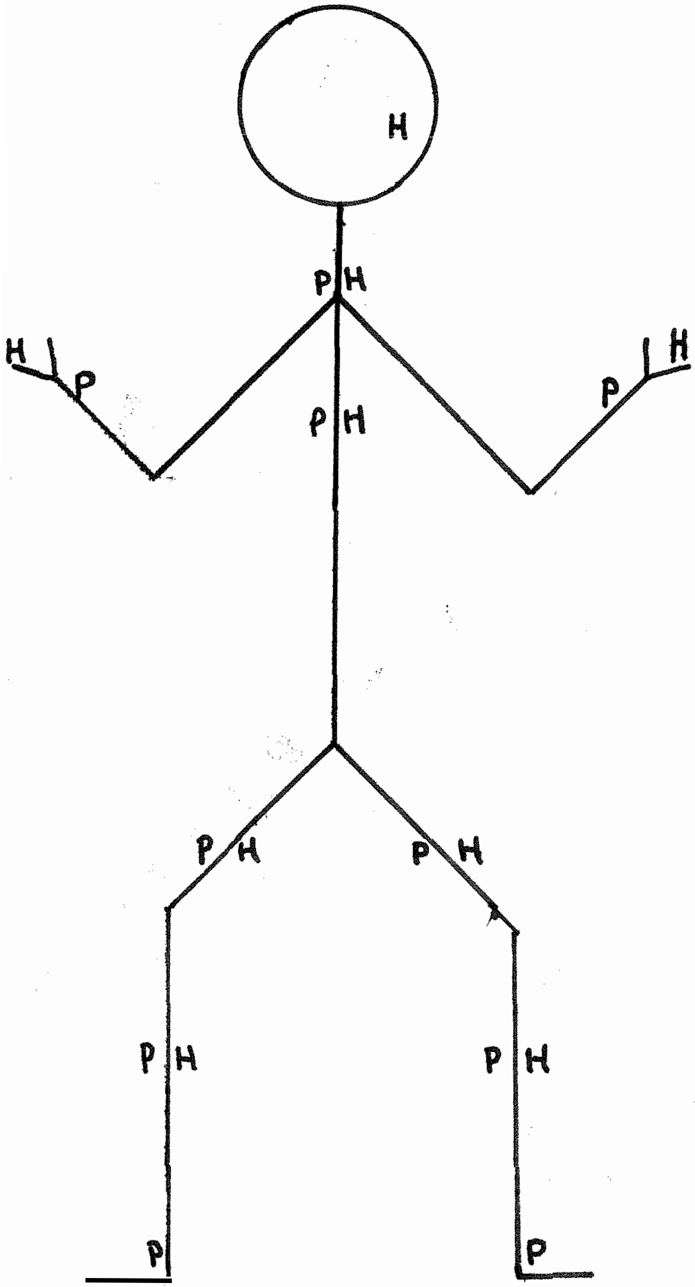
Figure No. 6 Airlock No. 2 Gamma Survey Map

FIGURE 7

TLD LOCATIONS

FOR

INITIAL REACTOR BUILDING ENTRY



P = Panasonic TLD

H = Harshaw TLD

Figure 8

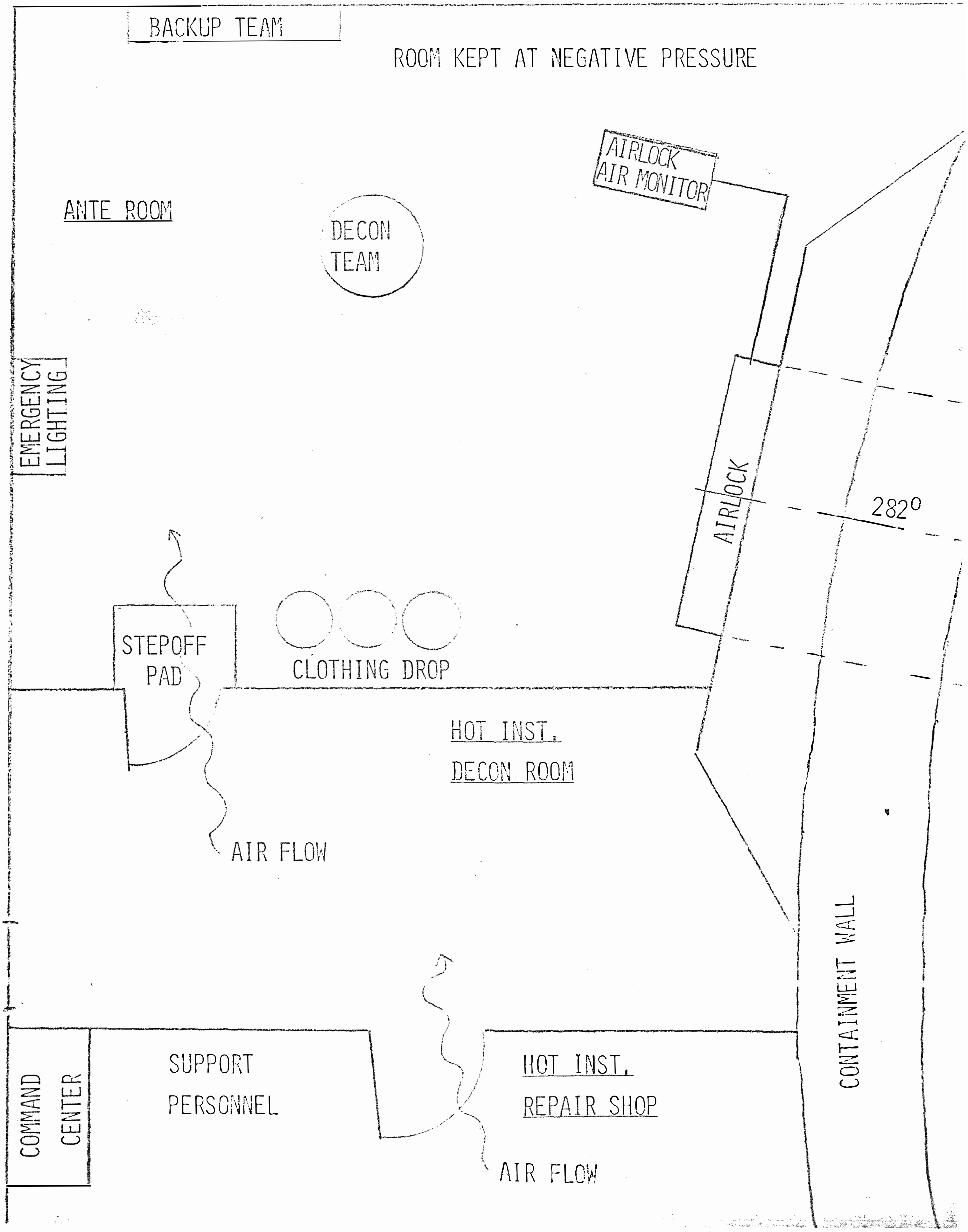

BACKUP TEAM
ROOM KEPT AT NEGATIVE PRESSURE
AIRLOCK AIR MONITOR
ANTE ROOM
DECON TEAM
EMERGENCY LIGHTING
AIRLOCK
282°
STEPOFF PAD
CLOTHING DROP
HOT INST. DECON ROOM
AIR FLOW
CONTAINMENT WALL
COMMAND CENTER
SUPPORT PERSONNEL
HOT INST. REPAIR SHOP
AIR FLOW

Figure 9

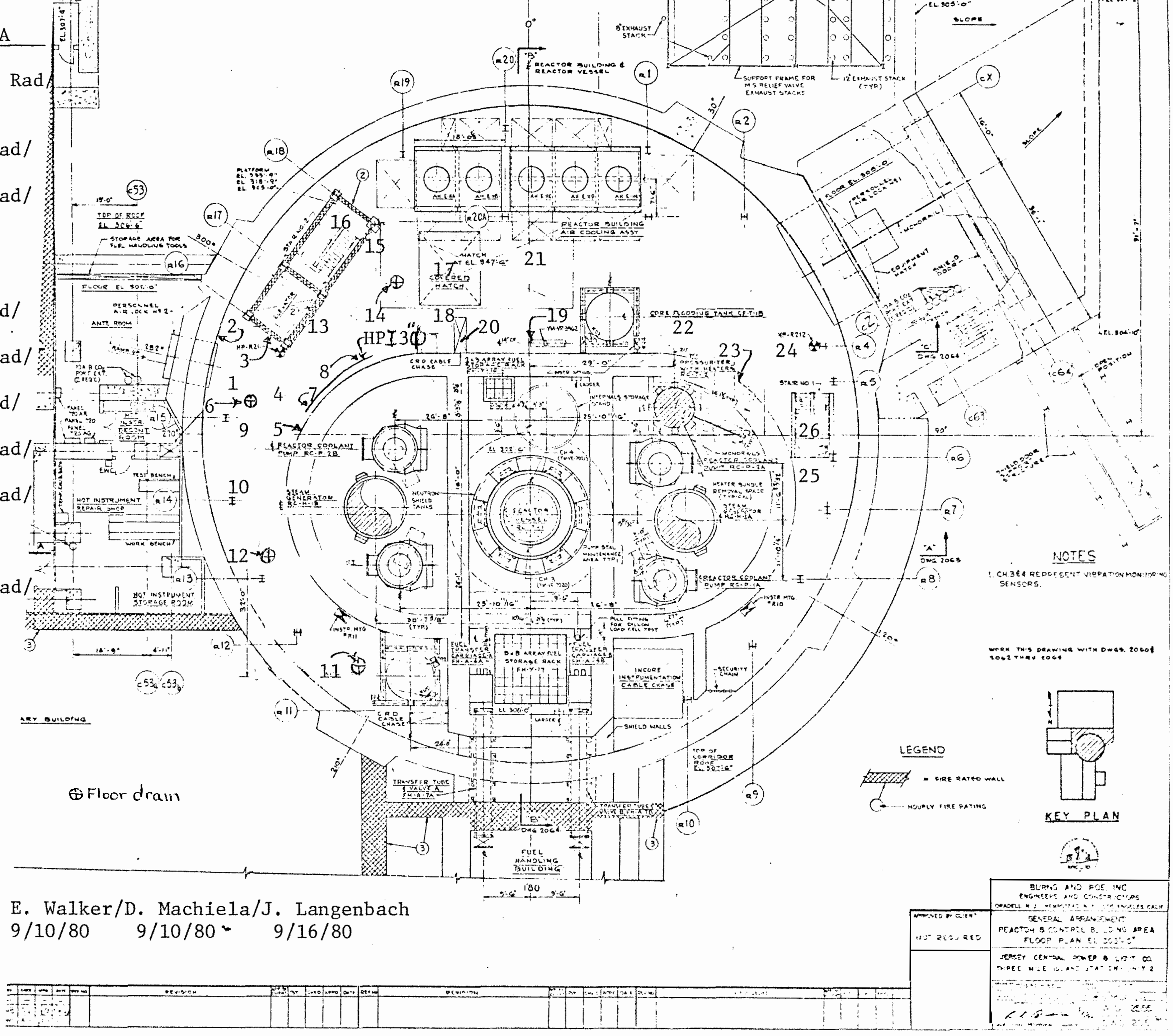
Reactor Building Radiation Survey Summary

305' El.

July 23, and Aug. 15, 1980

LOCATION	DOSE RATE GAMMA	BETA
1	0.4R/hr	-
2	0.2R/hr	1.6 Rad/hr
3	2.0R/hr	-
4	*0.5R/hr	2 Rad/hr
5	*0.5R/hr	2 Rad/hr
6	5R/hr	-
7	3R/hr	-
8	0.3R/hr	-
9	*0.5R/hr	7Rad/hr
10	0.5R/hr	1 Rad/hr
11	3R/hr	10Rad/hr
12	3R/hr	10 Rad/hr
13	3R/hr	10 Rad/hr
14	2R/hr	-
15	0.4R/hr	-
16	3R/hr	2 Rad/hr
17	10R/hr	-
18	4R/hr	-
19	3R/hr	-
20	3.5R/hr	-
21	1.4R/hr	-
22	0.7R/hr	-
23	0.4R/hr	-
24	8R/hr	-
25	2R/hr	-
26	45R/hr	-

*Estimated



E. Walker/D. Machiela/J. Langenbach

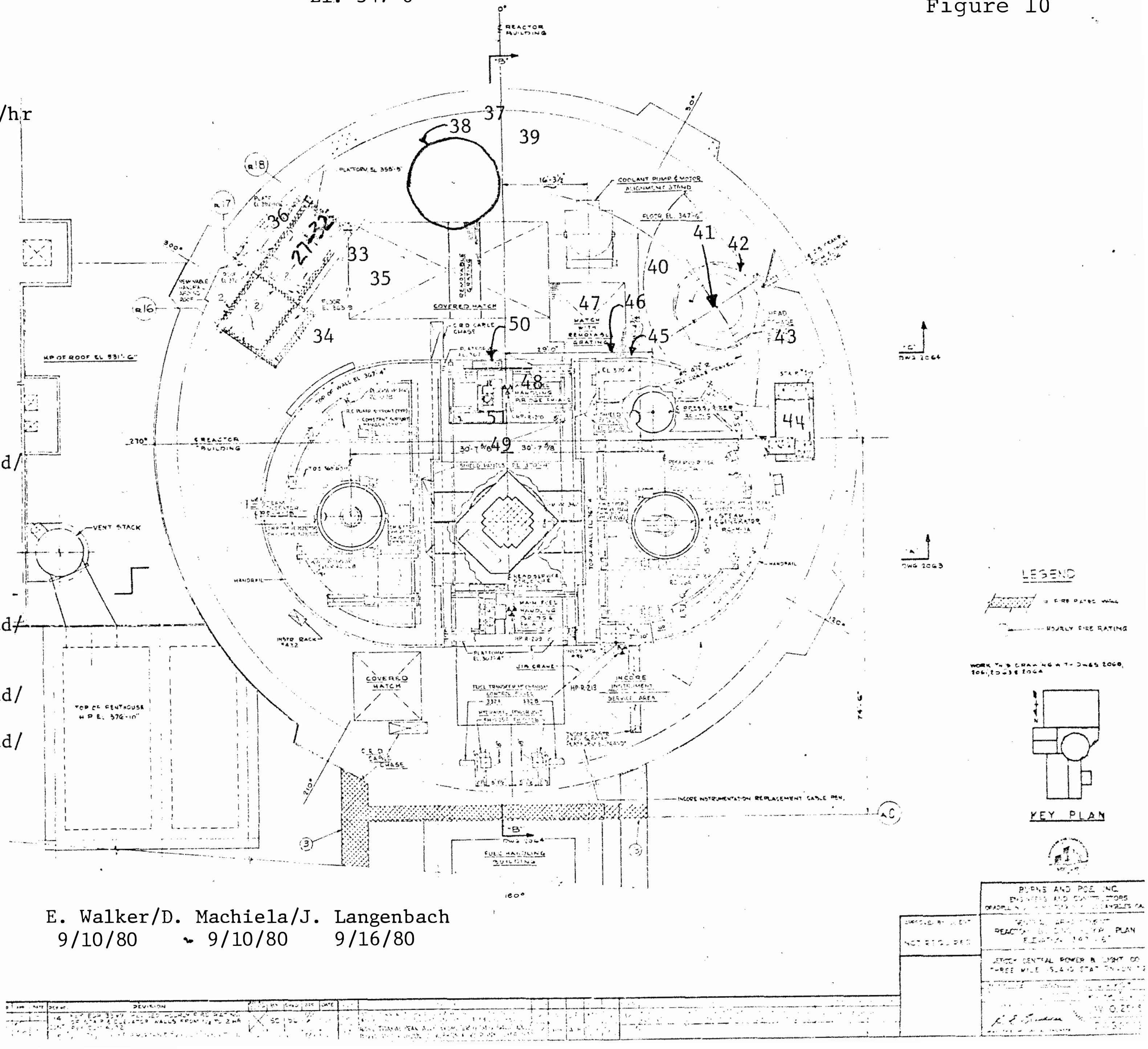
9/10/80 9/10/80 9/16/80

August 15, 1980
Radiation Survey
Reactor Building
El. 347'6"

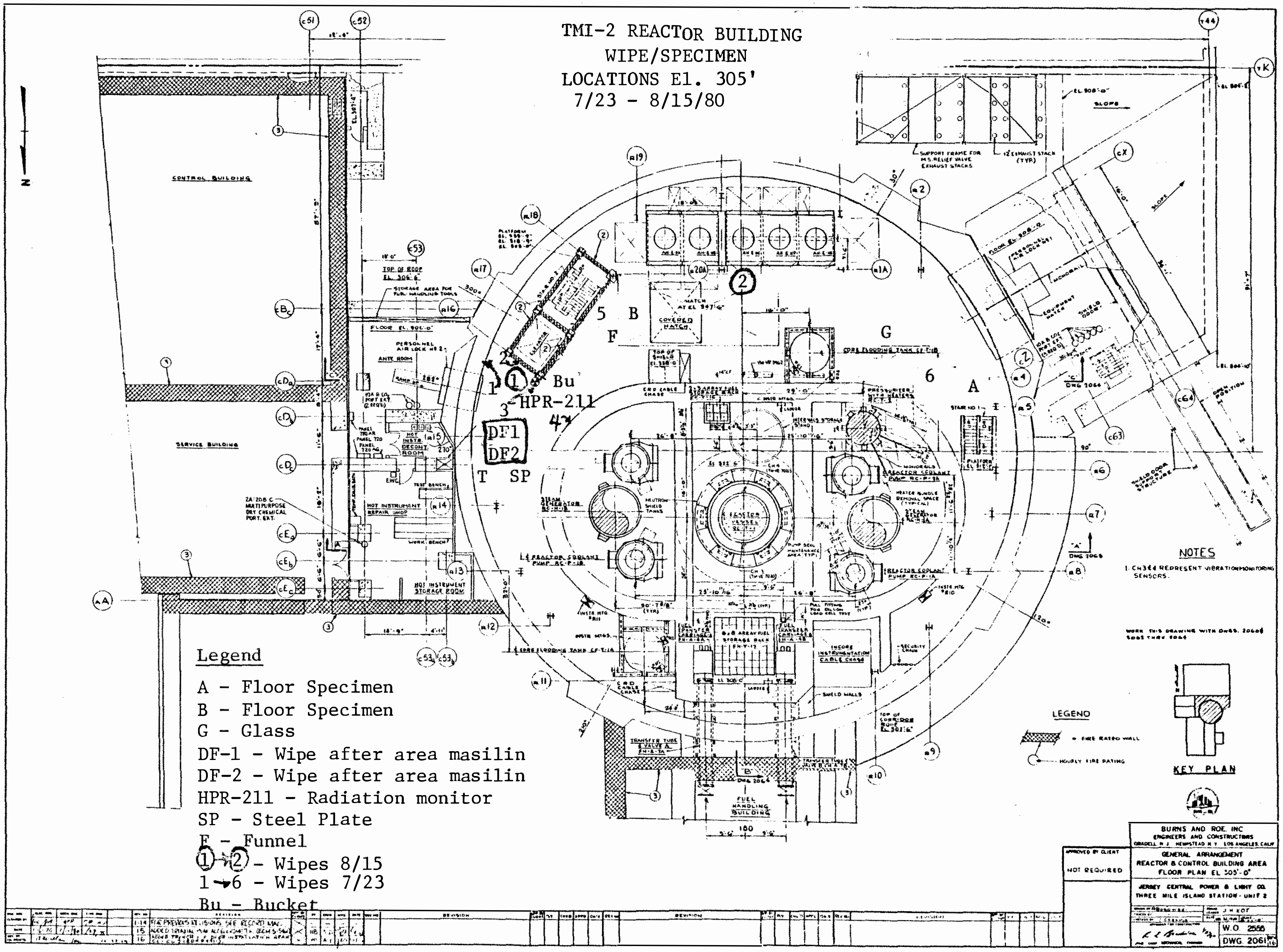
Figure 10

LOCATION	DOSE RATE GAMMA	BETA
#27 312' el.	2R/hr	4 Rad/hr
#28 319' el.	1R/hr	-
#29 326' el.	0.8R/hr	-
#30 333' el.	0.5R/hr	-
#31 340' el.	0.3R/hr	-
#32	0.18R/hr	-
#33	0.25R/hr	-
#34	0.1 R/hr	-
#35	0.6 R/hr	-
#36	0.05R/hr	-
#37	0.15R/hr	-
#38	0.03R/hr	-
#39	0.1R/hr	-
#40	0.4R/hr	-
#41	0.3R/hr	-
#42	0.45R/hr	6.2Rad/hr
#43	0.15R/hr	-
#44	0.55R/hr	-
#45	0.1R/hr	-
#46	2.5R/hr	-
#47	0.25R/hr	-
#48	0.17R/hr	0.9Rad/hr
#49	0.15R/hr	-
#50	*0.2R/hr	5.2Rad/hr
#51	0.12R/hr	-
#52	0.3R/hr	10.8Rad/hr

*Estimated



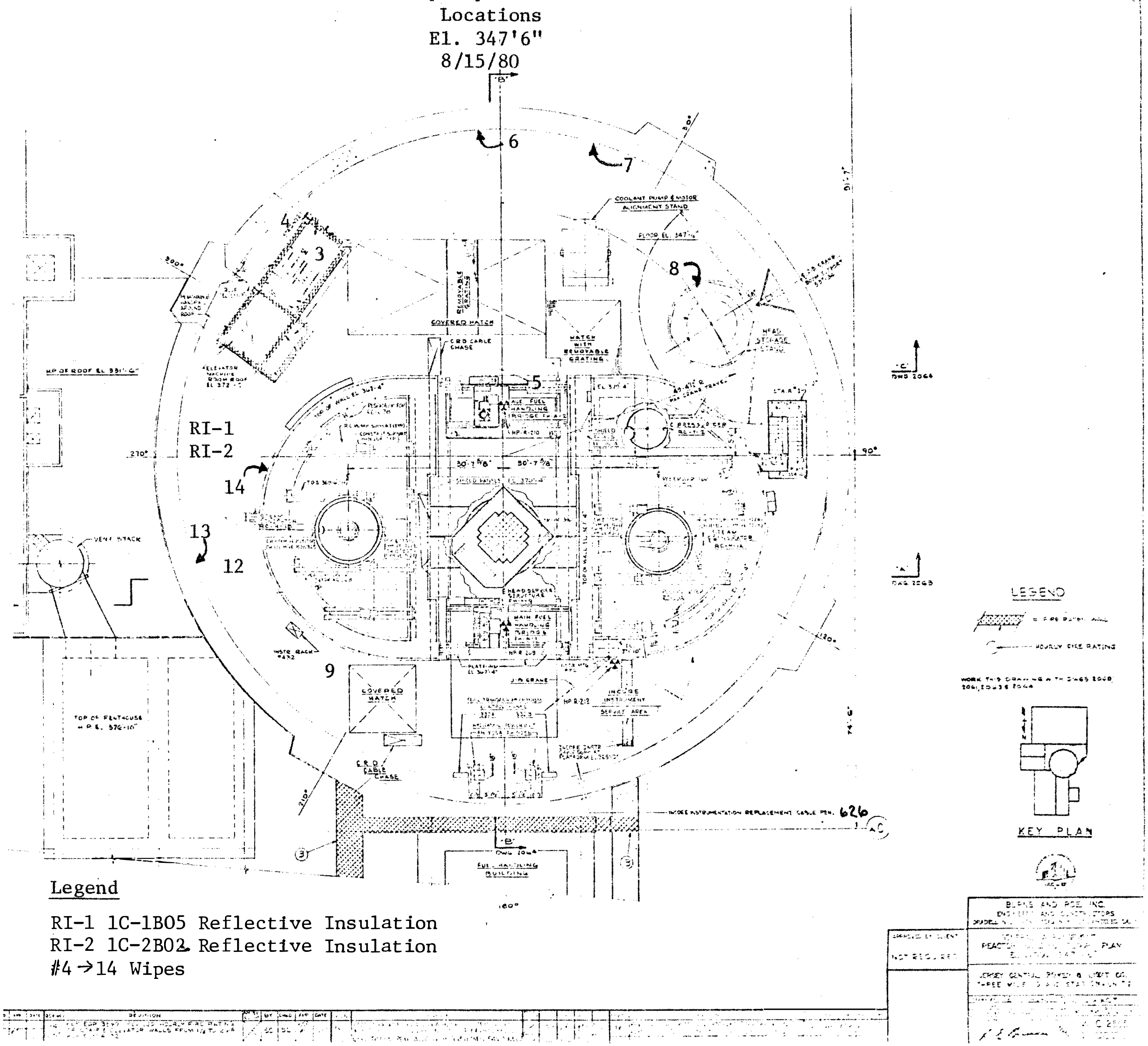
E. Walker/D. Machiela/J. Langenbach
9/10/80 9/10/80 9/16/80



Legend

A - Floor Specimen
B - Floor Specimen
G - Glass
DF-1 - Wipe after area masilin
DF-2 - Wipe after area masilin
HPR-211 - Radiation monitor
SP - Steel Plate
F - Funnel
(1)→(2) - Wipes 8/15
1→6 - Wipes 7/23
Bu - Bucket

TMI-2
Reactor Building
Wipe/Specimen
Locations
El. 347'6"
8/15/80



Legend

RI-1 1C-1B05 Reflective Insulation
RI-2 1C-2B02 Reflective Insulation
#4→14 Wipes

11.0 TRANSCRIPTS

ENTRY NO 1. JULY 23, 1980

ENTRY NO. 2 AUGUST 15, 1980

APPENDIX C

W. H. Behrle
7/23/80

CONTAINMENT ENTRY TRANSCRIPT

Benson: Benson to Base - I'm ready to turn the handwheel, over.

Command: Roger, out

Benson: Benson ... The airlock is equalizing over . . now . . over

Benson: Benson to Base - Still equalizing, over

Command: Roger, out

Behrle: Behrle to Benson - I'm ready Michael, over

Command: Base to Behrle - Are you commencing to open the door now? Over

Behrle: Behrle to Base - The inner airlock door in opening, over

Command: Roger, you're on the clock, over

Behrle: Behrle to Base - I read 400 millirem about 6 ft. inside the building, head height, over

Command: Roger, out

Behrle: Behrle to Base - I have entered the building,over

Command: Roger, out

Behrle: Behrle to Base - A swipe area reads 250 millirem gamma

Command: Base ... This is base - We did not copy, over

Behrle: "A" swipe area reads 250 millirem; "B" swipe area, swipe area reads 2 rem

Command: Roger, we copy

Benson: Benson to Base - I have taken the "A" and "B" swipes; the readings are one rad, over

Behrle: Behrle to Base - The red area reads between 400 and 600 millirem, that is shoulder height to floor, on contact with floor they all read about the same, over

Command: Roger, we copy

Benson: Benson to Base - Do you copy, over

Command: We copied the last transmission, over

Benson: I have taken the A, B, & C swipes; I am taking D, over

Command: Base did not catch the last end, repeat please, over

Behrle: Behrle to Base - The floor drain on contact next to the ramp reads about 5 rem on contact, over

Benson: Benson to Base - Do you read me, over

Command: Roger, we copied

Benson: I have taken all 4 swipes, over

Command: Roger, we copy; you took all 4 swipes, over

Benson: The surface readings for all the swipes are one to two rads, over

Command: Roger, one to two rads, over

Benson: The general area still reads zero rads (words?), over

Command: Base to Benson - We need a digital on you and Behrle, Benson first, over

Behrle: Behrle to Base - My digital reads 23 millirem, over

Command: Base to Benson - We did not get a transmission out of you. Could you give us your dosimeter, over

Benson: Benson to Base - 19 millirem, over

Benson: (Word?) That's 19 millirem, over

Command: Roger, 18 millirem, over

Behrle: Behrle to Base - The high pressure injection line above the D ring reads about 3 rem on contact

Command: Roger, we copy the 5 rem, we don't know the area, over

Behrle: Behrle to Base - The D ring reads about 300 millirem on contact at 5 or 6 different locations, over

Command: Roger, that's the yellow area. By the way, you are 5 minutes 35 seconds into entry, over

Behrle: Behrle to Base - It's the red to yellow area, over

Command: Did not copy, over

Command: Base to Benson, Base to Benson - Do you have any beta readings? over

Benson: Benson to Base - At the edge of the red area on contact with the floor I am reading 4 rad, over

Command: Roger, we copy. 4 rads - edge of the red

Benson: In the general vicinity, in the area its 1 rad, over

Behrle: Behrle to Base - The general area radiation levels in orange are about 500 millirem, over

Command: Roger, we copy. You are now seven minutes, twenty-one seconds into entry, please come back with your dosimeter readings, over

Behrle: Behrle to Base - My dosimeter reading is 43 millirem, over

Command: Roger

Behrle: Behrle to Base - Benson's air pressure reading is 1800 pounds, over

Benson: Benson to Base - I read 40 millirem, over

Command: Roger, we copy

Behrle: Behrle to Base - The elevator door reads 3 rem on contact, over

Command: Roger, we copy

Command: Base to Behrle - Was that the elevator door?, over

Behrle: Behrle to Base - The floor drain in yellow - reads 2 rem, over

Behrle: Behrle to Base - The stairwell door has been blown open by the explosion, over

Command: Base did not copy, over

Behrle: The stairwell door by the elevator has been blown (word?) open by the explosion. It reads 400 millirem, over

Command: Roger, we copy, over. Base to Benson - Are you getting pictures?, over

Behrle: The radiation reading in the stairwell is 8 rem, 8 rem, over

Command: Roger, we copy, 8 rem in the stairwell. Are you getting pictures, over

Benson: Benson to Base - I have taken several pictures. The reading in the stairwell is 4 rads, over

Command: Roger, we copy. 4 rads in the stairwell, over

Command: Base to Benson & Behrle - You are now 10 minutes, 22 seconds into entry. We need your dosimeter readings, over

Behrle: Behrle to Base - My dosimeter reads 73, 73 millirem, over.

Command: Roger, 43 millirem, over

Benson: Benson to Base (interruption by Behrle 73 millirem, over.

Command: We had dual transmission. Was that 83 millirem, Behrle?, Over

Behrle: Affirmative, over.

Benson: Benson to Base - I have 60 millirem, over

Command: Roger, we copy - 60 mr, over

Darryl: Osdon to Base- I have completed wiping down the inner reactor door and seal area

Command: Base - We could not understand the last transmission and we don't know who it came from, over

Darryl: Osdon to Base - I have completed wiping down the inner reactor door and seal area.

Command: Roger, we copy.

Behrle: Behrle to Base - The highest reading over the hatch, over the hatch is 10 rem, over.

Command: Roger, 10 rem, over.

Benson: Benson to Base - The beta reading over the hatch is 6 to 7 rad, over

Command: Roger, we copy - 67 rads

Behrle: Behrle to Base - at the edge of the hatch it is 4 rem, over

Command: Base could not copy, try again, over

Benson: Benson to Base - The beta reading over the hatch is about 7 rad, over, over

Command: Roger, we copy.

Behrle: Behrle to Base - The flood pipe reads 3 rem on contact, over

Command: Roger, we copy. You are now 13 minutes, 10 seconds into entry. We would like a dosimeter reading, over

Behrle: Behrle to Base - 108 millirem, over

Command: Roger, we copy

Command: Base to Benson - We need a digital dosimeter on you, over

Benson: Benson to Base - One hundred and sixteen millirem, over.

Command: Roger, we copy. 115, over

Behrle: It is 1400 millirem at air cooler

Command: We did not copy, please repeat

Behrle: Air cooler

Command: We copy, 115 m rads, I mean m rem beta,

Behrle: Behrle to Base - General background radiation readings in blue is 700 millirem, over

Command: Roger, we copy, over

Behrle: Behrle to Base - Ramp? on contact is reading 1200? millirem

Command: Roger, we copy

Command: Base to Benson & Behrle - You are now 16 minutes, 3 seconds into entry, please give us your dosimeter readings.

Behrle: Behrle to Base - The D ring on contact reads 400 millirem, over

Command: Roger

Behrle:	Behrle to Base - My digital dosimeter reads 135 millirem, over
Command:	Roger, We copy
Command:	Base to Benson - We need your dosimeter reading, over
Behrle:	Behrle to Base - The floor drain in blue reads 8 rem, over
Command:	Roger - Benson, we need your dosimeter, over
Benson:	One forty three millirem, over
Command:	Roger, Benson, we copy; 143 mr.
Command:	Base to Benson and Behrle - Start procedure to exit the building, over
Behrle:	Behrle to Base - Affirmative, over
Command:	Roger, We copy your acknowledgement, over
Benson:	Benson to Behrle - Don't forget the light, over
Command:	Base did not copy, come back, over
Benson:	Bill, don't go around behind the core flood tank.
Command:	Base to Benson and Behrle - You are now 18 minutes, 45 seconds into entry, over
Command:	Base to Benson and Behrle - Please notify us when you get to the airlock, over
Command:	Base to Benson and Behrle - Please give us your location, over
Command:	Base to Darryl, Base to Darryl - Where is the entry team?, over
Darryl:	Benson & Behrle on for the airlock commencing to shut the outerdoor.
Command:	Roger, we copy, you're getting ready to shut the outer door. Is that affirmative?, over.
Benson:	Benson to Base - My dosimeter reading is 172 millirem, the other
Command:	Base to Behrle - What is your dosimeter reading?, over
Command:	Base to Behrle, Base to Behrle - What is your dosimeter reading, over
Behrle:	176

Command: Roger, we copy - 176

Benson: Benson to Base - My digital dosimeter on my left arm is 175 and the right arm dosimeter reads 216, over

Command: Base to Behrle - Keep it in your head, we can't copy all the information, over.

Transcript of Second Entry

Command Center Tape Channel #1 - Benson/Griffith

Benson to Base:	Marty has just closed the outer door, over.
Base to Benson:	Roger, we copy.
Benson to Group:	I guess it's about time to open the inner door. Everybody ready? You ready Sam?
Griffith to Benson:	I'm ready Mike!
Benson to Base:	Everybody's ready, here goes nothing. The airlock is equalizing quickly, and I'm continuing to open.
Base to Benson:	Roger, out.
Griffith to Base:	- - - - - - - - - -
Base to Griffith:	Go ahead Sam, over.
Griffith to Base:	Breakers one and eight are open.
Base to Griffith:	OK Sam, what happened to seven? over.
Griffith to Base:	It was open.
Base to Griffith:	How is breaker seven?
Griffith to Base:	Breaker 7 was already in the open position.
Base to Griffith:	Roger, we copy, over.
Base to Griffith:	Sam are you taking pictures P2, P3, and P4?
Base to Griffith:	Yes, they have been taken.
Base to Griffith:	Sam, we need your digital dosimeter, over.
Griffith to Base:	Seventeen.
Base to Griffith:	Roger, 17 over.
Base to Benson:	We need your digital over.
Benson to Base:	I'm reading 46 mr, over.

Base to Benson: Roger, out.

Griffith: - - - - - - - - - - -

Base to Griffith: Give me status, over.

Griffith to Base: Taking surveys.

Base to Griffith: Roger, doing survey, over.

Benson to Base: I think some of the lights are on.

Base to Benson: Roger, we copy.

Base to Griffith: How about giving us your survey readings as you go, over.

Benson to Base: - - - - - - - - - - -

Base to Benson: Go ahead.

Benson to Base: Behrle has just taken the scrape sample, over.

Base to Benson: Roger we copy. Scrape sample taken. Give us your digital, Mike, over.

Benson to Base: I'm reading one-one-seven (117) millirem, over.

Base to Griffith: Give us your digital, over.

Griffith to Base: Twenty-nine millirem, over.

Base to Griffith: Roger we copy two-nine (29).

Benson to Base: The inner airlock door is rusted in the locked position, over.

Base to Benson: Roger we copy, in the locked position. You guys hurry up and get out of there. Start moving back, over.

Griffith to Base: - - - - - - - - - - -

Base to Griffith: Roger, go ahead Sam

Griffith to Base: - - - - - - - - - - - (?)

Base to Griffith: Go ahead, I can't copy, Speak slower, over.

Griffith to Base: Everything looks good.

Base to Griffith: Roger we copy, everything looks good. Did you get the tie-wraps, over?

Base to Griffith & Benson: You're now 7 minutes-45 seconds into entry , over.

Griffith to Base: Didn't hear you, Base.

Base to Griffith & Benson: You are now 7 minutes-48 seconds into entry, over.

Griffith to Base: Roger, 7 minutes-48 seconds into entry.

Base to Griffith: Have you moved over and rejoined Cooper yet? Over.

Griffith to Base: Roger, Base. The four of us are all together in front of the air coolers taking smear sample.

Base to Griffith: Roger, in front of air coolers, taking smear sample, over.

Griffith to Base: I have a reading of 3.5 R over penetration.

Base to Griffith: Roger.

Base to Benson: We need a digital on you, over.

Benson to Base: One-four-zero (140) millirem, over.

Base to Griffith: Roger we copy. We need a digital on you, over.

Griffith to Base: 61 millirem.

Base to Griffith: Roger, out.

Benson to Base: We've got both scrape samples, the funnel, and the piece of broken glass. We're ready to move to the front of stairs, over.

Base to Benson: Roger, you've taken both scrapes and moving to assembly area for trip up the steps.

Benson to Base: Roger.

Base to Griffith & Benson: You are now 10 minutes-15 seconds into entry, over.

Griffith to Base: Roger, Base.

Base to Benson: Let us know when you are getting ready to go up the stairwell, over.

Griffith to Base: - - - - - - - - - -

Base to Griffith: Roger, Sam. Go ahead.

Griffith to Base: I have the plastic ties, over.

Base to Griffith: No copy, repeat.

Griffith to Base: I have the plastic ties.

Griffith to Base: Three R-open window, first landing.

Base to Griffith: Roger, out.

Griffith to Base: 800 mr open window, second landing.

Base to Griffith: Roger, out.

Griffith to Base: Next landing 400.

Base to Griffith: Roger, we copy.

Griffith to Base: Fifth landing, 320.

Base to Griffith: Roger, out.

Griffith to Base: Sixth landing, 180.

Base to Griffith: Roger.

Griffith to Base: Door is open on the 347.

Base to Griffith: Roger we copy. In or out, over.

Base to Benson: Could you give me you digital, you're now 12 minutes-32 seconds into entry, over.

Benson to Base: 187, over.

Base to Griffith: Roger we copy. Sam, could we have your digital, over.

Griffith to Base: 97 millirem.

Base to Griffith: Roger we copy.

Griffith to Base: Some lights tried to come on, but they tripped out.

Base to Griffith: Roger, lights tried to come on, but they tripped, is that all three pushbutton stations, over.

Griffith to Base: OK, there on, they'are tripped out again!

Base to Griffith: Roger, they tripped out again. Try the other pushbutton station, over.

Griffith to Base: - - - - - - - - - -

Base to Griffith: Roger, go ahead, Sam.

Griffith to Base: 30 mr at the indexing fixture.

Base to Griffith: Roger, out.

Griffith to Base: - - - - - - - - - - -

Base to Griffith: Roger, go ahead.

Griffith to Base: 600 over top the decking just outside stairwell door.

Base to Griffith: We don't copy, but 600 somewhere.

Griffith to Base: 600 on the diamond plate decking in front of stairwell door.

Base to Griffith: Roger we copy.

Benson to Base: The 347 telephone is melted, over.

Base to Benson: Roger we copy. Also like a dosimeter on you Benson, over.

Benson to Base: 195 millirem, over.

Base to Benson: Roger we copy. Sam we need digital on you, over.

Griffith to Base: 104.

Base to Griffith: Roger, we copy.

Griffith to Base: Contact reading underneath the (Head Stand) 300. Do you copy, Base.

Base to Griffith: Roger we copy, 300, over.

Base to Griffith & Benson: You're now 16 minutes-17 seconds into entry, over.

Griffith to Base: Roger, Base.

Griffith to Base: Contact reading 2 Rad open window?

Base to Griffith: Roger, you took one open window, over.

Griffith to Base: - - - - - - - - - - -

Base to Griffith: Roger, go ahead.

Griffith to Base: The Pressurizer Spray Line reads 2.5 R contact at the elbow by the penetration.

Base to Griffith: Roger, we copy.

Griffith to Base: The lighting is well warmed up. It is very bright.

Base to Griffith: Roger, we copy.

Griffith to Base: Contact reading on the D-ring wall opposite the pressurizer 100 mr, contact.

Base to Griffith: Roger, we copy. We need your digital dosimeter, Sam. You're 18 minutes-14 seconds into entry, over.

Griffith to Base: Roger, 18 minutes-14 seconds. My digital reads 112, over.

Base to Benson: Roger we copy. Mike we need yours also, over.

Base to Benson: Could we have your digital?

Benson to Base: 219 millirem, over.

Base to Benson: Roger, we copy.

Griffith to Base: Open window reading looking in cavity under the bridge is 400 open window, over.

Base to Griffith & Benson: Roger, we copy. Hey, we would like you guys to try the pushbuttons by the open stairwell for the lights if they are not on, over.

Griffith to Base: We copy.

Griffith to Base: 50% of the lighting is on.

Base to Griffith: Roger, 50% are on, out.

Griffith to Base: Contact readings on the fuel bridge 1.5 R open window.

Base to Griffith: Roger, 1.5 R, over.

Base to Griffith & Benson: We want you guys to go ahead and stay while Cooper and Behrle leave, over.

Griffith to Base: Roger, Base.

Base to Griffith: Sam, also take the teletector from Behrle, over.

Base to Benson: Please repeat, you were stepped on, over.

Benson to Base: 210 millirem, over.

Base to Griffith: Roger, we copy, 210. Sam, can we get your digital, over.

Griffith to Base: 123 over.

Base to Griffith: Roger, we copy. Sam take the teletector from Behrle, over.

Griffith to Base: It's with Behrle, over.

Base to Benson: Give us your digital again, over.

Benson to Base: 213 millirem, over, 14, over.

Base to Benson: Roger, we copy 214, over.

Benson to Base: How much time are we into this thing, over?

Base to Benson: Roger, you're 22 minutes-54 seconds into entry, over.

Benson to Base: Roger.

Base to Benson: Could you tell me what's going on, over.

Benson to Base: We are walking around to the east side of D-ring, over.

Base to Benson: Roger, we copy. Walking the east side, over.

Benson to Base: There is a 55 gallon drum beside the elevator, and it looks like somebody put it in a vice-grip and caved it in, over.

Base to Benson: Roger, we copy. Smashed! Take a picture, over.

Benson to Base: I don't have anymore photos, over.

Base to Benson: All out of film, over.

Benson to Base: Roger, but we're still going to take a visual, over.

Base to Benson: Roger, go ahead, over.

Base to Benson: Do you have the swipe box, over.

Benson to Base: Marty Cooper took it downstairs, over. However, we've got a couple swipes. Do you want us to take swipes, over?

Base to Benson: Roger, take swipes, note area, over.

Base to Benson: You're now 25 minutes-26 seconds into entry. Could you give me your digitals, over.

Benson to Base: 220 over.

Base to Benson: Could you repeat your digital, over.

Benson to Base: 220. I took swipe #12 off of the tool locker in front of D-ring on the north side of the building, over.

Base to Benson: Roger, we copy.

Base to Griffith: Could you please give us your digital, over.

Griffith to Base: 144.

Base to Griffith: Roger, we copy.

Base to Benson:	When you guys pick up those instrument packages, let me know so we know what the time frame is, over.
Benson to Base:	- - - - - - - -
Base to Benson:	Go ahead.
Benson to Base:	Where are Behrle and Cooper, over.
Base to Benson:	They are in the AnteRoom, over.
Benson to Base:	Is the door shut? I have to open it to exit?
Base to Benson:	Roger, you have to open the inner door to exit.
Benson to Base:	Roger, my digital reads 230, over.
Base to Benson:	Roger, your digital jumped to 230, over.
Benson to Base:	We are tired, over!
Base to Benson:	Roger, where are you located, over?
Benson to Base:	Got a flight to go, over!
Base to Benson:	Roger, we got you. Let us know when you get down and when you pick up the instrument packs. Let us know, over.
Benson to Base:	Roger.
Base to Benson:	The outer door is closed. You can proceed to inner at your will, over.
Base to Benson & Griffith:	You're now 31 minutes into entry. Could we have digitals when you get out on the 305 level, over.
Griffith to Base:	We're already on 305.
Benson to Base:	245. I'm opening the door, over.
Base to Benson:	Roger, opening the door. Are you then going to go and get the experimental package, over.
Benson to Base:	I'll get it after Sam exits, over.
Base to Benson:	Roger, we copy.
Benson to Griffith:	Go ahead and exit, Sam.
Base to Benson:	Michael, are you going to go over and pick up the steel plate and the experimental package, or are you going to leave the steel plate and just get the experimental package?
Benson to Base:	Yeh, Yeh, Yeh, we will do it.
Base to Benson:	Roger, we copy. We can rely on you, over.

Griffith to Base: I have a reading of 300 closed window on grating over the B core flook tank, over.

Base to Griffith: Roger, we copy, over.

Benson to Base: Swipe #6 was taken off the cable tray, over.

Base to Benson: Roger, off the cable tray, over.

Griffith to Base: At the same location, I have 3 Rad, open window.

Base to Griffith: Roger, we copy.

Benson to Base: Swipe 13 taken off liner.

Base to Benson: Roger, number 13 off the liner.

Benson to Base: There's a box on the ground, numbered 1C-2B-02, over.

Benson to Base: There was an instrument cover on the grating, number is 1C-2B-02, over.

Base to Benson: Roger, we copy 1C-2B-02, over.

Benson to Base: Something like that, Sam's bringing it out, over.

Base to Benson: Could we have your digital, over.

Benson to Base: 224 over.

Base to Griffith: Roger, we copy, Sam we need your digital.

Griffith to Base: 137 over.

Base to Griffith: Roger, we copy.

Benson to Base: That last swipe 14 was taken off D-ring. In front of me is an instrument and it looks like some type of pressure tank. It's 26, I don't see any tags on it and it is destroyed. Everythings rusted up. The glass or plastic in it melted and I don't think it could be used for anything.

Base to Benson: Roger, well we probably won't reuse it again, OK, over.

Benson to Base: I've had it, we're coming out, over.

Base to Benson: Roger, we copy. You're coming out. You're now 29 minutes-5 seconds into entry.

Benson to Griffith: Take off your gloves, Sam.

Base to Benson: Are you going to tell us when you pick up the experiments, correct, over!

Benson to Base: They're now at the airlock.

Base to Benson: Have you picked up the experiments, over?

Benson to Base: Yes.

Base to Benson: Roger.

Base to Benson & Griffith: Can we have your digitals, over?

Griffith to Base: Not right now, Base.

Base to Benson: Can we have your digital?

Benson to Base: 258.

Base to Griffith: Roger, we copy. Sam could we have your digital, over?

Griffith to Base: 174.

Base to Griffith: That was a 174, Roger?

Griffith to Base: Roger, Base.

Base to Griffith: Roger, out.

Base to Benson: Notify us when you close the inner door, over.

Benson to Base: I will.

Base to Benson: Thank you very much.

Benson to Base: That fire hose is still pretty rubbery, over.

Base to Benson: We didn't copy Benson, try again, over.

Base to Benson: We didn't get your last transmission, over.

Benson to Base: I'll tell you later, over.

Base to Benson: We still didn't copy. You're speaking too fast. If it's pertinent information go ahead and repeat, if not, hold off. Just let us know when you close the inner door, over.

Benson to Base: Please have someone open the door for us. We're in the airlock.

Base to Benson: Roger, we copy. Inner door closed, we'll have the outer door opened, over.

Benson to Base:	I wish you would train those guys not to open it. My ears hurt now.
Base to Benson:	Roger, we copy. They are getting ready to open the door, over.
Benson to Base:	No, they already opened it-my ears have poppped, over.
Base to Benson:	Roger, we copy.

Transcript of Second Entry

Command Center Tape Channel #3 - Behrle/Cooper

Behrle To Base: The inner door is open, over.

Base To Behrle: Door is open, Roger.

Base To Behrle/Cooper: Time is 1042.

Behrle To Base: I read about 400 mR/hr, over.

Base To Behrle: 400 mR, Roger, out.

Cooper To Base: The inner airlock door is shut.

Base To Cooper: The inner door is shut, aye.

Behrle To Base: I have opened breakers 1, 4, 7, & 8 at panel 3A, over.

Base To Behrle: Understand you have opened breakers 1, 4, 7, & 8, over. Out.

Base To Behrle: Both breakers are closed.

Behrle To Base: I am reading about 2 R behind the open stairwell, over.

Base To Behrle: Say again.

Cooper To Base: The cable on HP-R-211 broke!

Base To Cooper: Say again.

Cooper To Base: The cable on HP-R-211 broke!

Base To Cooper: The cable broke, over and out.

Base To Behrle: Give us a reading on your digital dosimeter, over.

Base To Cooper: Give us a reading on your digital dosimeter. This is 4 minutes into the entry, over.

Cooper To Base: 15 mR.

Base To Behrle: Give us a reading on your digital dosimeter, over.

Behrle To Base: My digital reads 120 millirem, over.

Base To Behrle: Understand 120, over.

Base To Behrle: Turn the lights on, over.

Behrle To Base: I have turned the lights on and most of the lights I can see are coming on, over.

Base To Behrle: The lights are coming on, over.

Base To Behrle/Cooper: 6 minutes into entry, give me your digital dosimeter readings, over.

Cooper To Base: Dosimeter, 40.

Base To Cooper: Understand 40, over

Cooper To Base: Correct, over.

Base To Behrle: Give me a digital reading please, over.

Behrle To Base: 174.

Base To Behrle: Understand 144, over.

Base To Behrle: Have you gotten your scrape sample, over?

Behrle To Base: Yes, I got the scrape sample, over.

Base To Behrle: Roger, out.

Base To Cooper: Did you get the old detector? Over.

Base To Behrle/Cooper: 9 minutes into entry. Give me your readings please. Over.

Base To Cooper: Give me a reading on your dosimeter, over.

Base To Cooper: Radio check, over.

Cooper To Base: (?)

Base To Cooper: You're cutting out.

Cooper To Base: Dosimeter, 86.

Base To Cooper: Dosimeter 86, Roger, Out.

Base To Behrle: Give me a digital dosimeter reading, over.

Behrle To Base: 190 mR, over.

Base To Behrle: Say again, over.

Base To Behrle: Give me a reading on your digital dosimeter, over.

Behrle To Base: 210 milli-Rem, over.

Base To Behrle: Understand 210, over.

Behrle To Base: I am going up the steps, reading 3 Rem,
2 Rem at the first landing,
1 Rem at the second landing,
1 Rem at the third landing,
500 mR at the fourth landing.

Base To Behrle: Say again, over.

Behrle To Base: 300 mR at the last landing,
180 mR at the top landing.

Base To Behrle/Cooper: 12 minutes into the entry, give me digital dosimeter readings, over.

Cooper To Base: 107, over.

Base To Behrle : Give me a digital dosimeter reading, over.

Behrle To Base: 225.

Base To Behrle: Understand 225, over.

Behrle To Base: Reading behind elevator is 50 mR, over.

Behrle To Base: We are having a little trouble getting lights on upstairs, over.

Base To Behrle: Trouble with lights, over.

Behrle To Base: -(?)-

Base To Behrle: Say again, over.

Behrle To Base: The general background reading on the 347 elevation is 100-400 millirem, over.

Base To Behrle: Understand 100-300 milli-Rem, where was that reading taken, over?

Behrle To Base: Behind the indexing fixture is 100-200, 2-2-2-2-2.

Base To Behrle: Understant 100-200 mR behind the indexing fixture, out.

Base To Behrle/Cooper: Give me a digital dosimeter reading, 15 minutes into entry.

Cooper To Base: Dosimeter, 116.

Behrle To Base: 242.

Base To Behrle: Understand 442.

Behrle To Base: 242, 2-2-2. 4-4-4. 2-2-2, over.

Base To Behrle: Understand 242, over & out.

Behrle To Base: Radiation levels between reactor head and reactor coolant motor stands are about 400 milli-Rem, over.

Base To Behrle: Understand 400 mR.

Behrle To Base: Radiation levels on the D-ring next to the head storage stand are 100 milli-Rem, over.

Base To Behrle: 100 Milli-Rem next to the D-ring near the head stand, over.

Behrle To Base: Radiation levels over the open stairwell are 550 milli-Rem, over.

Base To Behrle: Understand readings are 550 milli-Rem at the open stairwell, out.

Behrel To Base: Radiation levels over the open grating and the core flood tank are 250 milli-Rem, over.

Base To Behrle: 550 Milli-Rem.

Behrle To Base: 2-2-2-5-0, over.

Base To Behrle: 250, Roger, out.

Base To Behrle/Cooper: 18 minutes into the entry, give me digital dosimeter readings, over.

Cooper To Base: 127, over.

Behrle To Base: I am reading 170 mR over the open fuel pool between the crane rails, over.

Base To Behrle: 170 milli-Rem, out.

Base To Behrle: I need a reading on your digital dosimeter, over.

Cooper To Base: - - - - - - - - - - -

Base To Cooper: This is Base, over.

Cooper To Base: Getting very tired and super hot, over.

Base To Cooper: Getting hot, what was the first statement, over?

Cooper To Base: Getting very tired, over.

Base To Cooper: Do you want to come out?

Cooper To Base: I want to come out.

Base To Cooper: Alright.

Base To Cooper: Come out with Griffith, over.

Base To Behrle/Cooper: Both of you come out.

Behrle/Cooper To Base: That's affirmative, we are on our way, over.

Base To Behrle : Give Griffith your teletector, over.

Behrle To Base: Too Late.

Base To Behrle/Cooper: 21 minutes into the entry, give me your digital dosimeter readings, over.

Base To Behrle/Cooper: Give me a Roger that you are coming out, over.

Cooper To Base: We are coming out, over.

Base To Behrle: Are you coming out with Cooper, over.

Behrle To Base: Affirmative.

Base To Behrle: Roger, out.

Cooper To Base: Opening the inner airlock door.

Cooper To Base: Opening the inner airlock door, over.

Base To Cooper: Roger on the inner door, over.

Base To Behrle: Give me a reading on your digital dosimeter, over.

Behrle To Base: It's not high.

Base To Behrle: Roger, out.

Cooper To Base: The inner airlock door is shut. Come and get us, over.

Base To Cooper: Inner airlock door shut, Roger, out.

Cooper To Base: Opening outer airlock door, please hurry, over.

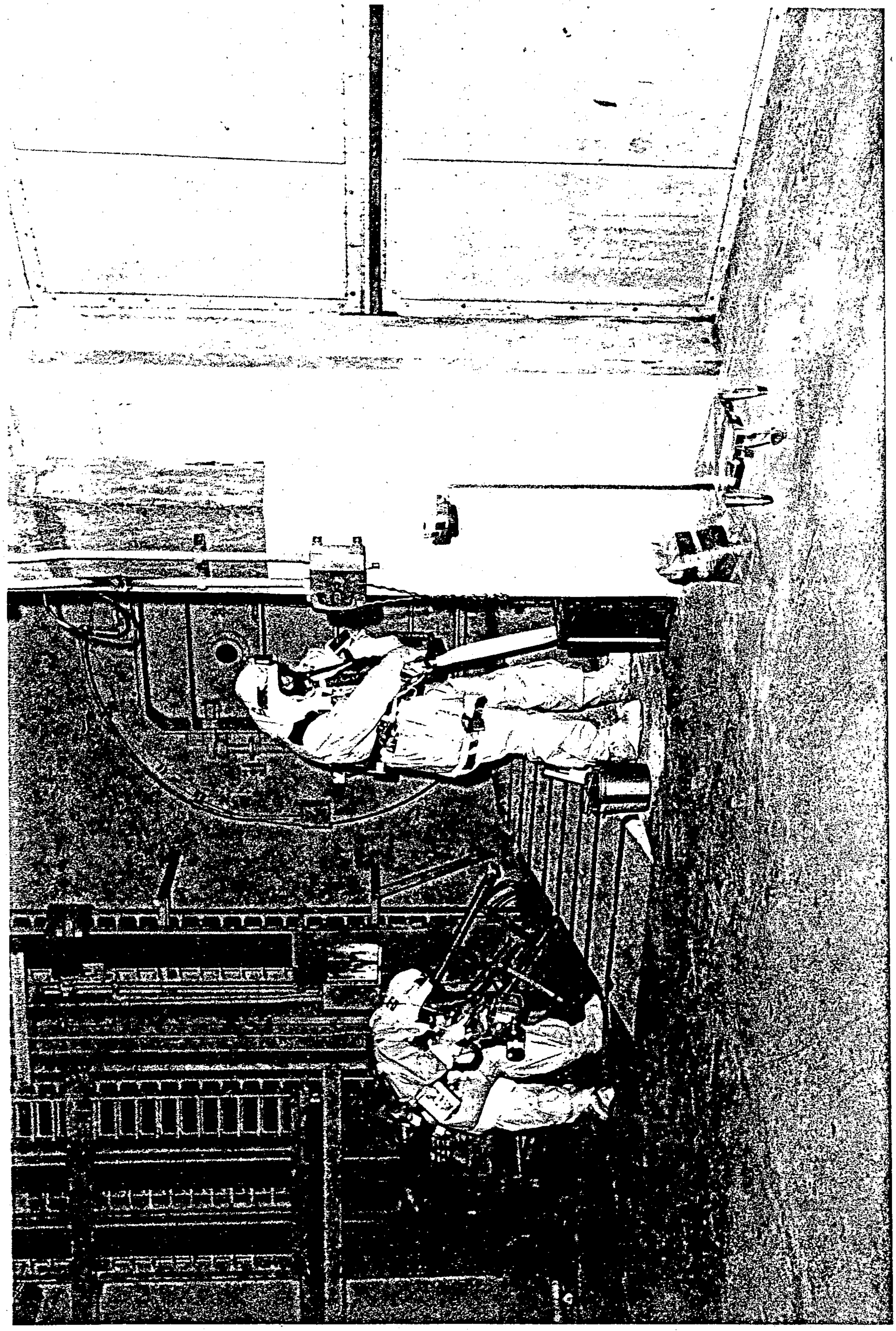
Base To Cooper: Hurry on opening outer door, over.

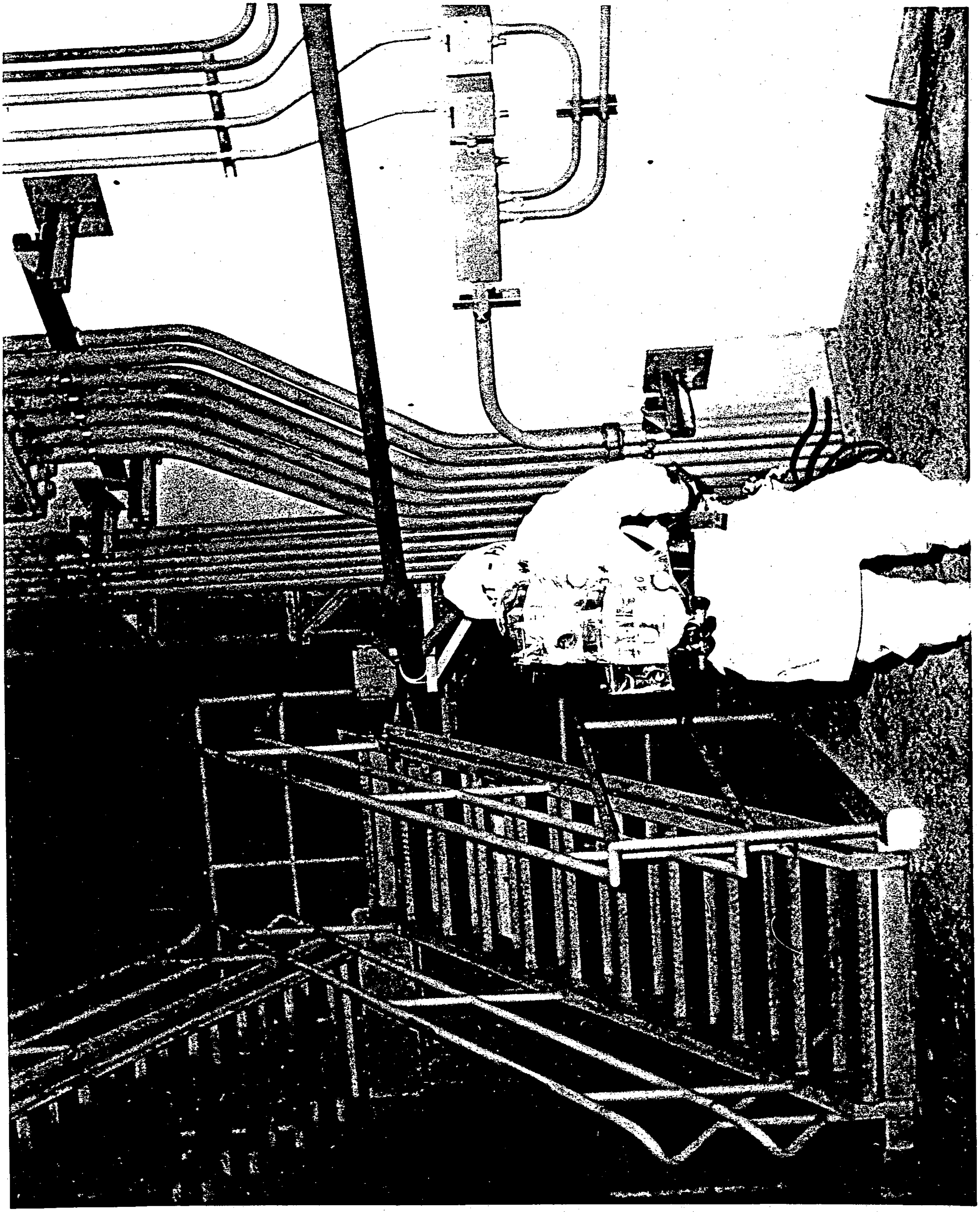
12.0 PHOTOGRAPHS

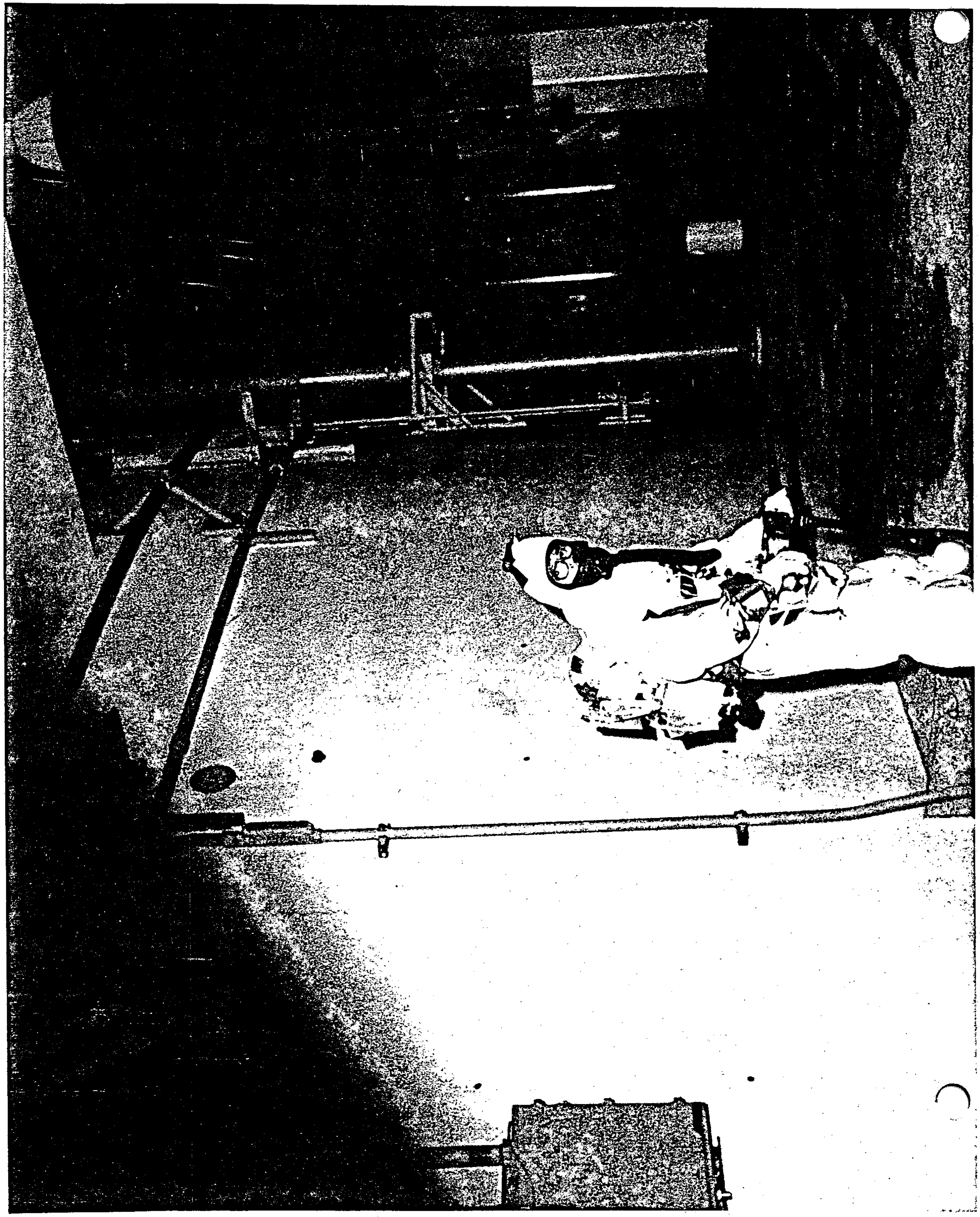
ENTRY NO. 1 JULY 23, 1980

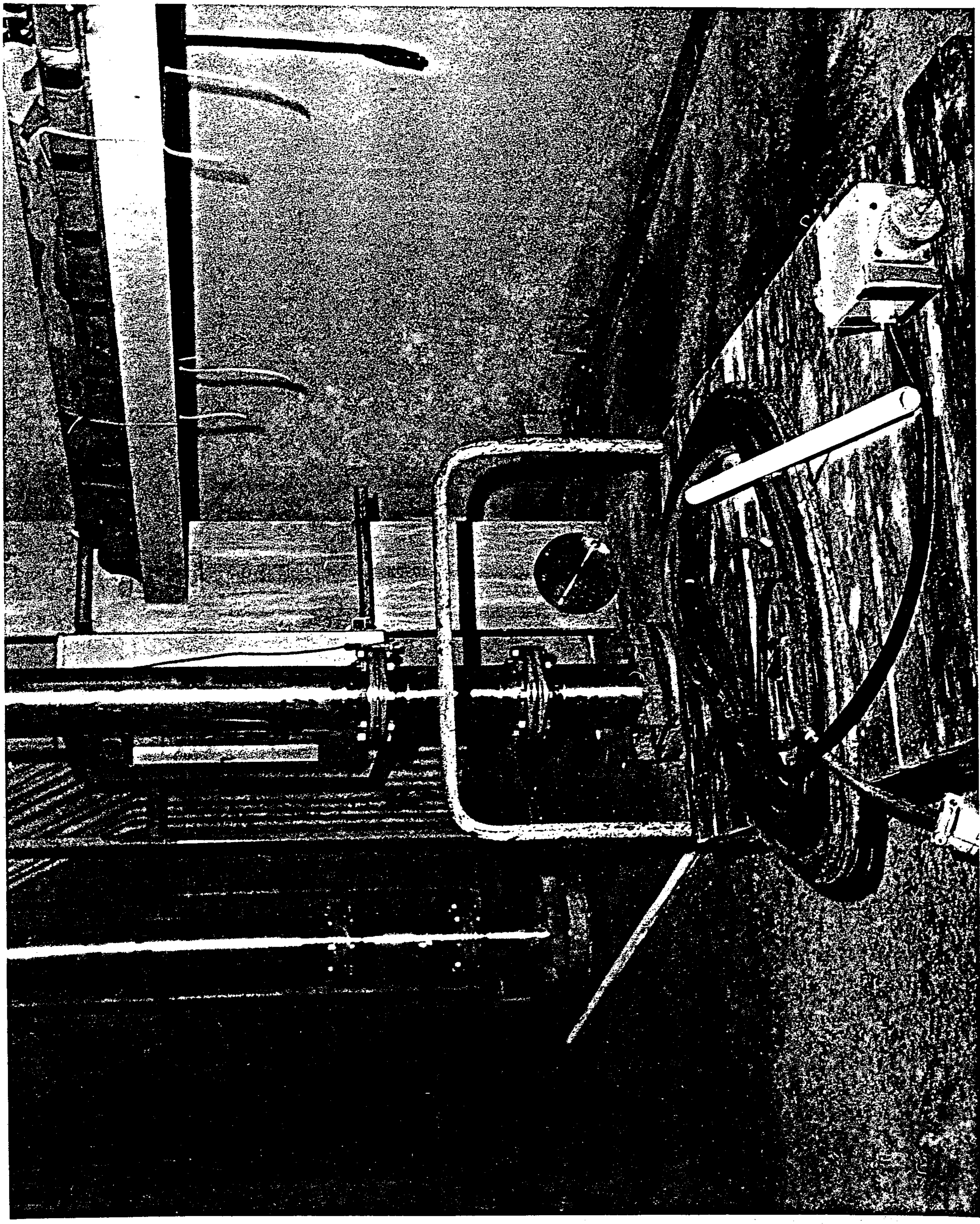
ENTRY NO. 2 AUGUST 15, 1980

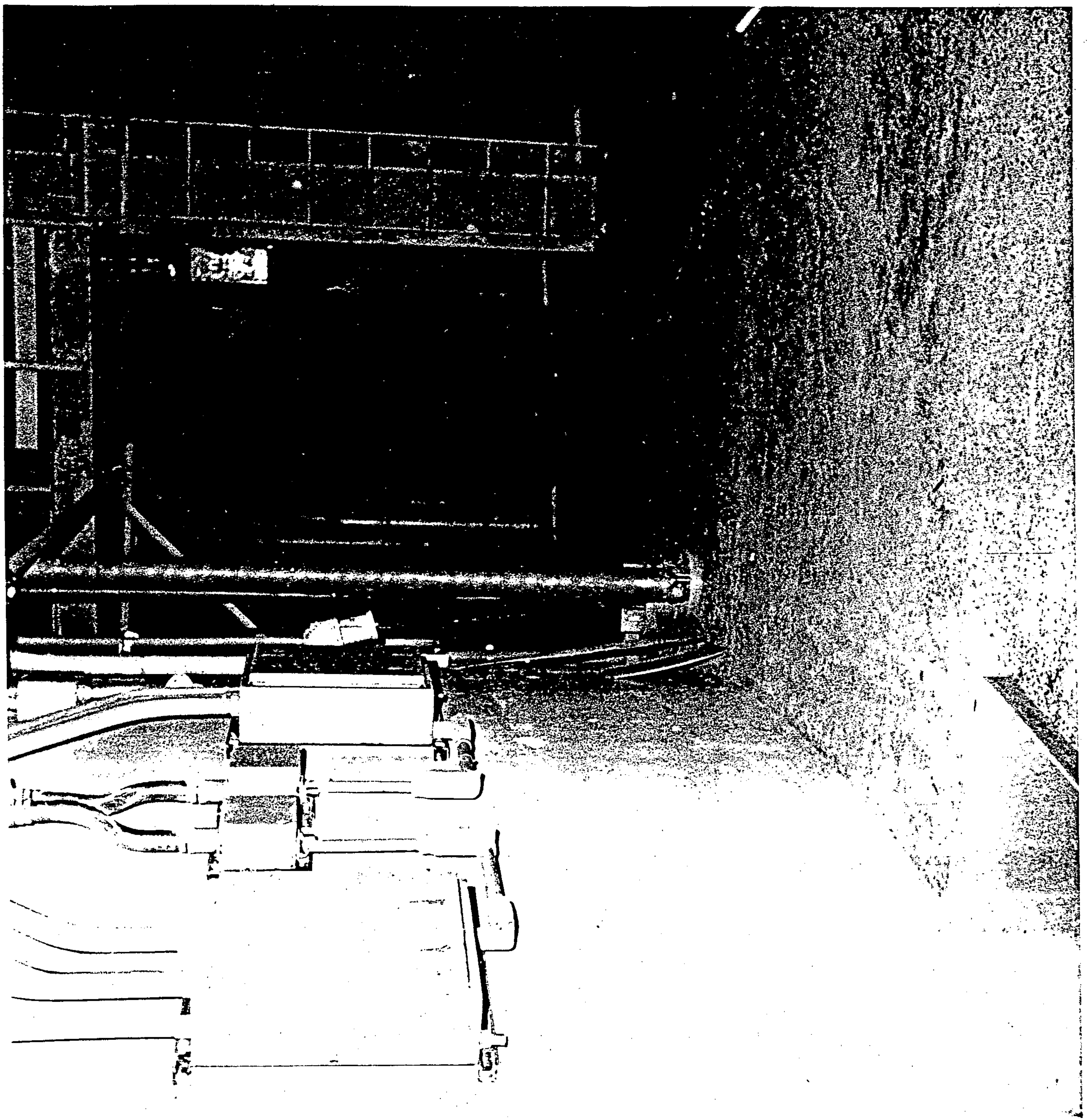
APPENDIX D

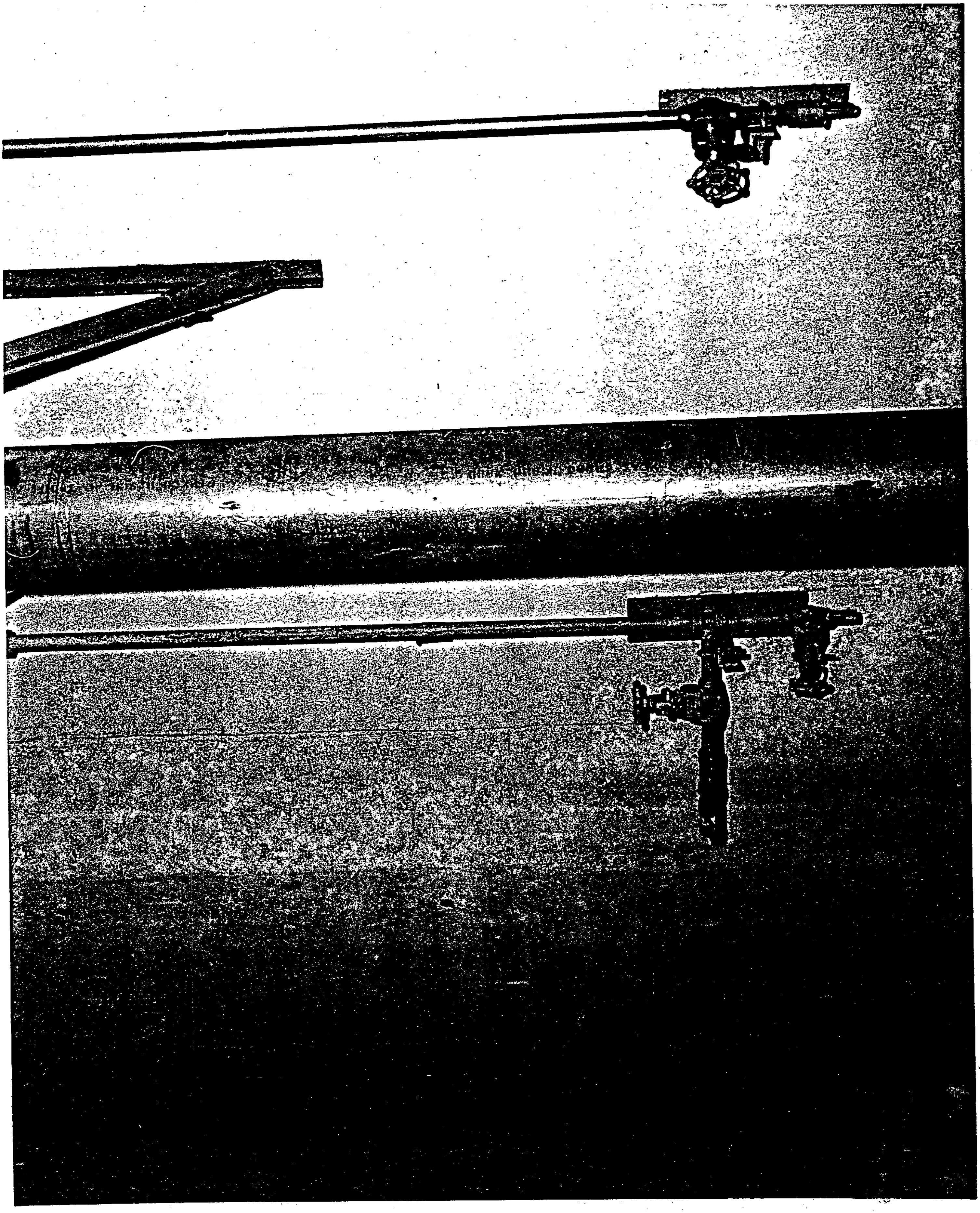


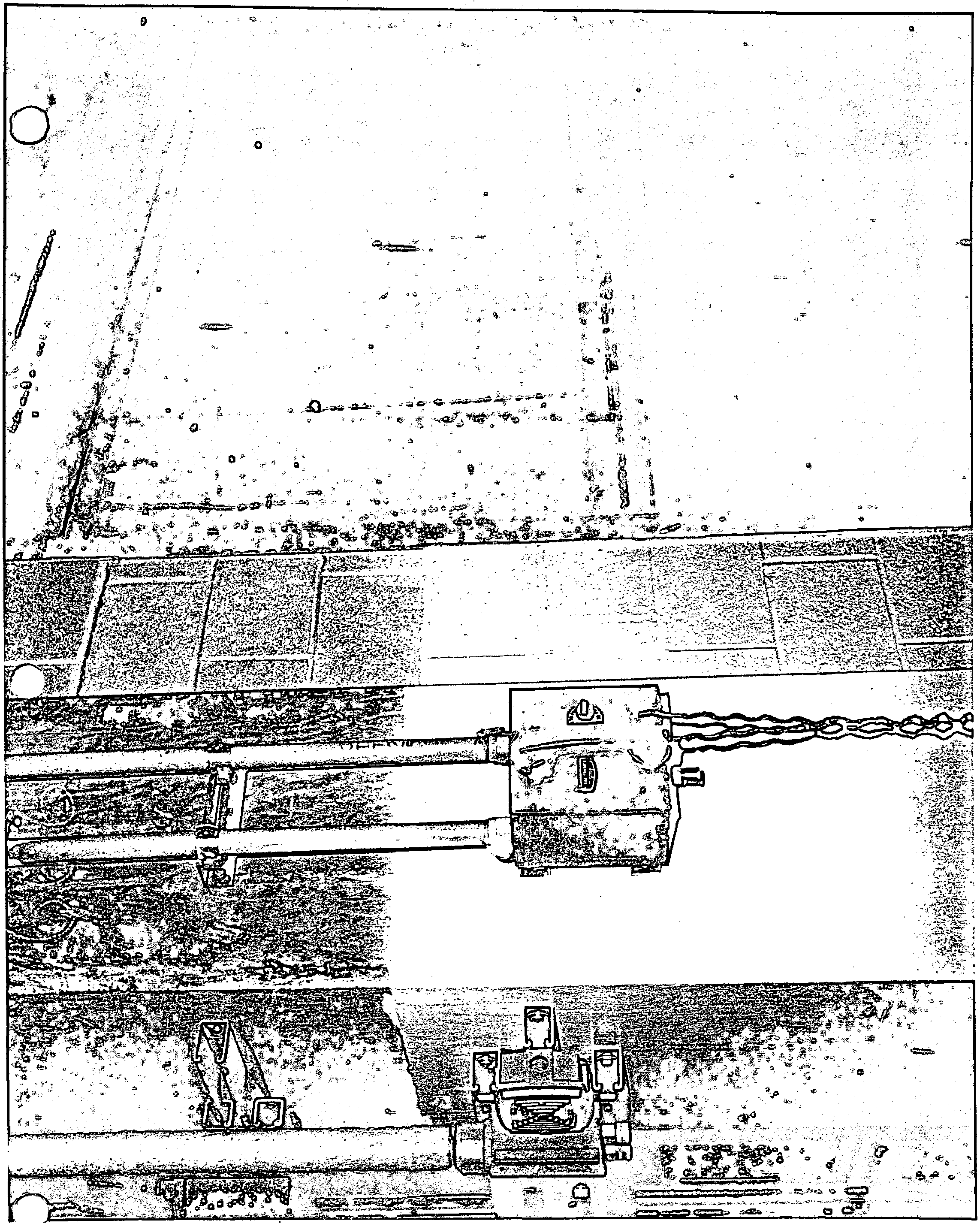


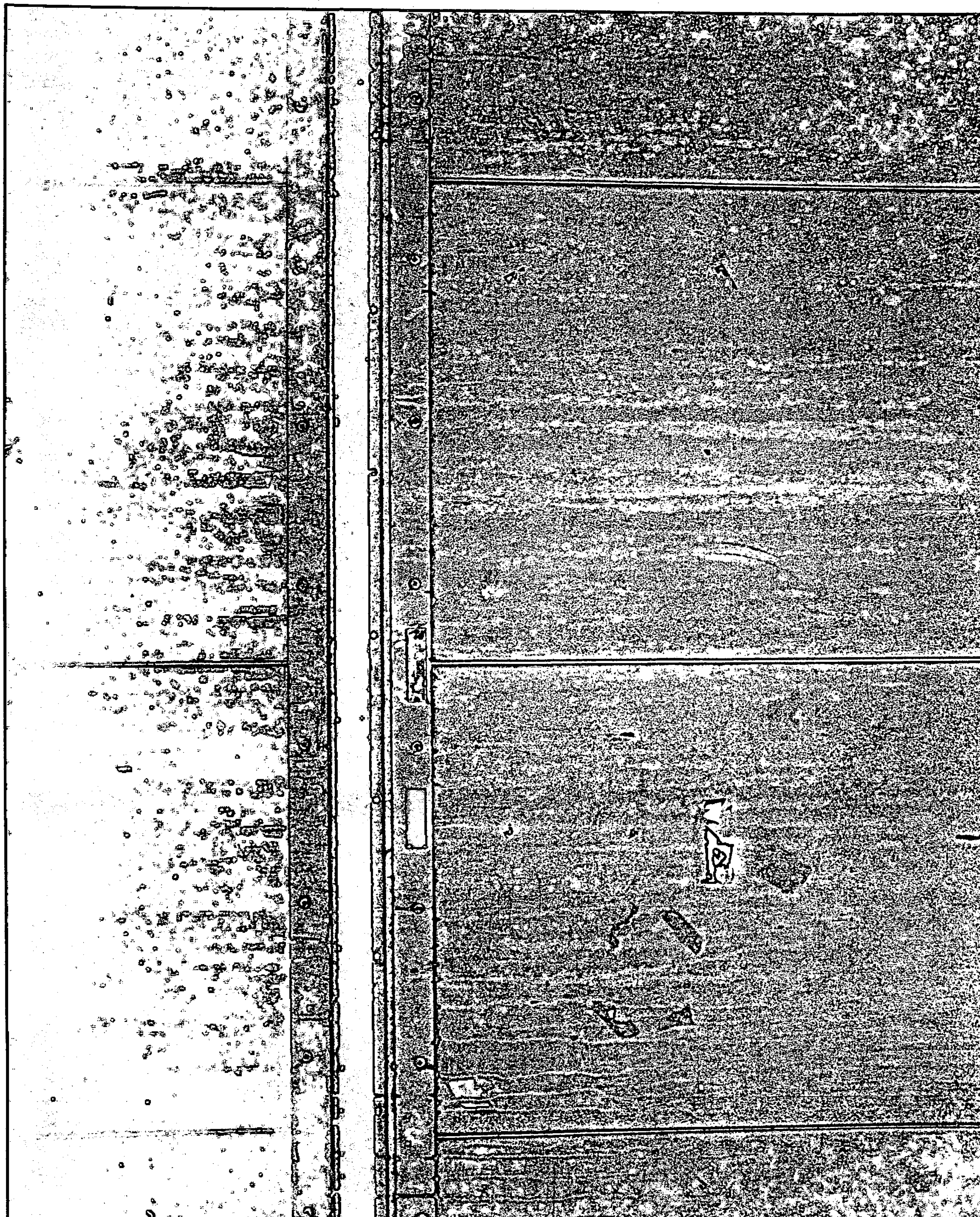


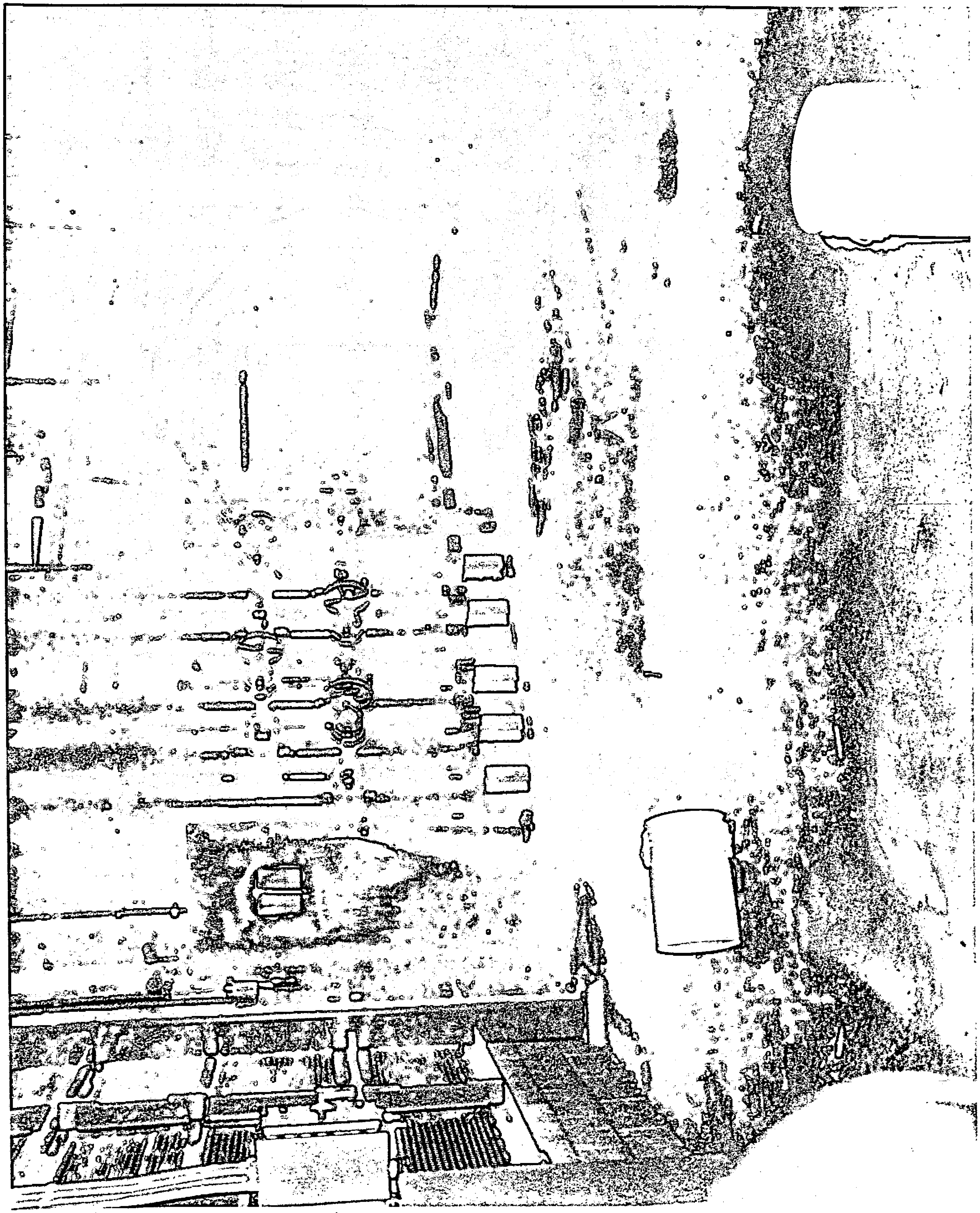


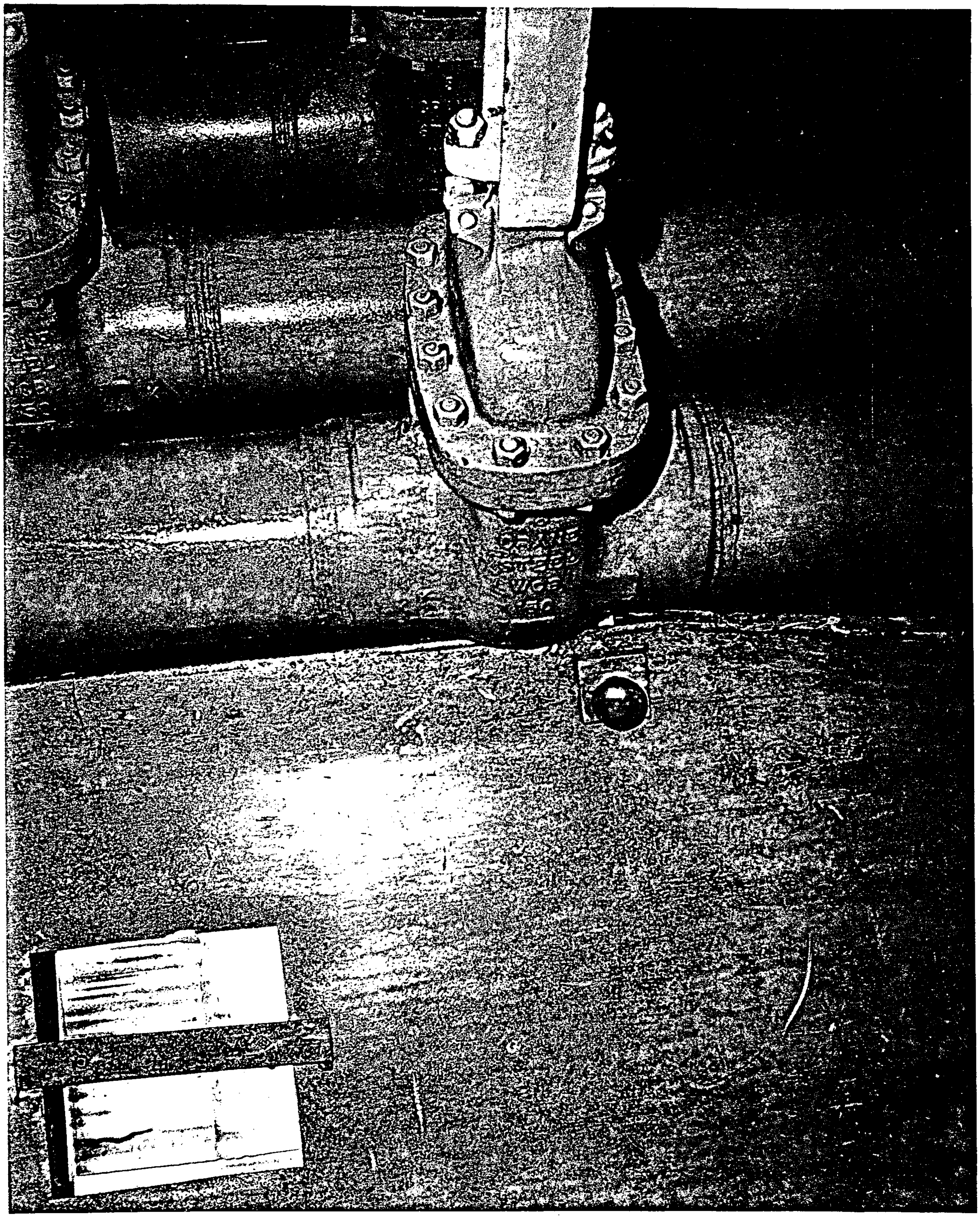


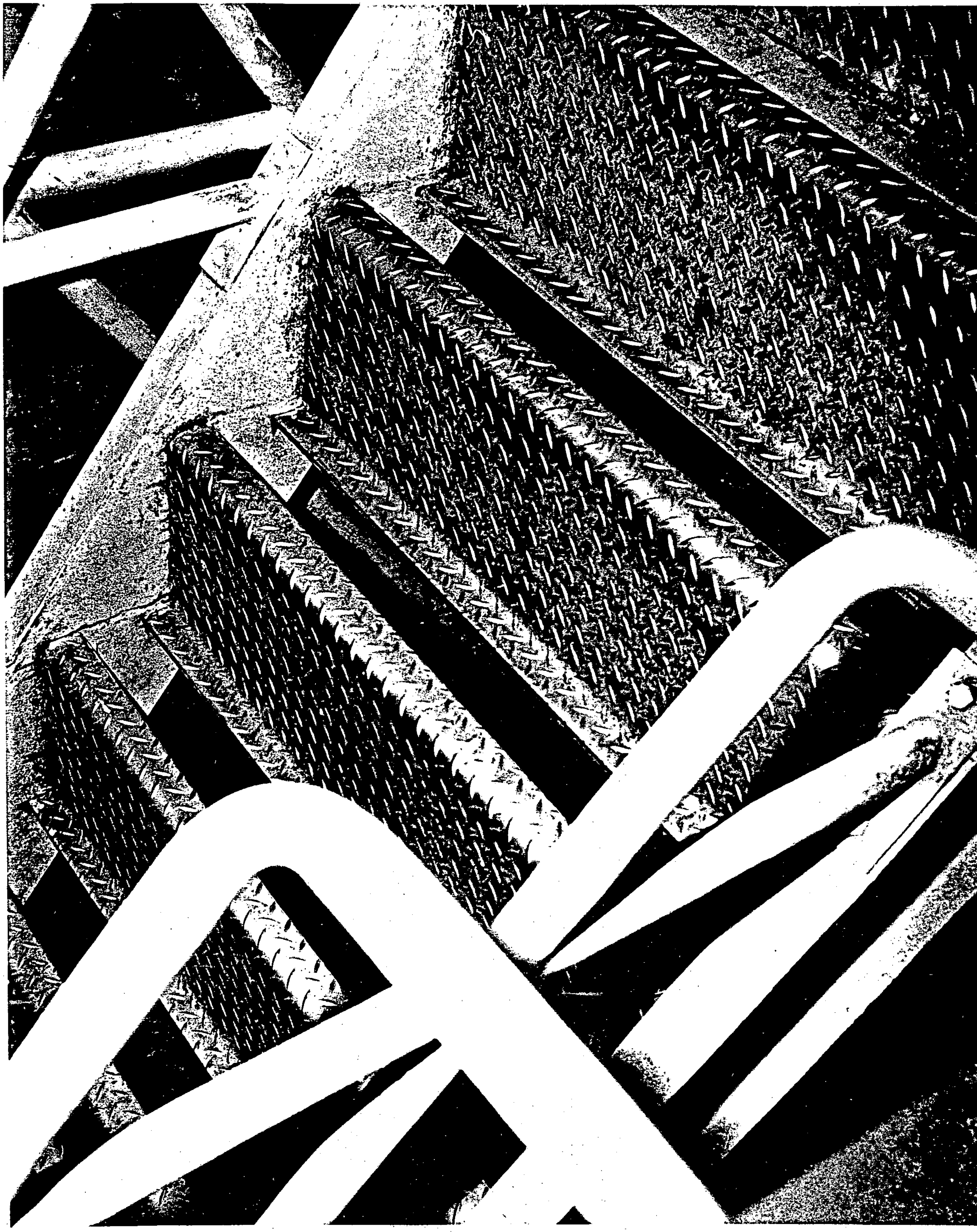


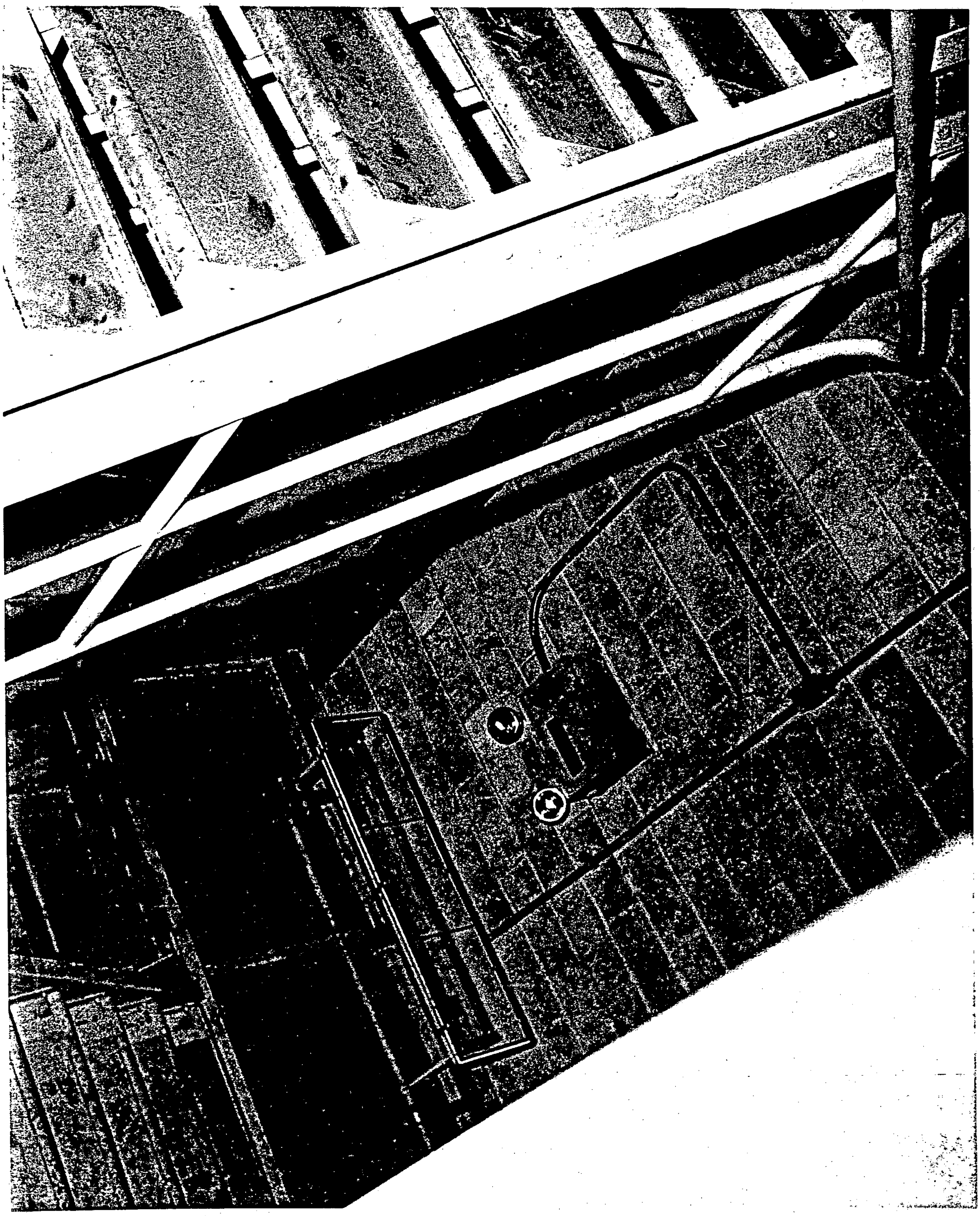


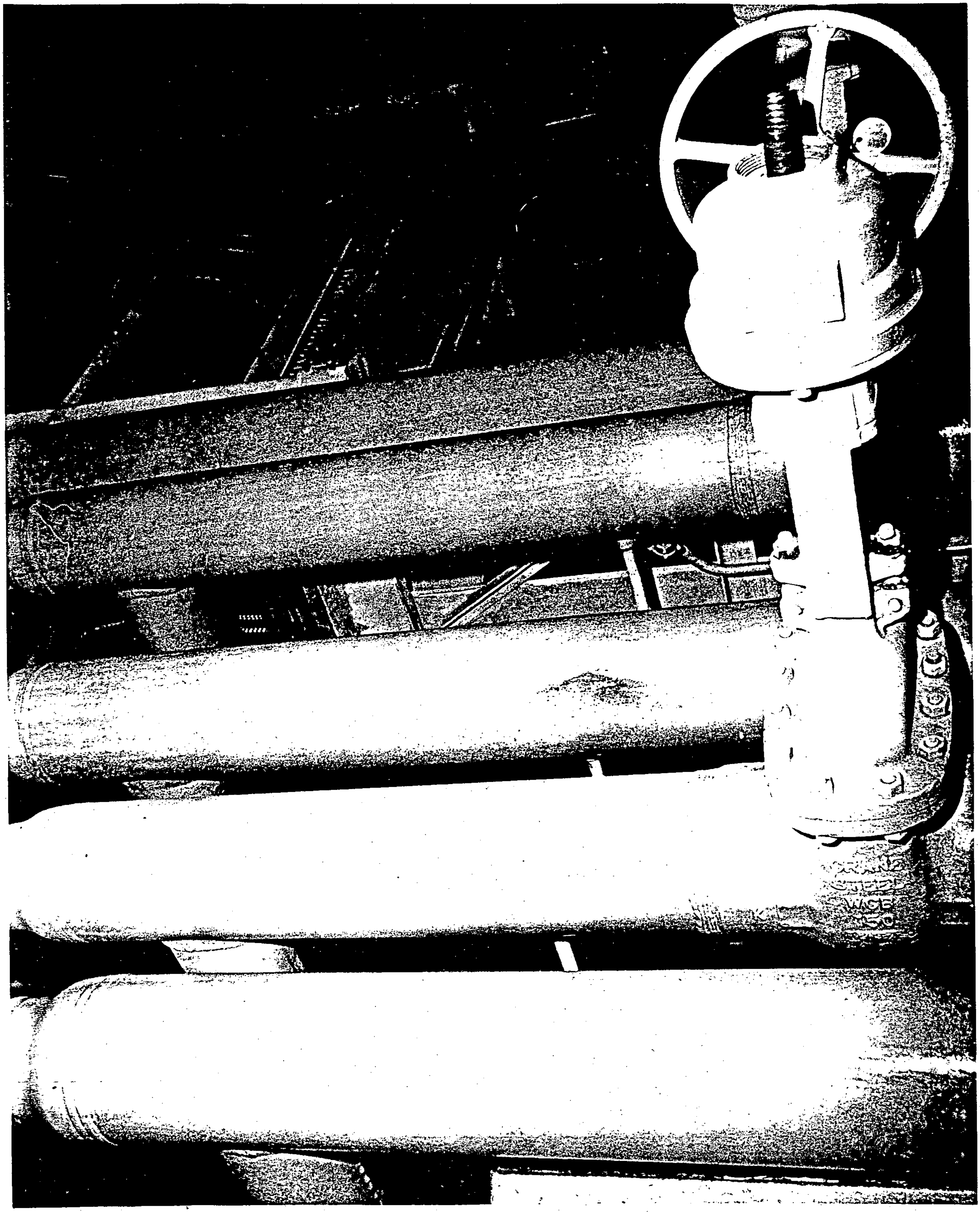


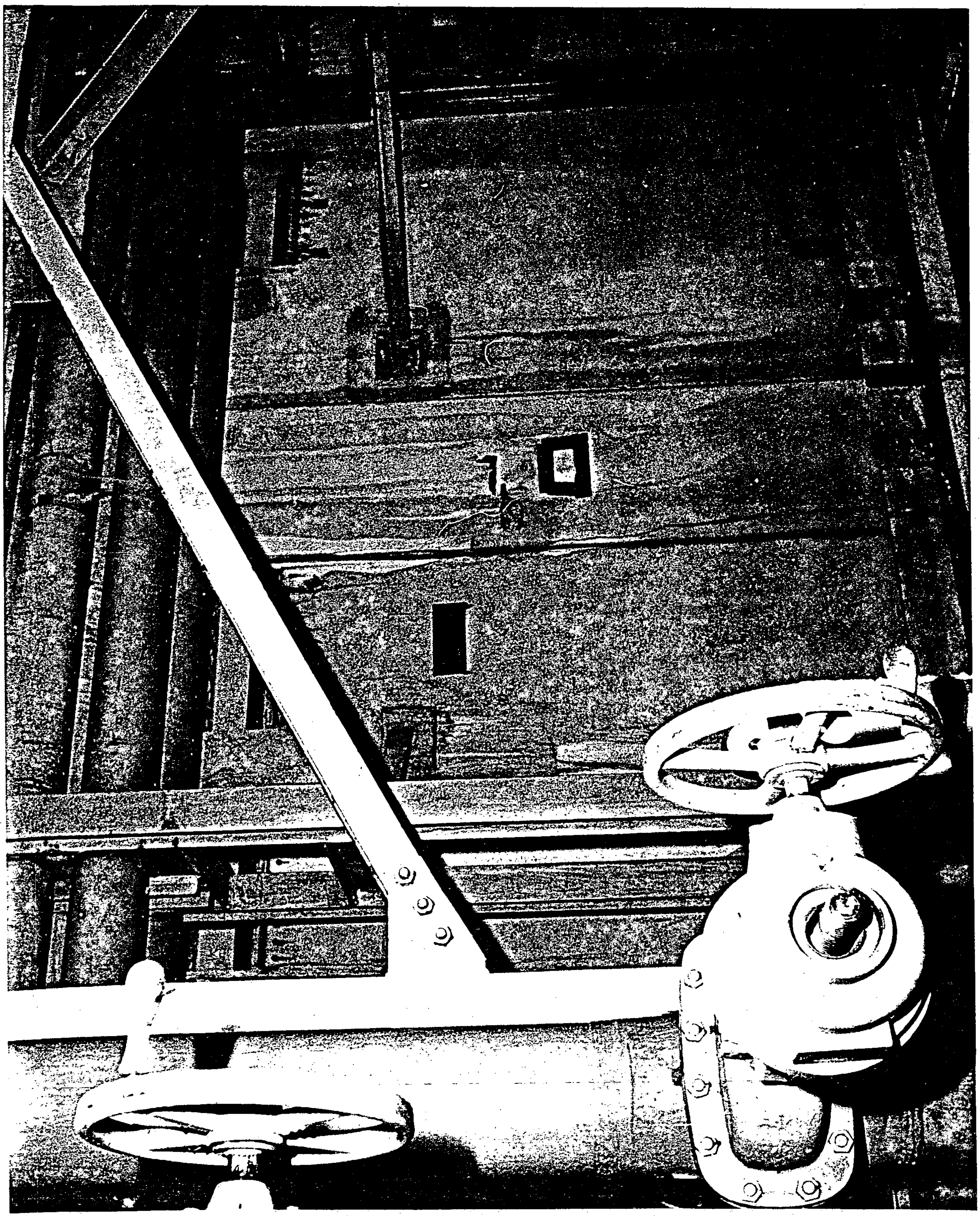


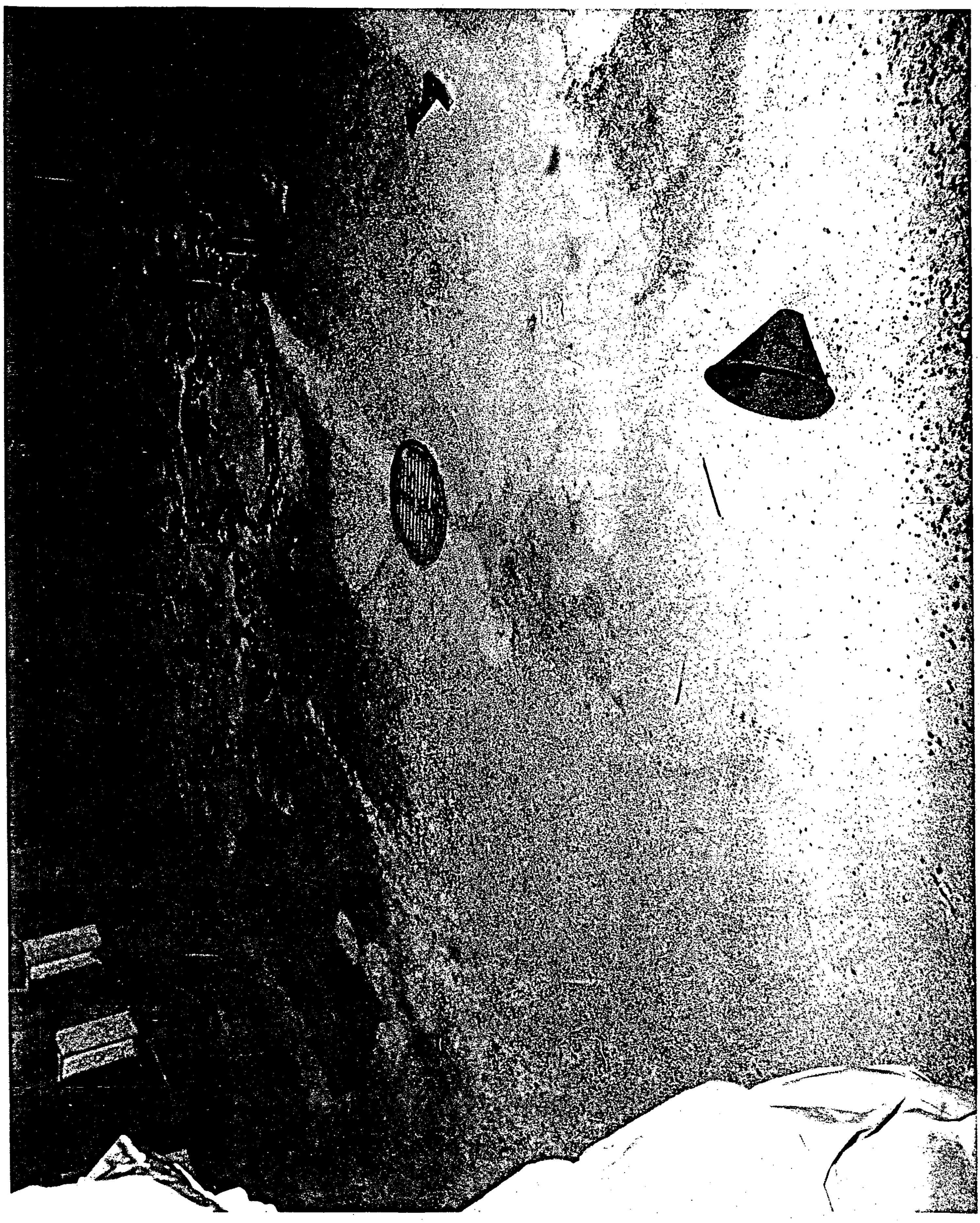


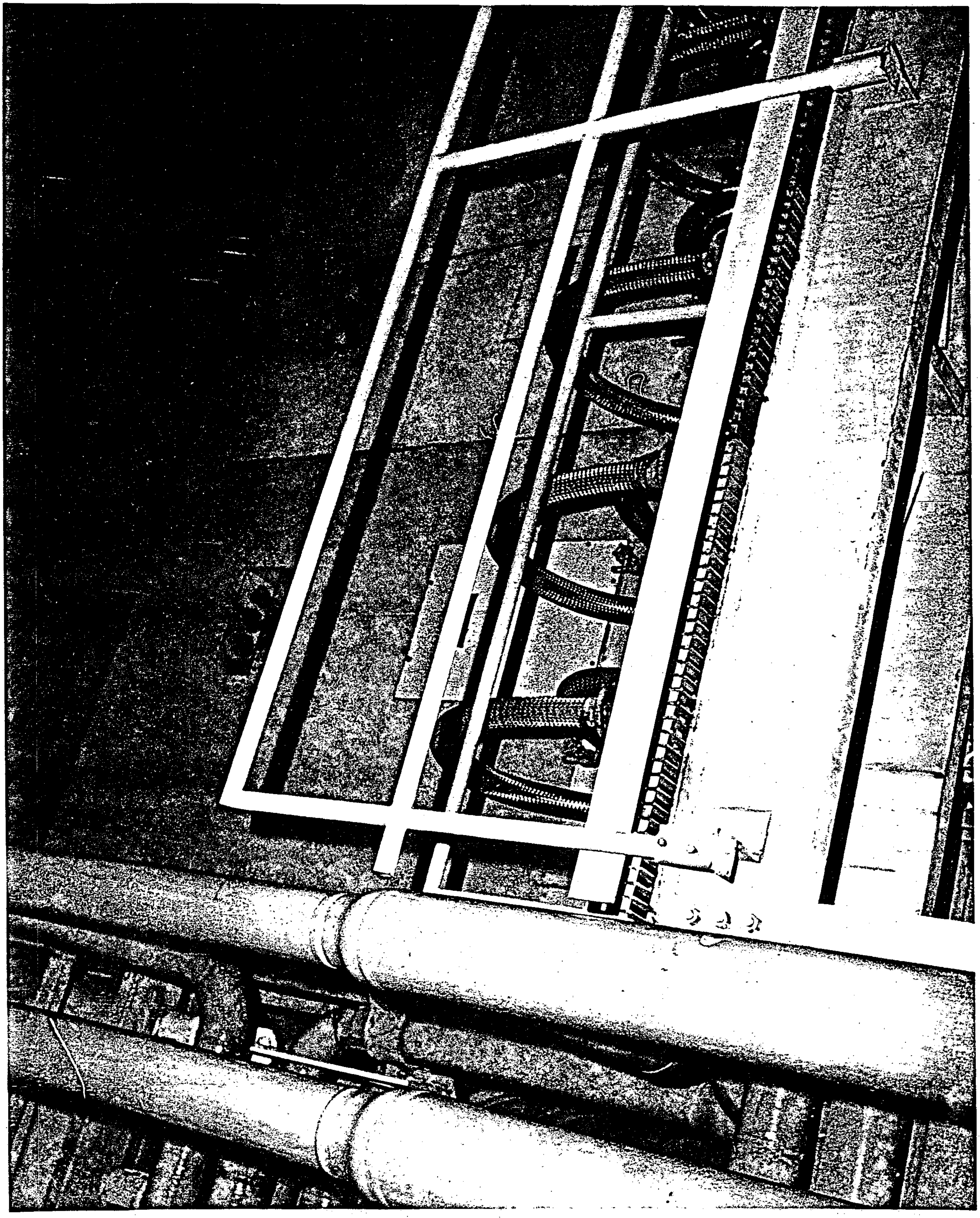


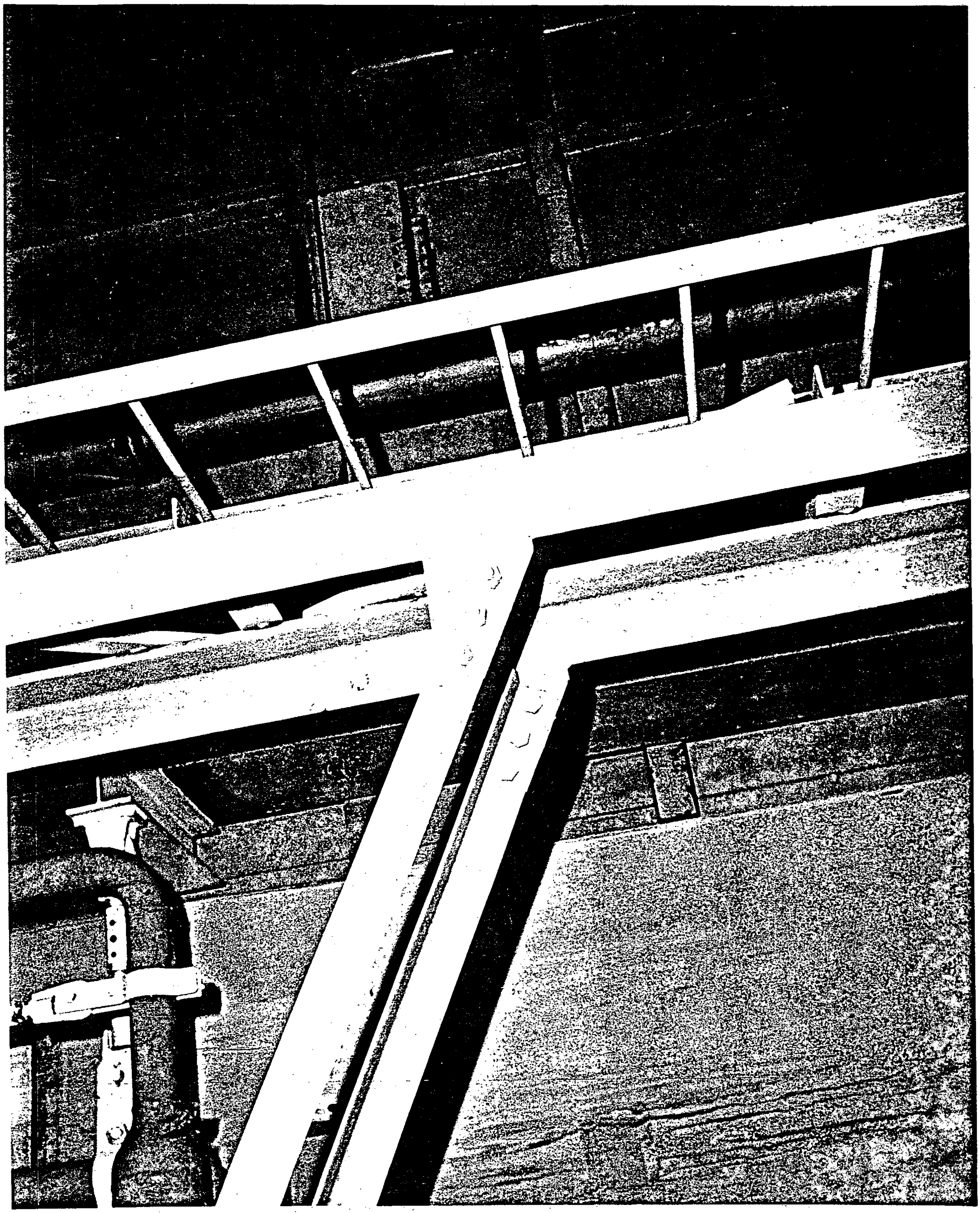


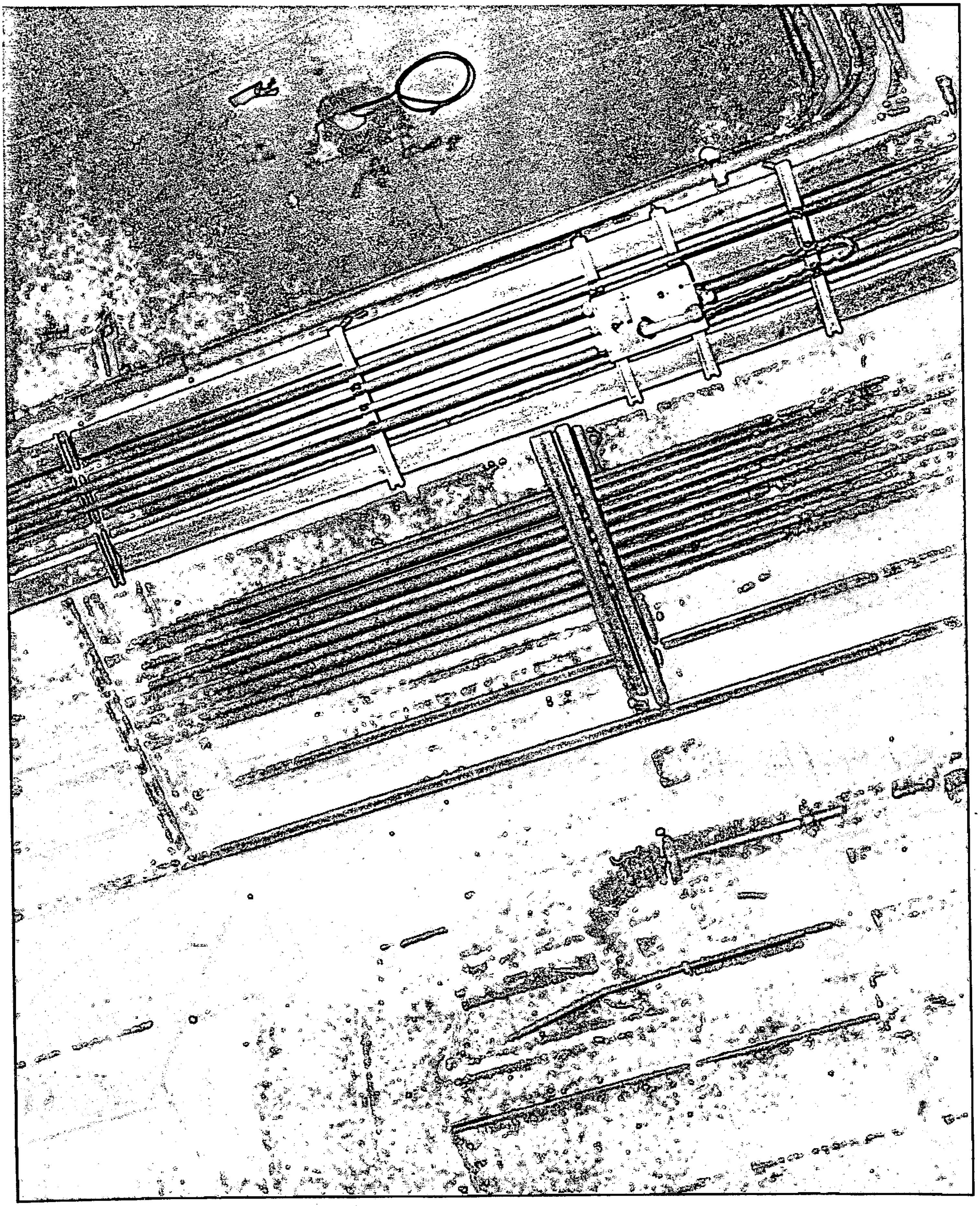


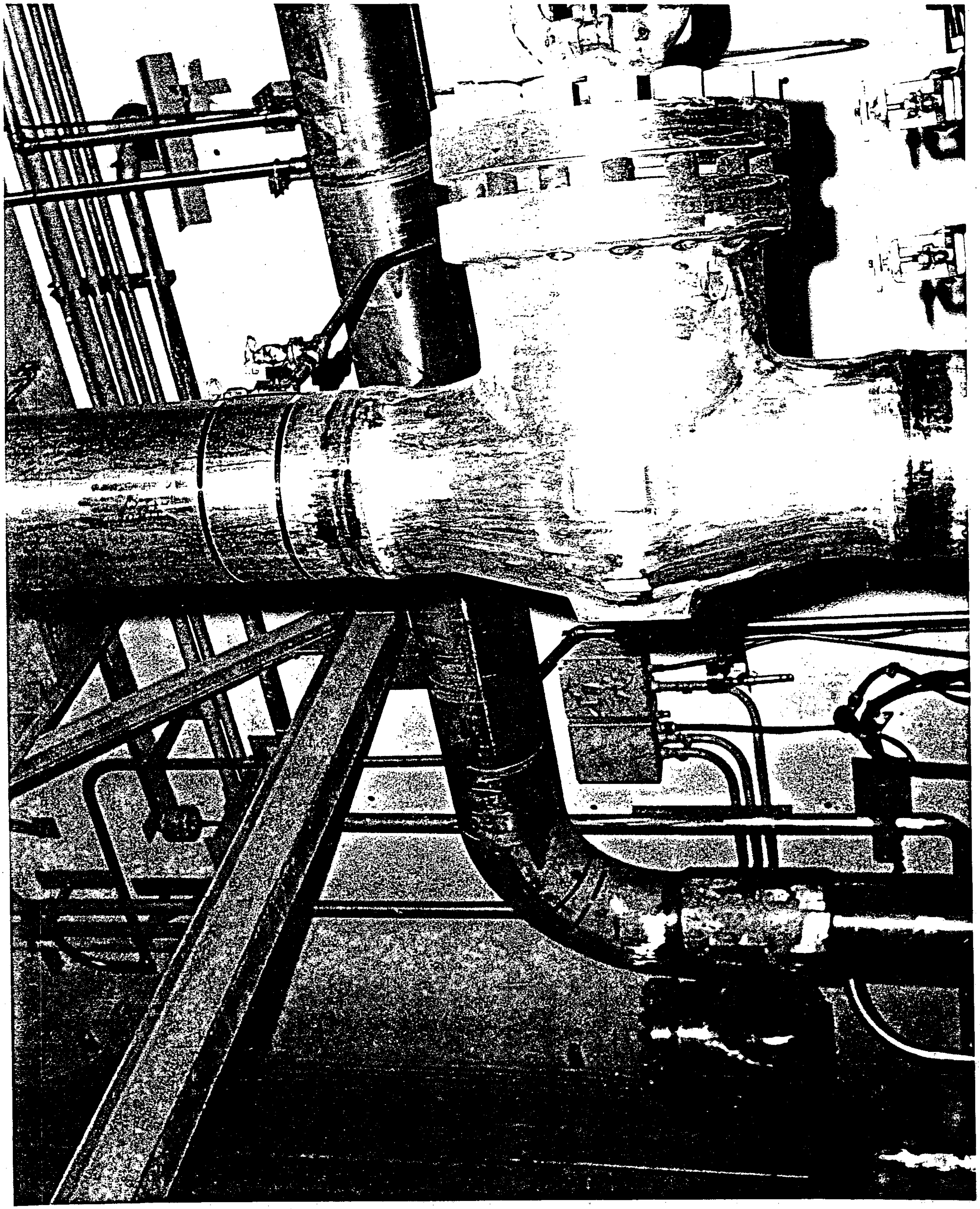


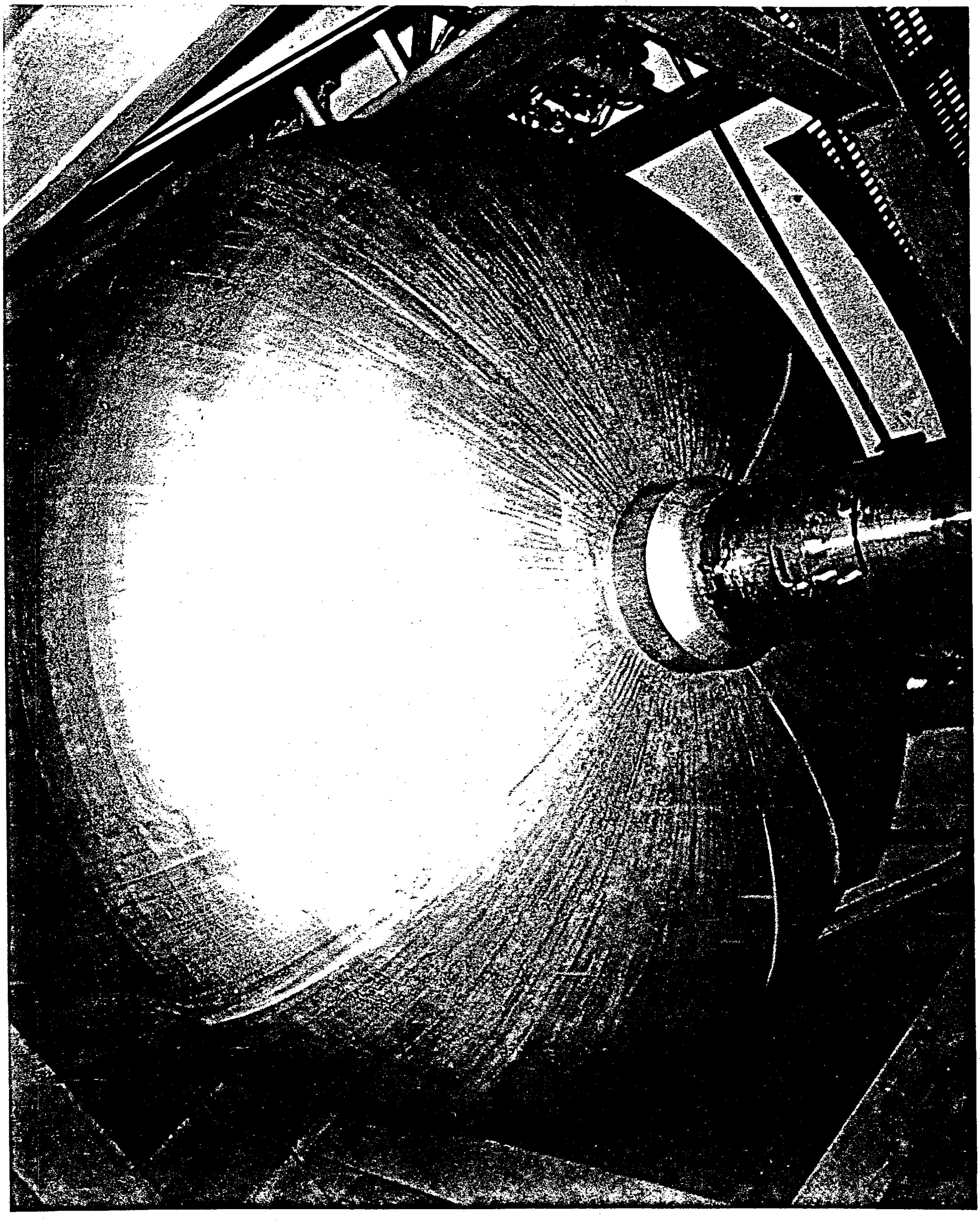


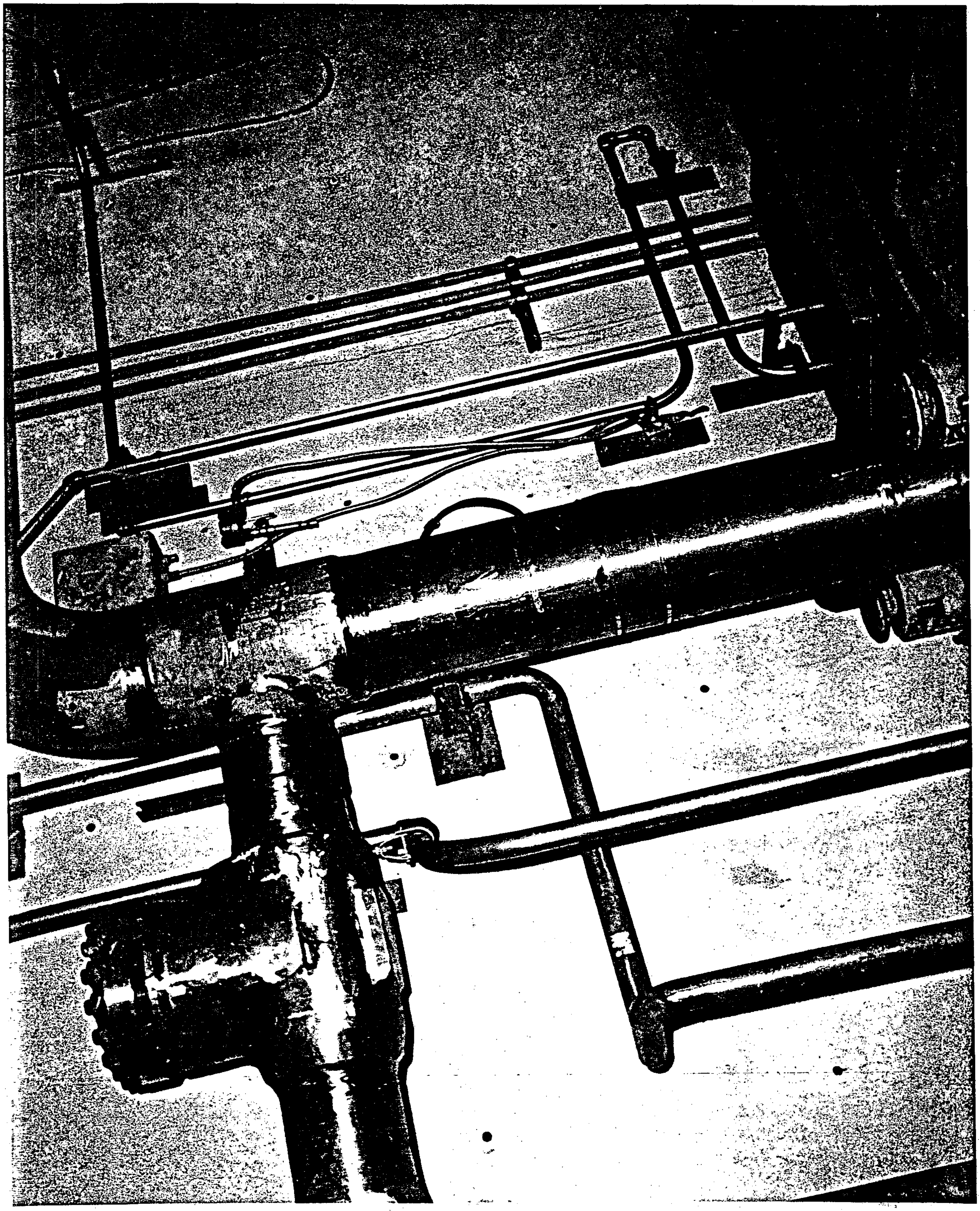


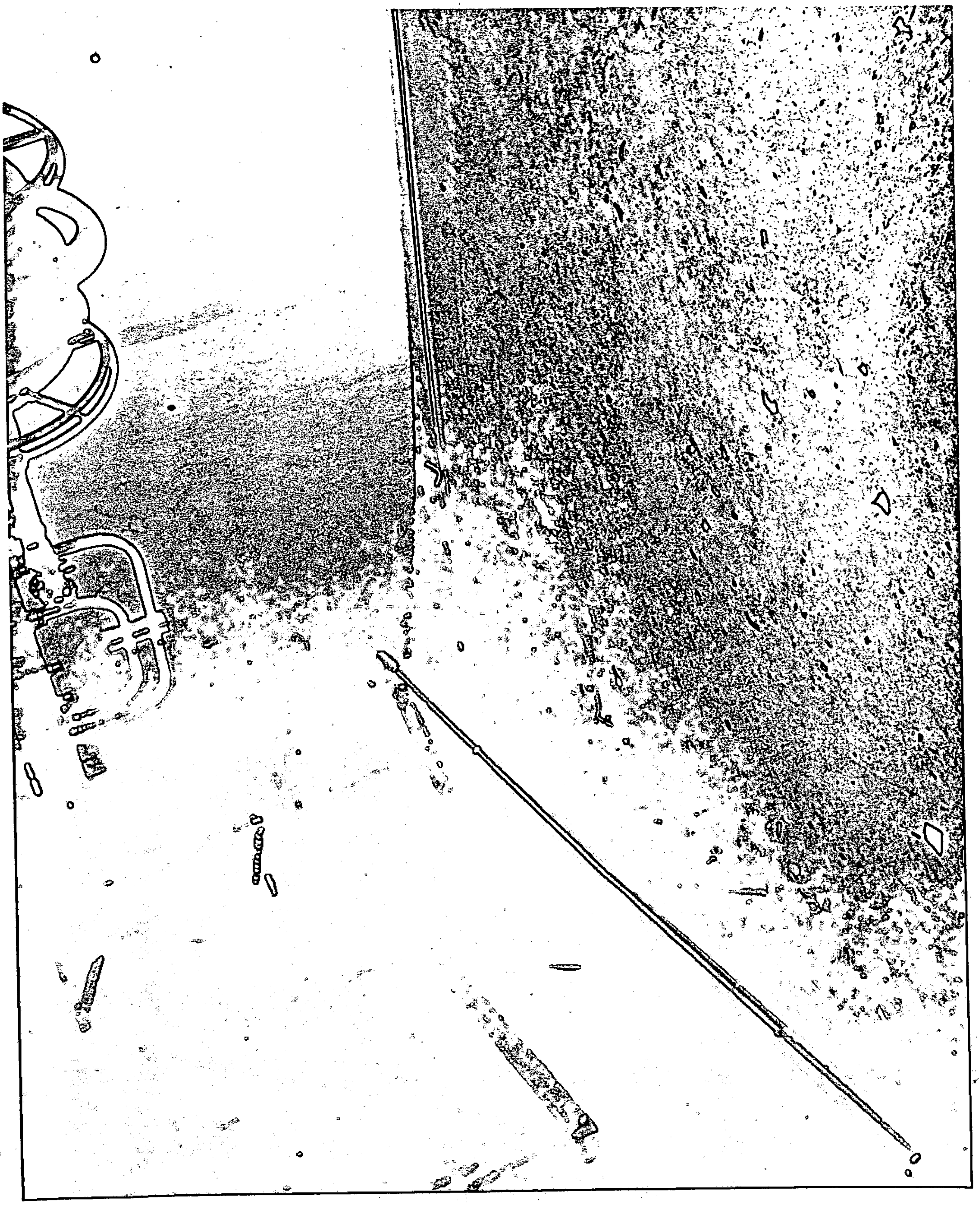


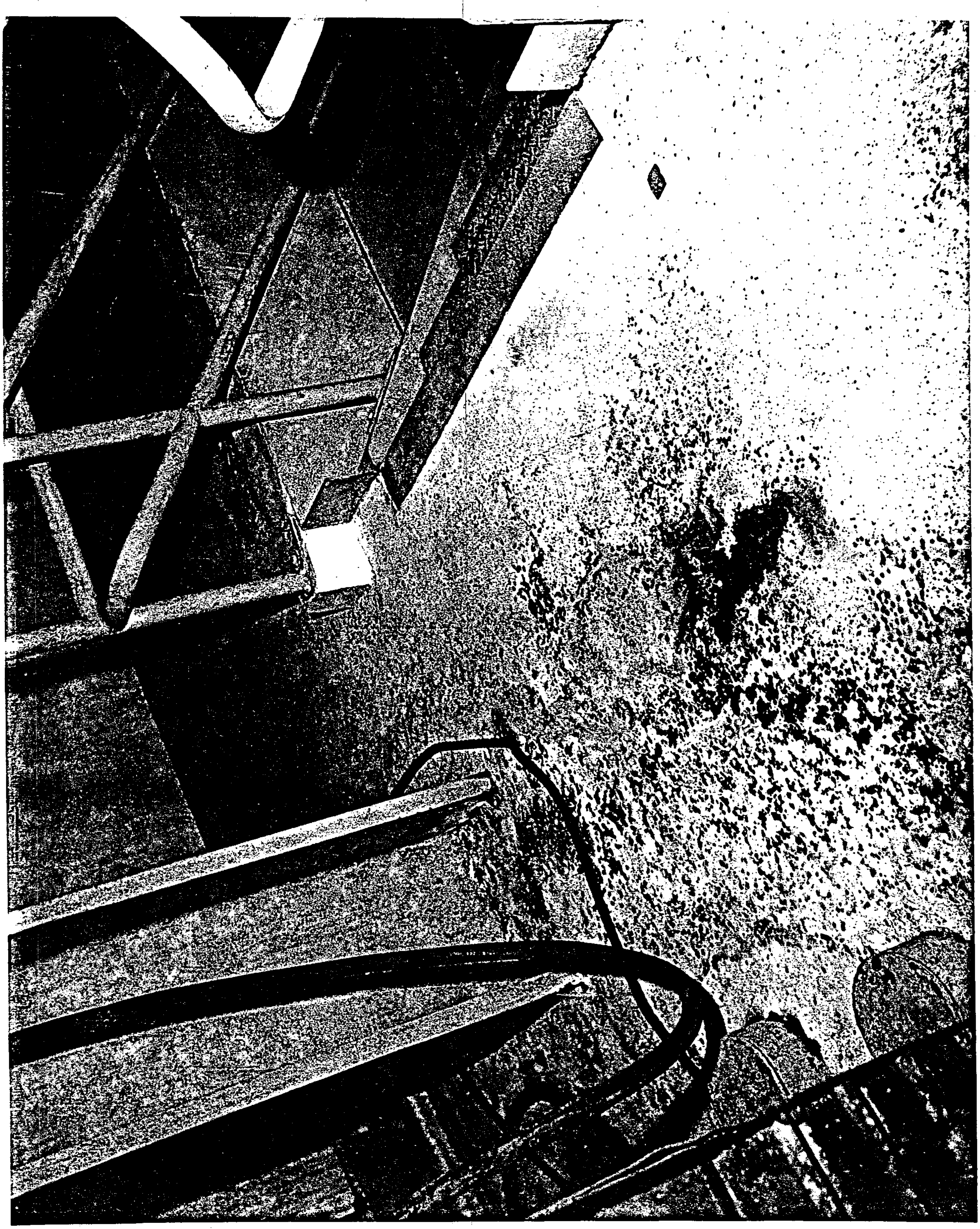


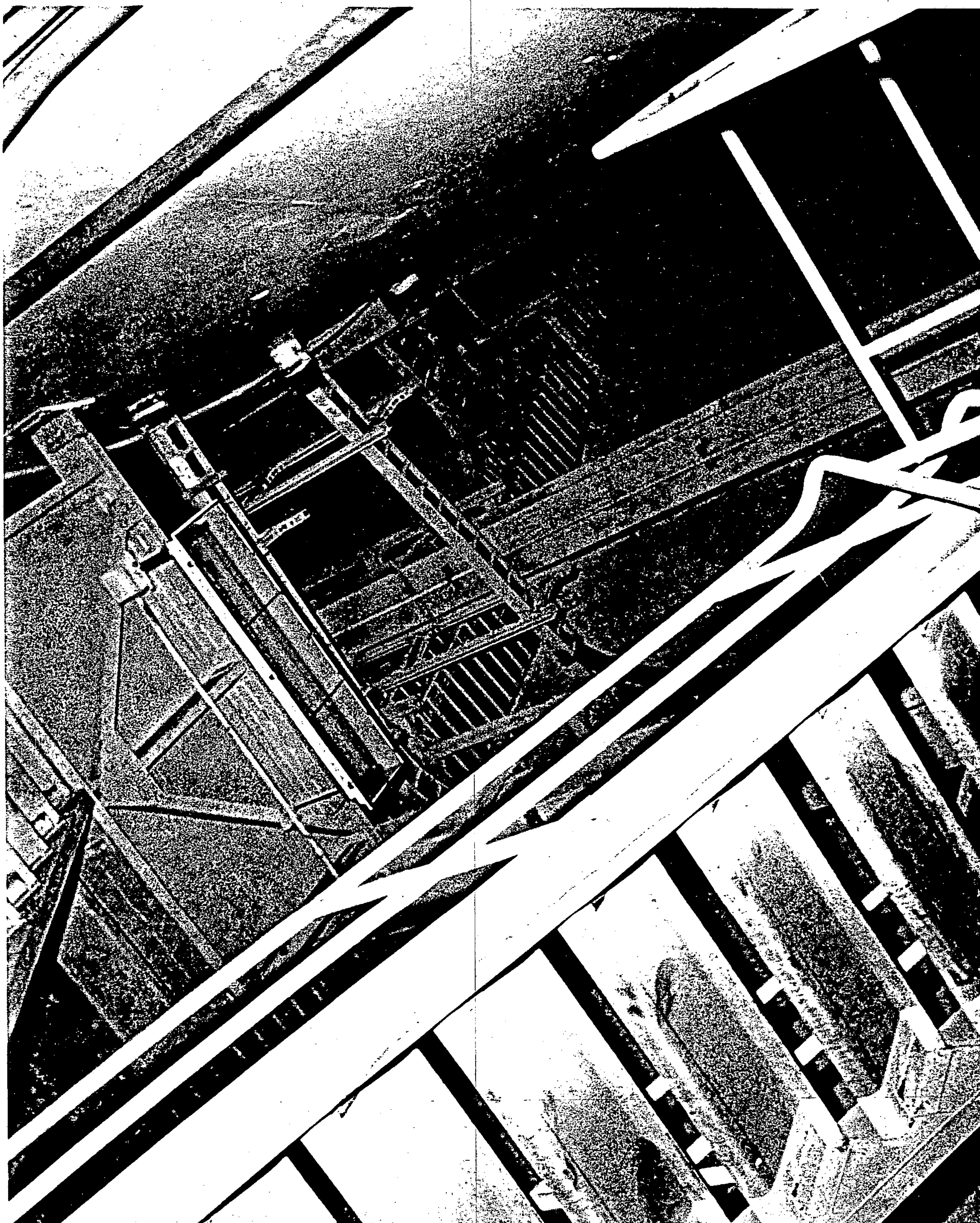


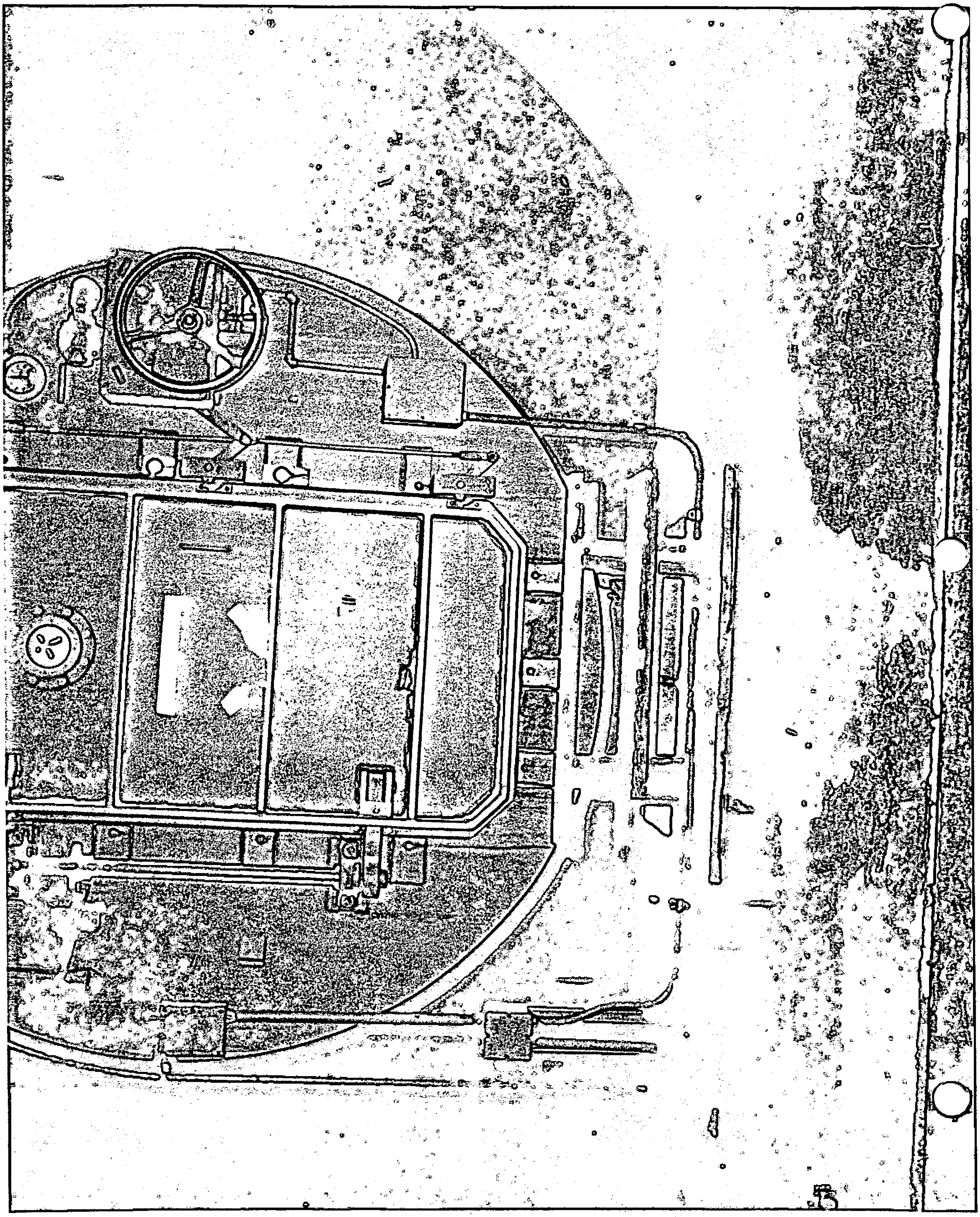


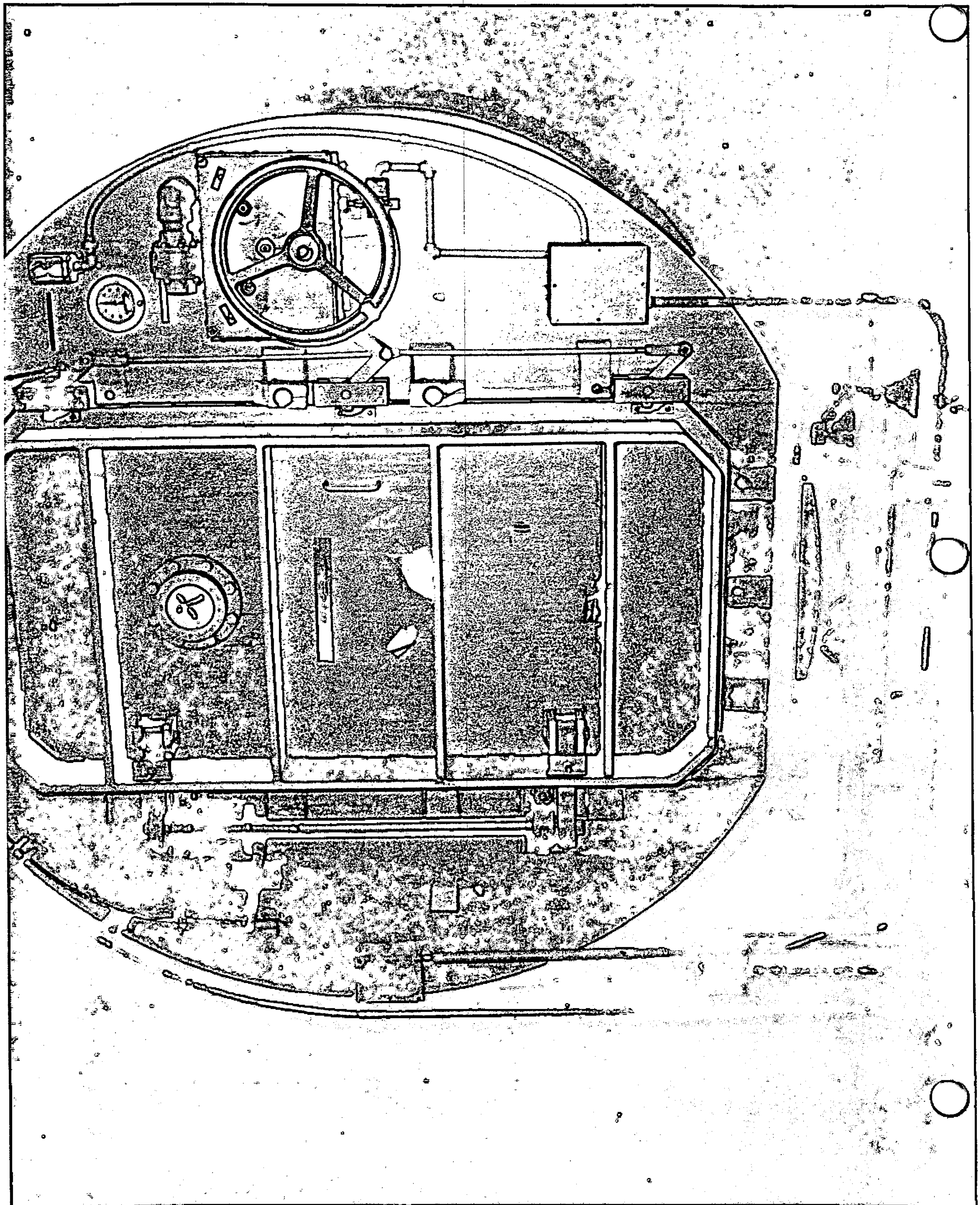


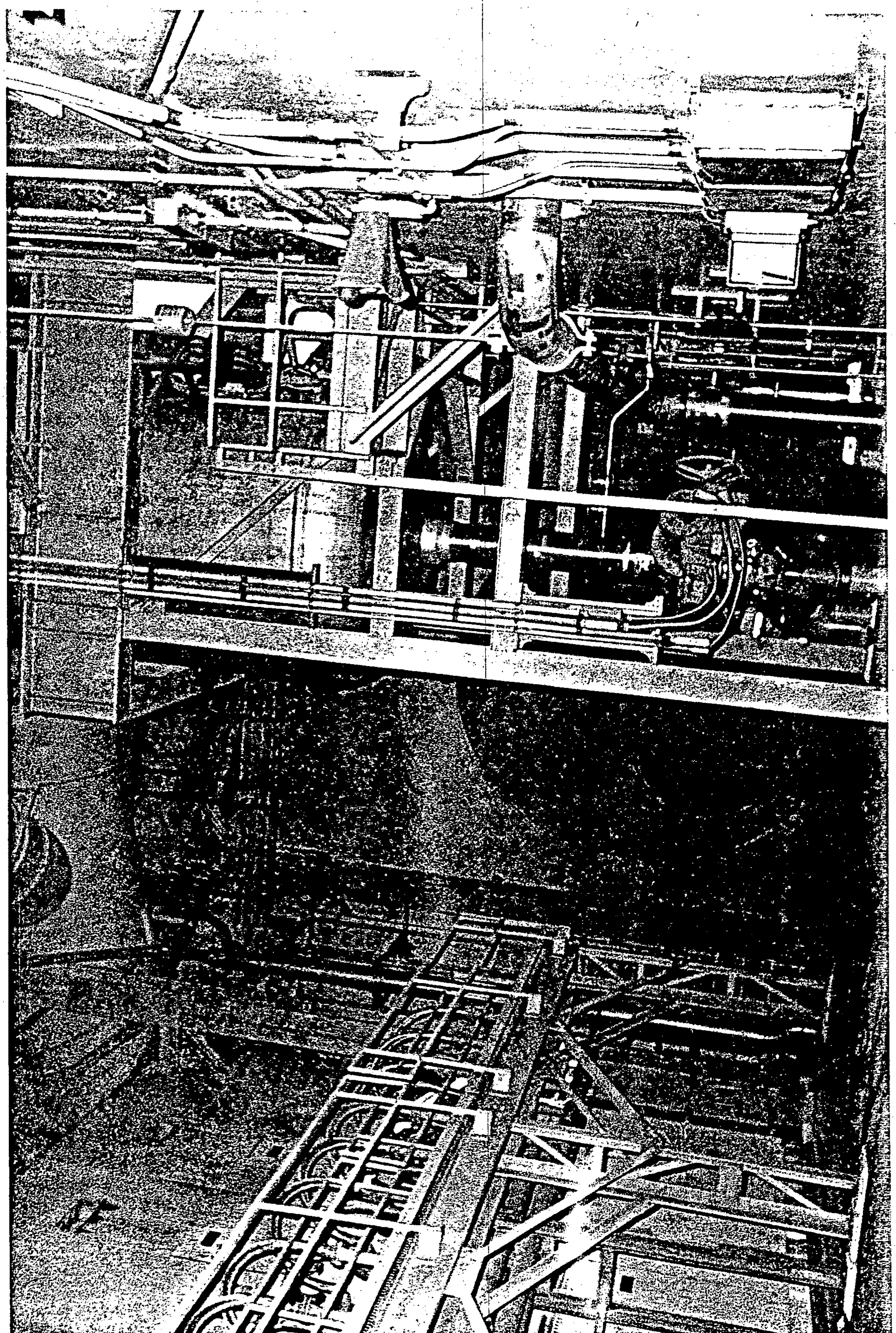


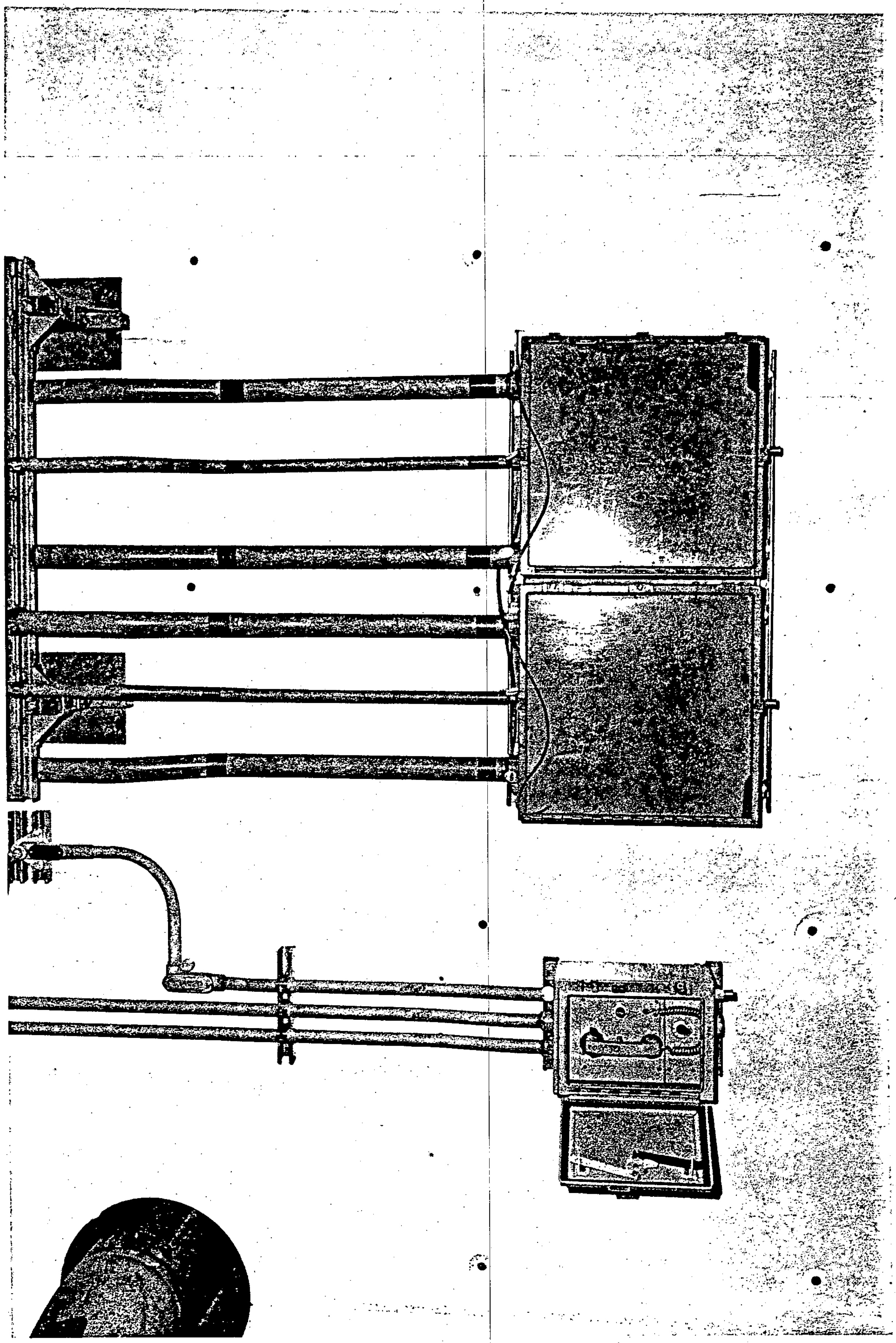


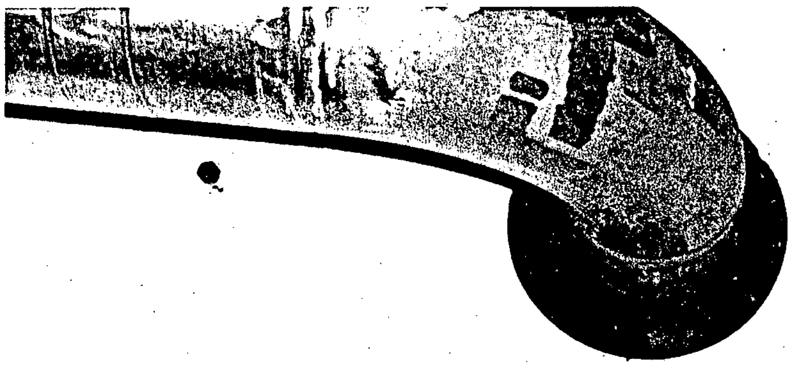




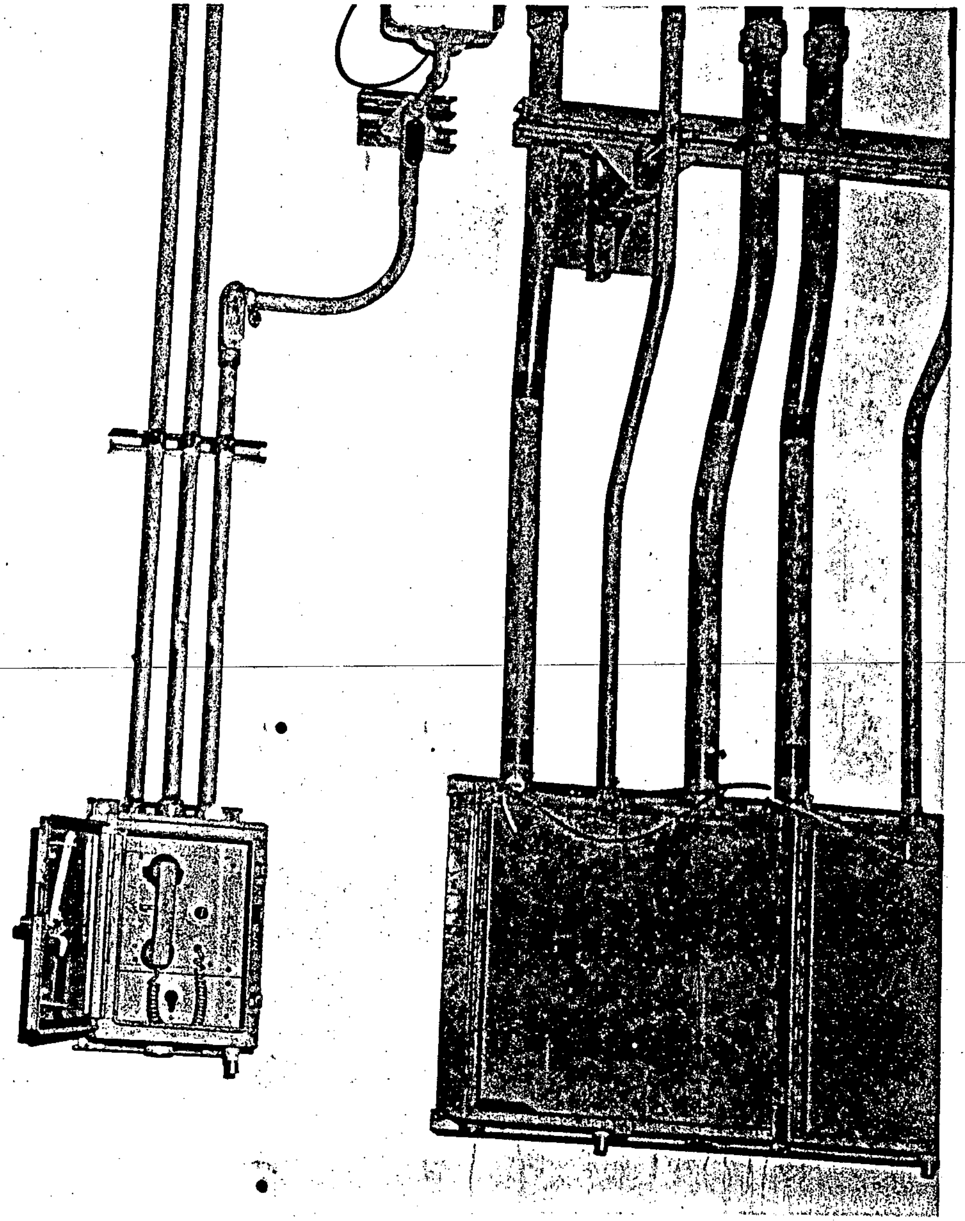


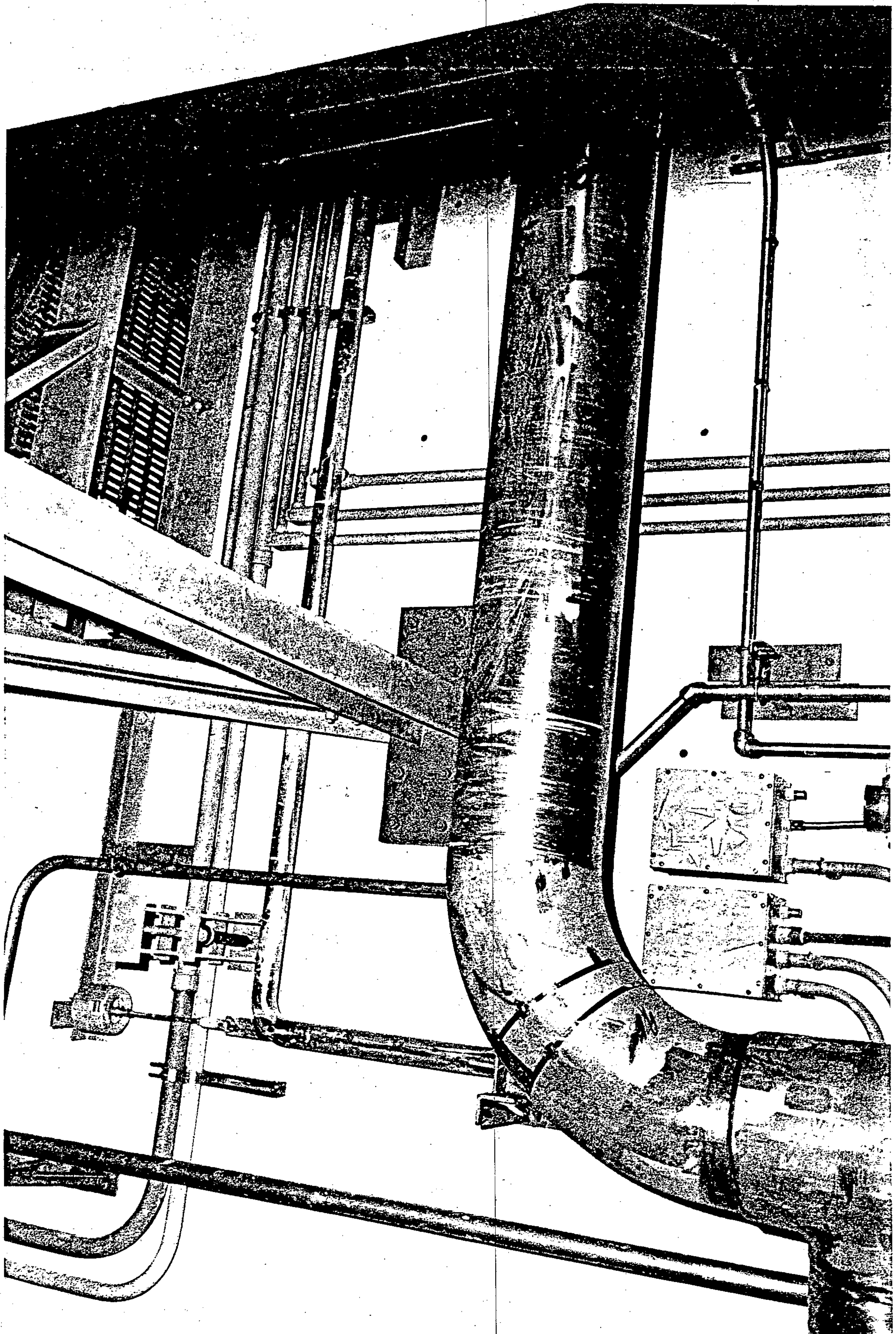


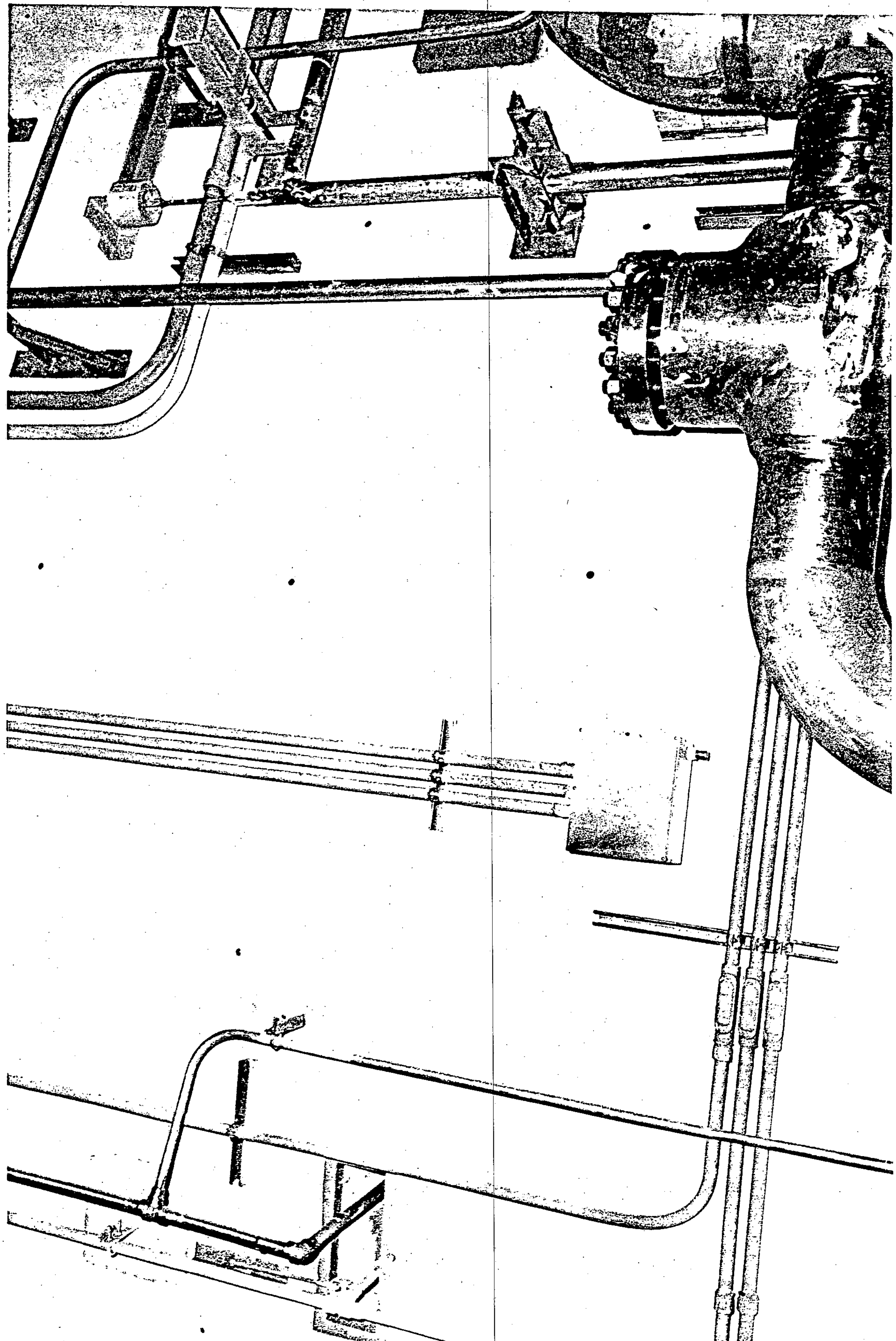


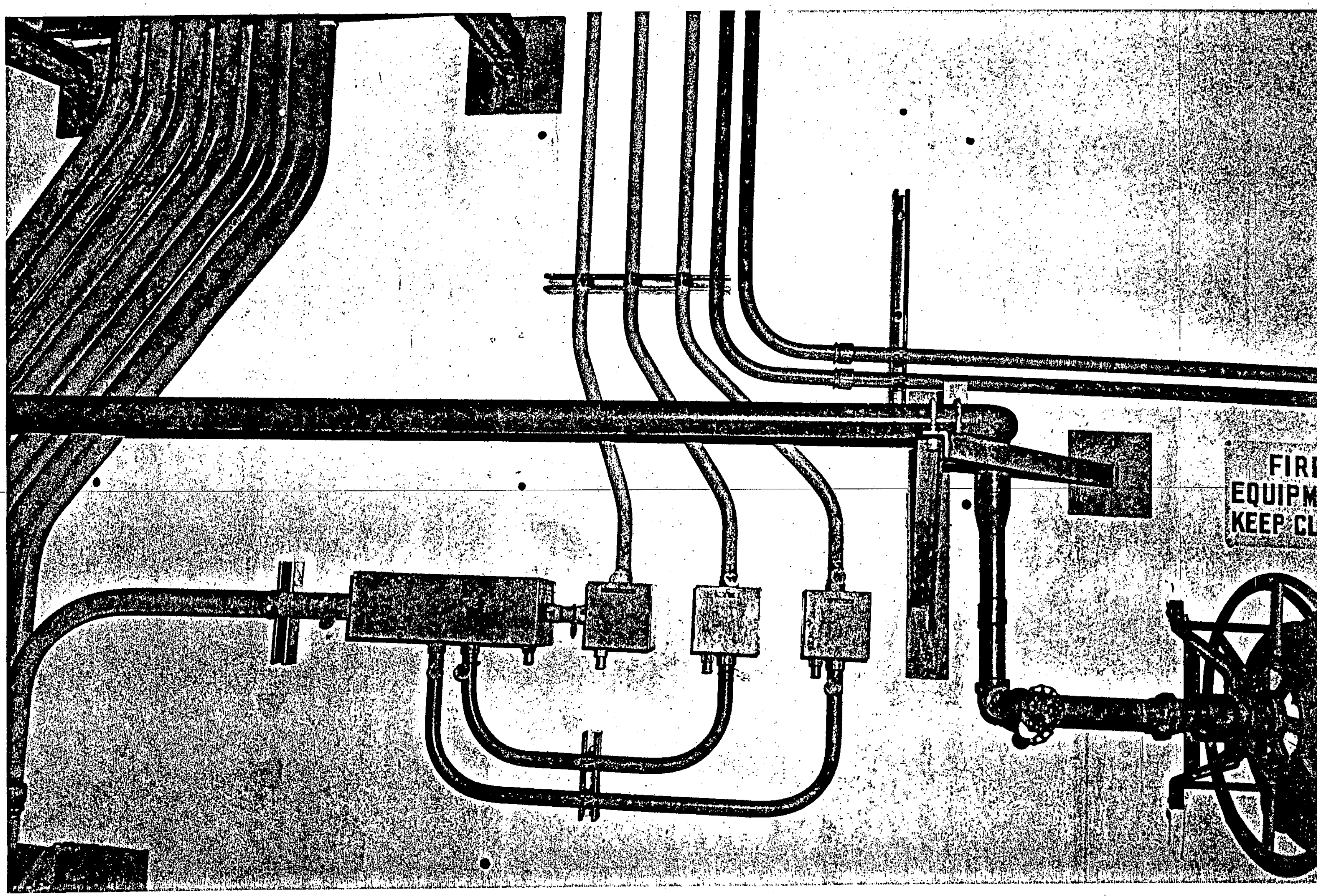


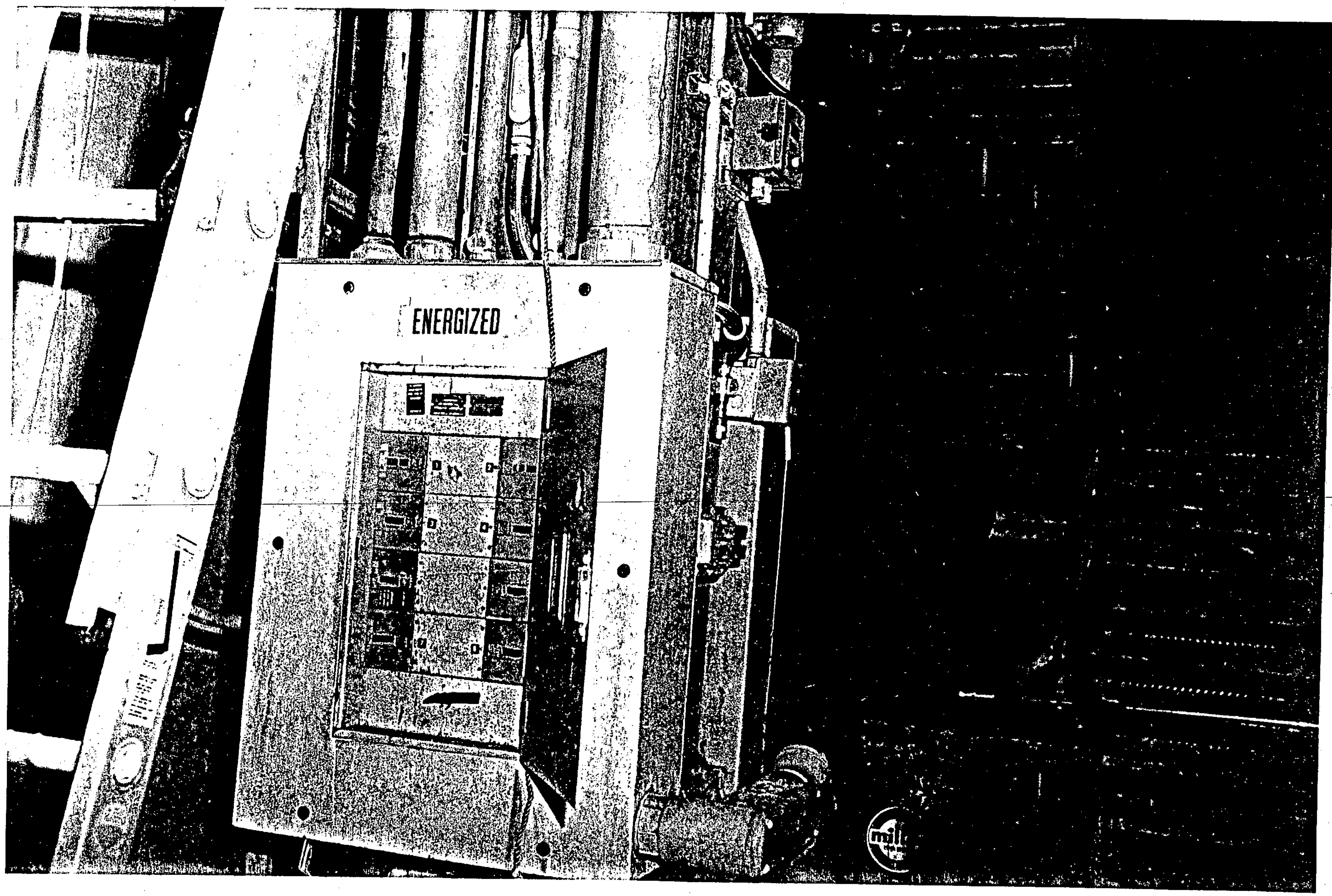
18

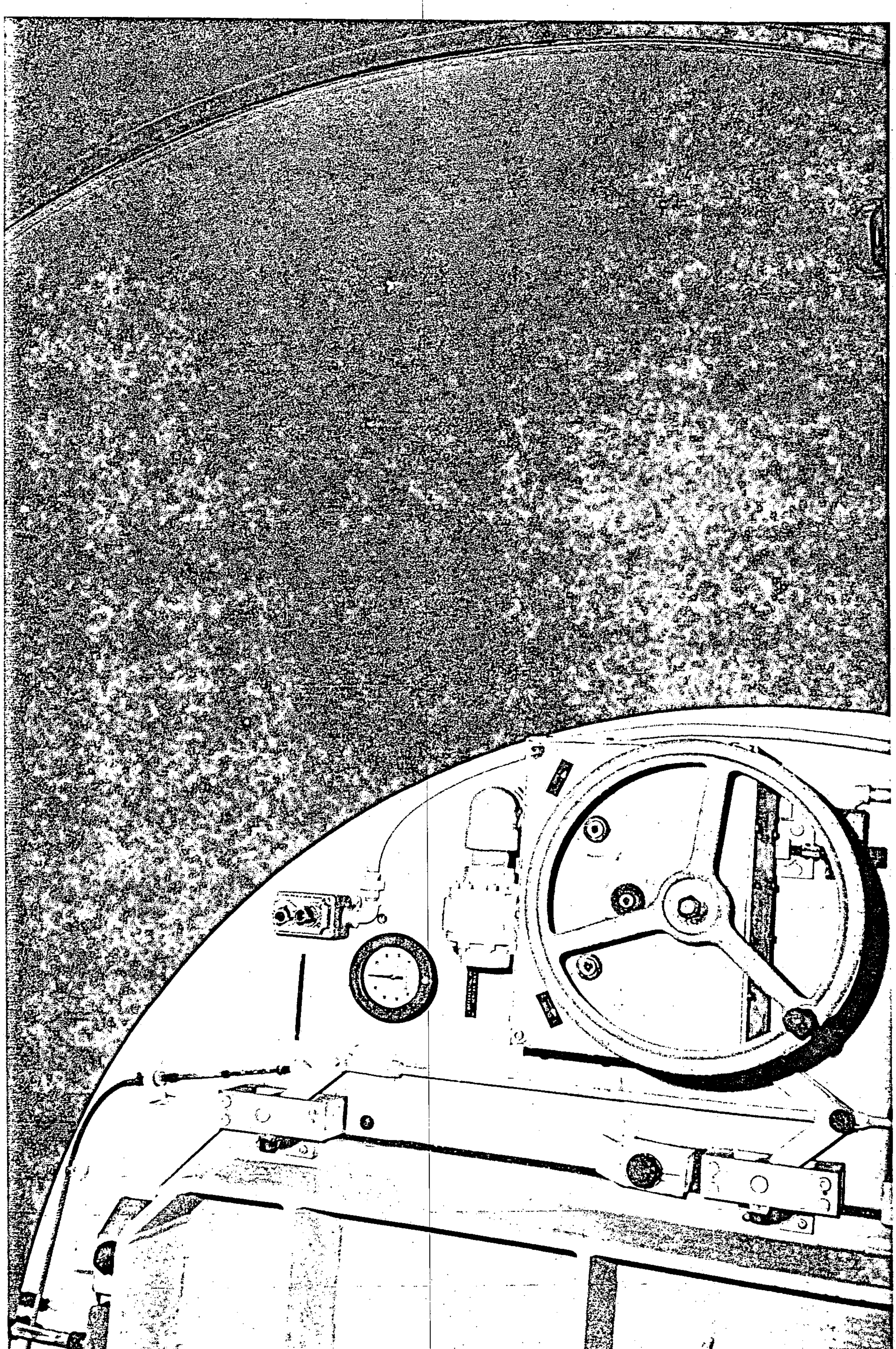


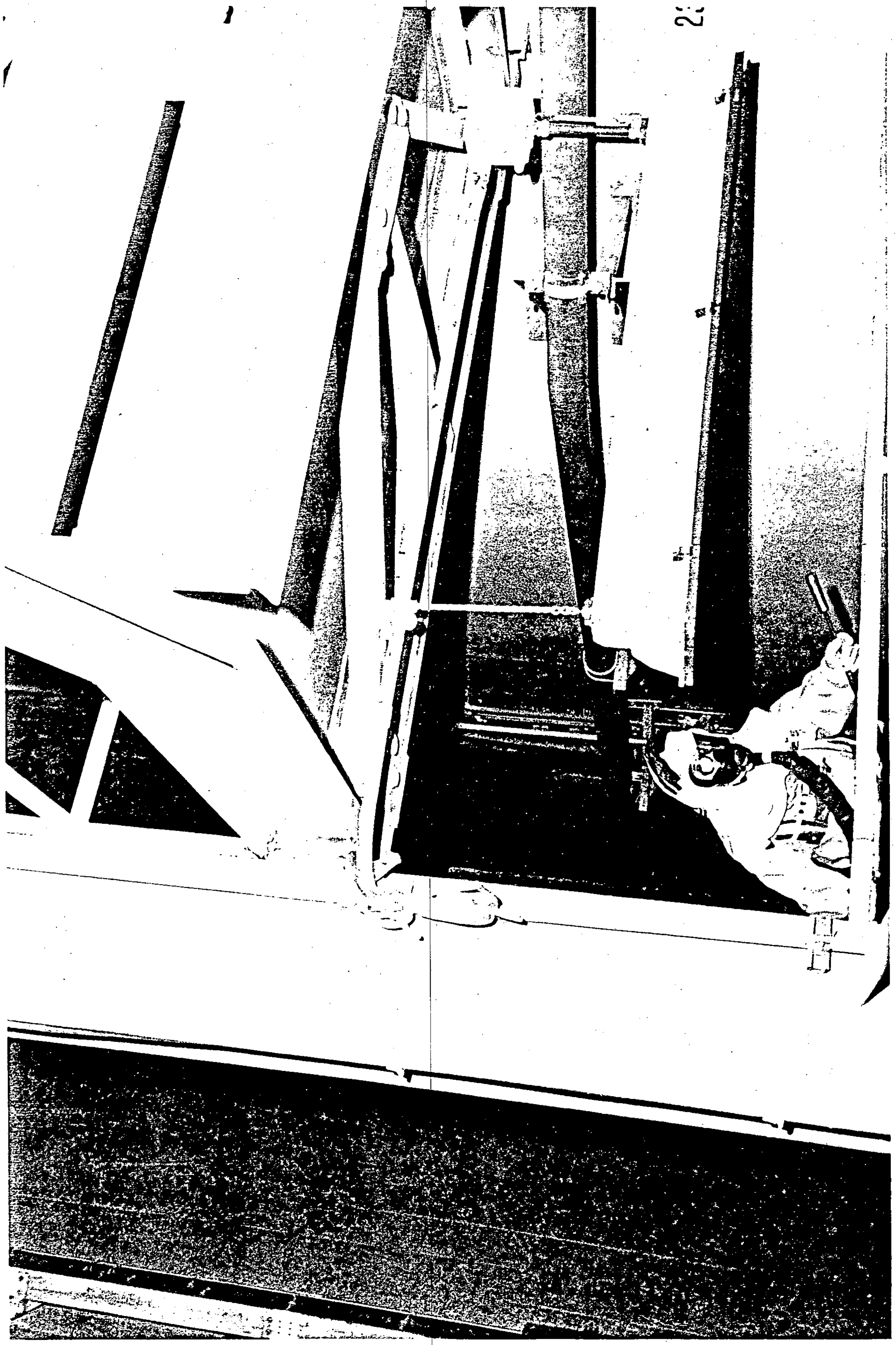


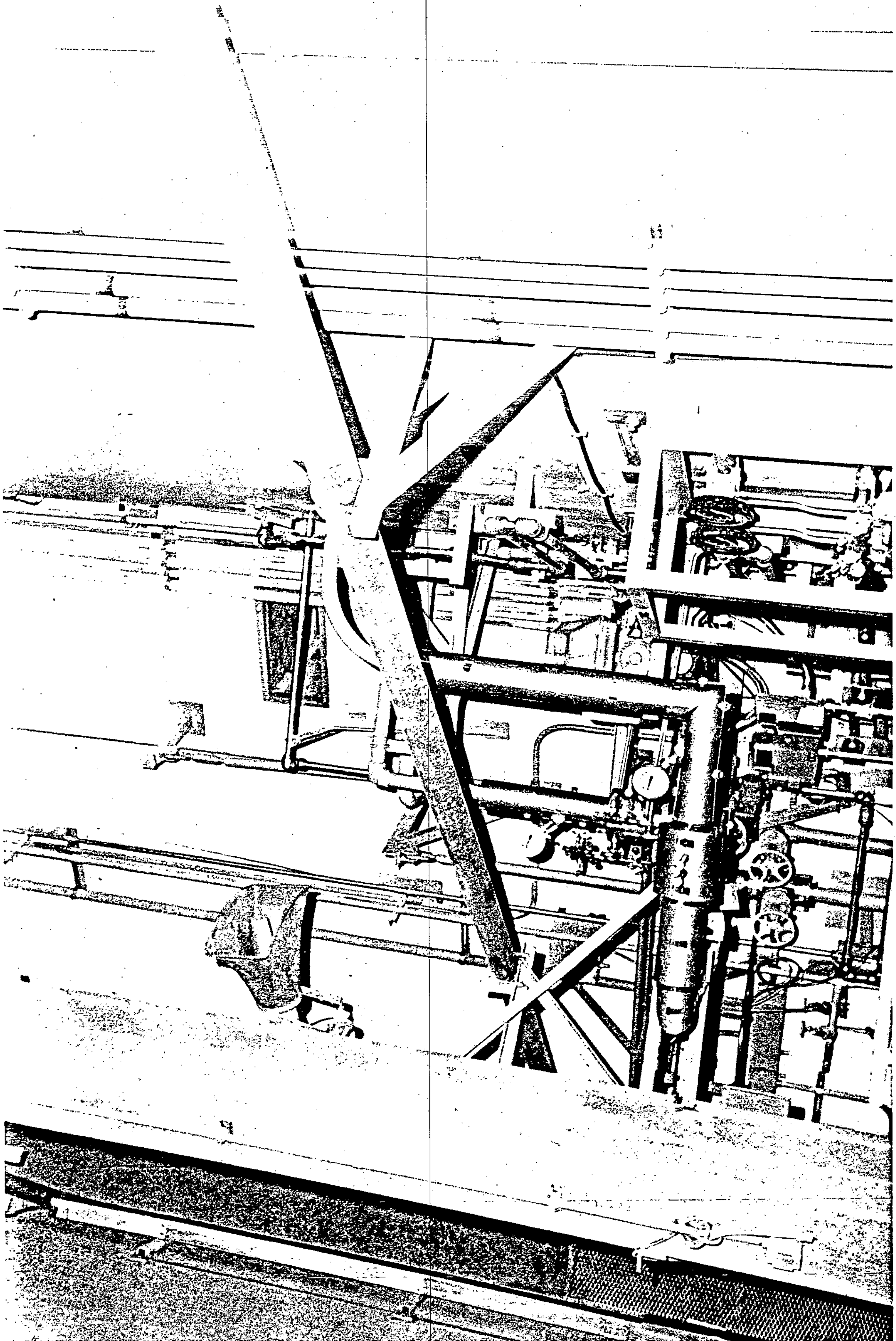


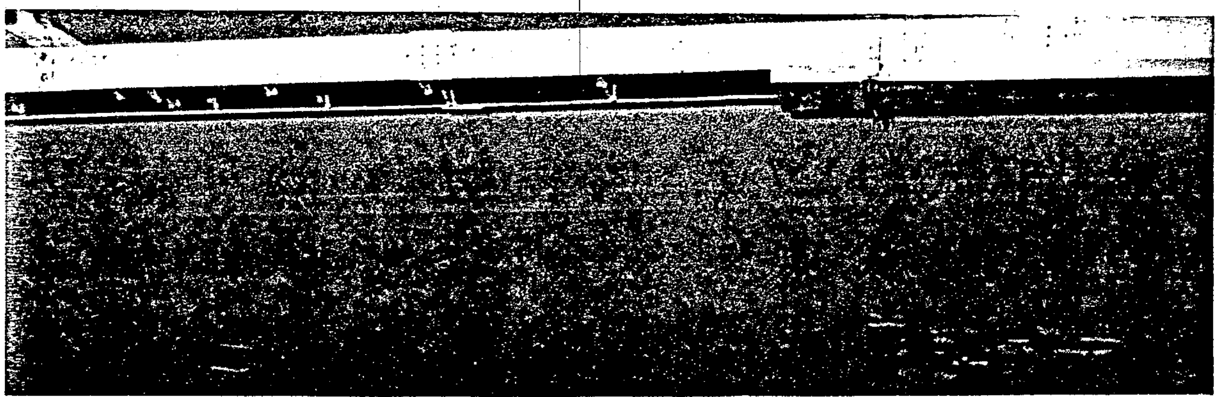

FIRE
EQUIPM
KEEP CL

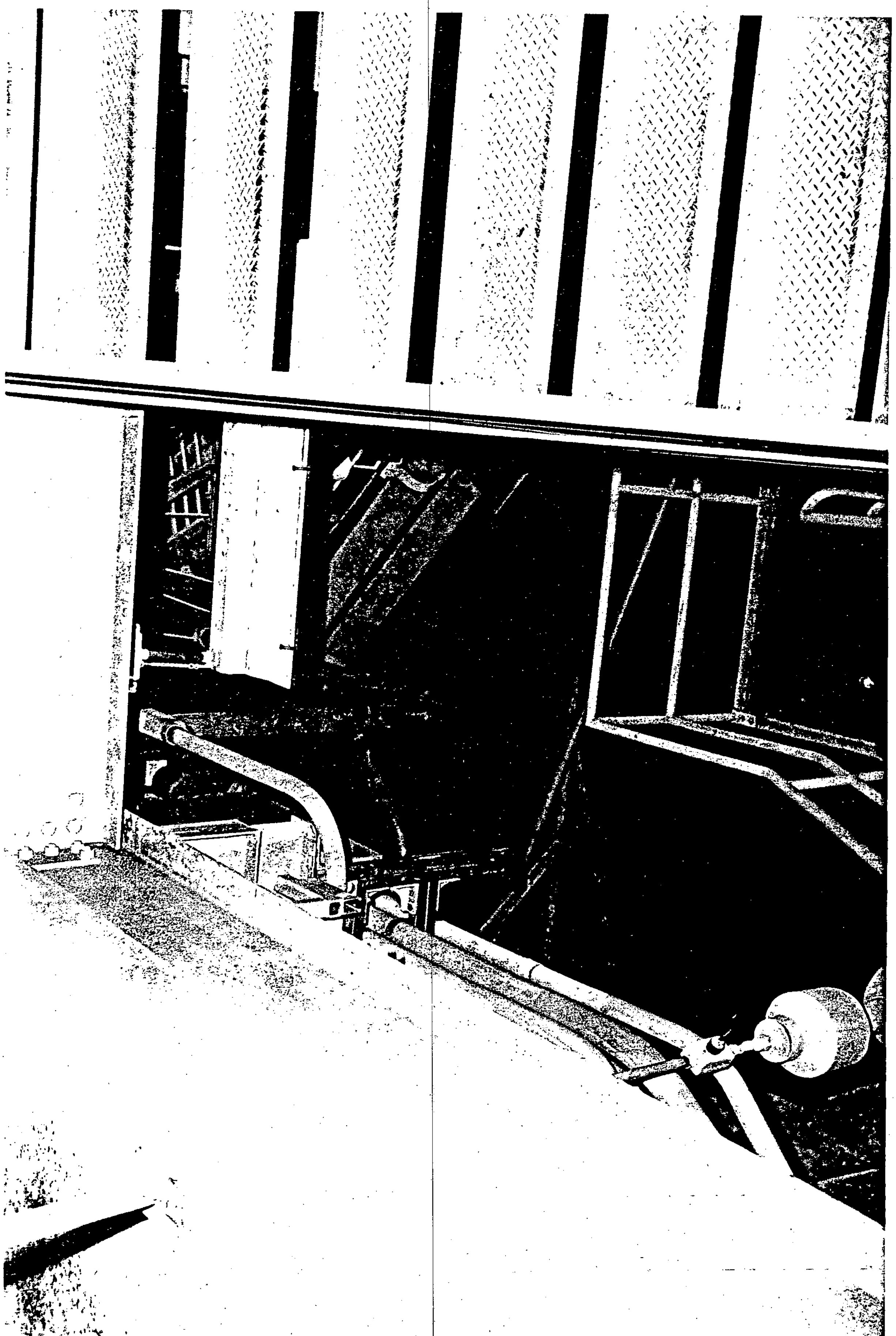

ENERGIZED

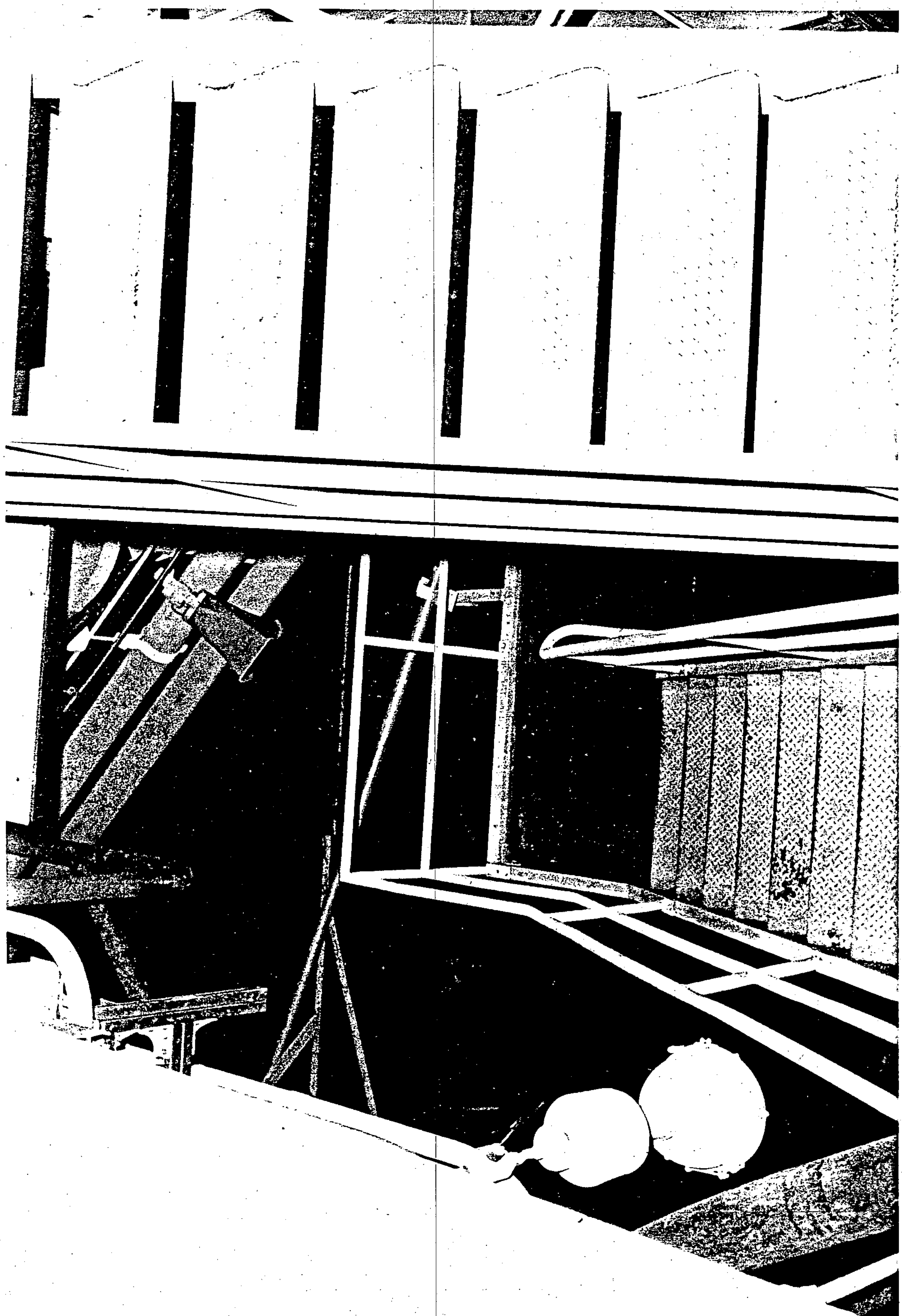


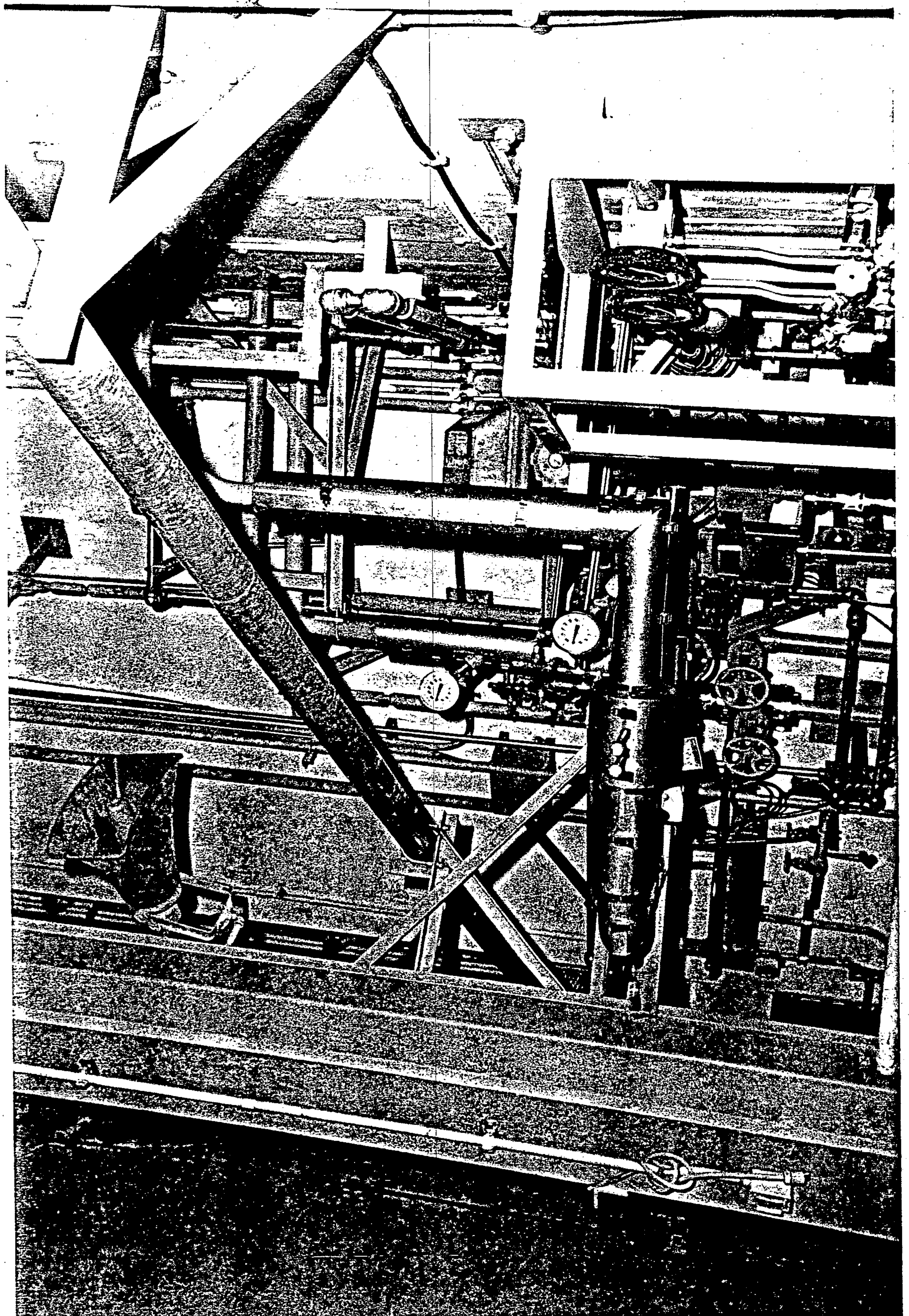


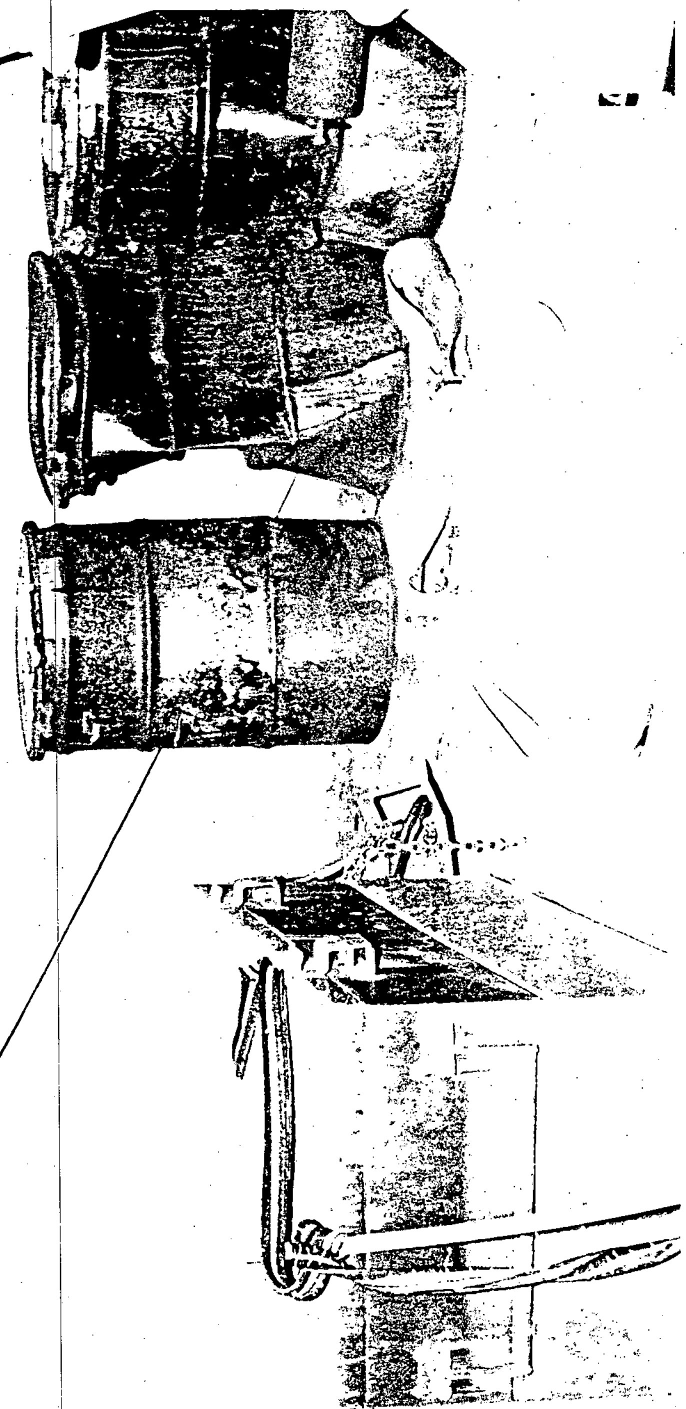


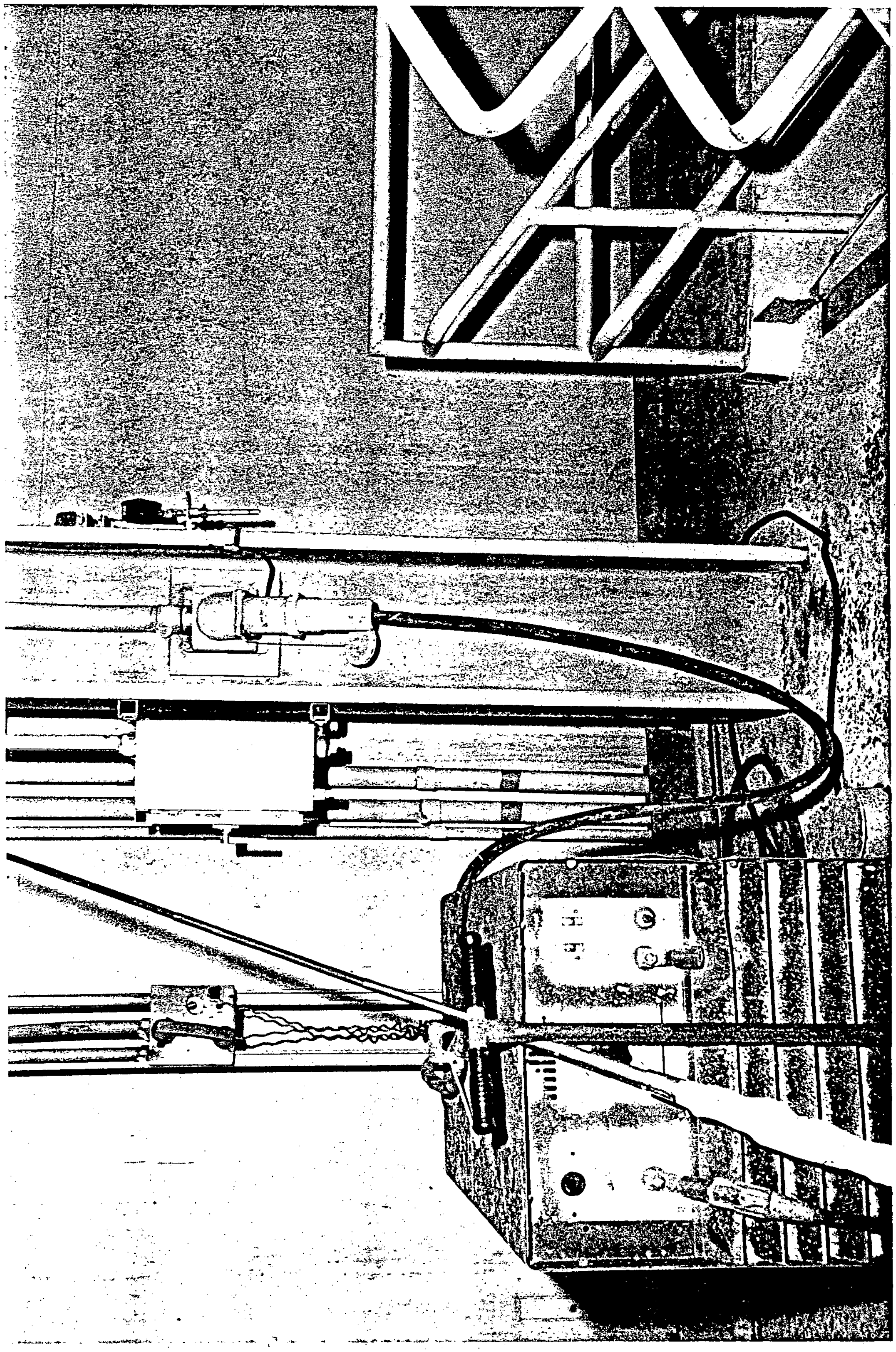


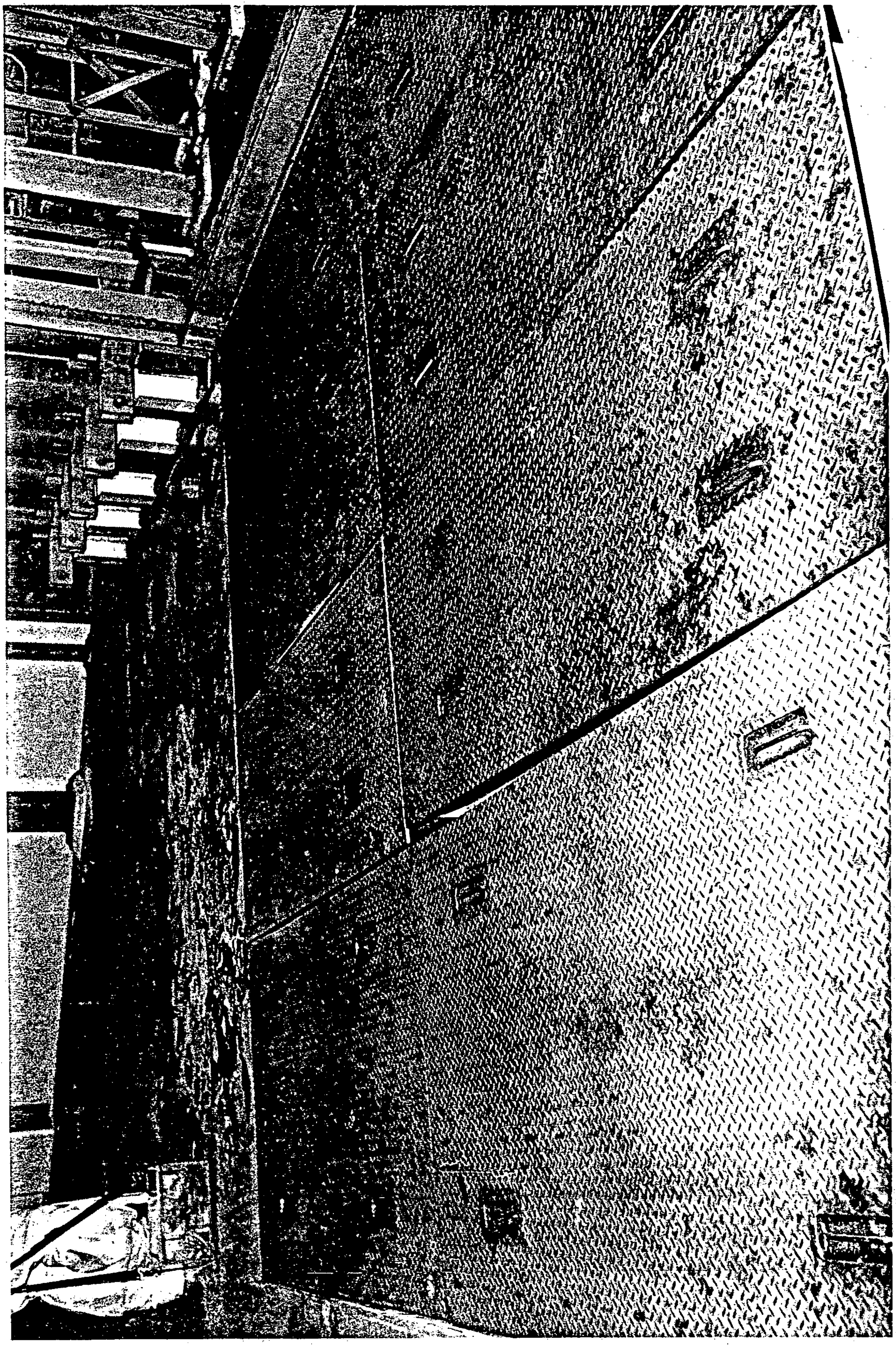


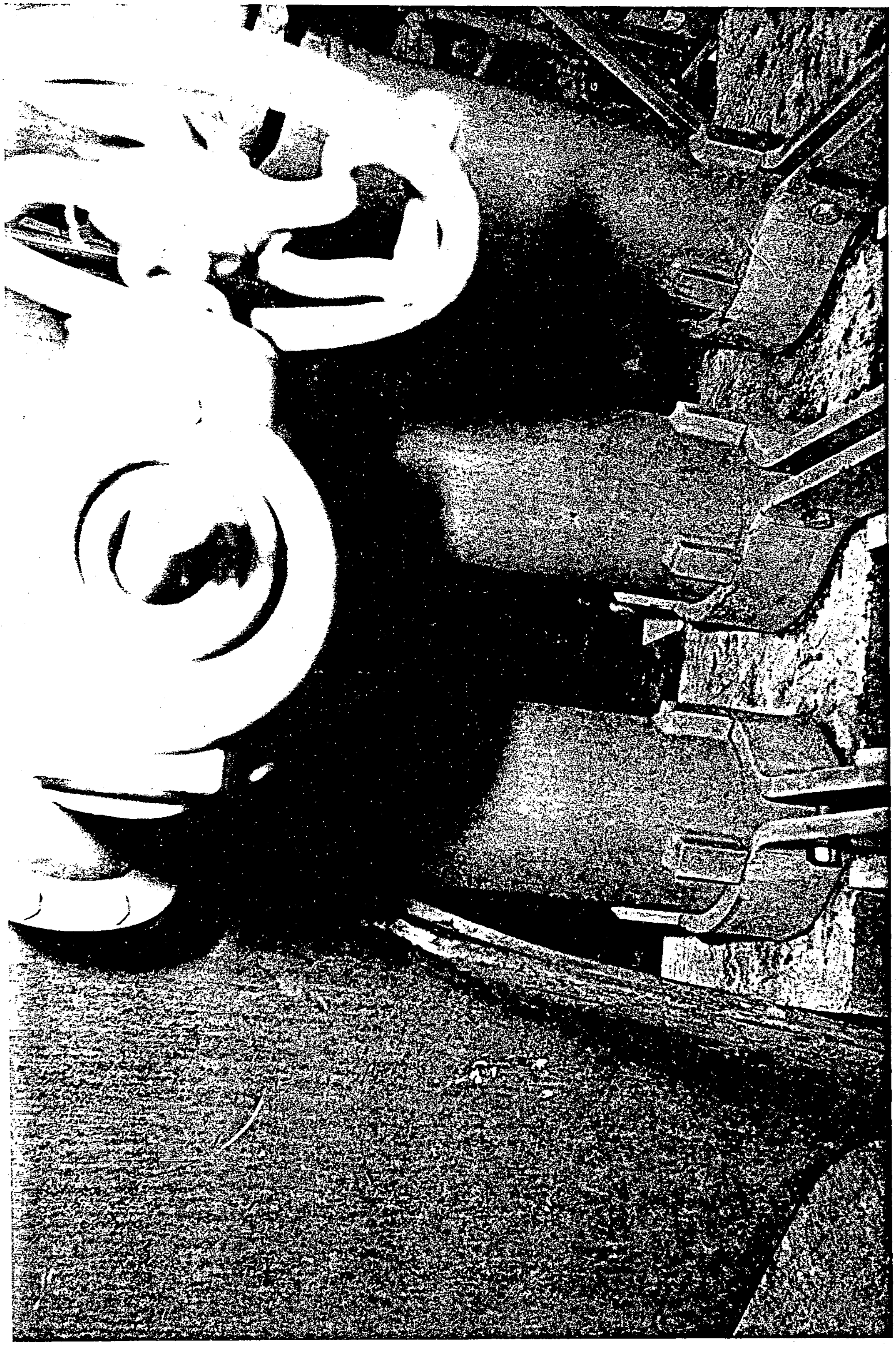


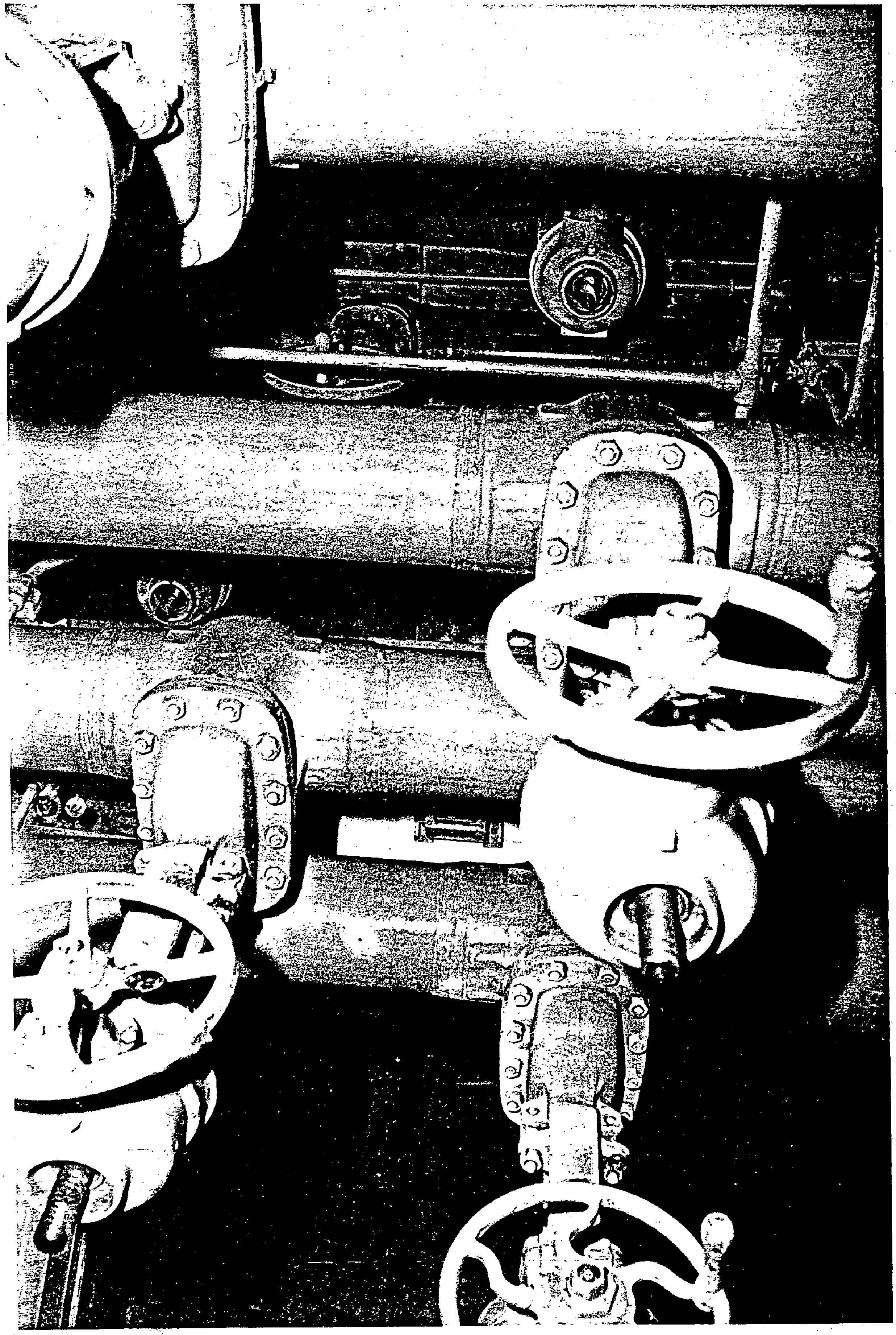


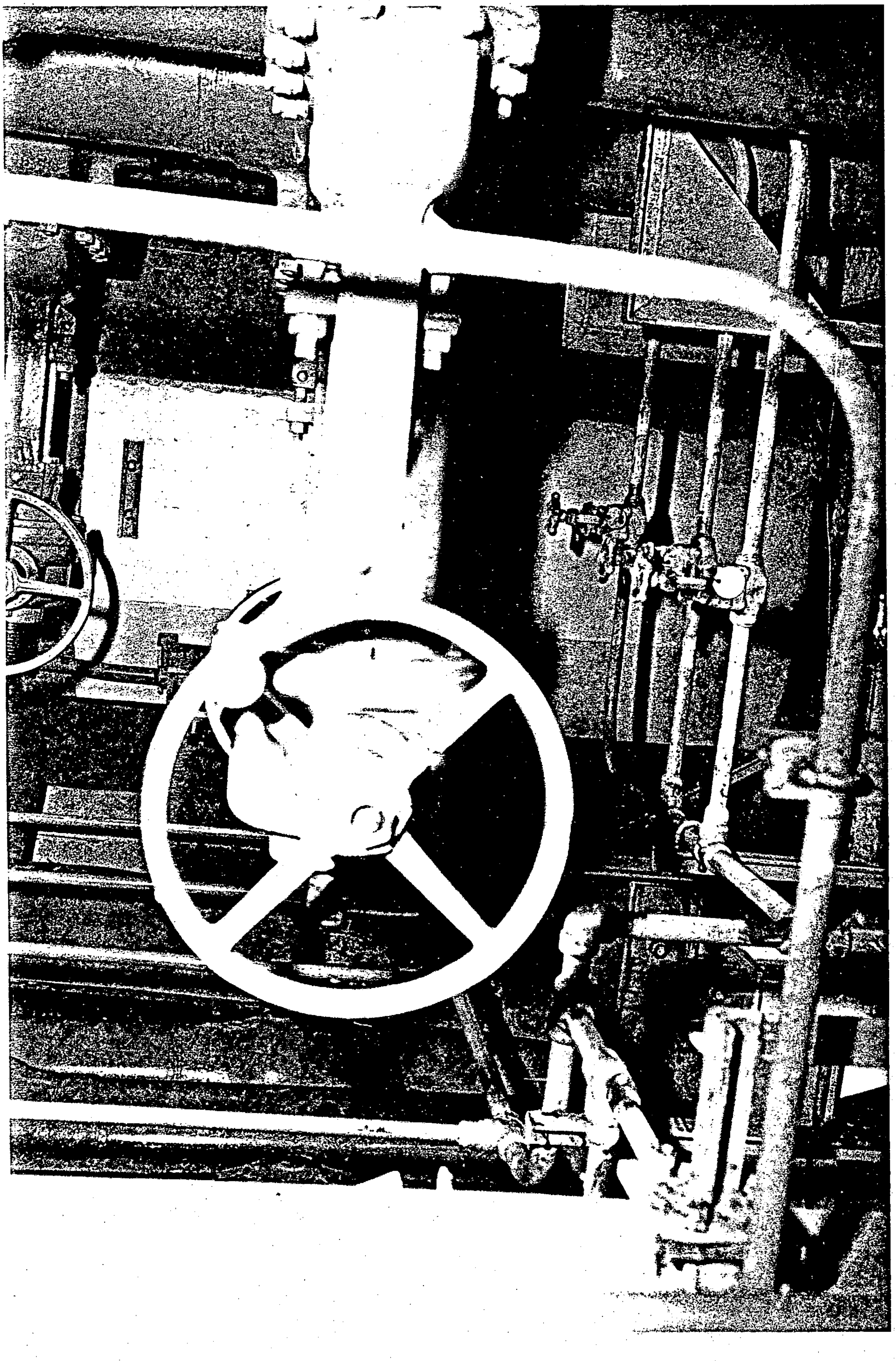


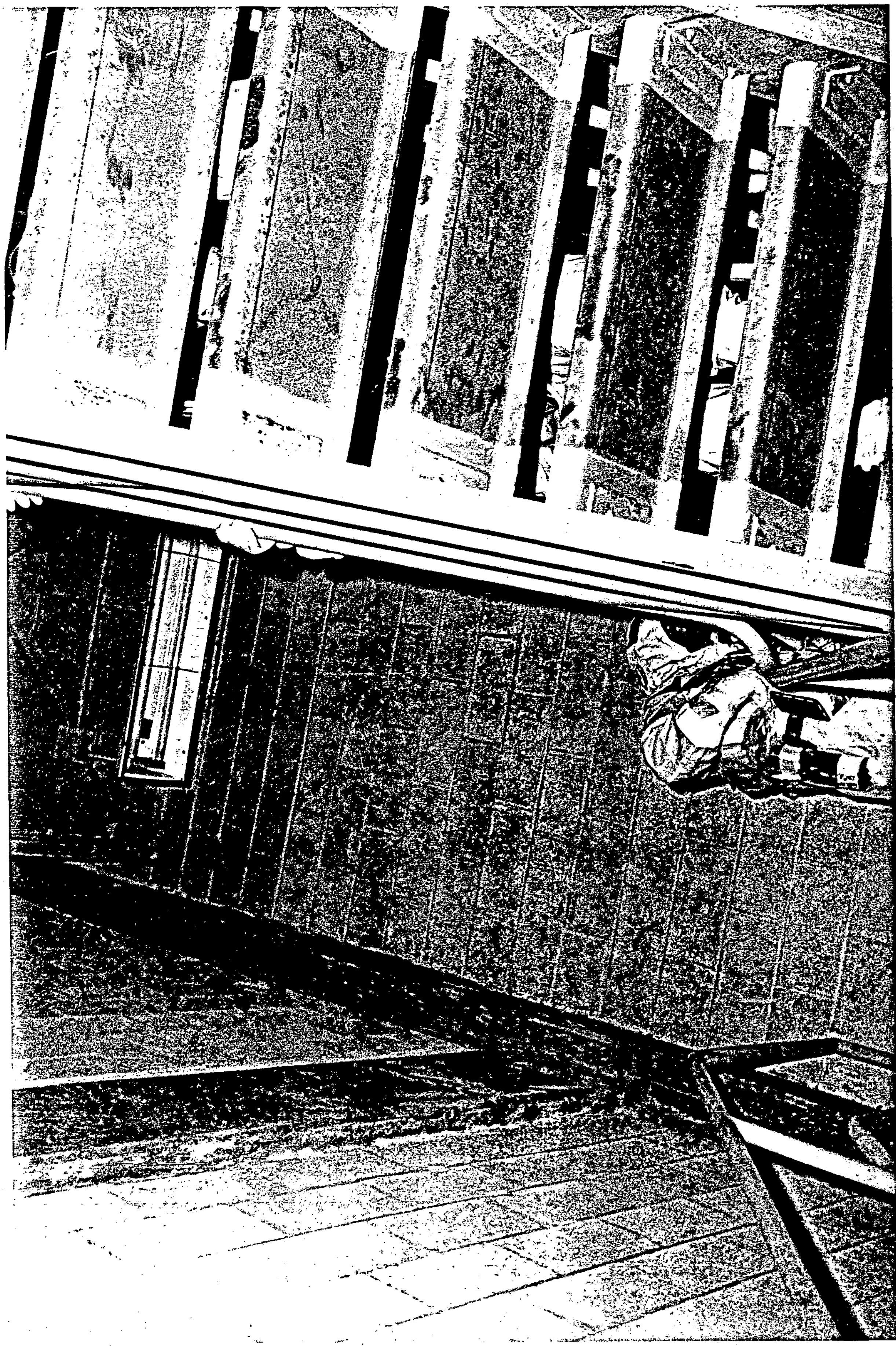


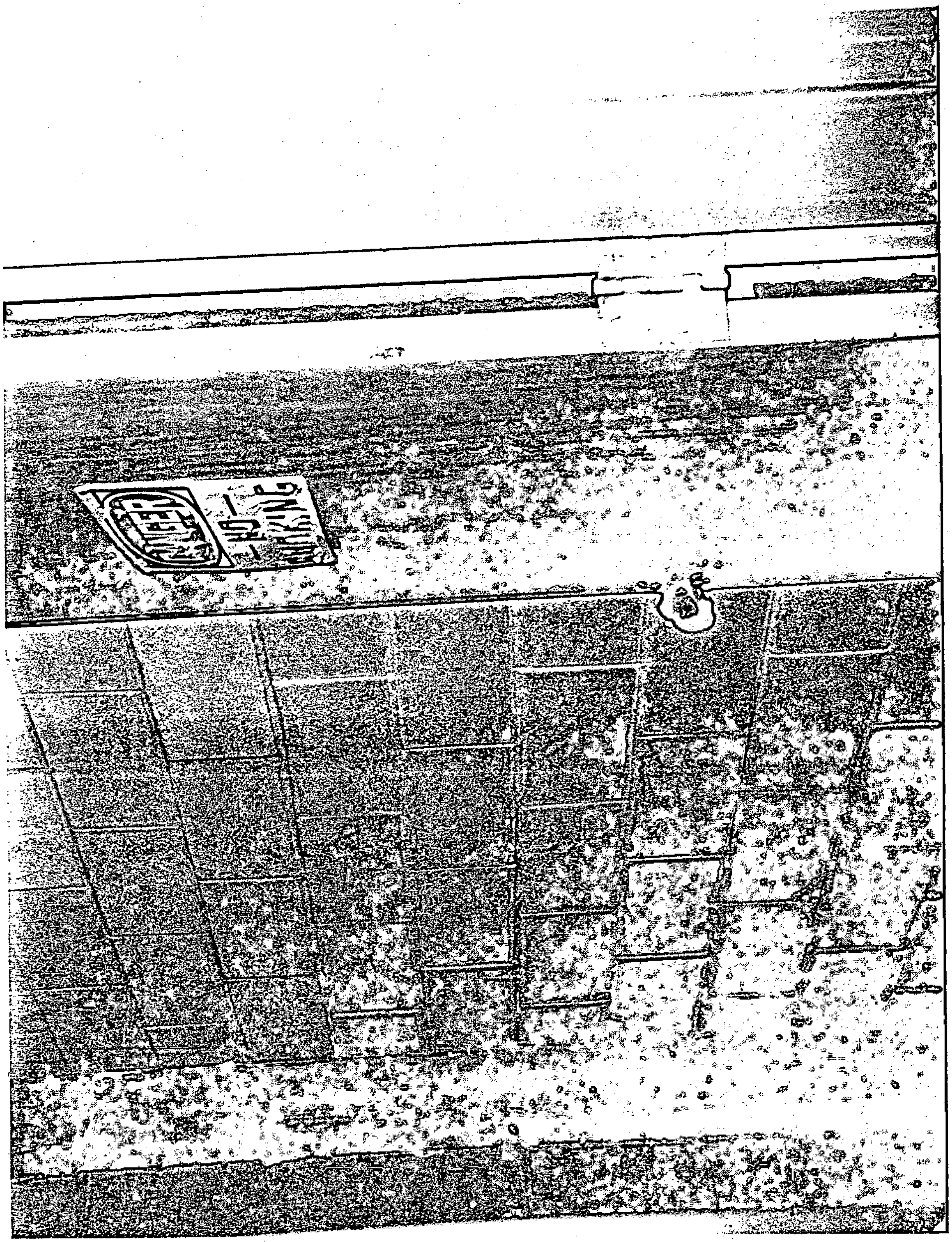


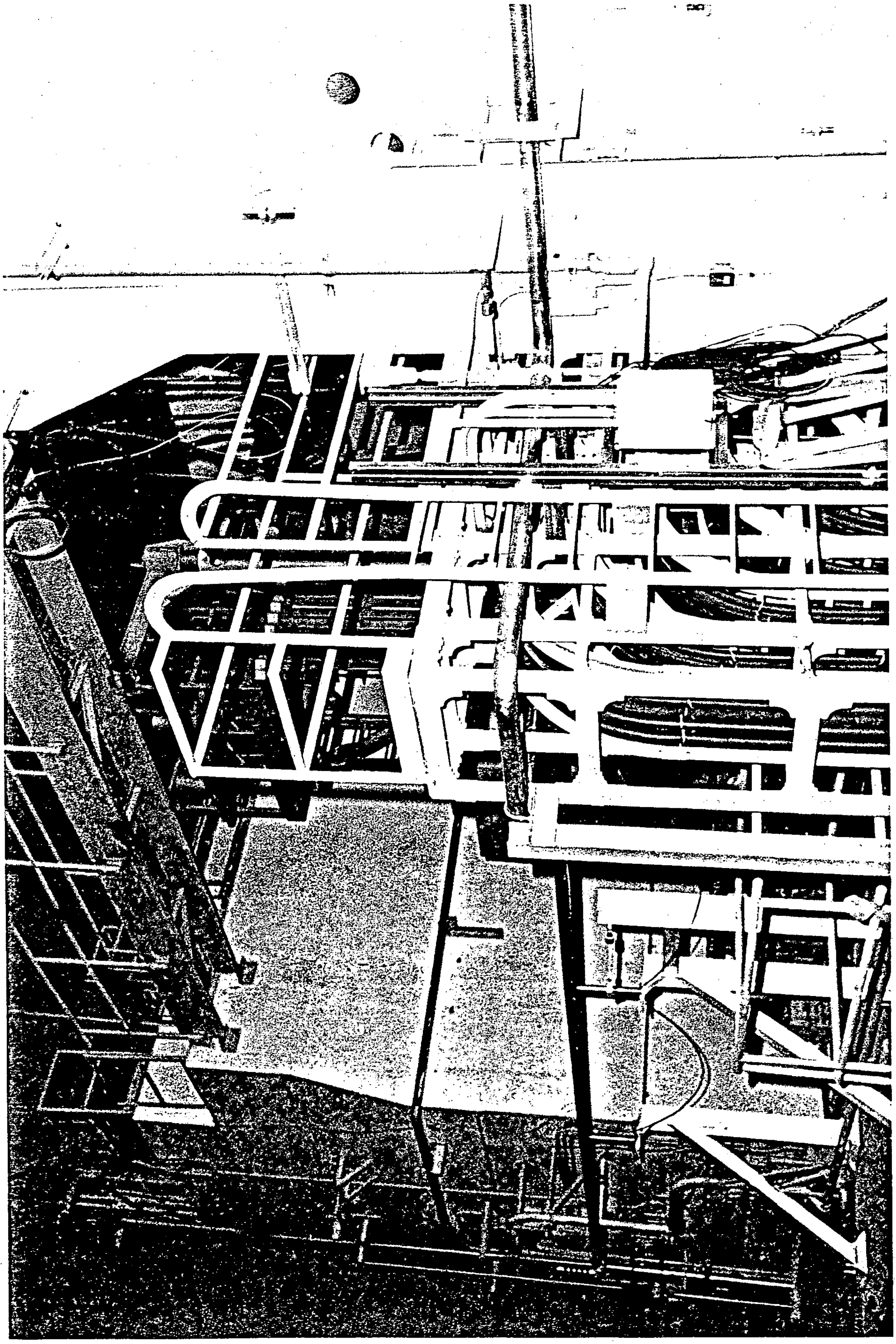


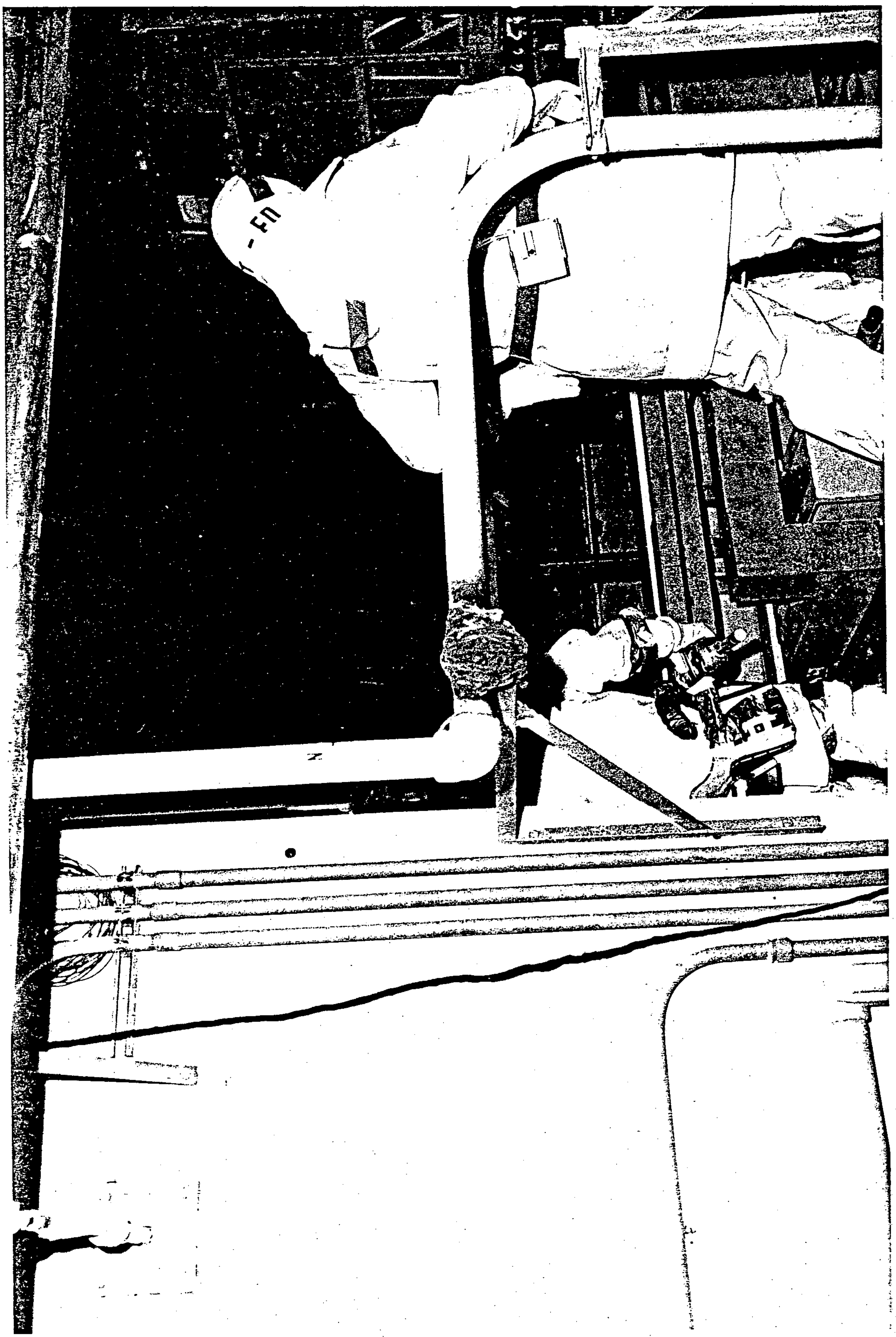


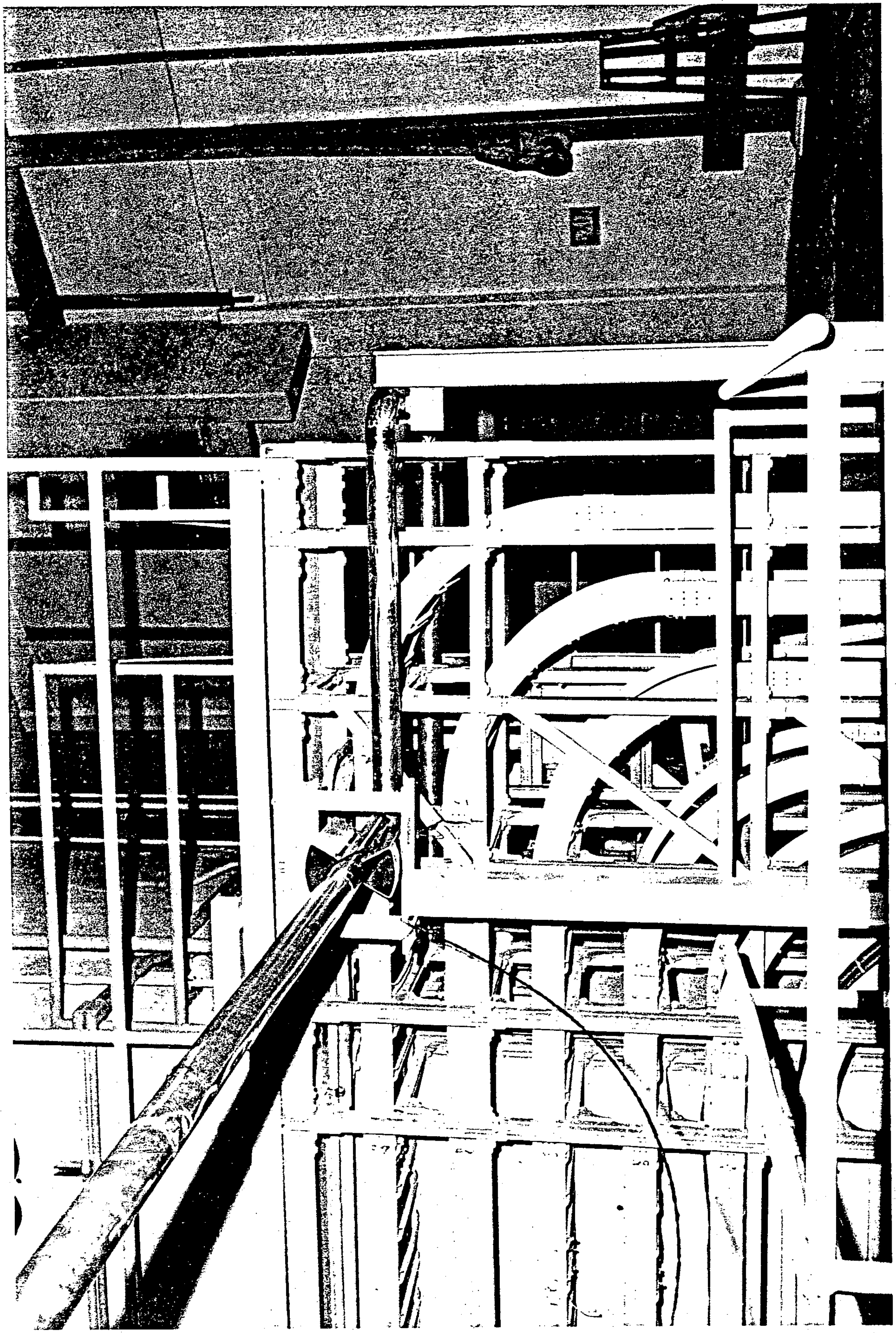


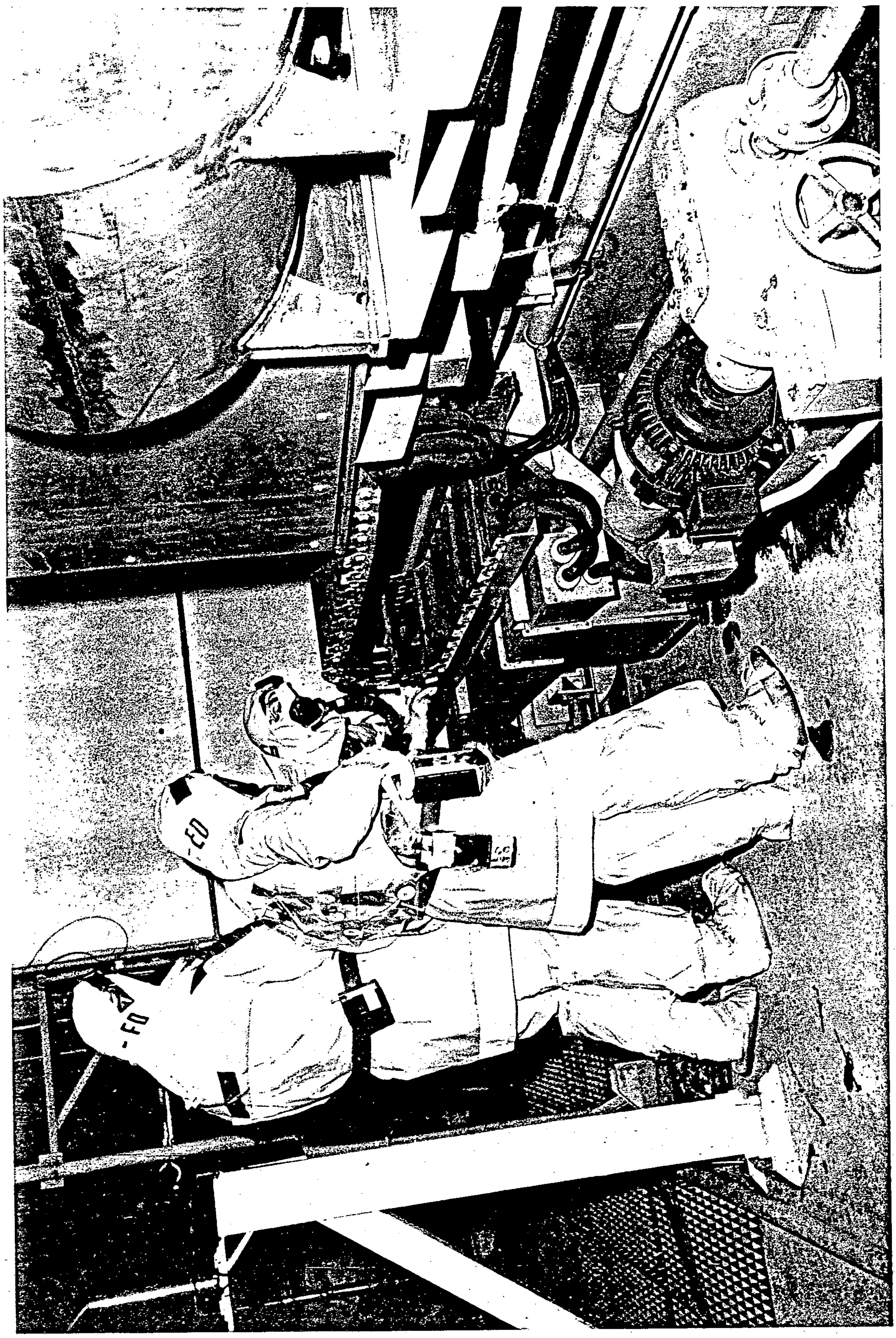


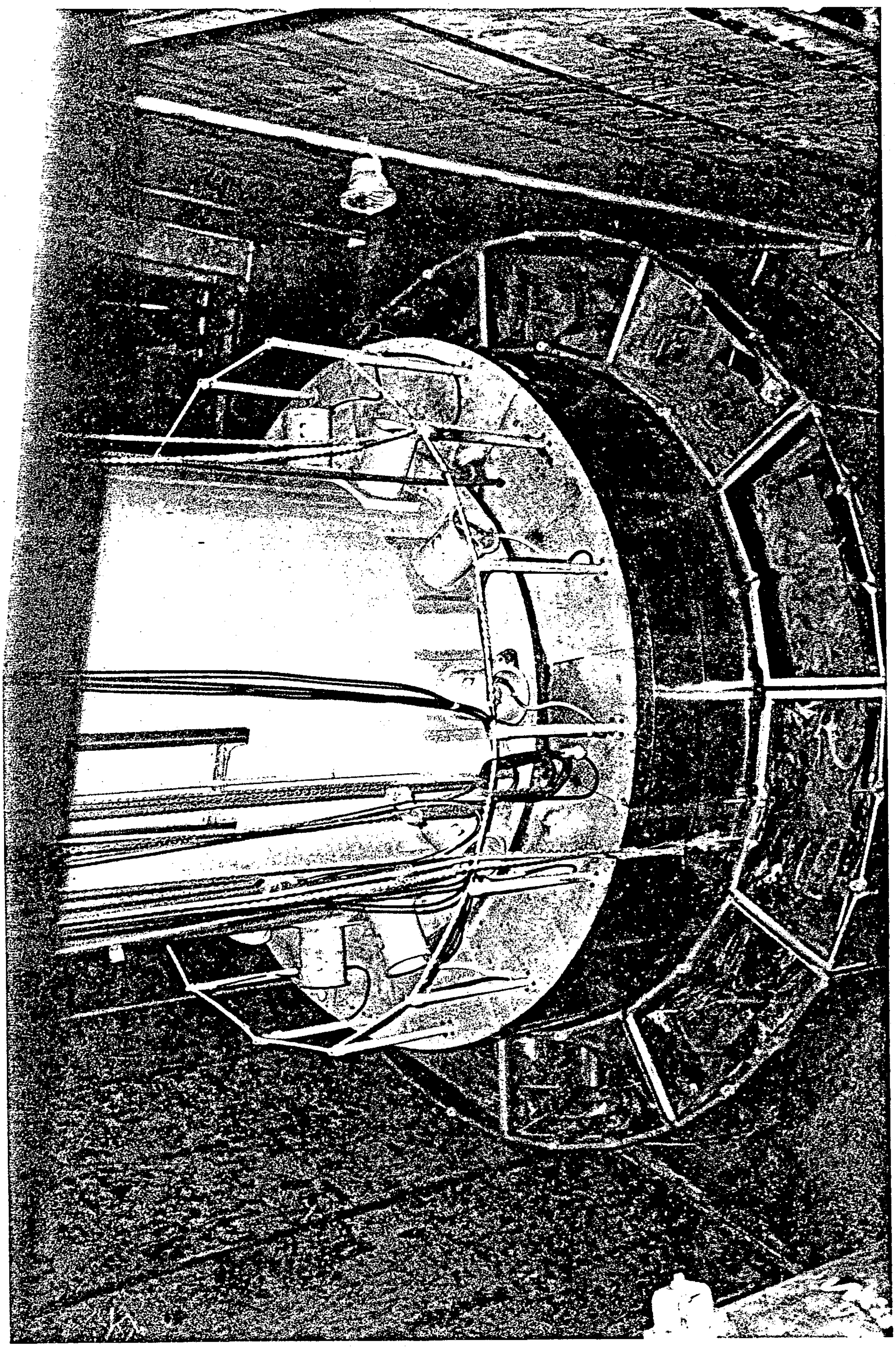


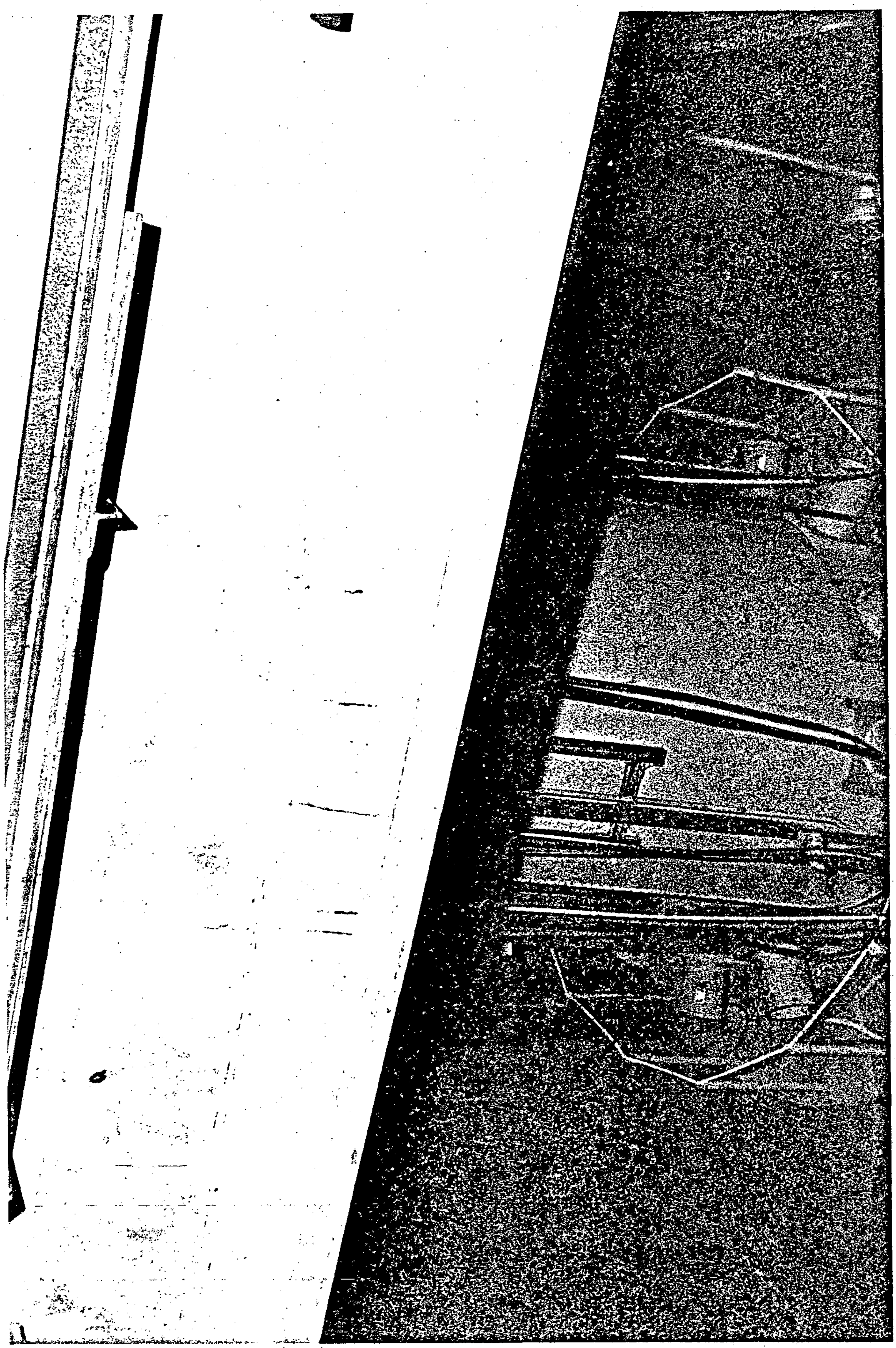


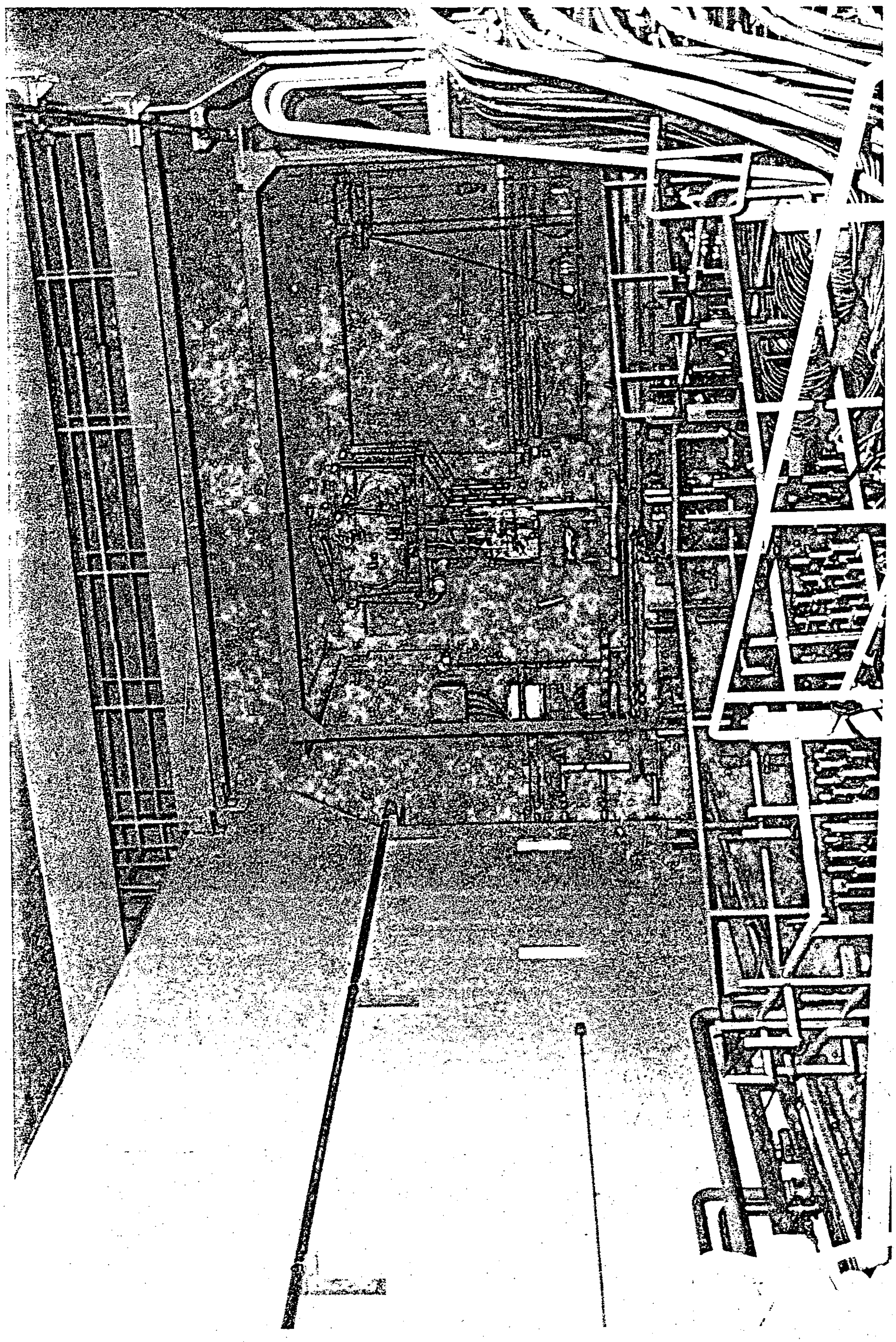


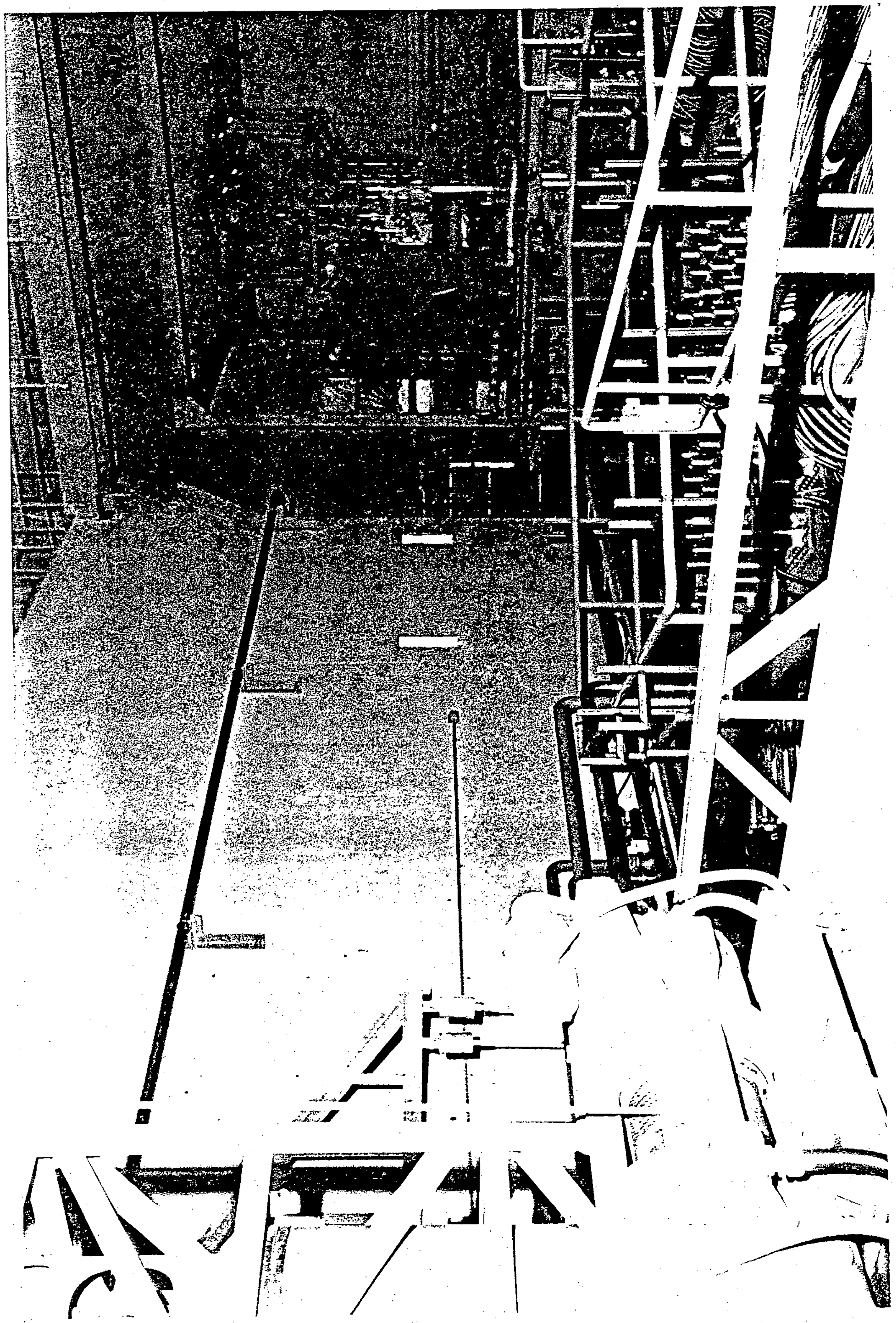


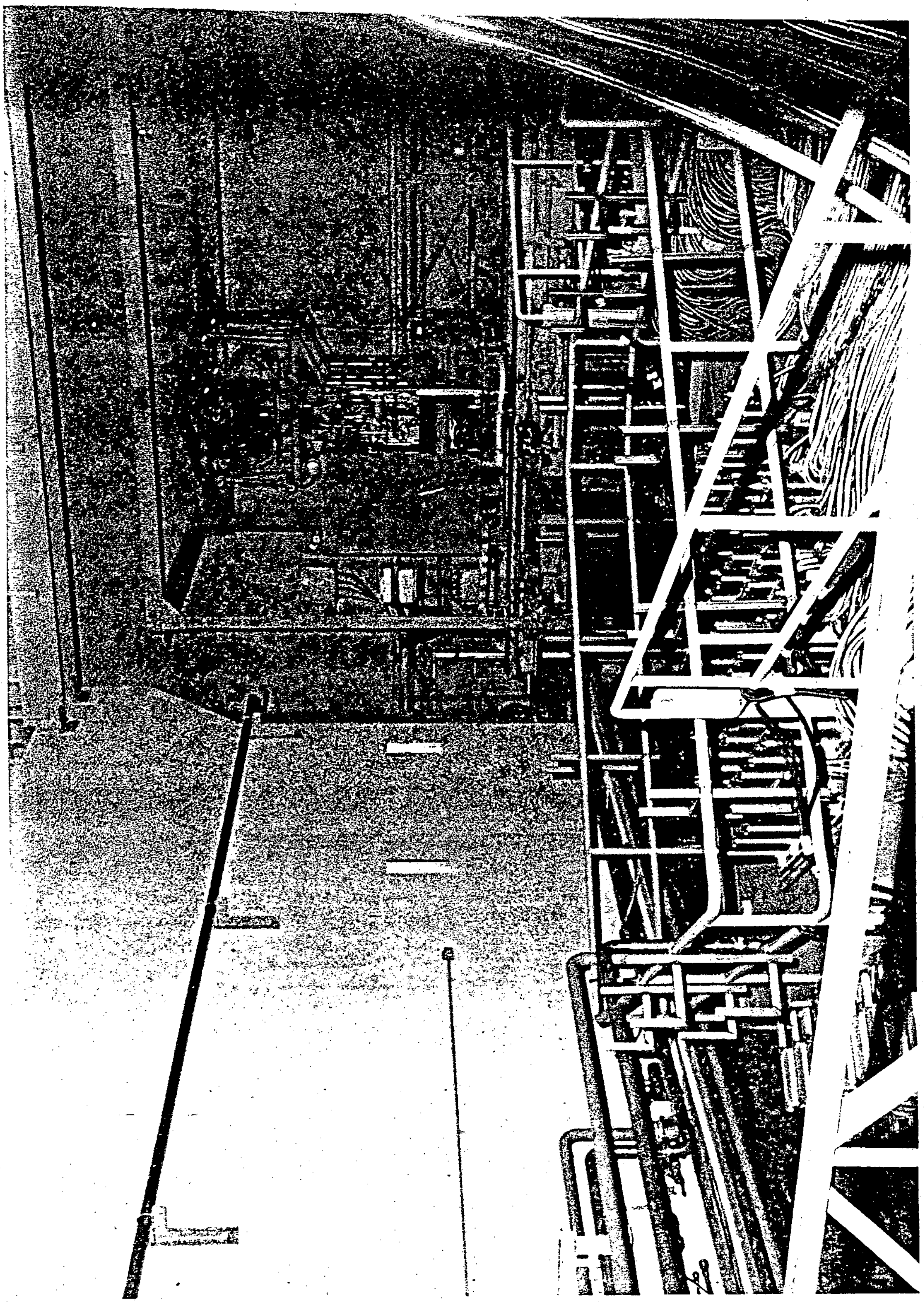


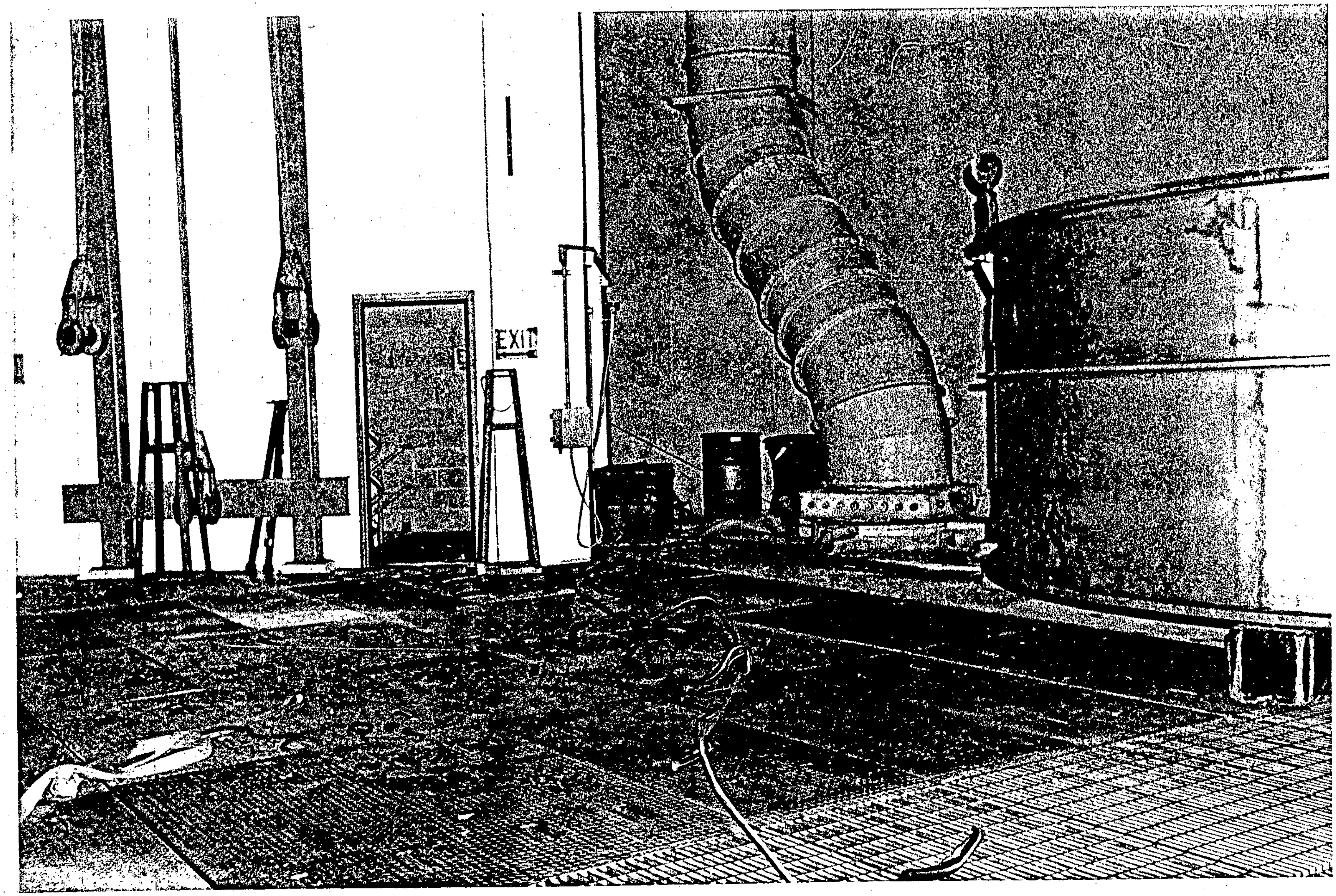


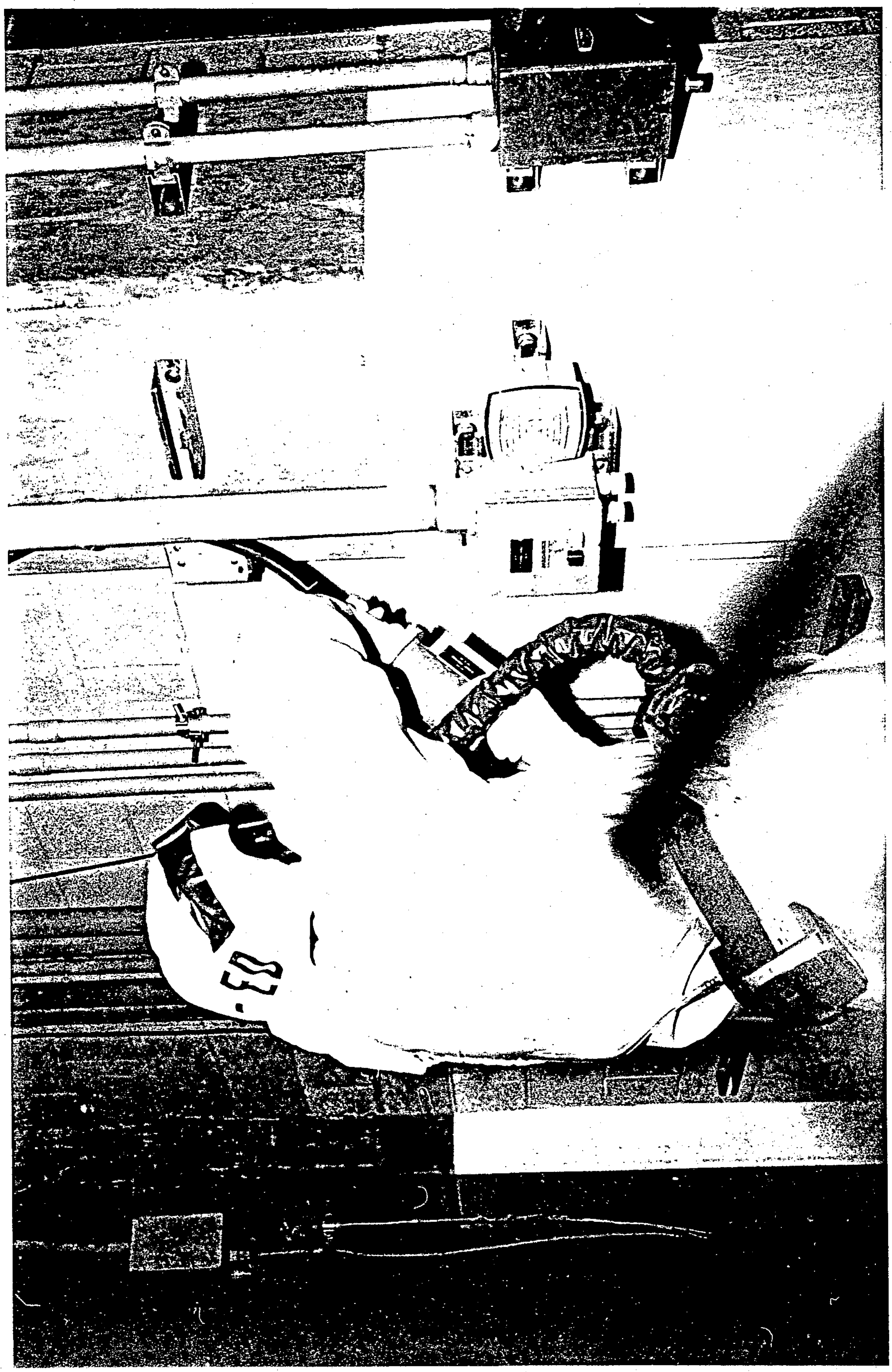


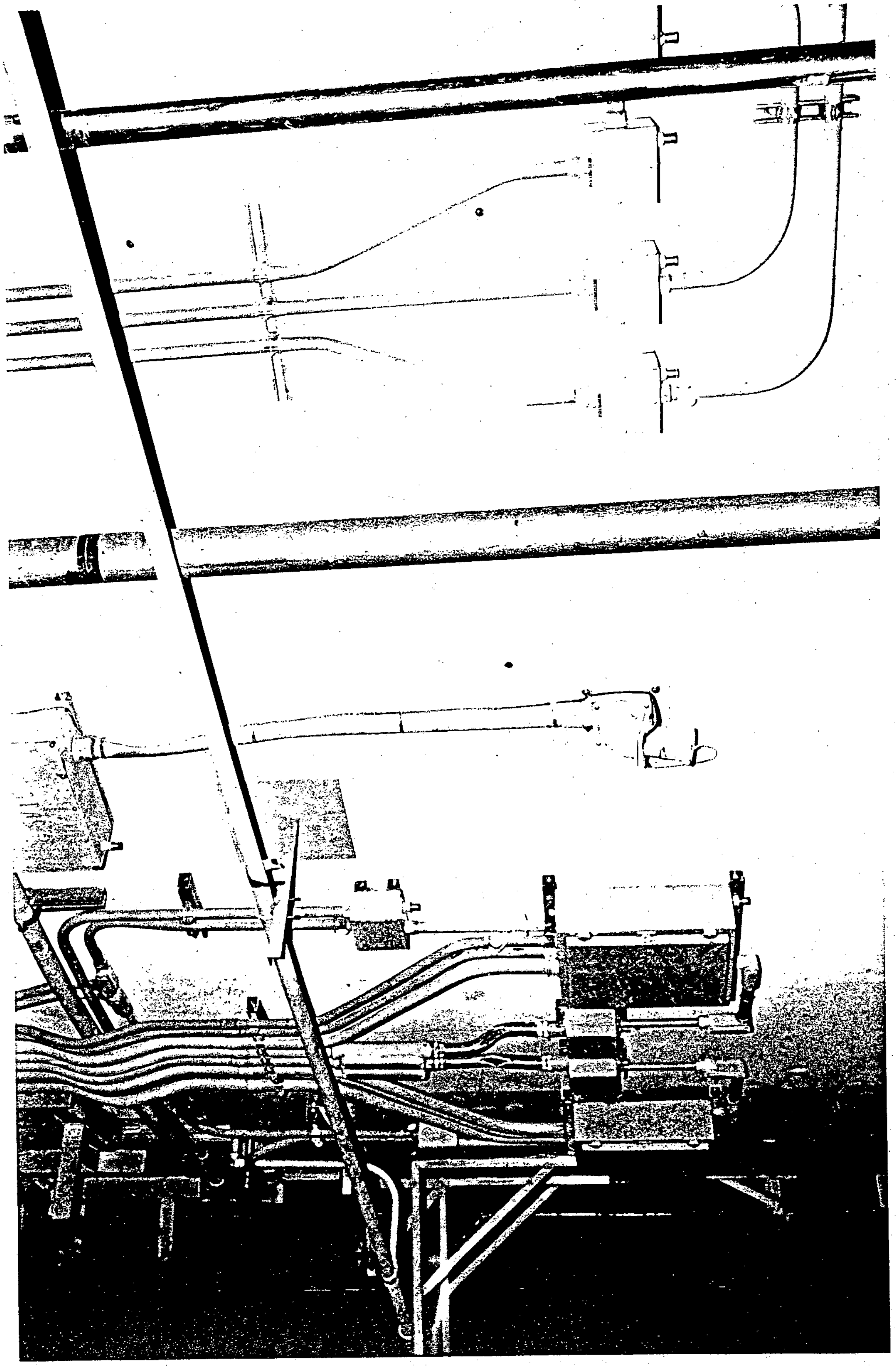


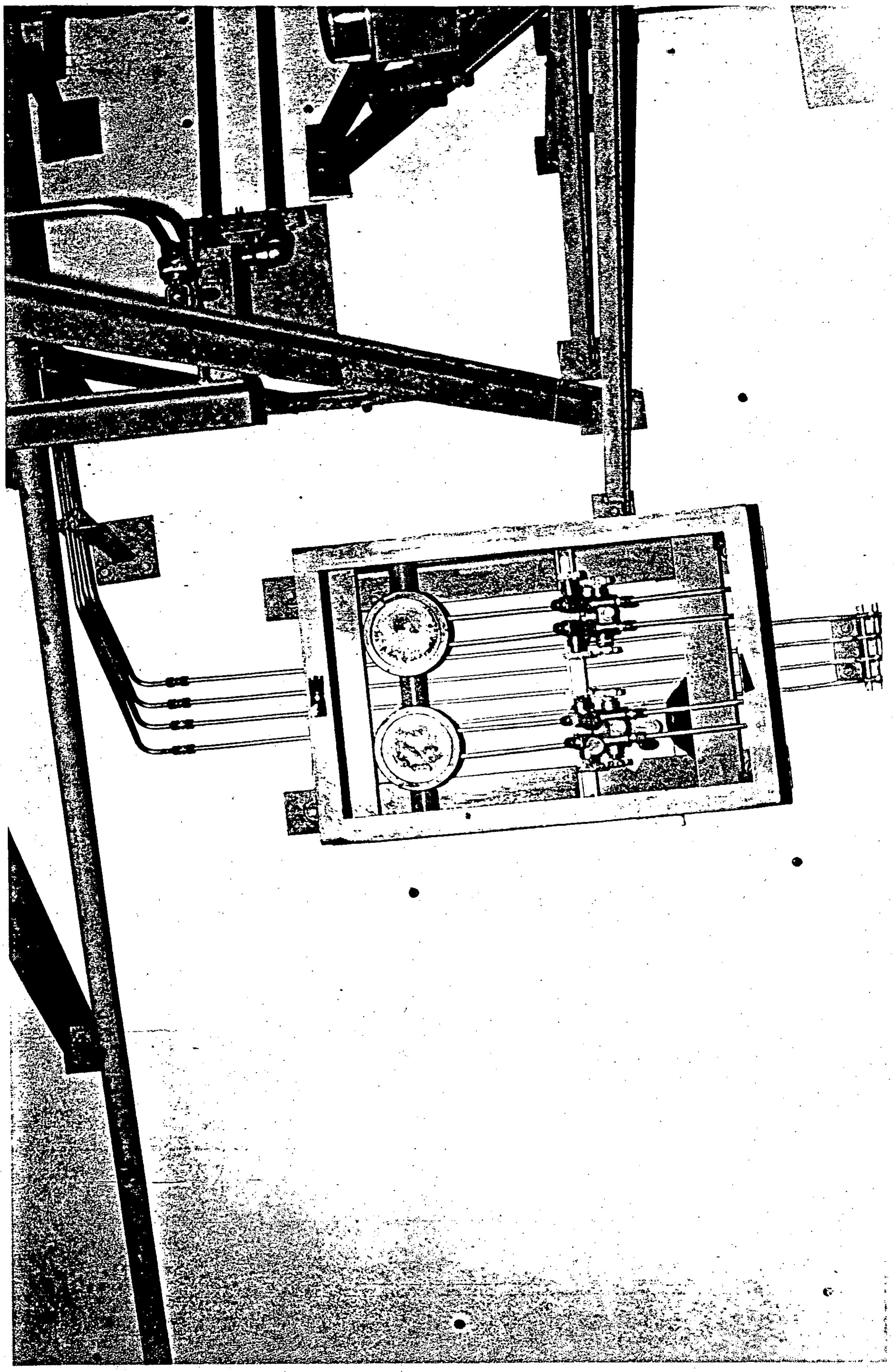


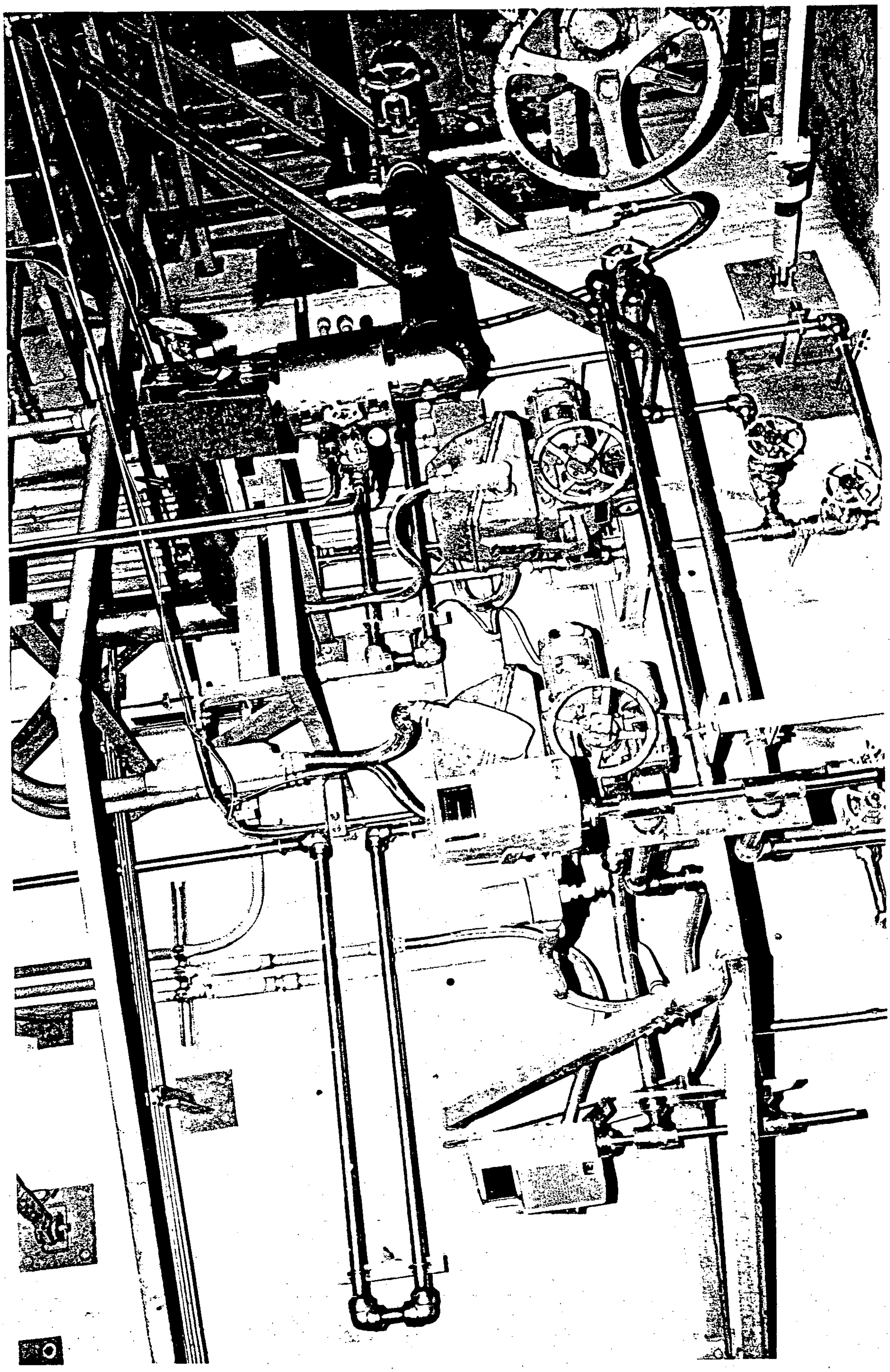


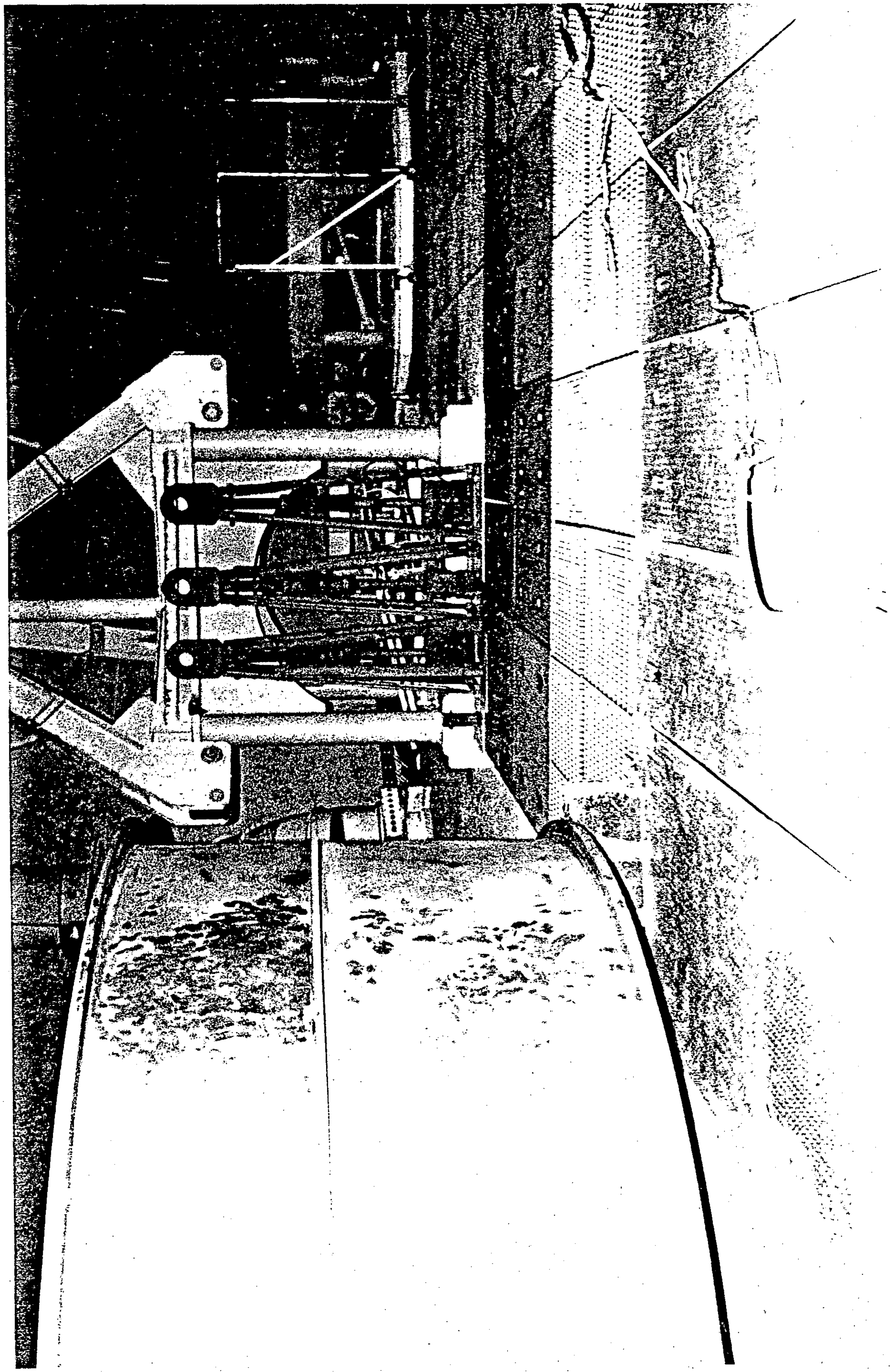

EXIT

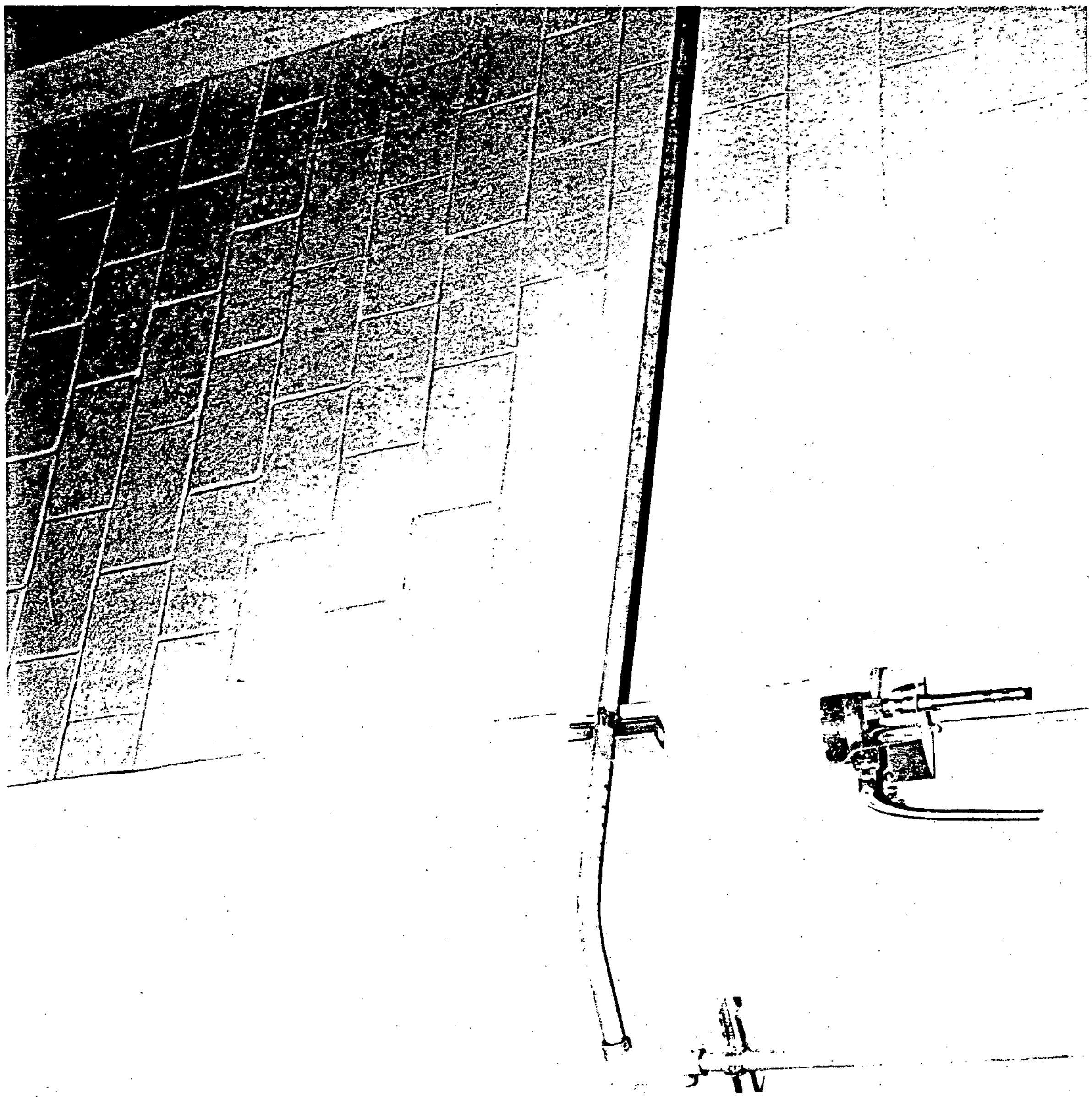


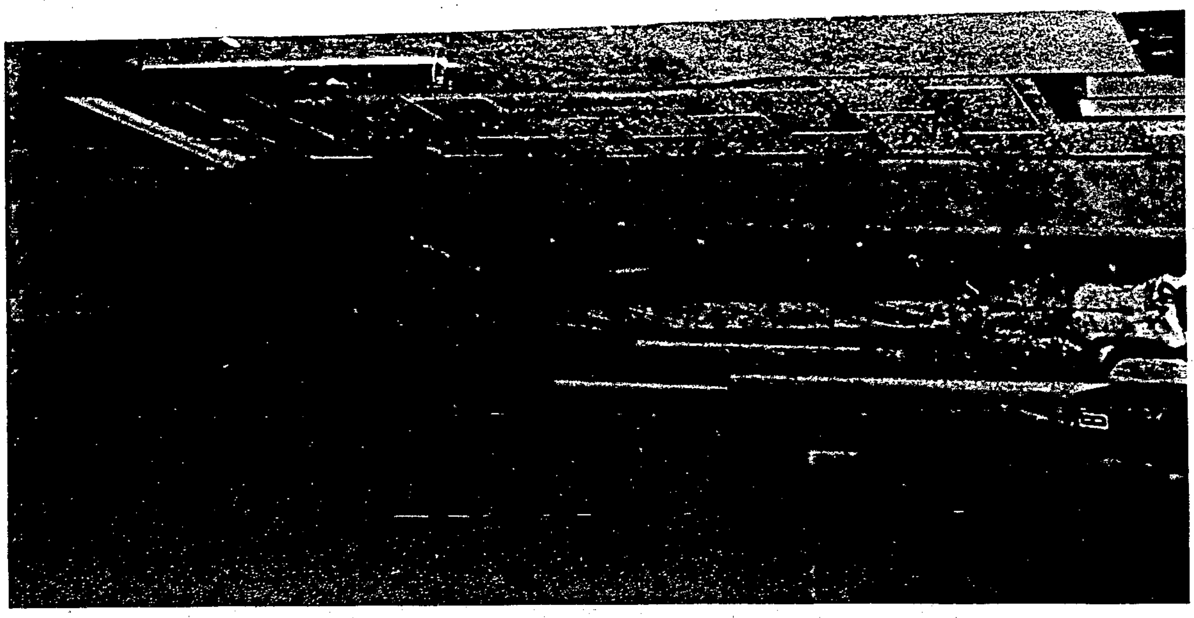


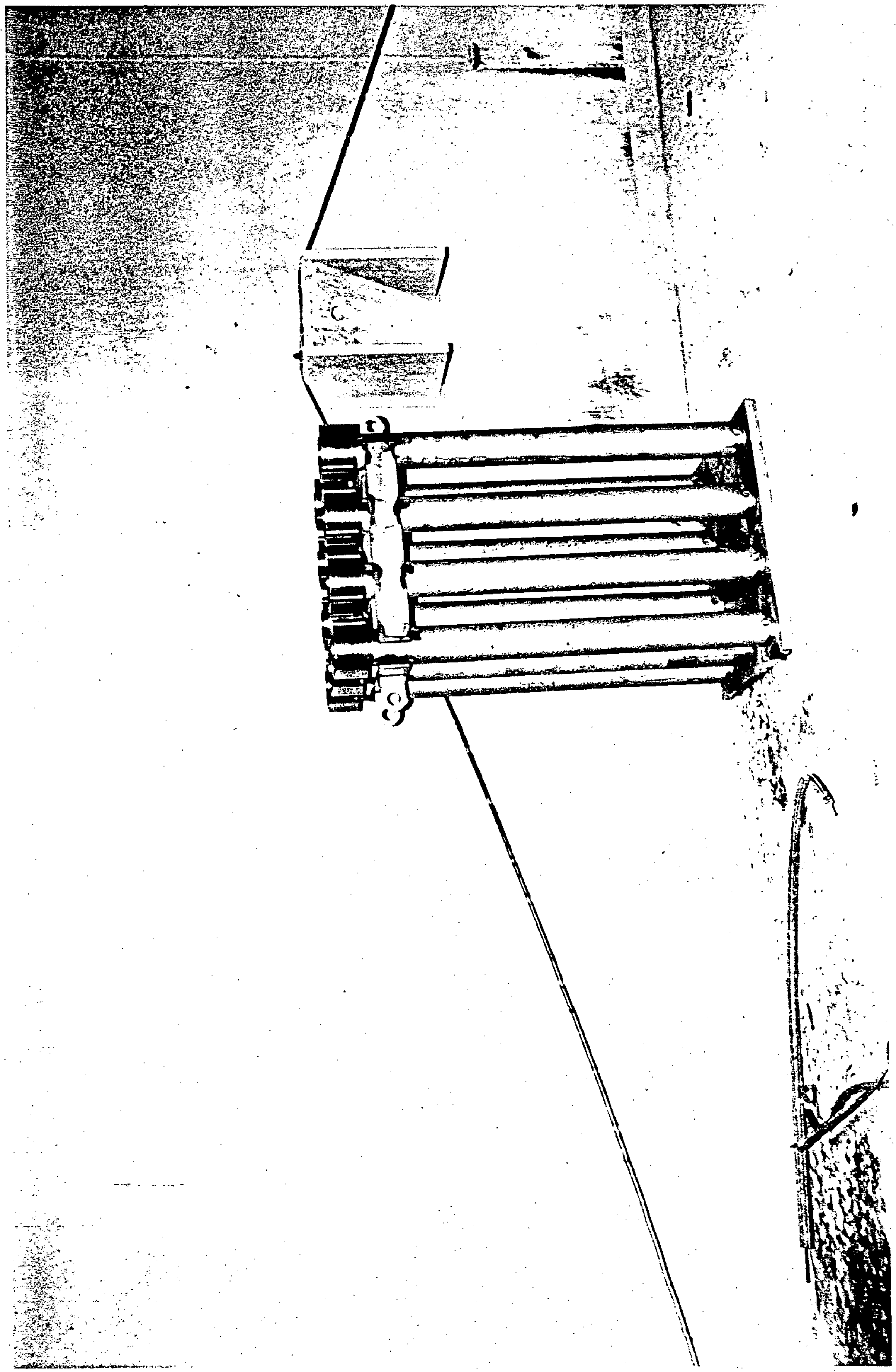


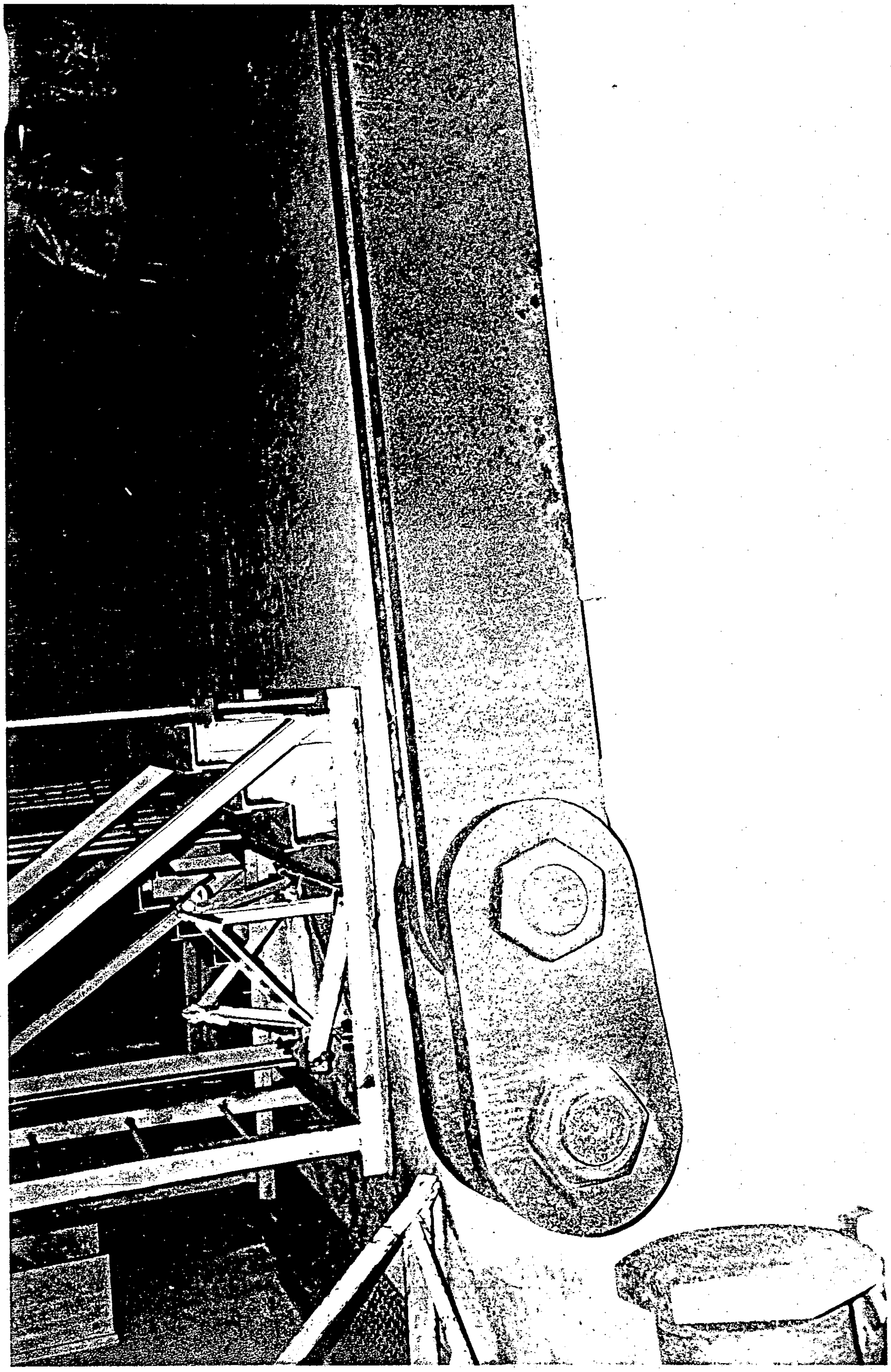


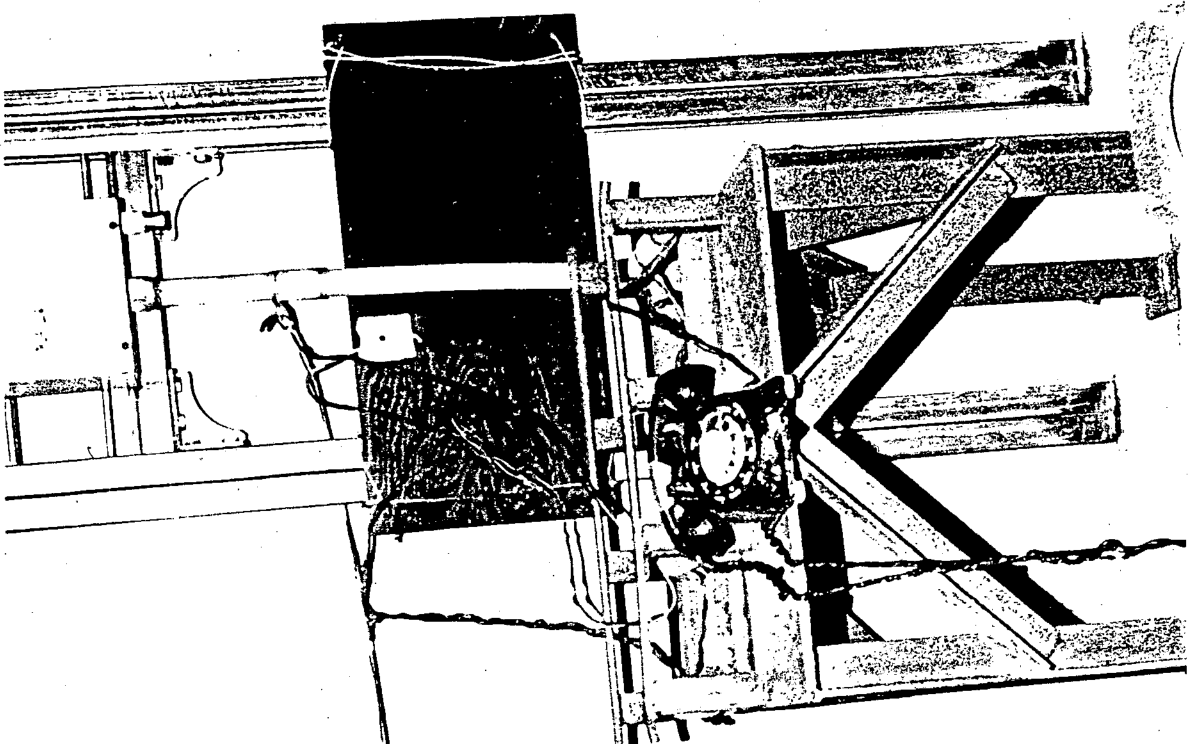


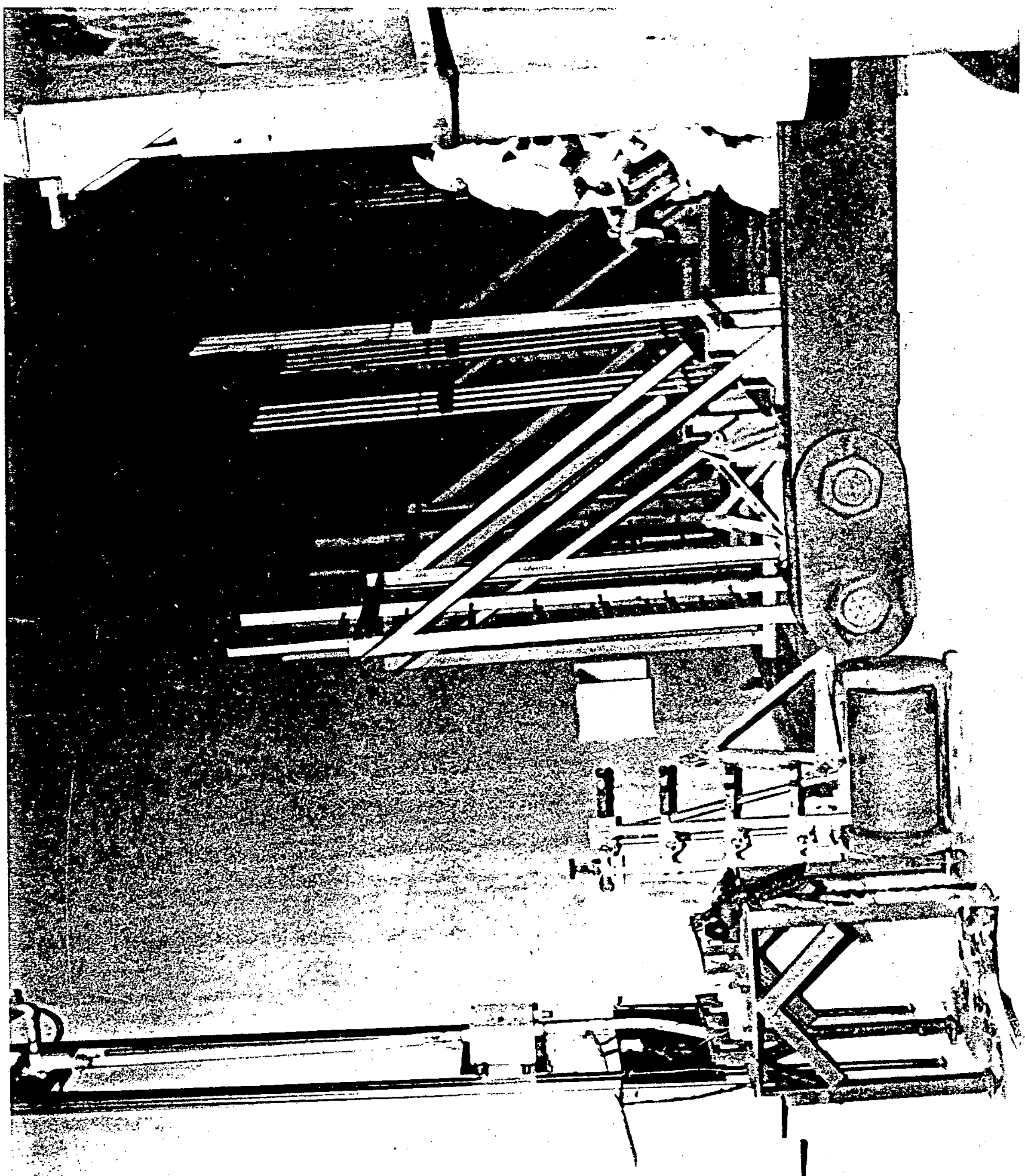


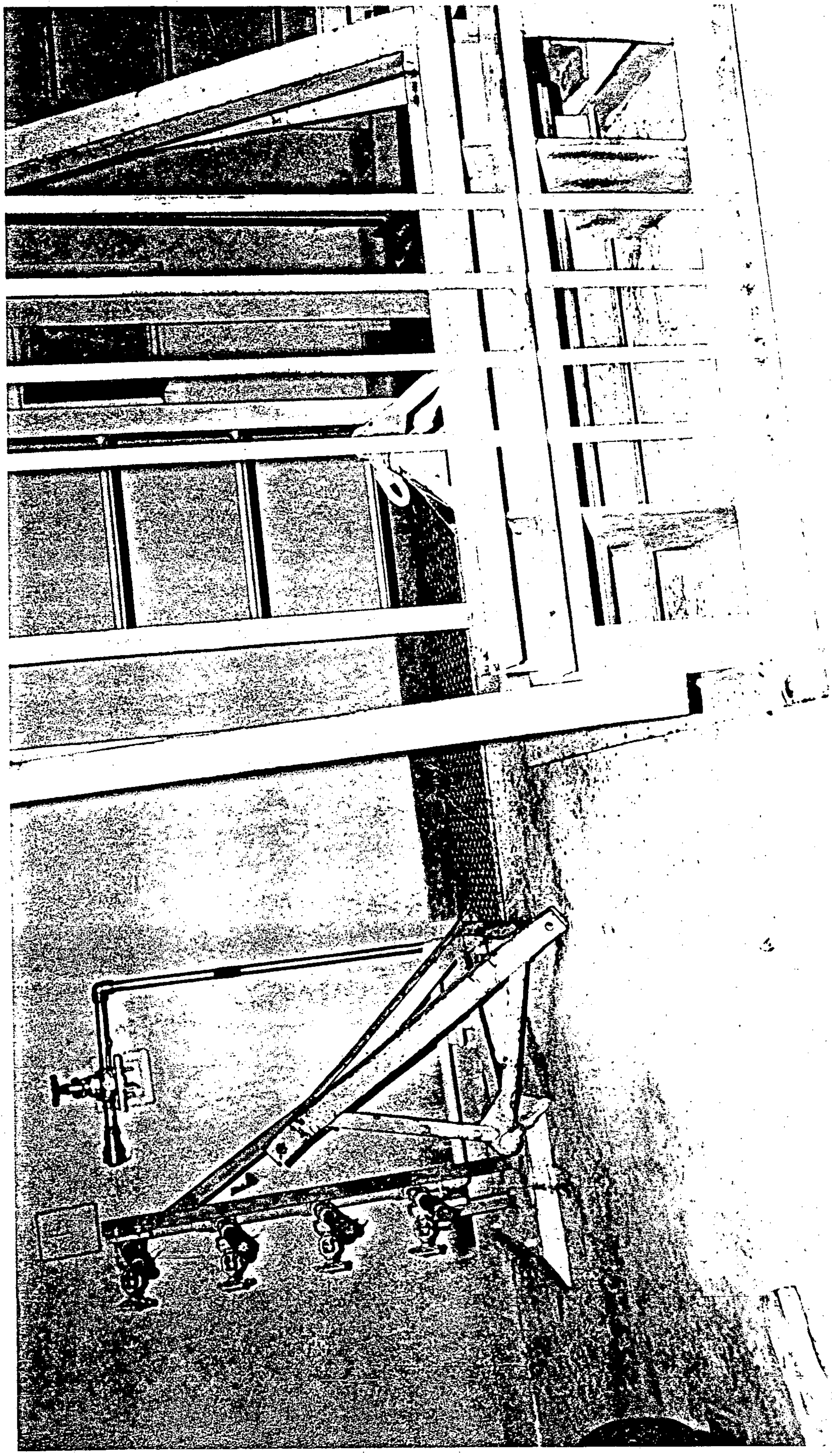


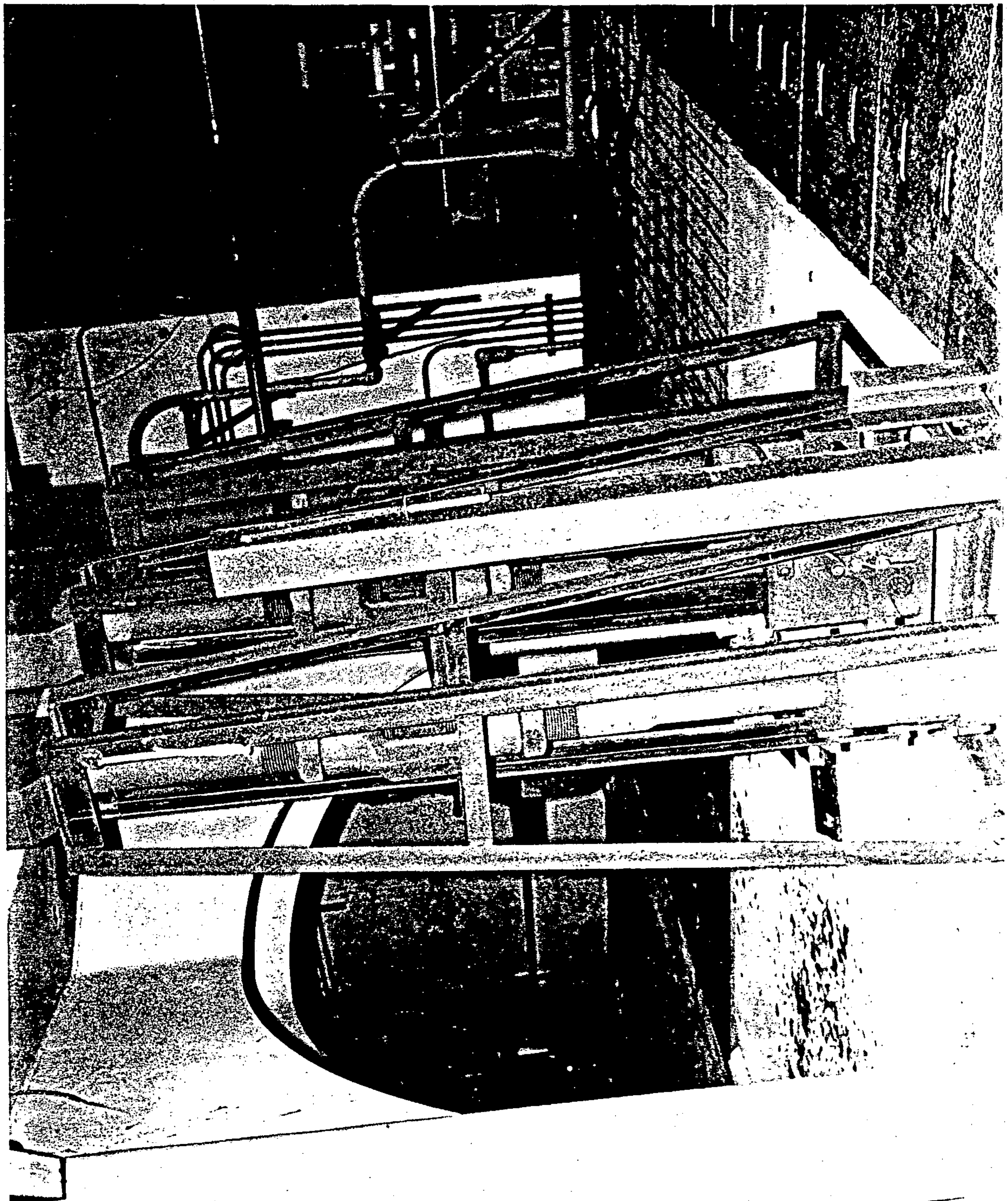


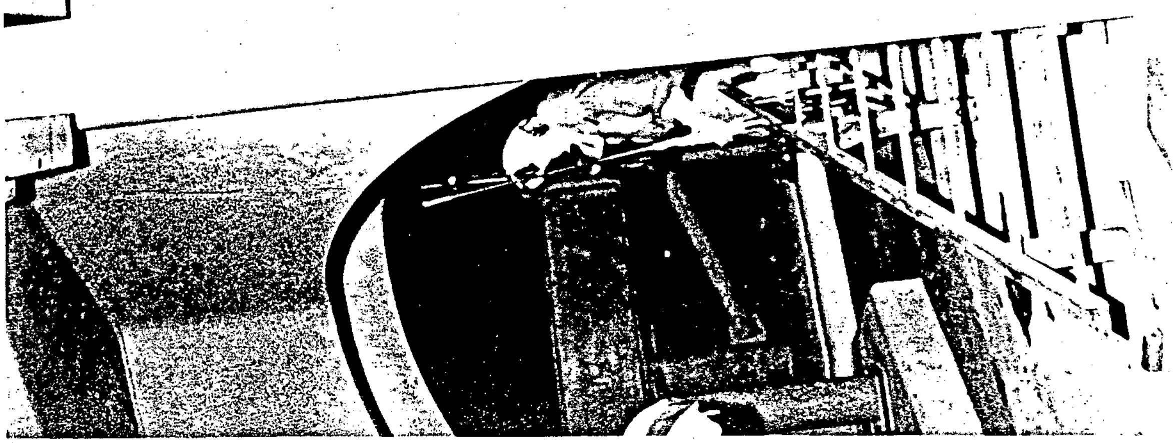


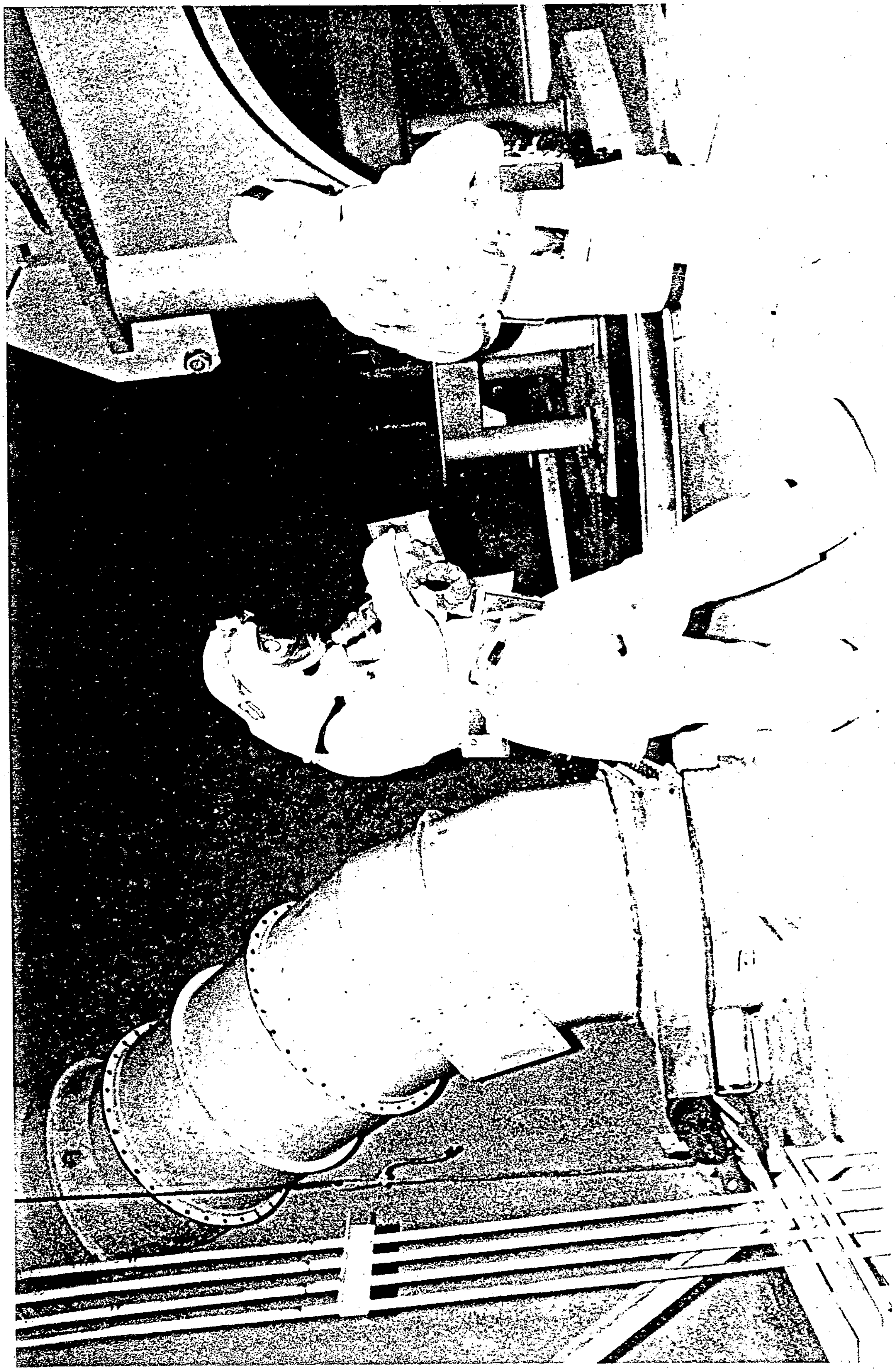


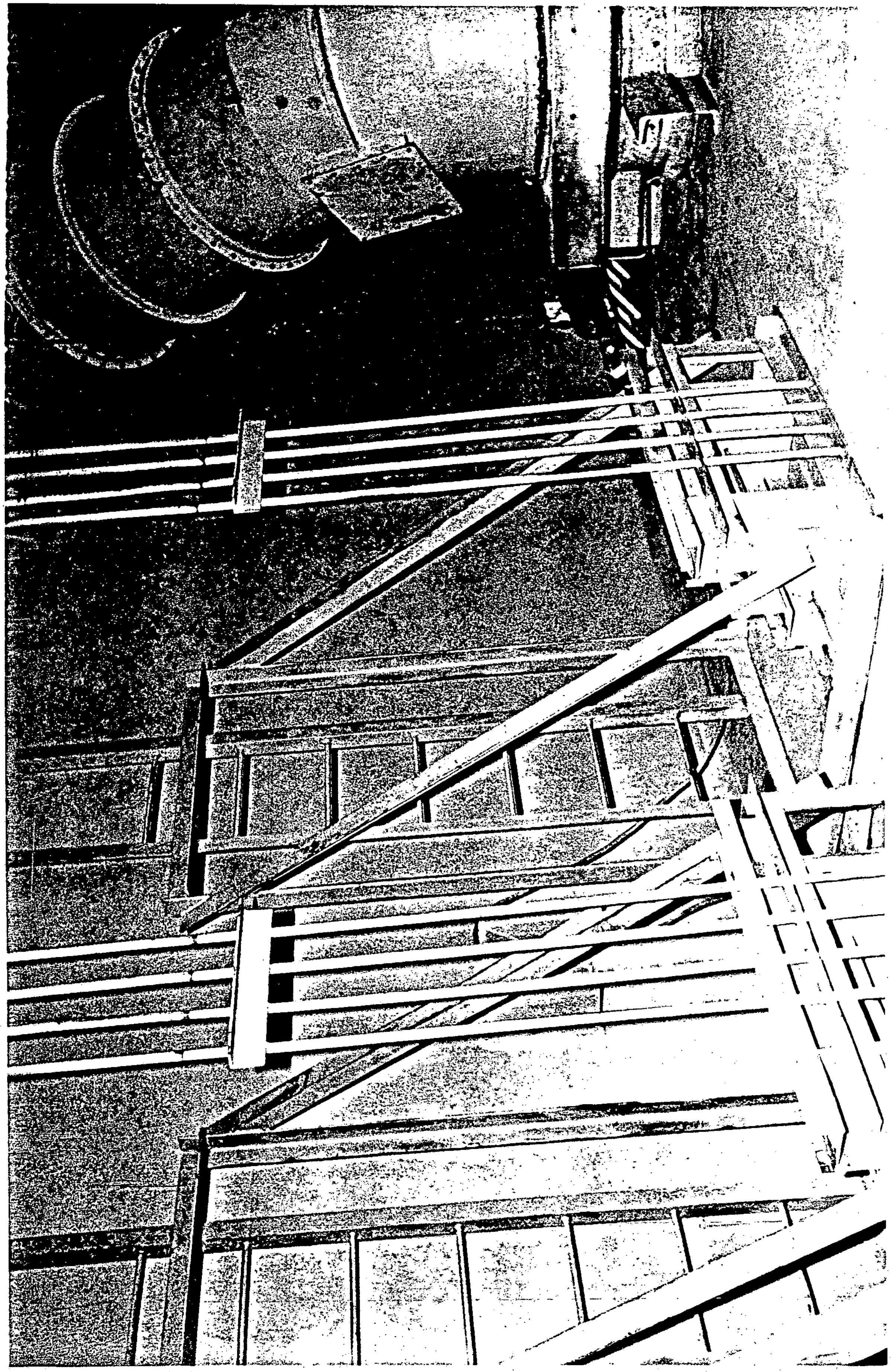


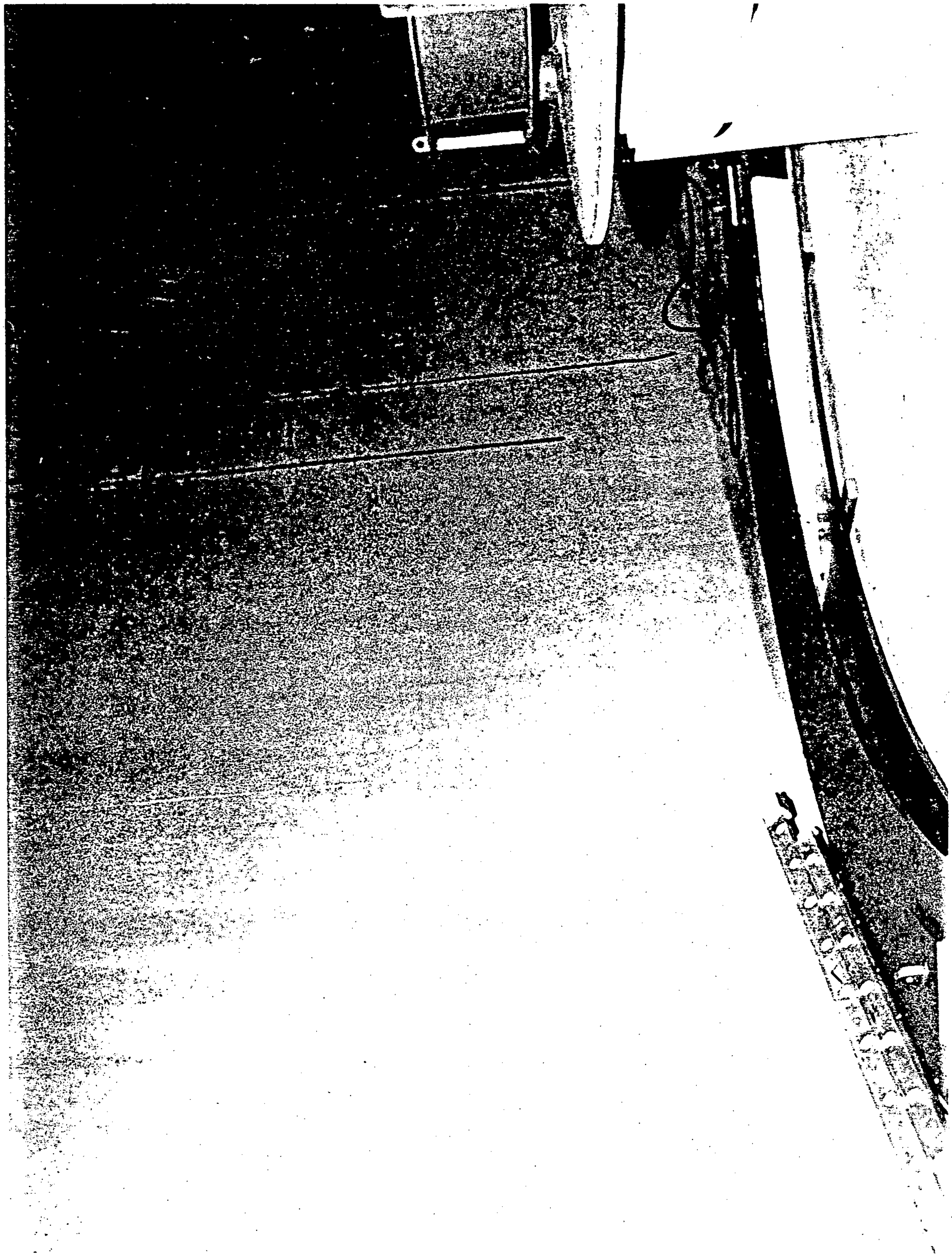


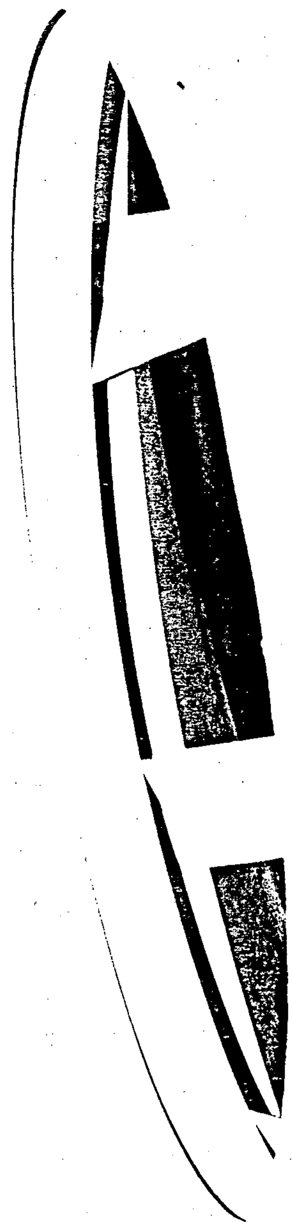


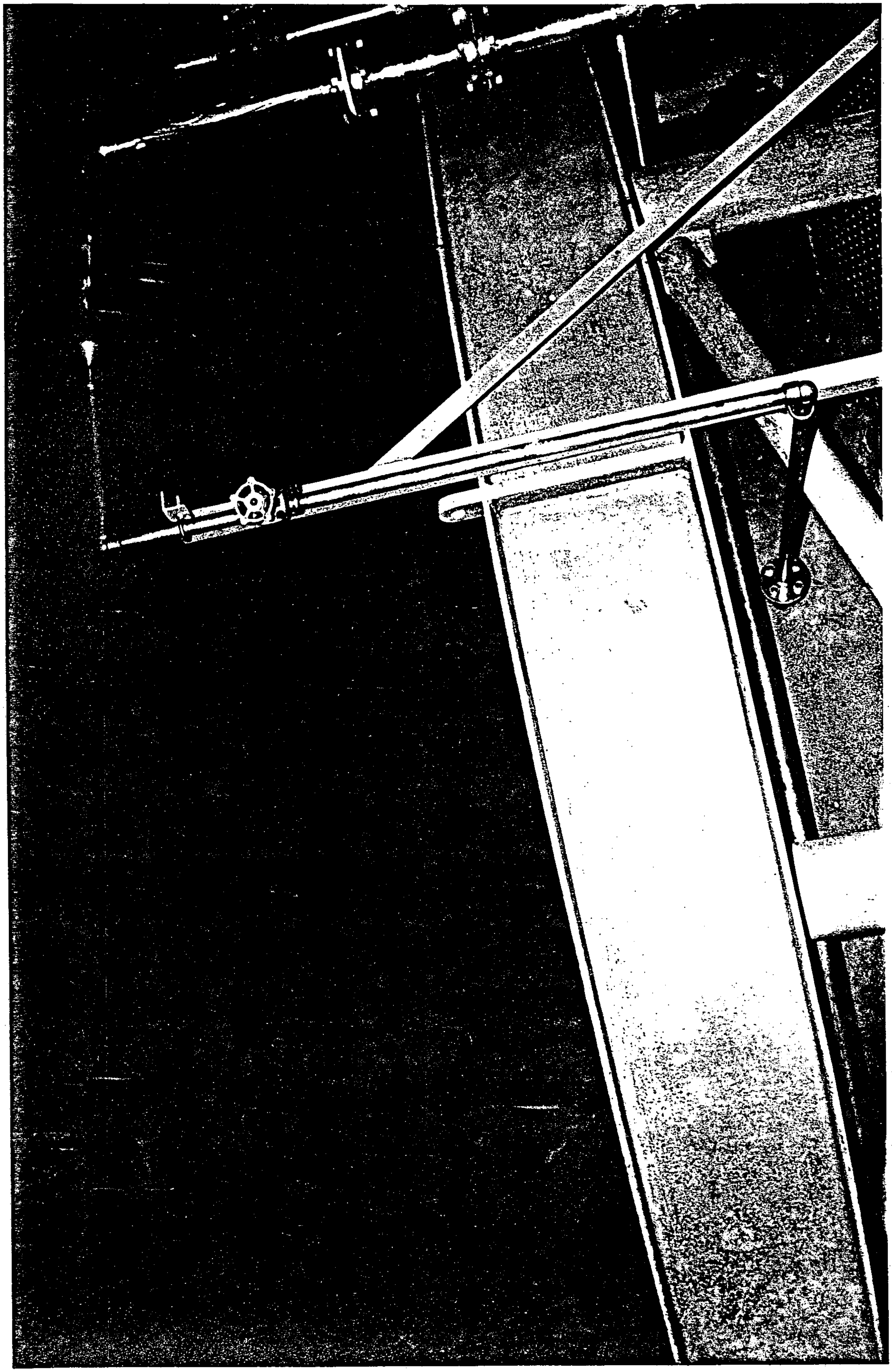


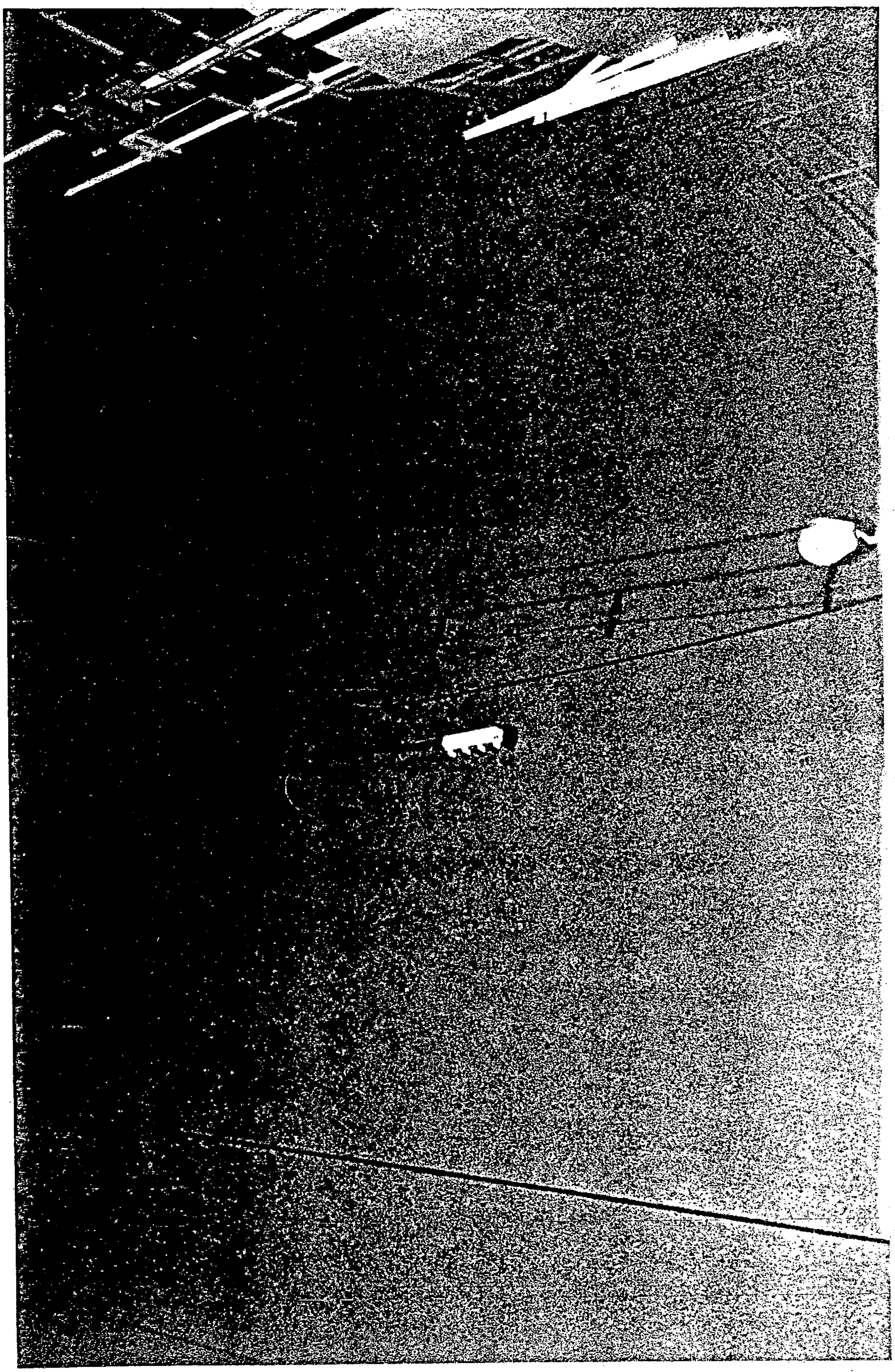


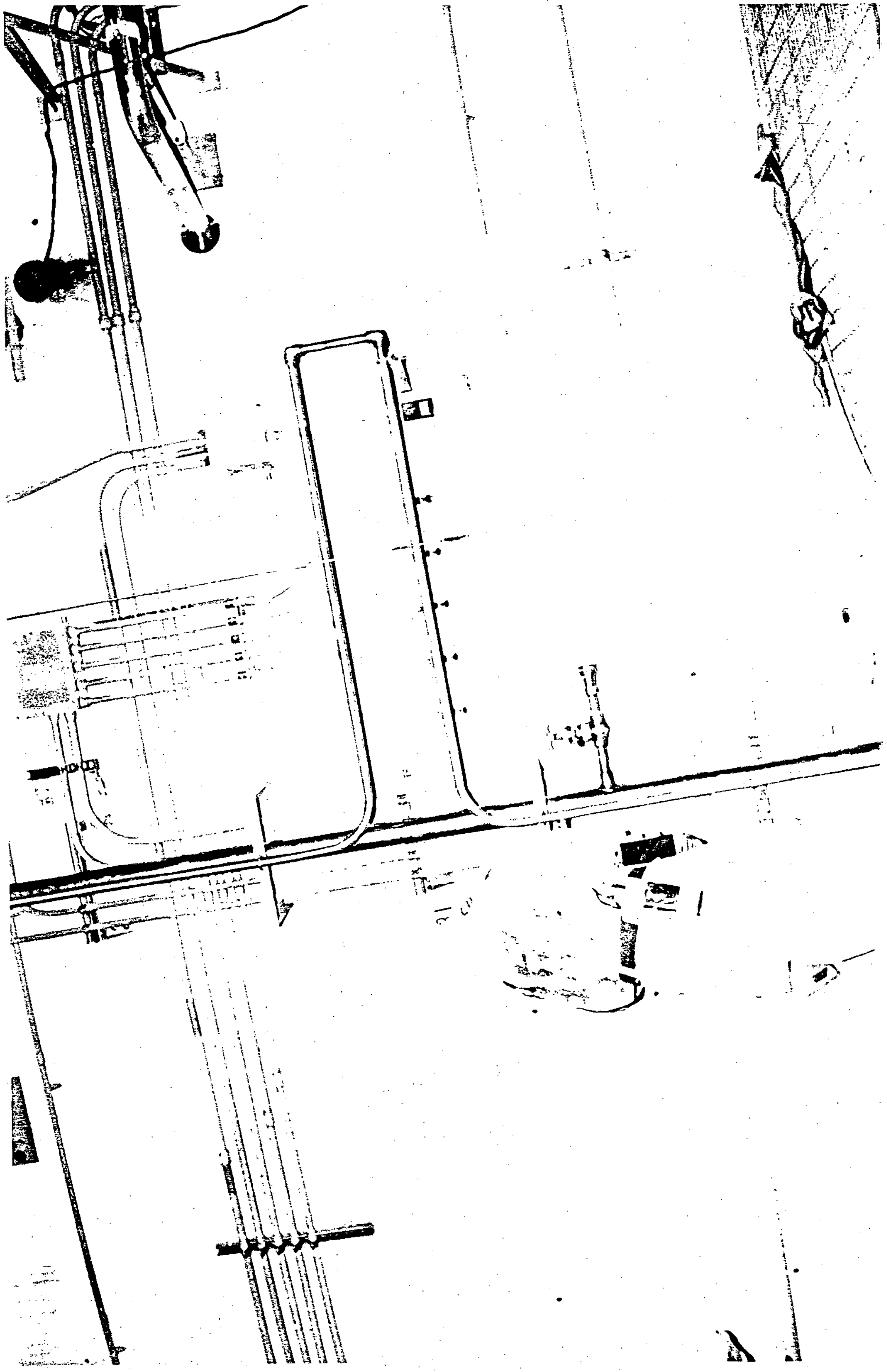


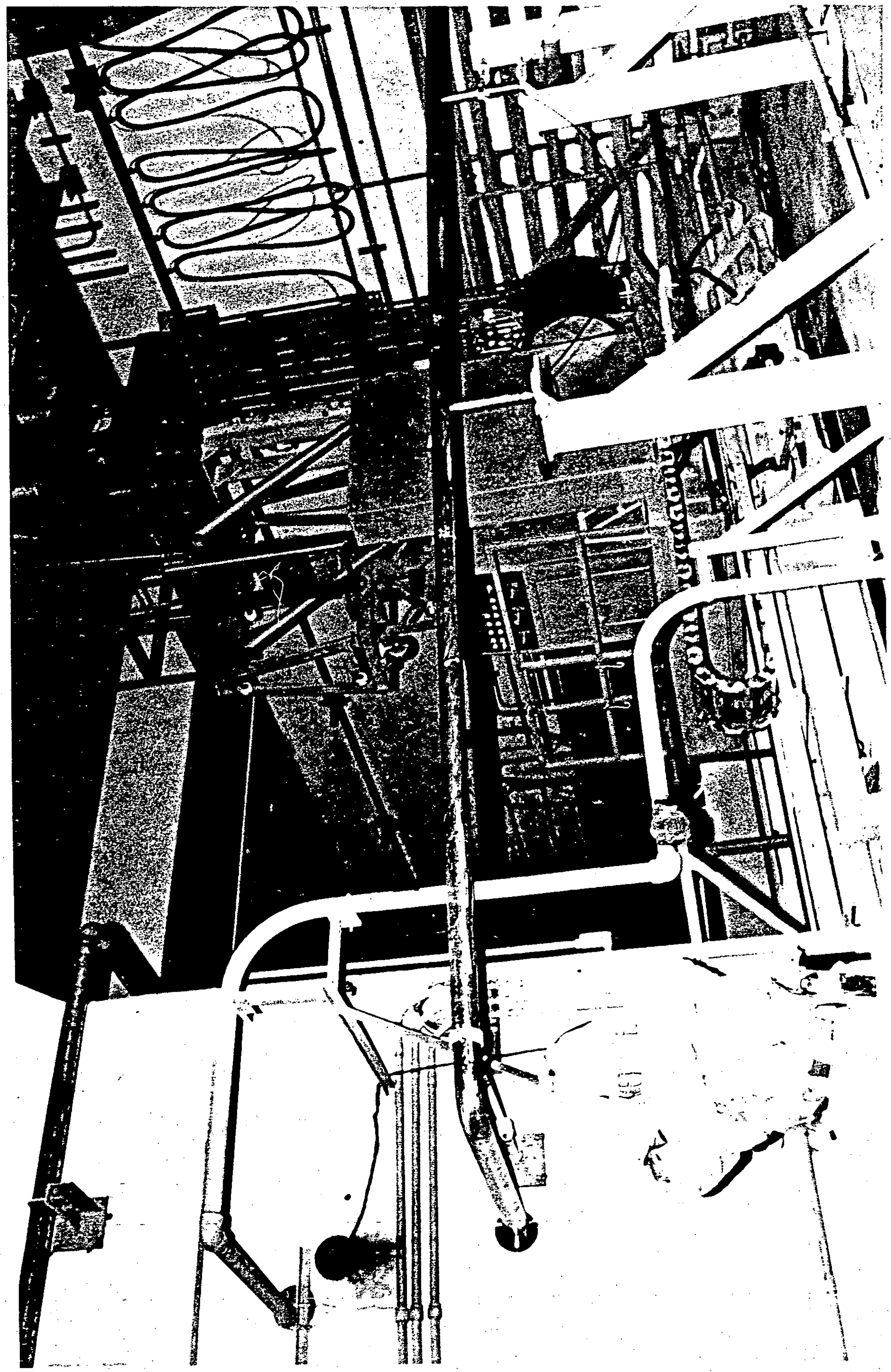


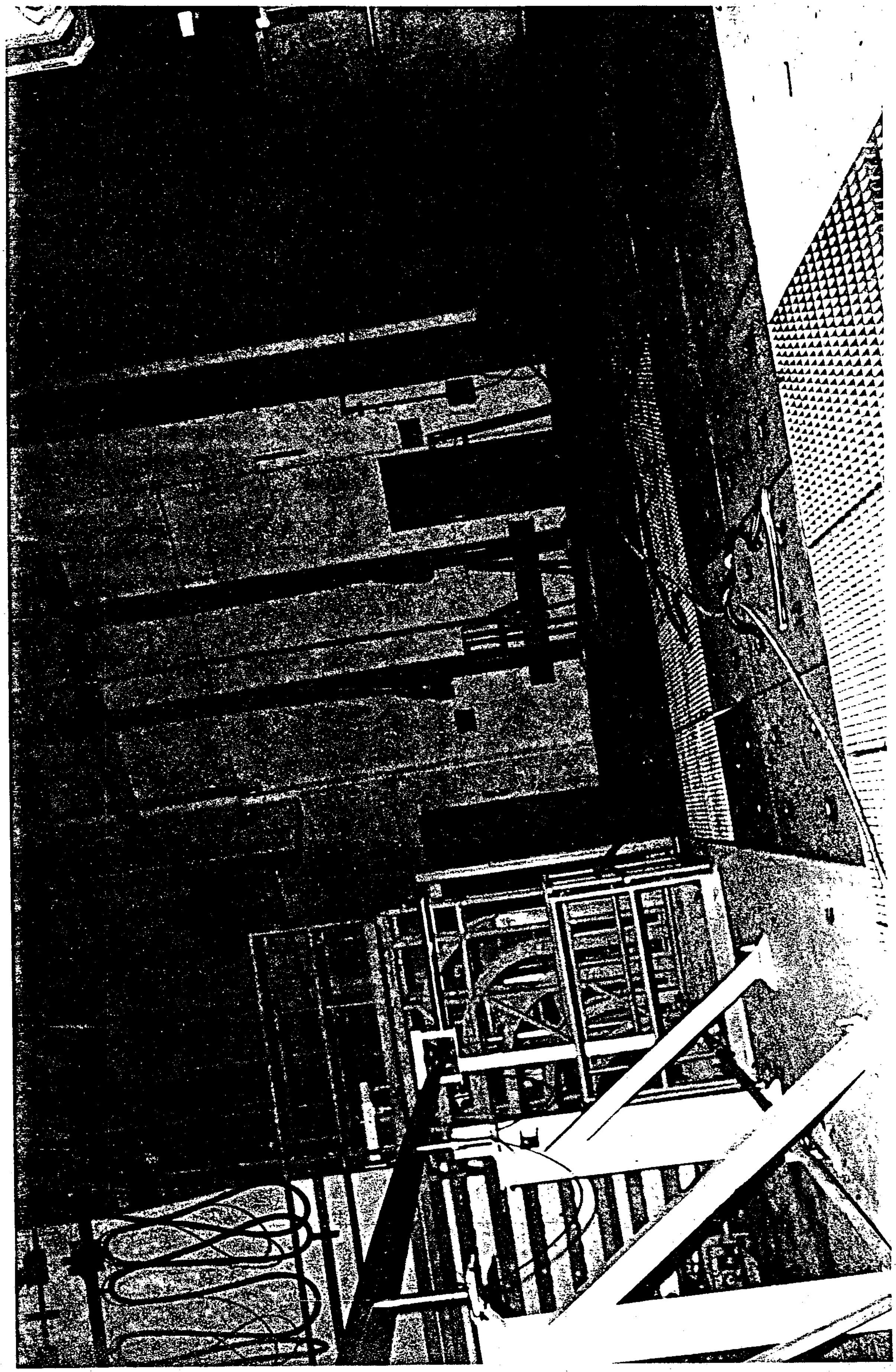


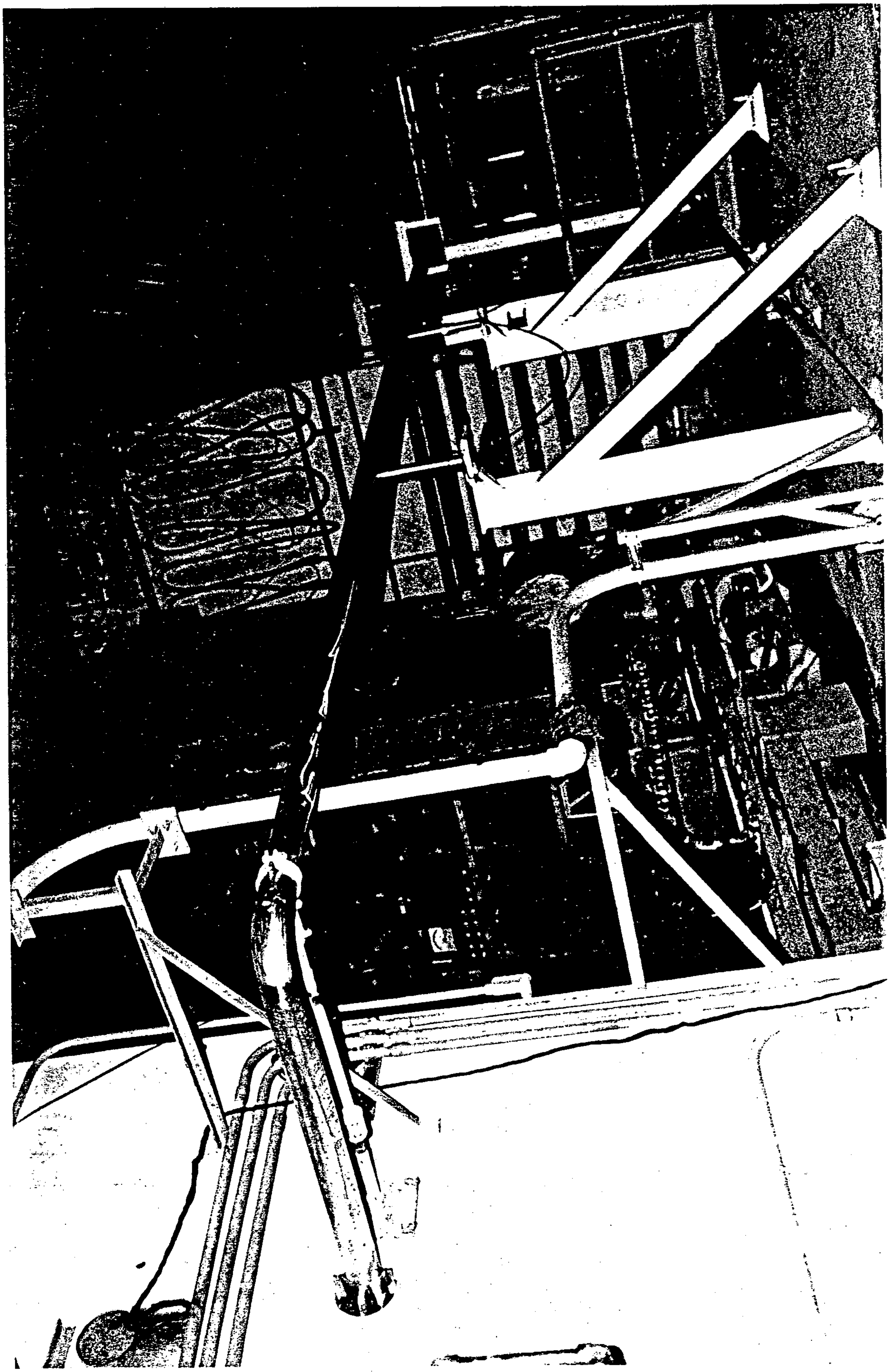


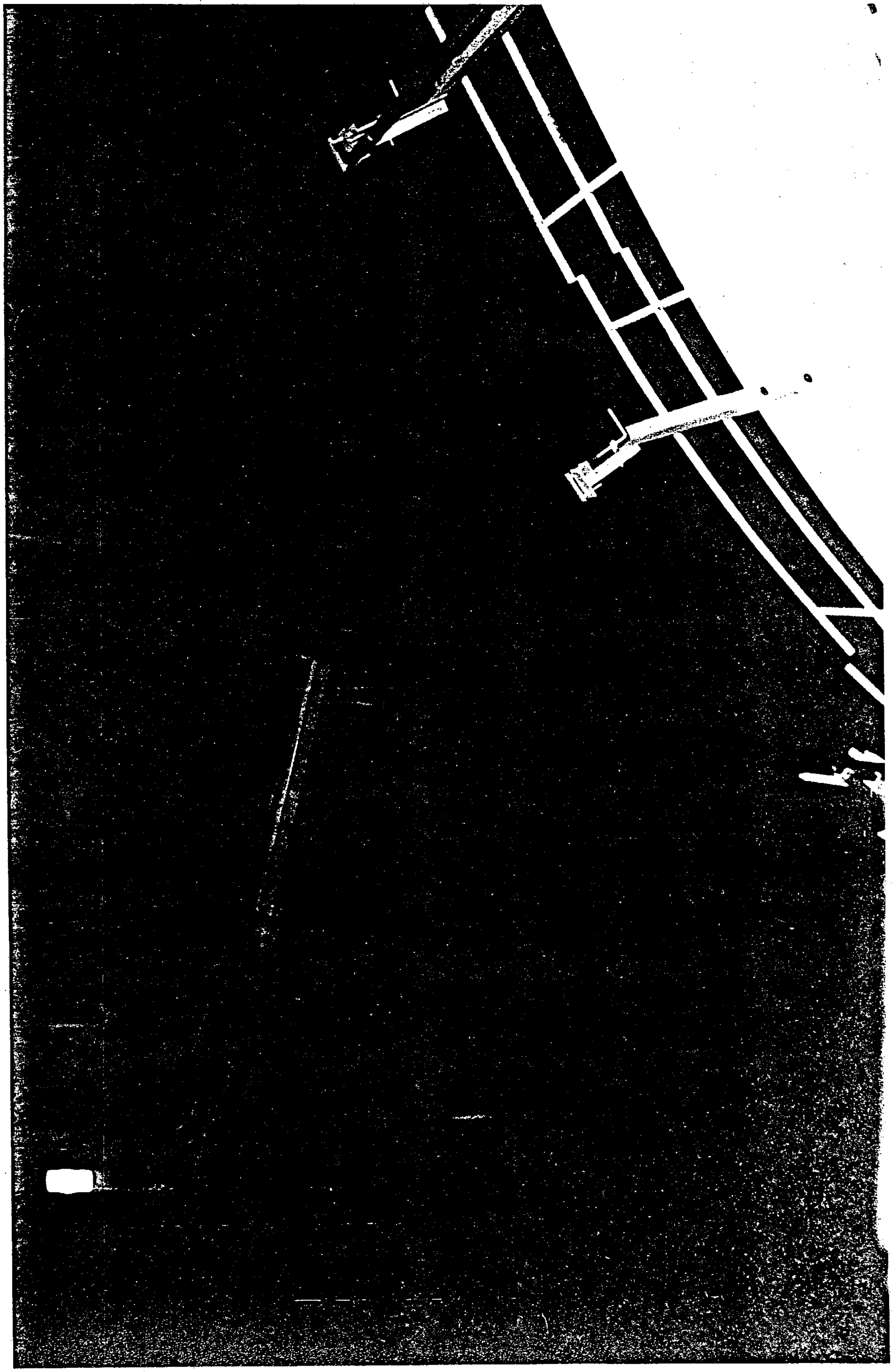


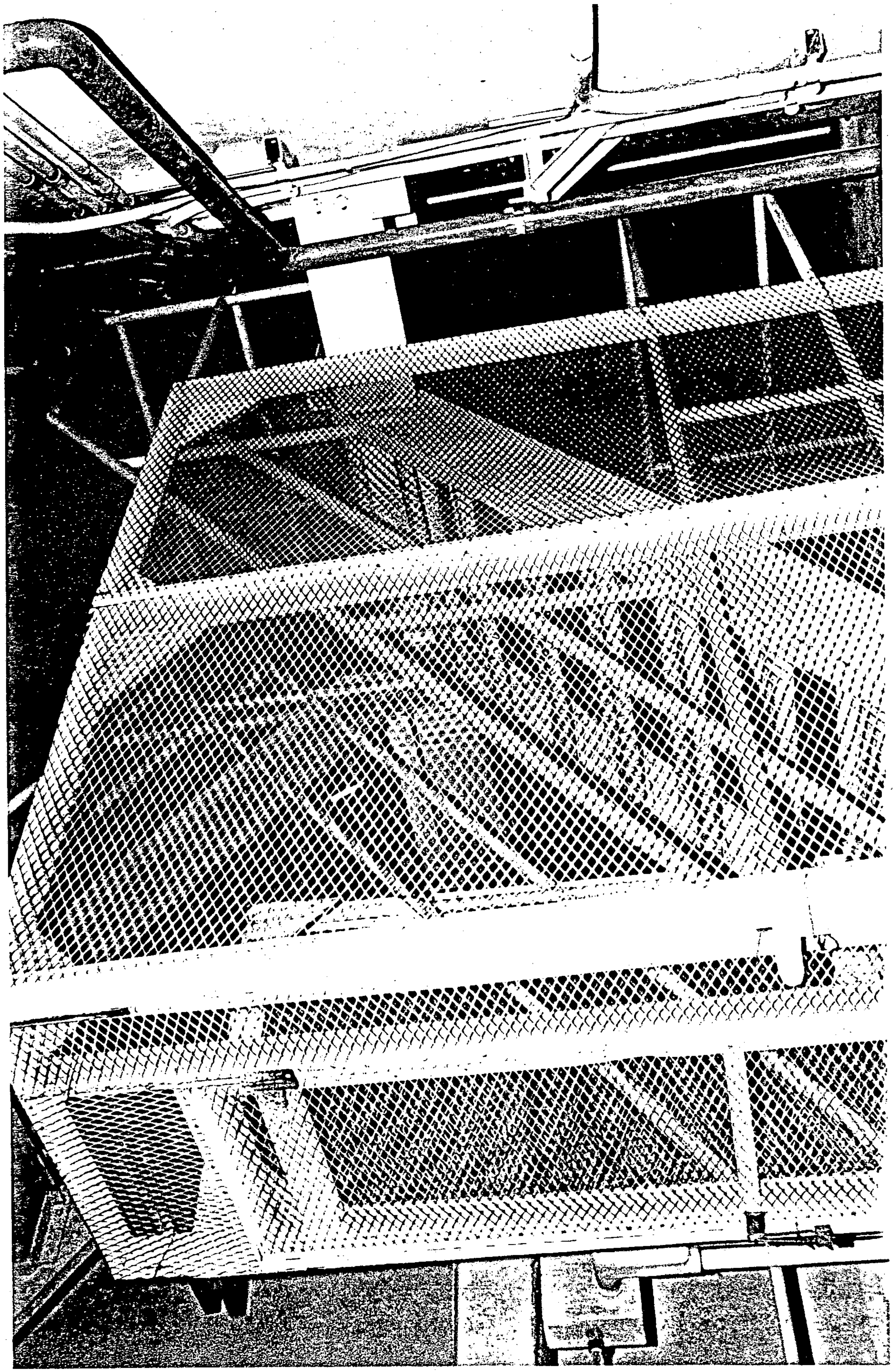


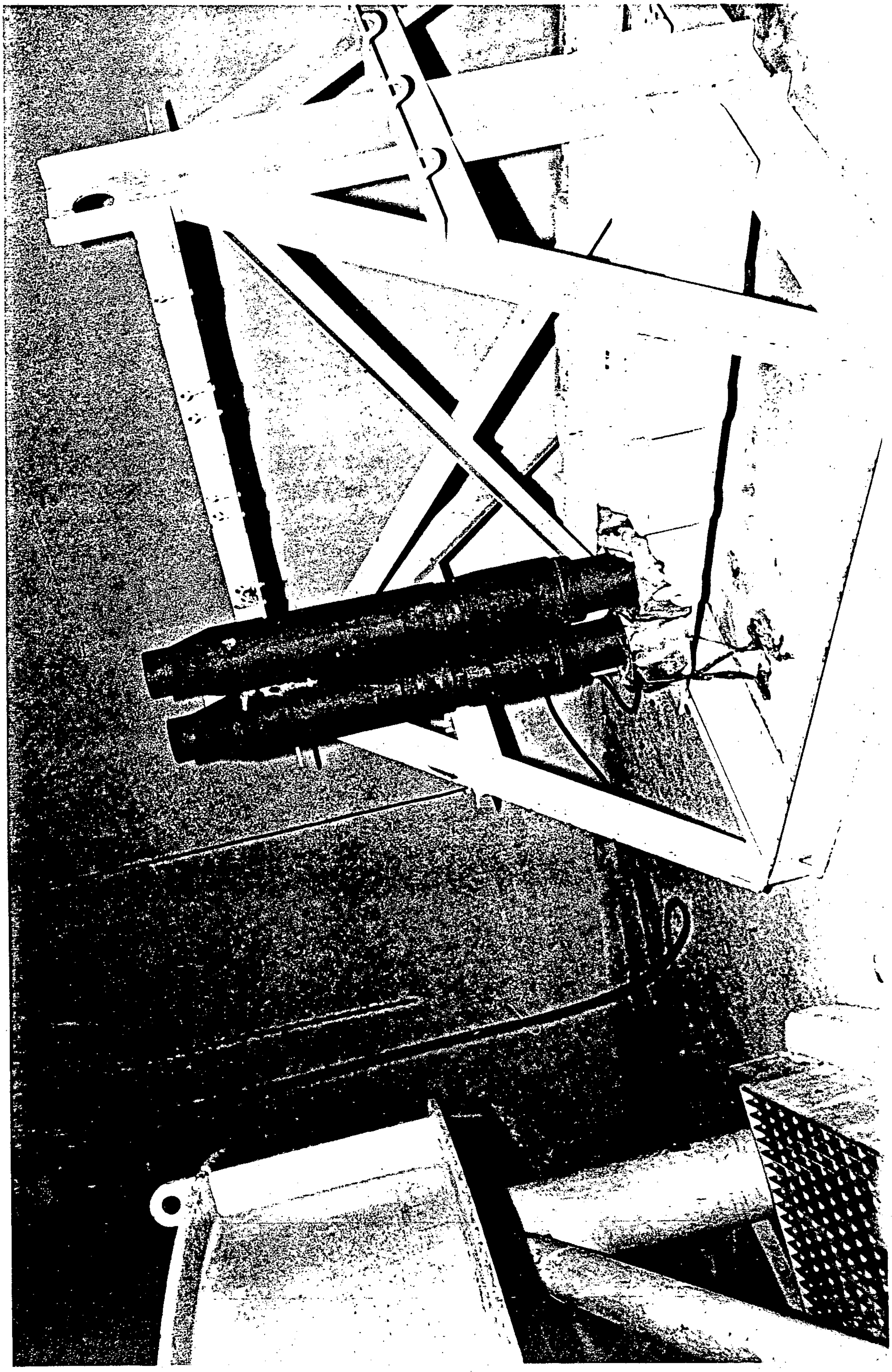


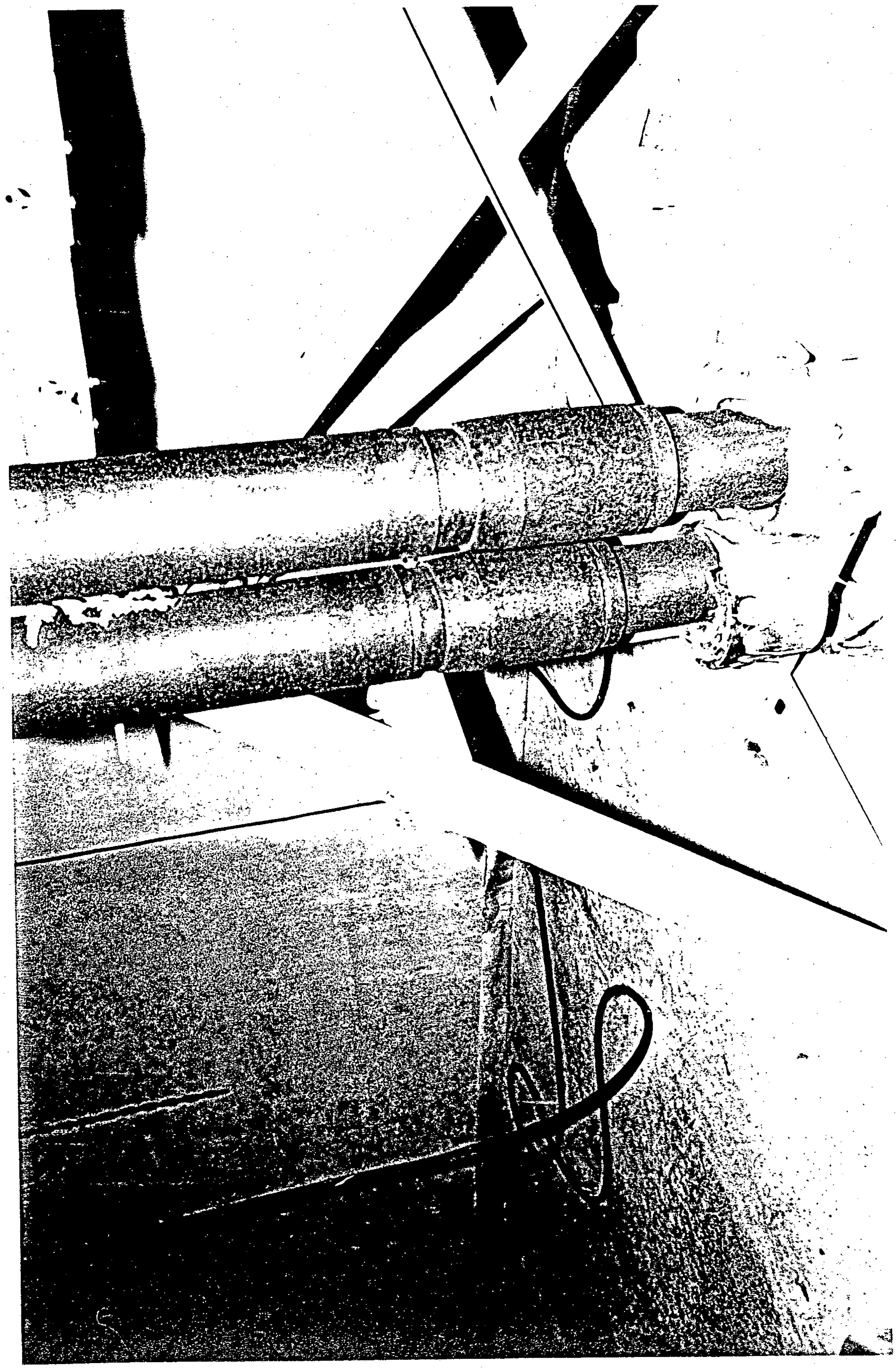


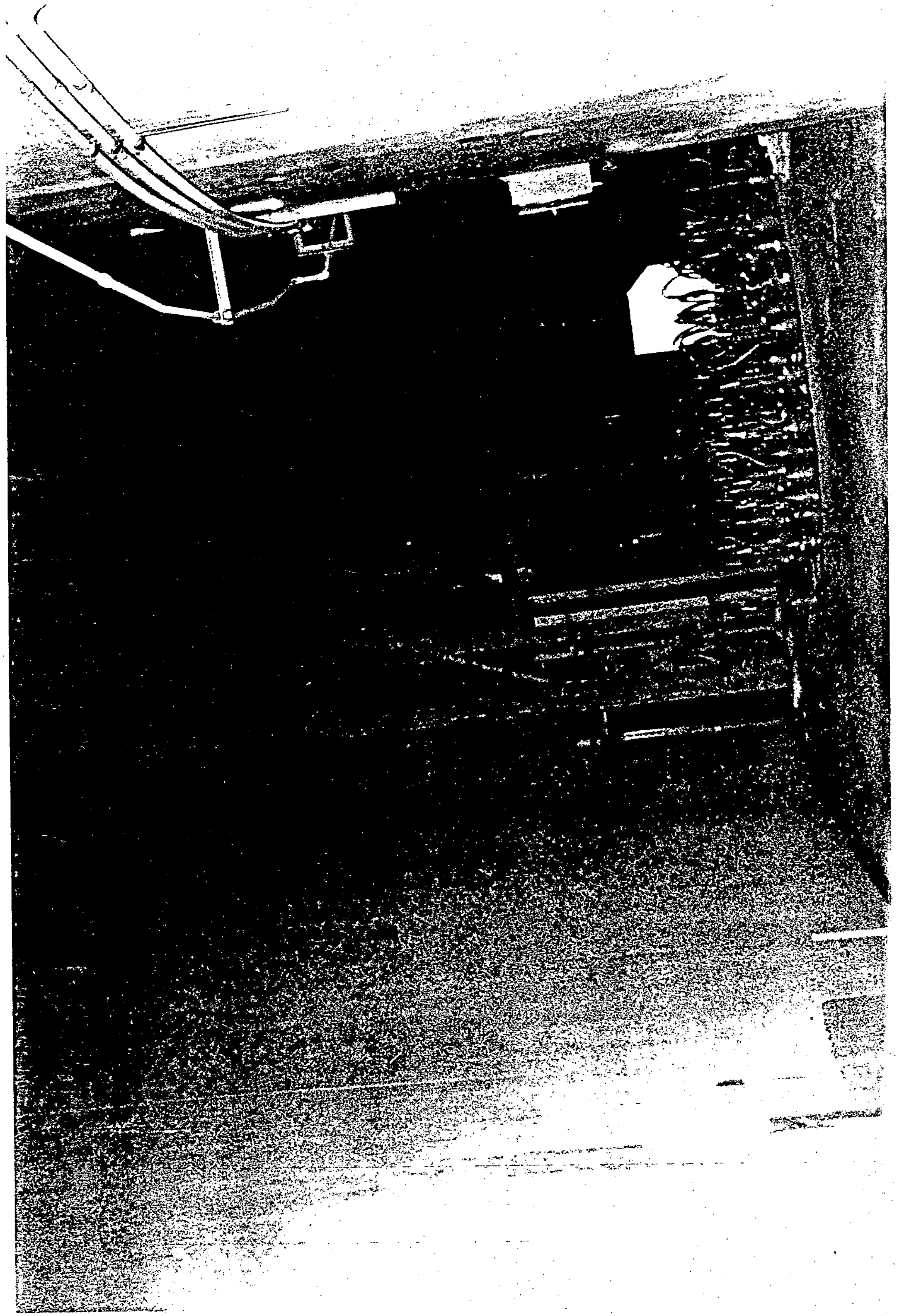


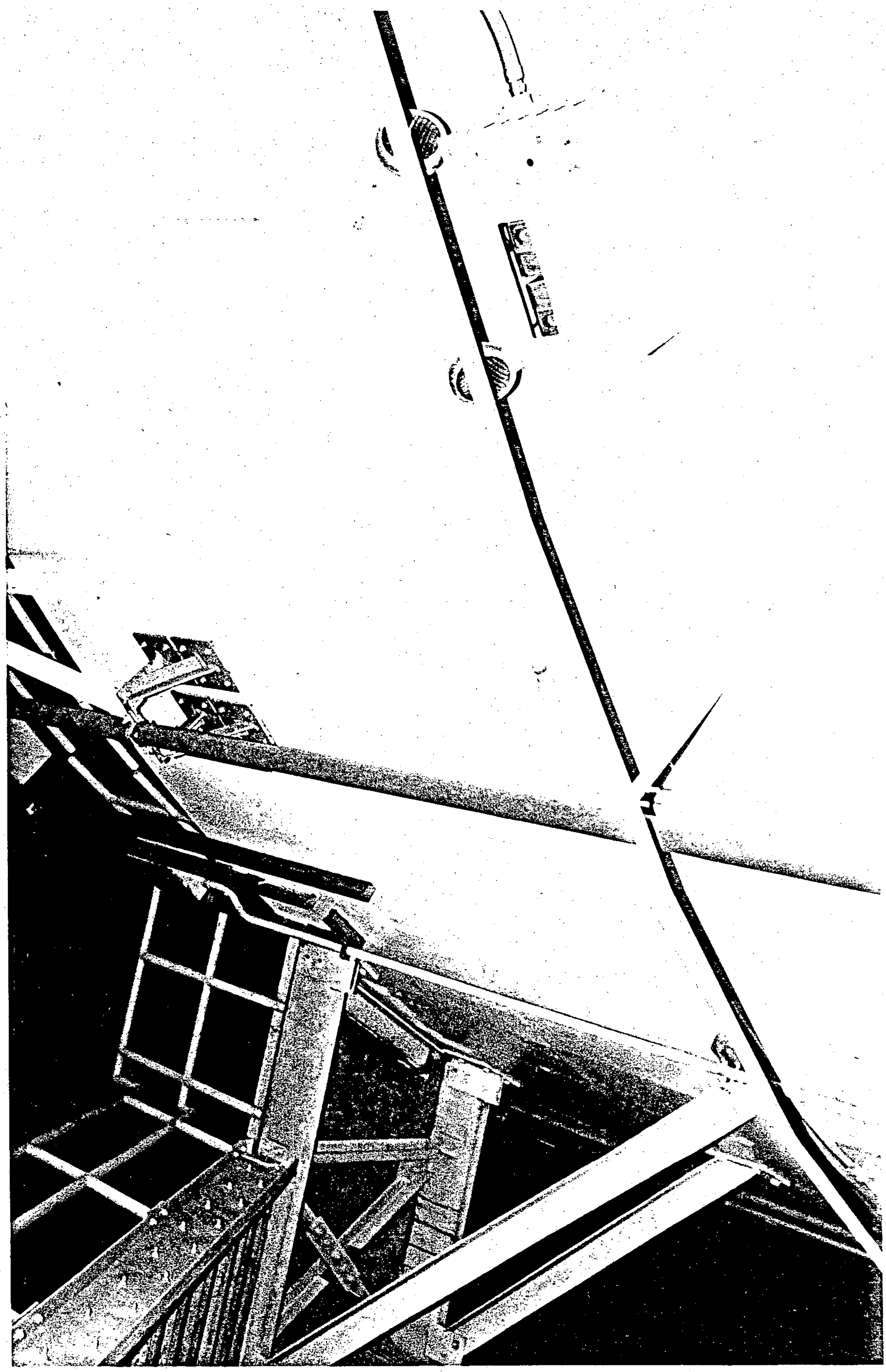












13.0 ENTRY PROGRAM OUTLINE

APPENDIX E

TMI-2

REACTOR BUILDING

ENTRY

I. PROGRAM

II. ORGANIZATION

III. SCHEDULE

SEPTEMBER 7, 1979

THREE MILE ISLAND UNIT 2
REACTOR BUILDING
ENTRY PROGRAM

I. HUMAN SUPPORT FACILITIES

   A. CONTAINMENT CONTROL ENVELOPE

      1. PROJECT ENVIRONMENT
      2. HOUSE DECONTAMINATION FACILITIES
      3. HOUSE SUPPORT FACILITIES

   B. PROTECTIVE CLOTHING

      1. PERSONNEL PROTECTION

   C. COMMUNICATIONS SYSTEM

      1. PERSONNEL PROTECTION
      2. AUDIO DATA ACQUISITION

   D. LIGHTING

      1. PERSONNEL PROJECTION
      2. VIDEO DATA ACQUISITION

   E. BREATHING AIR

      1. PERSONNEL PROJECTION

   F. RADIATION MAPPING

      1. PERSONNEL PROJECTION
      2. DATA ACQUISITION

   G. DATA RETRIEVAL

      1. FUTURE ACCESS
      2. DECONTAMINATION
      3. RECOVERY

II. HUMAN ADMINISTRATIVE SUPPORT

A. PUBLIC RELATIONS

B. ENTRY TEAM

1. PRIMARY TEAM
2. BACKUP TEAM

C. TRAINING

1. PHYSICAL FITNESS
2. PROCEDURAL
3. HEALTH PHYSICS

D. PROECDURE UPDATING

E. ENTRY PROCEDURE

1. HEALTH PHYSICS
2. RECONNAISSANCE
3. RECORDS - AUDIO/VISUAL
4. DATA ACQUISITION

F. EMERGENCY/CONTINGENCY PLANS

1. PERSONNEL PROTECTION
2. RECOVERY
3. ALTERNATIVE PLANS

THREE MILE ISLAND

UNIT 2

REACTOR BUILDING ENTRY

ORGANIZATION CHART

Reactor Building Entry Project Management

J. W. Langenbach
M. P. Morrell
E. D. Fuller

Human Facilities Support

- Control Envelope - Bechtel
- Clothing - Met-Ed HP
- Communications - GPU
- Lighting - GPU
- Breathing - Met-Ed HP
- Radiation Map - Bechtel
- Data Retrieval - GPU

Human Administrative Support

- Public Relations - GPU
- Entry Team - GPU
- Training - GPU/Met-Ed
- Procedure Updating - GPU
- Entry Procedure - GPU
- Emergency Plans - GPU

TMI - UNIT 2

REACTOR BUILDING

INITIAL ENTRY RECONNAISSANCE PROGRAM

September 7, 1979

INTRODUCTION

REACTOR BUILDING ENTRY

SCOPE: Develop a program for initial entry into the Three Mile Island Unit 2 Reactor Building. The initial entry into the Reactor Building should not be made until proper precautions are taken and conditions exist inside the Reactor Building, that will not pose an undue hazard to the health, safety and well-being of the public or personnel.

PURPOSE: Initial entry into the TMI Unit 2 Reactor Building will provide Met Ed, GPU and other agencies with additional technical information which will be the basis for determining the extent of damage to the Unit 2 Reactor Building and facilities, and for evaluating alternatives available for decontamination and recovery of the unit.

PREREQUISITES FOR REACTOR BUILDING ENTRY: In addition to the preparation identified for the initial entry program, the following activities should be completed prior to entry into the Reactor Building. All pertinent data gathered from these prerequisites should be incorporated into the analysis covered by the Bechtel Power Corporation "Planning Study for Containment Entry and Decontamination" indicating expected radionuclide activity within the reactor building. The analytical radiation levels inside the reactor building at the time of entry can then be incorporated into the entry program.

1. A sample of the water located in the Reactor Building sump must be taken, analyzed and determined representative to aid in determination of area radiation levels.

2. Reactor Building airborne sample taken, analyzed and determined representative. Expected radiation levels inside the Reactor Building established. Hydrogen and oxygen concentrations analyzed and within safe limits to be established.

3a Purge of the Reactor Building completed and the airborne activity determined to be "ALARA."

3b Provisions for entry into the reactor building without the purge being performed shall be provided as an alternate.

4. Integrity of the #2 personnel air lock established.

5. Radiation mapping of #2 personnel air lock inner door completed and expected radiation levels inside the Reactor Building near the hatch established.

6. Periodic reactor coolant samples taken, analyzed and data incorporated into analysis to aid in establishing expected radiation levels.

7. Reactor Building remote instrumentation and video equipment installed, operational and data assessed and incorporated into other analysis of radioactivity and equipment status.

8. Reactor Building pressure maintained slightly negative (2" water) in relation to the access area to minimize leakage of airborne radioactivity.

REACTOR BUILDING ENTRY PROGRAM

I. HUMAN SUPPORT FACILITIES

A. Contamination Control Envelope

A temporary contamination control envelope should be constructed. This can be constructed using sheet plastic and fire-resistant treated wood. The intent is to close off the area around the entry point with two or more barriers and to vent each control zone through a filter train. Doors would be provided in the plastic "tents" to permit personnel entry and egress.

An evaluation of the filtration system requirements and location of support facilities (e.g., communications, lighting) is required.

B. Protective Clothing

Since radiation levels are going to be substantially higher than normally encountered by nuclear generating plant personnel, consideration must be given to various alternative types of clothing worn by the initial reactor building entry team.

Protective clothing might consist of full anti-C's (Number of pairs to be determined) with surgical cap, hood, rubber boots, outer layer plastic suit, rain gear including hat and coat and pants.

The protective clothing must be compatible with the following:

- Hard hat with miner's lamp
- Self-contained breathing apparatus (60 minutes) (e.g., Bio Pak 60 - Bio Marine)
- TLD (several including finger rings)
- High range self-reading dosimeter.
- Alarming dosimeter
- Regular self-reading dosimeter
- All dosimetry in plastic bags
- Communication devices

The clothing should provide the wearer with the maximum mobility achievable and should provide the wearer with some degree of comfort. Alternative clothing such as a "NASA type space suit" should be evaluated.

C. Reactor Building Access Communications System

1. The system should be a two-way voice communication and recording sytem. The system should be compatible with a television system should a T.V. system be selected so that the audio signal from this system can be combined with the corresponding video signal from a television

system. The system should be capable of allowing any or all of the decontamination team members to verbally communicate with each other and with the central control unit operation independently at will.

2. The central control unit should be equipped with at least one integral earphone and microphone headset in addition to a speaker. The central control unit operator should have the capability to verbally contact any or all of the decontamination team members independently or collectively at will. Consideration should be given to having several communications operators with each operator responsible for an individual on the entry team.

3. The audio receiver/transmitter unit worn by the decontamination team members should be self-contained and compact to permit free, unrestricted movement. The headset worn by the decontamination team members should be an integral earphone and microphone unit compatible with anti-contamination headdress and air masks selected. The microphone worn by the decontamination team members should be voice actuated or actuated by a means which does not involve the deliberate use of their hands. All equipment should be explosion-proof and should not actuate sparks.

4. A determination must be made as to whether direct communications can be accomplished or if a repeater or antenna is required.

D. Lighting Requirements

Soon after the incident the unit substation for the lighting system was Turned off de-energizing the latch circuit for the lights in the Reactor Building. It is possible that the lights may have been damaged during the postulated hydrogen detonation. Miner's lamps or an auxiliary lighting (e.g., flashlight) must be considered. Lighting equipment should be explosion-proof and should not actuate sparks.

A determination of the type of lighting and capacity (lumens, amp hr, etc.) required must be made. The utilization of the installed lighting system should be evaluated prior to entry. The evaluation should consider the possibility of hydrogen gas pockets being ignited by turning on lights, along with the possibility of shorts or grounds. The need for having the Reactor Building vented and purged prior to turning the lighting system on and making entry, should also be evaluated. These possibilities of electrical fire, shock or ignition of gaseous vapor must be thoroughly reviewed.

E. Breathing Air For Reactor Building Entry

Breathing equipment for initial Reactor Building entry should be totally self-contained, lightweight and allow the user a high degree of mobility. The capacity of the equipment must be determined based on worst case levels of physical activity (highest rate of consumption) by the user, factoring in projected radioactivity levels and stay time, and yet provide sufficient reserve for the user to exit the Reactor Building. An alarm warning the user of limited availability of breathing air should be considered as should using an oxygen enriched breathing air supply. Compatibility with the communications system(s) and the personnel clothing is required.

F. Radiation Mapping

Prior to Reactor Building entry, a complete analytical mapping of expected radiation levels inside the Reactor Building should be prepared. The mapping should incorporate all data accumulated from the prerequisites for Reactor Building entry. Mapping should develop the recommended path for initial entry with expected radiation levels and recommended stay times. Contingency and alternate paths for the reconnaissance team should be identified. The mapping will establish recommended areas from which data should be collected during the entry program and will be integrated into the entry procedure and training program.

A prediction of expected radiation fields, especially the identification of hot spots, should allow work planning and the preparation of the procedures for entry and data acquisition to consider the proper balance between worker dose and data acquisition. For the case of initial entry, it is appropriate to allow higher worker doses for radiation field mapping, consistent with Federal Regulations related to quarterly dose limits.

Every attempt will be made to assure that the quarterly allowable dose limit of 3 rem is not exceeded.

During initial entry, radiation mapping will aid in providing for planning subsequent entries for data acquisition and cleanup. A certain worker dose can be expected for this operation. Careful planning will assure that the exposure is consistent with Federal Regulations. This will be achieved by predictions of radiation fields, work planning; time motion study, and special procedural considerations and contingencies covered by this document.

G. Data Retrieval

During the actual entry, data retrieval becomes the primary mission of the reconnaissance team. The aquisition of a visual record is the secondary mission.

The following information should be evaluated for desirability and prioritized in order of need in order to best utilize the time available during the Reactor Building entry so that the acquisition of data can be maximized.

1. Survey Equipment

The following is a recommended list of survey equipment with recommendations for utilization:

	Person #
Portable data collection package including lights	*
Air sampler (particulate and iodine)	**
Gas sampler (noble gases)	**
Explosive gas meter	**
Teletector	1
Smear equipment	2
High range beta detector	1
Beam flashlight	2
Two-way radio communications	All
Visual account device	2

*To be set inside R.B. at airlock
**Standby person in air lock

Atmospheric samples should be taken of the air lock through the vent valve connections before personnel open the outer door. These should be analyzed for particulate, iodine and gaseous radioactivity, explosive or toxic gases and oxygen sufficiency. The PING-2A installed at the air lock be used for this purpose.

2. Radiation Levels

The radiation levels will dictate the plans for data acquisition for future entries and, therefore, become the highest priority for the initial entry. The maximum permissible general area radiation fields for entry should be based on a time and motion study with contingencies and the administrative limits established. Methods of measuring and recording various radiation levels should be determined.

3. Smear Samples

As time and conditions permit, smear samples of contamination of the surfaces within the Reactor Building should be obtained. Methods and procedures for smear sampling must be determined.

4. Audio/Visual Account

Pictures, film or video tape and voice accounts of Reactor Building status is important for future reconnaissance and cleanup planning. A method for acquiring the audio/visual account should be determined.

5. Continuous Monitoring

Instrumentation/equipment to be left behind for continuous monitoring should be evaluated. Consideration should be given to portable equipment necessary to measure general area gamma radiation levels, airborne radioactivity.

6. Personnel Radiation Monitoring

Personnel will be protected by proper use of their survey instruments, personnel dosimetry and calculated stay time in high radiation areas. Frequent checking of their self-reading dosimeters is required. Dosimeters must be capable of readout in a low light environment. Prompt compliance with health physics instructions on the termination stay times is mandatory.

7. Structural Survey

When the hydrogen detonation occurred, it could have caused structural damage in the Reactor Building. Personnel should look for cracks in the floor or separation from the walls before venturing into the Reactor Building.

8. Glass Sample

The reconnaissance team should retreive a piece of glass if possible since glass objects have a tendency to act as high range TLDs.

II. HUMAN ADMINISTRATIVE SUPPORT

A. Public Relations

Since the March 28th accident, public awareness of the TMI recovery operation has been a prime concern of GPU. It is important that all activities undertaken in relation to TMI be properly presented in order that the public better understand the intentions of GPU (Met Ed) and the implications and after-effects of the TMI 2 accident with regard to the Reactor Building entry.

The personnel involved with the Reactor Building entry will be subject to the questions of the public and press. There will be many questions of GPU, both prior to and subsequent to the Reactor Building entry, concerning health, safety and well-being of both the public and the personnel entering the Reactor Building.

In order that we respond to the questions asked with meaningful answers, the anticipated questions should be reviewed and the public relations personnel furnished with the answers beforehand. In addition, the P-R personnel should be fully appraised of the activities associated with the Reactor Building entry program so that they can field unanticipated questions properly. It is suggested that a knowledgeable engineer involved in the entry program be present at any press briefing.

B. Reactor Building Entry Team

Since the duration of stay time during the entry program will be determined by the radiation levels experienced inside the Reactor Building, it is recommended that personnel familiar with the Unit 2 Reactor Building layout and with a knowledge of health physics procedures make up the entry team.

Physical health and previous exposure must be considered in personnel selection. A complete and thorough physical examination of all team members prior to and after the reactor building entry must be performed.

Due to ALARA and safety considerations, it is suggested that the entry team be made up of three individuals; two persons familiar with Reactor Building systems and layout and one health physics person, one individual familiar with the Reactor Building systems remaining inside the personnel air lock and the HP and other person familiar with the physical and system configuration doing reconnaissance inside the Reactor Building. A complete backup team of three individuals will also be provided for safety considerations should rescue or support be required. They should be suited up and standing by outside the air lock in a ready state. Team identification and selection should occur as soon as practical in order to allow them to participate in the program development.

C. Training Program

The initial entry will be made with a precise plan for data acquisition. Familiarity with health physics procedures and policies is a must. A complete understanding of the Reactor Building entry program and procedures is required along with an understanding of all contingency and emergency plans. Physical conditioning and hands-on experience with the hardware used is necessary. In order to accomplish this, a training program must be developed.

The prediction of radiation fields should be used in conjunction with training dry runs using the 1/4 inch scale model and full scale Unit 1 facility. Stay times will then be verified by experience. Simulation training should be conducted in full protective clothing and breathing apparatus to obtain proper times for each procedure step. This planning will allow tradeoffs to be made for optimizing the surveys if the radiation levels are significantly different from predictions.

D. Procedure Updating

The health physics procedures and required personnel equipment for personnel entry to the Reactor Building have essentially been established in the plant procedures manual. Since Reactor Building conditions are expected to be significantly different than anticipated when plant procedures were written, all procedures employed should be reviewed and revised if applicable. Where existing procedures are non-existant or inadequate new procedures will be prepared.

Specific procedures governing Reactor Building re-entry are:

1630	Reactor Building Entry
1630.2	Reactor Building Entry (Unit 2 only)
1670.8	Emergency Reentry for Repair or Rescue
1670.15	Post Accident Reentry and Recovery Plan

In addition, there are a number of ancillary procedures that should be reviewed for applicability, which deal with radiation/-radioactivity/smear surveys and discussing protective clothing, personnel dosimetry, decontamination, etc.

1605	Portable Air Sampling for Radioactive Particulates
1606	Air Sampling for Radioactive Iodine
1607	Air Sampling for Radioactive Gas
1608	Air Sampling for Tritium
1609	Loose Surface Contamination Surveys
1611	Area and Equipment Decontamination
1612	Monitoring for Personnel Contamination
1613	Radiation Work Permits
1616	Use of Respiratory Protection Devices
1628	Program for Medical and Bioassay Examinations
1632	Radiation Shutdown Survey
1632.2	Radiation Shutdown Survey (Unit 2 only)
1640	Personnel Dosimetry, Issuance, Administrative and Record Keeping
1641	Self-Reading Dosimeter Usage and Record Keeping
1642	Operation and Calibration of the TLD System
1676	Radiation Protection Responsibilities for Planned and Unplanned Releases
1681	Control of Contaminated Spills
1682	Control of Contaminated Tools, Equipment and Material
1683	Handling of Contaminated Vacuum Cleaners
1686	Use of Protective Clothing
2202-1.2	Unanticipated Criticality

E. Entry Procedure

A detailed entry procedure should be prepared prior to Reactor Building entry and the entry team trained on this procedure to assure the safety of the entry team.

In addition to the prerequisites noted previously, it is suggested that a specific set of criteria be established as part of the prerequisites to serve as a checklist for last minute assessment of Reactor Building conditions. This list would serve to flag conditions or a range of conditions which, if exceeded, would indicate conditions outside the limits of the procedural assumptions. If undesirable conditions were found, special evaluation would be required before Reactor Building entry is permitted.

The criteria would be established for the major indicators of conditions inside of the Reactor Building. This would include the following parameters:

- Sample of sump water
- Sample of Reactor Building air
- Sample of reactor coolant system water
- Radiation levels at the inner door of the #2 personnel lock
- Penetration R-626 radiation monitor installed and operating
- Reactor Building pressure and temperature
- Hydrogen concentrations
- Oxygen sufficiency

It may be desirable from a personnel comfort standpoint and to improve worker efficiency to have the Reactor Building coolers in operation to aid in controlling the atmospheric temperature in the reactor building. This must however be evaluated with consideration given to the possibility of cooler operation disturbing the particulate and causing additional airborne activity. The communications system should be thoroughly checked out prior to entry. The operation of reactor building purge and purification system in the purification mode to minimize airborne activity should be evaluated, there is a possibility that operation could increase the airborne activity.

The hydrogen concentration inside the Reactor Building should be analyzed. If the concentration is above 4%, personnel entry should be restricted until the purge or the recombiner is used to reduce the hydrogen concentration.

The duration of stay time is expected to be from 5 minutes to 30 minutes depending upon radiation levels. Levels in excess of 36 rem/hour just inside the inner door should be considered as too high to proceed with the entry program.

Attachment A gives an outline for the entry procedure. This can serve as a guideline for preparation of the procedure.

F. Emergency Plans

Contingency planning and emergency preparedness is necessary prior to reactor building entry. Emergency plans must be developed for at least the following situations:

1. Failure of Personnel Breathing Apparatus

   This procedure should instruct the data acquisition team to immediately withdraw from the reactor building, with the unaffected member and the backup person providing assistance to the affected team member.

2. Personal Injury

   Same as in 1., except it may be necessary to provide immediate assistance at the place of occurrence, depending on the situation.

3. Personnel Lock Seal Failure

   This would result in airborne release to the control building which does not directly affect in-reactor building operations but might result in an upset of supervision or communications between the efforts of the personnel inside and the support group outside of the reactor building.

4. Hatch Interlock Malfunction

   Malfunction of personnel hatch door interlocks preventing rapid egress.

5. Beta Gamma Variability

   Extreme variability of beta and soft gamma radiation. Personnel should wear several TLD's in order to properly assess the worker doses along with a real time survey meter to provide the entry team with a continuous readout.

6. Communications Systems Failure

   Procedure should indicate the reentry team should withdraw back to the hatch area or out of the reactor building until communications are restored, as long as a visual link with the entry team can be maintained reconnaissance may continue.

7. Lighting Failure

A strong battery-powered light should be set up just inside of the reactor building to provide lighting during reconnaissance and egress.

8. Structural Damage Resulting in Hazardous Conditions to Personnel

Visual observation should be made to avoid areas which may have been rendered unsafe during the incident.

9. Faulty Radiation Monitors

Diverse, high level radiation monitors should be carried into the reactor building by the reentry personnel.

10. Potential Problems and Hazards Analysis

There are a number of potential problems and hazards that may be faced, not only on initial entry but also on subsequent entries. A summary list is as follows:

- Explosive gases
- Oxygen deficient atmosphere
- Toxic gases or particulate material
- Fire
- Electrocution
- Asphyxiation due to respirator problems
- Personal injury (cuts, falls, broken bones, concussion)
- Structural failure (due to hydrogen burn)
- Lack of lighting - lights burned out
- Overexposure due to direct radiation
- Inhalation overexposure
- Personal contamination
- Unanticipated criticality
- Falling objects
- Rapid Pressurization

a. Explosive Gases

There already has been a hydrogen detonation. It may be possible that there are still pockets of hydrogen left. In addition, hydrogen and methan can be generated by radiation induced decomposition of organic materials. The reactor building should not be entered if the concentration of explosive gases is above 4%. Purging should be used to reduce this as much as possible. Testing of the atmosphere prior to entry can verify this. The use of explosion proof equipment, anti sparking equipment and SCBA gear should alleviate this problem should the building not be purged.

b. Oxygen Deficient Atmosphere

Since there has already been a hydrogen detonation, some of the oxygen has been used up in the combustion process. Purging the reactor building before personnel entry should alleviate this problem but there may be a possibility that pockets of oxygen deficiency exist. This should not be a problem on initial entry since SCBA gear should be worn due to airborne radioactivity problems. Testing of the R.B. atmosphere prior to entry will verify this.

c. Toxic Gases or Particulate Material

The nature of damage in the Reactor Building could have released toxic gases or particulate material into the reactor building due to radiation dose, the hydrogen detonation effects on materials, etc. SCBA gear should provide necessary protection until air samples are taken.

d. Fire

Fire is an important consideration especially when the possibility of damage to electrical equipment may have occurred during the postulated hydrogen detonation.

e. Inhalation Overexposure

Personnel should be trained in the proper use of breathing apparatus and tested for proper fit. Whole body counts, both baseline and after reactor building entry, should be carried out to check for possible inhalation exposures.

f. Personal Contamination

Several layers of protective clothing should be worn inside of the reactor building. Personnel should be trained in the proper procedures for donning and removing this clothing. Decontamination of personnel should be covered.

g. Unanticipated Criticality

While the likelihood of accidental criticality remains small, installed instrumentation should be utilized to detect and alarm, personnel should evacuate the reactor building as quickly as possible.

h. Falling Objects

Since there was a hydrogen detonation, there is a possibility that there is structural damage to floors and walls in the reactor building. In addition, the anchors for cable trays, piping, etc. could have been loosened. The stairways and elevator could be damaged. An inspection of the structural integrity of the reactor building and equipment inside should be performed. Personnel should be extremely cautious concerning loose equipment until the inspection is complete. Hard hats should be required. Climbing on equipment supports will not be permitted.

i. Rapid Pressurization (Explosion)

While the likelihood of a rapid pressurization of the reactor building is very remote, the possibility must be evaluated and prepared for due to the possibility of hydrogen gas or methane being present.

ATTACHMENT A

THREE MILE ISLAND
UNIT 2
REACTOR BUILDING ENTRY PROCEDURE

A. Prerequisites completed and verified by check sheet.

B. System/facility conditions prepared for reentry.

C. Final data evaluation within reentry criteria.

D. Data acquisition tasks and priorities reviewed.

E. Communications and lighting systems prepared for entry.

F. Three persons are assumed to form the reentry team for the purpose of this study (one of which is health physics type and two familiar with plant layout), one person standing by in the air lock, two individuals inside the Reactor Building doing reconnaissance and three persons acting as the emergency backups, outside the air lock in the control area.

G. Open the outer hatch door of the #2 personnel lock.

H. Take radiation survey at the inner bulkhead of the personnel lock and take other surveys to be determined. Before the inner door is opened, beta, gamma and smear surveys should be performed and two-way communications checked.

I. Close the outer hatch door.

Before opening the inner hatch of the air lock, the following radiation/radioactivity surveys should be made to the extent feasible: These surveys can be accomplished prior to the initial entry.

Airborne Particulates and Iodine

To determine whether or not the seals on the inner door are leaking.

Noble Gases

Same reason as above.

Smears

Same reason as above.

Gamma Survey of Inner Door Area

To determine expected gamma dose rates immediately inside of the air lock in order to estimate stay times.

J. Open the inner hatch door and immediately make a radiation survey inside of the Reactor Building as described herein.

NOTE: These surveys can be accomplished without opening the door prior to initiating entry as part of the hatch survey.

Gamma Survey

A gamma survey can easily be performed by inserting the teletector probe through the cracked open door to determine general gamma radiation levels.

Beta Survey

A Rad-Owl with window open can be held through the open door at floor level to determine beta levels.

Explosive Gas and Oxygen

Before personnel enter the Reactor Building, the explosive gas and oxygen meters should be utilized to determine what concentrations exist in the Reactor Building atmosphere. Acceptable limits must be established.

Airborne Particulates and Iodine

Before physical entry into the Reactor Building, airborne activity should be analyzed for particulates and iodine. This step can be performed separate from and prior to the initial entry.

CAUTION: If radiation levels at this point exceed the maximum specified in the procedure, personnel shall withdraw and close the inner hatch door for procedure re-evaluation.

NOTE: Although entry may be permitted at higher levels, a general gamma field of 36 rem/hr* just inside the inner air lock is suggested as a maximum level for re-evaluation of the entry procedure to reassess data acquisition priorities.

*Stay time would be limited to 5 minutes at this level to stay below the allowable quarterly limits and 8 minutes to stay below the annual limits.

If all of the gamma, beta, oxygen and explosive gas readings are within permissible levels for personnel entry, then the structural integrity of the floor slab should also be inspected as much as possible. When all of the above steps have satisfactory results, then actual personnel entry into the Reactor Building can commence.

K. Take smear samples inside the personnel lock inner door.

L. Make radiation surveys. For the initial entry, it probably will not be possible to perform a detailed survey of the entire Reactor Building due to high radiation levels. Rather, it would be more important to survey the areas needed first for cleanup and subsequent tasks. In this regard, the area around the #2 personnel air lock, the equipment hatch, the stairways, the elevator and the pathways between should be of prime importance. The operating deck, the ladder to the polar crane and the polar crane itself are important but most likely will have to be surveyed later.

The surveys to be taken on the initial entry should be radiation levels, hot spots, general area and plateout. Beta plateout surveys on surfaces, especially floors, are important. The smear surveys should be isotopically analyzed to determine which isotopes are present so that the decontamination chemicals can be choosen appropriately. All of the above surveys will affect the allowable personnel stay times in the Reactor Building. Each of these survey duties should be divided up among the entry team.

M. Make visual observations of the status of the Reactor Building.

N. Make audio and visual recordings of the status of the Reactor Building.

O. Take contamination smear samples.

<u>CAUTION</u>: Length of stay is limited by worker dose limits which in turn depend on the radiation levels experienced. Initial health physics guidance will be provided by a time limit which is established based on assumed radiation levels. If higher levels are encountered, the time of stay must be reduced accordingly. Constant communications with additional health physics and supervision personnel outside of the Reactor Building is necessary.

P. Grab small samples of loose material (if any) and place in plastic bags. A piece of glass would be especially valuable.

Q. Return to the #2 personnel air lock.

R. Close the inner hatch door.

S. Purge the air lock.

T. Open the outer hatch door and exit.

U. Carefully remove protective clothing in accordance with health physics practices to avoid unnecessary spread of contamination.

Once entry has been made, it is imperative that a continuous survey be made by the reentry team and subsequent teams who follow until such time as detailed radiation mapping has been performed or a firm determination is made on method of remote decontamination.

14.0 ENTRY PROCEDURE

APPENDIX F

"TEMPORARY CHANGE" Working

AP 1001
Figure 1001 - 5

Three Mile Island Nuclear Station
Temporary Change Notice (TCN)

SIDE 1

NOTE: Instructions and guidelines in AP 1001 must be followed when completing this form.

TCN NO. 2-80-295
(From TCN Log Index)
Unit No. II
Date 8-11-80

1. Procedure 2104-4.55 (No.) REACTOR BUILDING ENTRY (Title)

2. Change (Include page numbers, paragraph numbers, and exact wording of change.)
Pg. 4.0 STEP 3.8 Change 2311-5 TO READ 4311-5
Pg 9.0 STEP 5.3.4.7 change 2311-5 TO READ 4311-5

3. Reason for Change:
TO INCORPORATE NEW RECOVERY MODE SURVEILLANCE

4. Recommended by M. Cooper 8-11-80 (Date)   5. M. Cooper (Supervisor's Signature) 8-11-80 (Date)

6. Duration of TCN - No longer than ninety days from effective date of TCN or as in (a) or (b) below whichever occurs first.

(a) TCN will be cancelled by a procedure revision issued as a result of a Procedure Change Request to be submitted by M. Cooper (Supervisor Submitting TCN) (Submit PCR as soon as possible) [X]

(b) TCN is not valid after ______ (fill in circumstances which will result in TCN being cancelled) [ ]

7. (a) Is the procedure on the Nuclear Safety Related Procedure List? (Sec. AP 1001 – Appendix B) If "Yes", complete Nuclear Safety Evaluation. (Side 2 of this Form) Yes [✓] No [ ]

(b) Is the procedure on the Environmental Impact Procedure List? (Sec. AP 1001 – Appendix B) If "Yes", complete Environmental Evaluation. (Side 2 of this Form) Yes [ ] No [✓]

(c) Does the change effect the intent of the original procedure? Yes [ ] No [✓]

NOTE: If all answers are "no" the change may be approved by the Shift Supervisor. If question (c) is answered "yes", the change must be reviewed by the PORC and approval by the Station/Unit Superintendent prior to implementation. If the answer to question (c) is "no" the change may be approved by two members of the plant management staff at least one of whom holds a senior reactor operators license on the unit affec ed in accordance with paragraph 3.6.4.2 of AP 1001.

8. Review and Approval

Block (c) "yes"

Approved ______ (Shift Supervisor/Foreman) ______ (Date)

Reviewed ______ ______

Members Of PORC ______ ______

Contacted ______ (PORC Members) ______ (Date)

Approved ______ (Unit Superintendent) ______ (Date)

Block (c) "no"

Approved M V Cooper (SRO License) 8-11-80 (Date)

John [illegible] (Member Plant Mrg. Staff) 8/11/80 (Date)

Reviewed ______ (Chairman of PORC) ______ (Date)

Approved ______ (Unit Superintendent) ______ (Date)

NOTE: The block (c) "Yes" review and approval chain may be followed at anytime.

9. Approval
Manager, Generation Quality Assurance ______ Date ______
NOTE: M.G.Q.A. approval required only on certain Administrative Procedures listed in Enclosure 7 of AP 1001

10. TCN is Cancelled ______ (Shift Supervisor/Shift Foreman) ______ (Date)

TMI-56 Rev - 8-77

"EVALUATION"

AP-1001

Figure 1001-4

Three Mile Island Nuclear Station

SIDE 2

Nuclear Safety/Environmental Impact Evaluation

1. Procedure 2104-4.55 (No.) REACTOR BUILDING ENTRY (Title) / (Temporary Change Notice No.)

2. Nuclear Safety Evaluation

Does the attached procedure change:

* (a) increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety? . . . . . yes ☐ no ☑

* (b) create the possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report? . . . . . yes ☐ no ☑

* (c) reduce the margin of safety as defined in the basis for any technical specification? . . . . . yes ☐ no ☑

Details of Evaluation (Explain why answers to above questions are "no". Attach additional pages if required.)

This change is to just to reflect new Surveillance Numbering for Recovery Mode Tech Specs. It has no effect on Nuclear Safety

Evaluation By M. V. Coga Date 8-11-80

3. Environmental Impact Evaluation

Does the attached procedure change:

(a) possibly involve a significant environmental impact? . . . . . yes ☐ no ☐

(if 3(a) is "yes", answer questions (b) and (c) and fill in "Details of Evaluation" below. If "no", state why by filling in the "Details of Evaluation" below) . . . . . yes ☐ no ☐

* (b) have a significant adverse effect on the environment? . . . . . yes ☐ no ☐

* (c) involve a significant environmental matter or question not previously reviewed and evaluated by the N.R.C. . . . . . yes ☐ no ☐

Details of Evaluation (Attach additional pages if required)

Evaluation By ____________ Date ________

4. Unit Superintendent requests PORC review ☐ Check if YES.

5. Approval

Evaluation Accompanying PCR

____________ Unit Superintendent ________ Date

Evaluation Accompanying TCN

Approval M. V. Coga (SRO Licensee) 8-11-80 (Date)

Reviewed [signature] (Member of Plant Staff) 8/11/80 (Date)

Approval ____________ (Unit Superintendent) ________ (Date)

NOTE: The Evaluation "Accompanying a PCR" evaluation and approval chain may be followed at anytime.

RECOVERY

CONTROLLED COPY FOR USE IN UNIT II ONLY

CONTROL ROOM WORKING COPY

THREE MILE ISLAND NUCLEAR STATION
UNIT #2 SURVEILLANCE PROCEDURE 2104-4.55

REACTOR BUILDING ENTRY AND PRE-DECON

Table of Effective Pages

Page	Date	Revision	Page	Date	Revision	Page	Date	Revision
1.0		1	26.0		2	51.0		
2.0		0	27.0		2	52.0		
3.0		2	28.0		2	53.0		
4.0		2	29.0		2	54.0		
5.0		2	30.0		2	55.0		
6.0		2	31.0			56.0		
7.0		2	32.0			57.0		
8.0		2	33.0			58.0		
9.0		2	34.0			59.0		
10.0		0	35.0			60.0		
11.0		0	36.0			61.0		
12.0		1	37.0			62.0		
13.0		0	38.0			63.0		
14.0		1	39.0			64.0		
15.0		2	40.0			65.0		
16.0		2	41.0			66.0		
17.0		2	42.0			67.0		
18.0		2	43.0			68.0		
19.0		2	44.0			69.0		
20.0		2	45.0			70.0		
21.0		2	46.0			71.0		
22.0		2	47.0			72.0		
23.0		2	48.0			73.0		
24.0		2	49.0			74.0		
25.0		2	50.0			75.0		

Unit 1 Staff Recommends Approval Approval ______________ Date ________ Cognizant Dept. Head	Unit 2 Staff Recommends Approval Approval N/A Date Cognizant Dept. Head
Unit 1 PORC Recommends Approval ______________ Date ________ Chairman of PORC	Unit 2 PORC Recommends Approval R W Bond Date 7/18/80 Chairman of PORC
Unit 1 Superintendent Approval ______________ Date ________	Unit 2 Superintendent Approval [signature] Date 7/22/80
MGQA Approval ______________ Date ________	NRC Approval [signature] Date 7/22/80

FOR USE IN UNIT II ONLY

THREE MILE ISLAND NUCLEAR STATION
UNIT #2 SURVEILLANCE PROCEDURE 2104-4.55
REACTOR BUILDING ENTRY AND PRE-DECON

TABLE OF CONTENTS

FOR USE IN UNIT II ONLY

THREE MILE ISLAND NUCLEAR STATION
UNIT #2 SURVEILLANCE PROCEDURE 2104-4.55
REACTOR BUILDING ENTRY AND PRE-DECON

1.0 PURPOSE

To provide personnel entry into and exit from the Unit 2 Reactor Building for pre-decon surveillance. This procedure will pre-empt existing procedures for Reactor Building entry and exit for the duration of the pre-decon surveillance program.

2.0 REFERENCES

2.1 Three-Mile Island Nuclear Station Radiation Protection Manual, 1003.

2.2 Three Mile Island Nuclear Station Health Physics Procedure 1602, "Radiation Dose Rate Surveys."

2.3 Three Mile Island Nuclear Station Health Physics Procedure 1609, "Loose Surface Contamination Surveys."

2.4 Three Mile Island Nuclear Station Health Physics Procedure 1612, "Monitoring for Personnel Contamination."

2.5 Three Mile Island Nuclear Station Health Physics Procedure 1613, "Radiation Work Permits."

2.6 Three Mile Island Nuclear Station Health Physics Procedure 1616, "Respiratory Protection Program."

2.7 Three Mile Island Nuclear Station Health Physics Procedure 1628, "Program for Medical and Bioassay Examinations."

2.8 Three Mile Island Nuclear Station Health Physics Procedure 1630.2, "Reactor Building Entry (Unit II Only)."

FOR USE IN UNIT II ONLY

2.9 Three Mile Island Nuclear Station Health Physics Procedure 1632.2, "Radiation Shutdown Survey (Unit II Only)."

2.10 Three Mile Island Nuclear Station Health Physics Procedure 1630.2 "Reactor Building Entry (Unit #2 Only)".

2.11 Operation and Maintenance Manual for the Personnel Airlocks for Three Mile Island Nuclear Plant Unit No. 2, December, 1970 PDM Contract 19142.

3.0 LIMITATIONS AND PRECAUTIONS

3.1 The beta energy and high-range beta dose rate response must be determined for the portable survey instruments to be used in the surveillance programs. This requirement derives from the high beta-to-gamma dose ratios that have been observed in the Auxiliary Building and may be expected in the Reactor Building.

3.2 A respiratory protection system may be required to provide protection from airborne radioactive particulates which may be encountered inside the Reactor Building.

3.3 Each entry shall be planned to ensure that radiation exposure limits, as defined in 10CFR20, Para. 20.101, are not exceeded.

3.4 Special lighting must be provided to entry teams if the Reactor Building lighting system is not in service.

3.5 Horizontal surfaces in the Reactor Building may be slippery due to the presence of NaOH from the building spray injection system actuation on March 28, 1979. Therefore, anti-skid footwear should be worn.

3.6 Hatchway and open stairwell areas must be approached with caution. There may be an abrupt increase in the radiation field near these areas due to decreased shielding.

3.7 There may be structural damage in the Reactor Building. Avoid areas of observable structural damage.

3.8 At the conclusion of this procedure, the outer and inner airlock door seals shall be leak rate tested in accordance with "THREE MILE ISLAND NUCLEAR STATION UNIT #2 SURVEILLANCE PROCEDURE 2311-5 CONTAINMENT INTEGRITY."

4.0 PREREQUISITES

4.1 The entry team has met all training requirements as determined by the Task Supervisor.

JW Langenbach ____________ 8/14/80 ____________
Task Supervisor Date

4.2 The Entry Task Sheet (Attachment 1), which defines the route to be taken and the tasks to be accomplished, has been completed by the Entry Task Supervisor.

JW Langenbach ____________ 8/14/80 ____________
Task Supervisor Date

4.3 The RWP Requirements (Attachment 3) have been completed and reviewed by the entry team members. A separate form has been completed for each entry team member and other support personnel who are to wear protective clothing.

JW Langenbach ____________ 8/15/80 ____________
Task Supervisor Date

FOR USE IN UNIT II ONLY

4.4 The planned entry tasks and the Entry Team Dose Assessment Sheets (Attachment 4) have been reviewed by the site Radiological Controls Staff.

Task Supervisor JW Langenbach   Date 8/15/80

4.5 An RWP has been obtained in accordance with Reference 2.5. The information from Attachments 1, 3 and 4 has been incorporated to the RWP.

Task Supervisor JW Langenbach   Date 8/15/80

4.6 The Entry Team, support HP's and support personnel have reviewed the RWP.

Task Supervisor JW Langenbach   Date 8/15/80

4.7 Each entry team member has received a whole body count in accordance with RWP requirements.

Task Supervisor JW Langenbach   Date 8/14/80

4.8 Each entry team member's quarterly exposure history is up-to-date and his allowable exposure (not to exceed the quarterly limits in IOCFR20, Para. 20.101) has been incorporated into the Entry Task Plan.

Task Supervisor JW Langenbach   Date 8/14/80

4.9 The Check Sheet for Systems Operability, Attachment 2, has been completed.

Task Supervisor JW Langenbach   Date 8/15/80

FOR USE IN UNIT II ONLY

4.10 The Reactor Building pressure is maintained in accordance with Tech. Spec. limits and is not positive with respect to the ante room.

-0.48" Hg 1005
Pressure

J W Langenbach 8/15/80
Task Supervisor Date

4.11 Written authorization has been obtained, as required by Reference 2.1, to allow members of the entry team to exceed plant administrative exposure limits, if required.

J W Langenbach 8/15/80
Task Supervisor Date

5.0 PROCEDURE

5.1 Entry

5.1.1 Notify the shift foreman/supervisor that this procedure is about to be executed.

5.1.2 Open the outer airlock door according to Reference 2.10.

5.1.3 A support HP shall enter the airlock and perform radiation and contamination surveys in accordance with Reference 2.2 and 2.3.

5.1.4 The support HP's and personnel shall prepare the airlock for entry and exit, e.g., place containers in the airlock for materials to be discarded during exit and install contamination control barriers.

5.1.5 The Entry Personnel shall enter the airlock and secure the outer door.

FOR USE IN UNIT II ONLY

5.1.6 Rotate handwheel for inner door 3/4 of a turn counter-clockwise. Allow pressure to equalize. Rotate the handwheel a second 3/4 of a turn, until the handwheel mechanical stop is felt. Open inner door.

5.1.7 Enter the Reactor Building to begin the surveillance program. Close the inner airlock door.

<u>NOTE</u>: If the door is not latched a person shall remain inside the airlock while personnel are inside the Reactor Building.

5.2 <u>Surveillance</u>

5.2.1 Proceed to excecute the preassigned tasks as described on the Entry Task Sheet, Attachment 1. The entry team and Command Center personnel shall observe the recommended actions to be taken in the event of a casualty considered in Attachment 5.

<u>NOTE</u>: At no time shall any member of the entry team be out of sight of at least one other team member.

<u>NOTE</u>: No tasks, other than those described on the Entry Task Sheet, shall be conducted if verbal communication with the Command Center is not in effect. Only the task supervisor in the Command Center shall be authorized to approve tasks not on the Entry Task Sheet.

5.3 <u>Exit</u>

5.3.1 Notify the Shift Foreman/Supervisor that the entry team is about to exit the Reactor Building.

5.3.2 The entry team shall return to the airlock. Open the door and enter the airlock. Close the inner airlock door and rotate the inner door handwheel until the mechanical stop is felt.

5.3.3 An entry team member shall turn the outer airlock handwheel 3/4 of a turn and allow pressure to equalize. After pressure has equalized, the handwheel shall be rotated until the mechanical stop is felt.

5.3.4 The entry team members shall be assisted by support HP's according to accepted HP practices and plant procedures as required.

NOTE: For the initial Reactor Building entry it is suggested that the support HP's referred to as HP-1, HP-2, HP-3 and HP-4, assist the team members as follows:

1) HP-1 shall enter the airlock and assist the team members in removing their outer layer of protective clothing. Respiratory protection should be maintained during this operation if possible. Protective clothing shall be discarded in the containers provided.

2) After removal of the outer protective clothing the entry team members shall exit the airlock into Anteroom. HP-1 shall remain in the airlock.

3) HP-2 and HP-3 shall assist the entry team in removing their remaining protective clothing, retrieving personnel dosimeters, and surveying them for contamination in accordance with Reference 2.4. If no contamination is encountered proceed to the dressing area and redress.

4) HP-2 shall enter the airlock and assist HP-1 in removing his outer layer of protective clothing.

5) HP-1 shall enter the Anteroom to complete protective clothing removal, dosimeter retrieval, and contamination survey assisted by HP-3. If contamination is encountered, decon HP-1 in accordance with Section 2.14 of Attachment 5.

6) HP-2 and HP-3 shall then remove materials from the airlock into the Anteroom and package for transport either to decon or to disposal.

7) HP-1 and HP-2 shall perform a leak rate test of the inner airlock door seals in accordance with "Three Mile Island Nuclear Station Unit #2 Surveillance Procedure 2311-5 Containment Integrity" (See Section 3.8). If the inner seals do not meet the acceptance criteria (leakage flow <2577 SCCM At 10 psig for 15 minutes) the caulking gun and caulking compound may be used to make a temporary door seal.

HP-2 and HP-3 shall perform a contamination survey of the airlock. If low levels of contamination are encountered, decon by wiping with dry massolin to extent practical, then secure the airlock in accordance with Reference 2.10. If gross levels of contamination are encountered, secure the airlock in accordance with Reference 2.10 without attempting decontamination.

8) HP-2 and HP-3 should assist each other in removing their protective clothing and exit the area in accordance with

Section 2.14 of Attachment 5. HP-4 shall survey all personnel and materials leaving the Anteroom.

9) All entry team members and support HP's shall receive a wholebody count within 24 hours of entry.

5.3.5 Perform actions as required in the airlock, exit in accordance with HP requirements and secure the airlock door in accordance with Reference 2.10.

5.4 Debriefing

5.4.1 Upon completion of the tasks associated with exit and decon, all entry team members, support HP's, and Command Center support personnel shall convene for a debriefing session.

5.4.2 Entry team members shall describe their observations using plant layout drawings and the model.

5.4.3 Results of all radiation surveys will be transposed onto plant and equipment arrangement drawings, and noted on the model.

ATTACHMENT 1 - ENTRY TASK SHEET

Entry Log Number 4

Purpose:

Entry Team Names: M. Benson, W. Behrle, M Cooper, W Griffith

Special Equipment: see supplemental sheets in addition to: Teledector, Camera (2), (3) RO-2A, (1) RO-7, (2) Telemetered Dosimeters, (4) Digital Dosimeters, ~(20) swipes, (1) gross swipe, TLD Pig, TLD Tree.

Performer is indicated prior to entry; recorder is in Command Center during entry if the Command Center is in verbal communication with the entry team.

Task		Performed by	Recorded by
1	see supplemental sheets.		
2			
3			

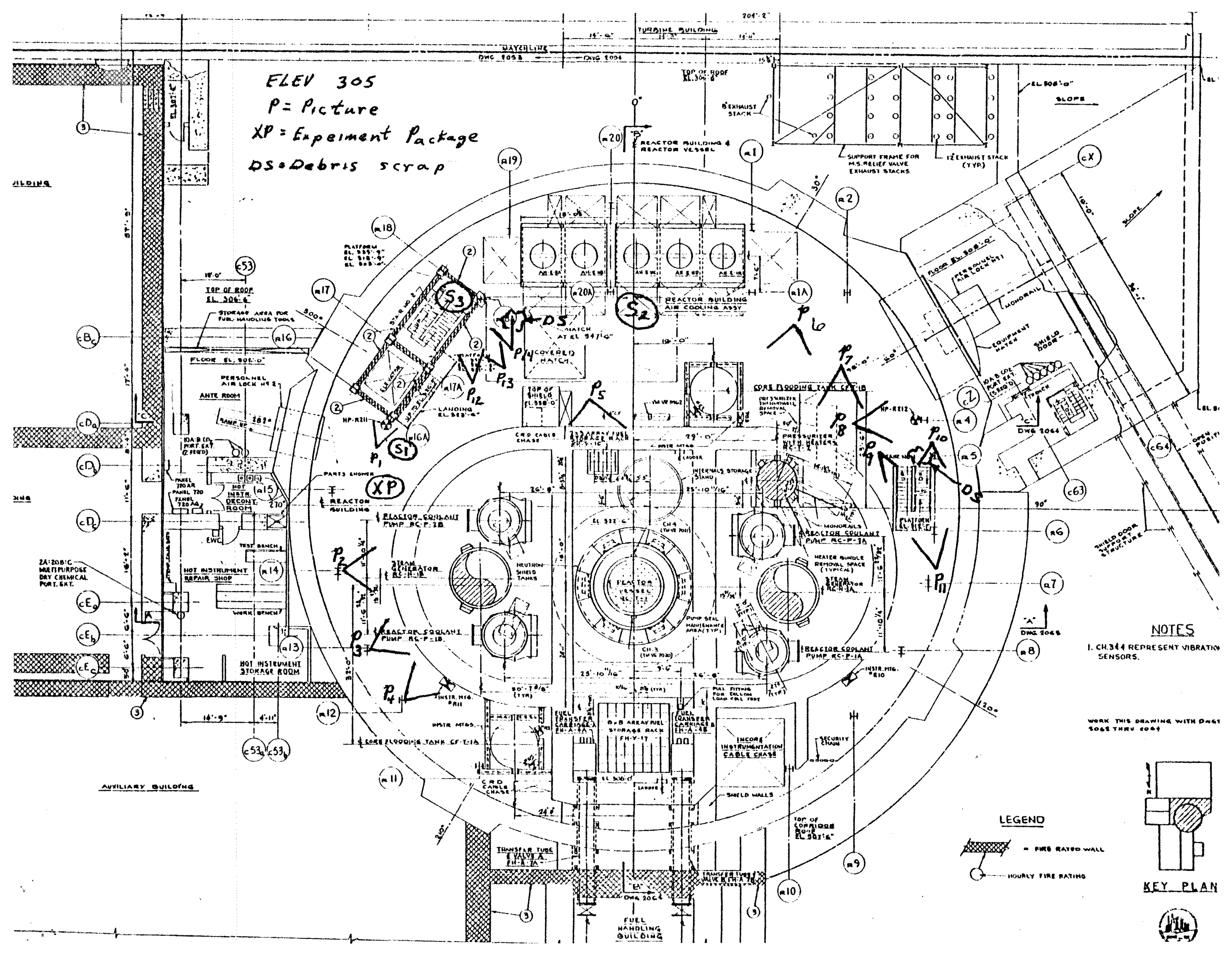
For additional tasks add supplemental pages.

FOR USE IN UNIT II ONLY

Time (Min.)	M. Benson (Ch 1)	W. Behrle (Ch 2)	M. Cooper (Ch 2)	W. Griffith (Ch 1)
0	Enter building, close inner door	Enter building	Enter building	Enter building
0-5	Take picture (P1) of area around HPR-211. Place experiment package down in designated area. Move to column R4 (#1 Airlock Area) with W. Behrle Take pictures P5, P6, P7, P8, P9)	Lead Benson to Column R4 and open breakers 1, 4, 7 and 8. On lighting panel PDP-3A. Inform the command center that breakers are open.	Remove HPR-211 and replace with new monitor. Place old monitor in container	Move to Column R14 and open breakers 1 and 8 on lighting panel PDP-3B and inform the command center that breakers are open. Take pictures (P2, P3, P4) from column R14, R13 and R12 looking toward the D-ring. Perform β/γ survey into areas before entering. Cut off a plastic tie from rack between column R14 and R15.
5-7	Assist W. Behrle with debris sample	Survey and take sample of debris at top of open stairwell	Survey area on R.B. floor near elevator, take gross area swipe with large wipe, resurvey area, take swipe (S1) of this area. Place gross swipe in bucket with radiation instrument	Return to HPR-211 and assist M. Cooper
	Take pictures (P10, P11)	Lead M. Benson to picture area (P11). Turn over debris sampler to M. Cooper	Follow W. Griffith and obtain debris sampler from W. Behrle	Lead M. Cooper to W. Behrle

Time (Min.)	M. Benson (Ch 1)	W. Behrle (Ch 2)	M. Cooper (Ch 2)	W. Griffith (Ch 1)
7-8		When instructed by Command Center turn on lights at P.B. sta 1A and 2B on column R4	Take swipe (S2) Take sample of debris on floor near air cooler by door to stairs	Survey air cooler where M. Cooper is to take debris sample and swipe
8-11	Pick-up darkened glass sample near equipment hatch (#1 airlock) Return to closed stairwell with W. Behrle and take camera from W. Griffith. Take pictures (P12, P13, P14)	Assist M. Benson with glass sample Return to closed stairwell	Return to closed stairwell	Return to closed stair-well and turn camera over to M. Benson
11-13	Follow behind Cooper	Lead group up-stairs to El. 347'6" using teletector	Follow behind Griffith Take swipe (S3) Take swipe (S4)	Follow behind Behrle
13-15	Take pictures (P15, P16, P17, P18)	Perform general area survey using teletector	Turn on lights at PB STA located behind stairwell	Perform β/γ survey of general area at top of stairs
15-18	Take pictures (P19, P20, P21)	Same as Griffith	Take swipes (S5, S6)	Survey area from enclosed stairwell toward open stairwell following southern cir-cumference of reactor building
18-22	Take pictures (P22, P23, P24)	Same as Griffith	Take swipe (S7)	"
	Take pictures (P25, P26)	Same as Griffith	Take swipe (S8)	"

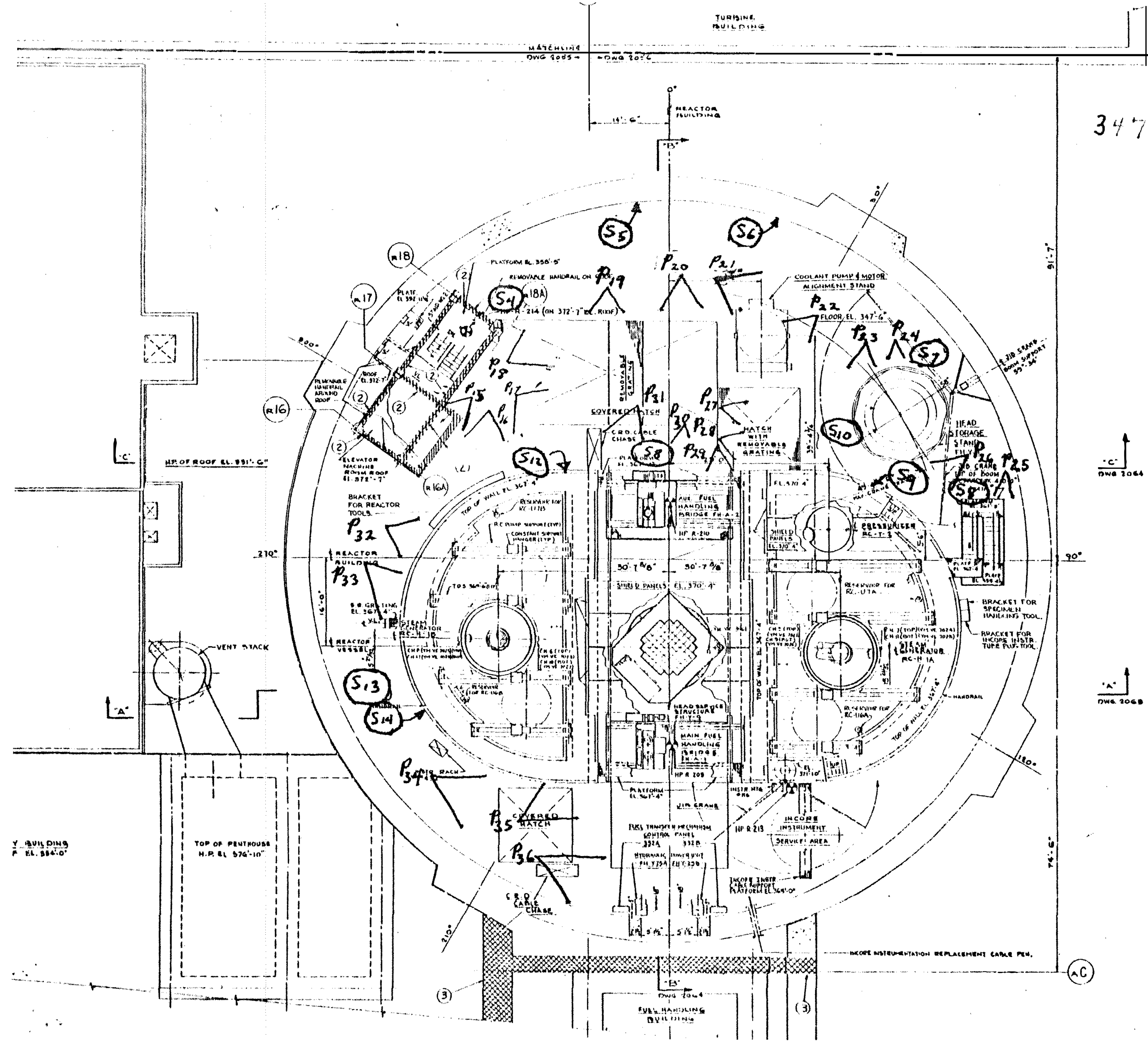
Time (Min.)	M. Benson (Ch 1)	W. Behrle (Ch 2)	M. Cooper (Ch 2)	W. Griffith (Ch 1)
22-28	Take pictures as required	———	Take swipes(S9, S10)	Perform survey along south wall of the west D-ring (pressurizer) toward 0° centerline of reactor building
28-32	Take pictures (P27, P28, P29, P30, P31	Teletector survey toward reactor head around fuel handling bridge into fuel pool	Take swipe (S11)	β,γ survey over core flood tank & removable grating β/γ survey area between D-rings where Behrle will stand to survey head area
32-35	Take pictures (P32, P33, P34, P35, P36)	Same as Griffith	Take swipes (S13, S14)	Survey east side of El. 347'-6" working north toward fuel transfer canal and north core flood tank
35-37	Return to enclosed stairwell and proceed to El. 305'	Same as Benson	Same as Benson	Same as Benson
37-40	Return to airlock area and pick up experiment package (remove antiskids before entering airlock) Close inner airlock door	Same as Griffith (Remove antiskids before entering airlock) Bag experiments, swipes and items picked up.	Return to airlock area and pick up radiation inst. (Remove antiskids before entering airlock) Same as Behrle	Return to airlock area, pick up painted steel plate at column R15 with Behrle (Remove antiskids before entering airlock) Same as Behrle
	——	——	Pass experiments, swipes and items picked up to HP's.	
	Exit airlock after removing booties	Same as Benson	Same as Benson	Same as Benson


ELEV 305
P= Picture
XP = Expeiment Package
DS=Debris scrap
TURBINE BUILDING
AUXILIARY BUILDING
FUEL HANDLING BUILDING
REACTOR BUILDING & REACTOR VESSEL
REACTOR BUILDING AIR COOLING ASSY
SUPPORT FRAME FOR M.S. RELIEF VALVE EXHAUST STACKS
12" EXHAUST STACK (TYP)
8" EXHAUST STACK
TOP OF ROOF EL 306'-6"
STORAGE AREA FOR FUEL HANDLING TOOLS
FLOOR EL. 305'-0"
PERSONNEL AIR LOCK NO 2
ANTE ROOM
HOT INSTR. DECONT. ROOM
HOT INSTRUMENT REPAIR SHOP
HOT INSTRUMENT STORAGE ROOM
WORK BENCH
TEST BENCH
PARTS SHOWER
2A:20B:C MULTIPURPOSE DRY CHEMICAL PORT. EXT.
REACTOR COOLANT PUMP RC-P-2B
STEAM GENERATOR RC-H-1B
REACTOR COOLANT PUMP RC-P-1B
NEUTRON SHIELD TANKS
REACTOR VESSEL
INTERNALS STORAGE STAND
PUMP SEAL MAINTENANCE AREA (TYP)
REACTOR COOLANT PUMP RC-P-2A
STEAM GENERATOR RC-H-1A
REACTOR COOLANT PUMP RC-P-1A
HEATER BUNDLE REMOVAL SPACE (TYPICAL)
MONORAILS
PRESSURIZER WITH HEATERS
CORE FLOODING TANK CF-T-1B
CORE FLOODING TANK CF-T-1A
COVERED HATCH
TOP OF SHIELD EL 338'-0"
CRD CABLE CHASE
FUEL TRANSFER CARRIAGE A
FUEL TRANSFER CARRIAGE B
STORAGE RACK
INCORE INSTRUMENTATION CABLE CHASE
SHIELD WALLS
SECURITY CHAIN
TRANSFER TUBE & VALVE A
PERSONNEL AIR LOCK NO 1
EQUIPMENT HATCH
SHIELD DOOR
MONORAIL
SHIELD DOOR SUPPORT STRUCTURE
SLOPE
S1
S2
S3
XP
DS
NOTES
1. CH.3&4 REPRESENT VIBRATION SENSORS.
WORK THIS DRAWING WITH DWGS 2063 THRU 2064
LEGEND
= FIRE RATED WALL
HOURLY FIRE RATING
KEY PLAN

NOTES

1. CH5 THRU CH 8 REPRESENT VIBRATION MONIT[illegible] SENSORS

347 elev.

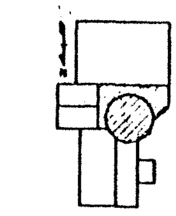


LEGEND

= FIRE RATED WALL

HOURLY FIRE RATING

WORK THIS DRAWING WITH DWGS 2068, 2061, 2065 & 2064



KEY PLAN

ATTACHMENT 2 - SYSTEMS OPERABILITY CHECK SHEET

The following systems, if required, shall be verified operational prior to Reactor Building entry and pre-decon surveillance.

	System	Checked by	Date
1.	Communication	JWL	8/15/80
2.	Lighting	JWL	8/15/80
3.	Respiratory Protection	JWL	8/15/80
4.	Dosimetry	JWL	8/15/80
5.	Portable Instrumentation	JWL	8/15/80
6.	Video	NOT USED JWL	8/15/80
7.	Photographic	JWL	8/15/80
8.	Airlock, Contamination Control Area and Anteroom Command Center Monitors	JWL	8/15/80
9.	Ventilation (Command Center to Anteroom)	JWL	8/15/80

JWL
James W Langenbach
8/14/80

ATTACHMENT 3 - RWP REQUIREMENTS (attach as supplement to RWP)

Entry Log No.: 4

Team Member See attachments to RWP

Protective Clothing:

Article	1st Layer	2nd Layer	3rd Layer	4th Layer
Coveralls				
Footwear				
Hands				
Head				

Respiratory Protection Requirement:

Personnel Dosimeters

	Location	Type	Identification Number
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			

FOR USE IN UNIT II ONLY

ATTACHMENT 4 - ENTRY TEAM DOSE ASSESSMENT

Entry Log No. 4

TEAM MEMBER NAME:	M.L. Benson		W.H Behrle		W Griffith		M Cooper	
	Estimate	Actual	Estimate	Actual	Estimate	Actual	Estimate	Actual
Whole Body	1 Rem	(0-5R) 225mR (0-1R) 300mR (0-500mR) 250mR (0-10R) 350mR	1 Rem	(0-5R) 200mR (0-1R) 245mR (0-500mR) 235mR (0-10R) 350mR	1 Rem	(0-5R) 200mr (0-1R) 160mR (0-500mR) 145mR (0-10R) 200	1 Rem	(0-5R) 200mR (0-1R) 140mR (0-500mR) 130mR (0-10R) 200mR
Head								
Hands								
Feet								
Skin								
*Internal:								
Critical Organ								
Isotope								
μCi								
Dose								

Approved: Manager, Radiation Protection J M Brasher 14 aug '80

*Based upon whole body/bioassay results

FOR USE IN UNIT II ONLY

ATTACHMENT 4 - ENTRY TEAM DOSE ASSESSMENT

2104-4.55
Revision 1
Page 2 of 2

Entry Log No. 4

FOR USE IN UNIT II ONLY

TEAM MEMBER NAME:	~~M.L. Benson~~ jwh		H. Kellogg		D Croll			
	Estimate	Actual	Estimate	Actual	Estimate	Actual	Estimate	Actual
Whole Body			0				0	
Head								
Hands								
Feet								
Skin								
*Internal:								
Critical Organ								
Isotope								
µCi								
Dose								

Approved: Manager, Radiation Protection J.W. Brasher 14 Aug 80

*Based upon whole body/bioassay results

ATTACHMENT 5

THREE MILE ISLAND NUCLEAR STATION
UNIT #2 ENTRY TEAM CASUALTY CONSIDERATIONS
FOR INITIAL ENTRY INTO THE REACTOR BUILDING

1.0 PURPOSE

The purpose of this document is to evaluate the potential hazards associated with the post accident entry into the Three Mile Island Unit 2 Reactor Building and to recommend actions to be taken to prevent, correct, minimize or mitigate the consequences of these hazards.

2.0 CASUALTY CONSIDERATIONS

2.1 Presence of Hazardous Atmosphere

2.1.1 Hazard Description

Reactor Building air sample analysis indicates that the atmosphere may contain radioactive airborne particulates which creates the possibility of personnel contamination.

2.1.2 Protective Precautions

2.1.2.1 Equipment

Entry team members will utilize respiratory protection and wear protective clothing in accordance with HP requirements. The details of the respiratory protection are given in 2.2. The details of protective clothing are given in 2.14.

2.1.2.2 Operating Procedure

Entry team members will follow procedures for protection from the hazardous atmosphere. The operating procedures for the respiratory protection are given in 2.2. The operating procedures for the protective clothing are given in 2.14.

2.2 Breathing Air System Failure

2.2.1 Hazard Description

Breathing air system malfunction may cause breathing difficulties, asphyxiation or internal radiation contamination. This hazard exists due to the possibility of breathing gear failure in the presence of Reactor Building atmosphere described in 2.1 of this attachment.

2.2.2 Protective Precautions

2.2.2.1 Equipment

The entry team members will utilize respiratory protection in accordance with HP requirements.

2.2.2.2 Operating Procedure

Entry members shall be trained in the safe operation and maintenance of the required breathing apparatus. Included in this training will be the use of self contained breathing apparatus and its built in safety features, which include:

a. An alarm to indicate service life remaining.

b. A bypass valve to allow manual regulation of the oxygen or air flow in the event of the failure of the automatic regulator. The valve is opened and closed as required to maintain a breathable air mixture.

c. A pressure gauge to indicate service life remaining.

If a team member's breathing apparatus completely fails, the team member shall immediately remove his face-mask and exit the Reactor Building. The Command Center shall be notified and all team members shall exit the Reactor Building.

2.3 Presence of Electrical Hazard

2.3.1 Hazard Description

An electrical shock hazard may exist due to the unknown condition of electrical equipment and the presence of possible highly conductive solutions within the Reactor Building.

2.3.2 Protective Precautions

2.3.2.1 Equipment

No protective equipment specific to this hazard is required.

2.3.2.2 Operating Procedure

Entry team members shall avoid all loose wire and all electrical equipment. They shall not attempt to activate any electrical equipment. If possible, wet locations should be avoided.

2.4 Rapid Reactor Building Pressurization

2.4.1 Hazard Description

Rapid pressurization may indicate the occurrence or threat of a major malfunction within the Reactor Building which could be injurious to the entry team members.

2.4.2 Protective Precautions

2.4.2.1 Equipment

Reactor Building pressure indicating recorder on Panel 3 in the Control Room.

Heise gauge T.V. monitor in Control Room which indicates Reactor Building pressure.

2.4.2.2 Operating Procedure

Symptoms of actual or potential rapid or excessive containment pressurization are as follows:

a. Pressure increases on Reactor Building pressure indicating recorder on Panel 3 by greater than 0.2 psi while personnel are inside containment.

b. Pressure increases on Heise gauge by greater than 0.2 psi while personnel are inside containment.

c. A feeling of intense pressure and/or a ringing noise experienced by the eardrums of personnel inside the Reactor Building.

d. A substantial breach of Reactor Coolant System pressure boundary as visually detected by personnel inside the Reactor Building or as detected by Control Room operators.

If symptoms are observed by the Control Room operator, the Shift Foreman/Supervisor shall immediately notify the Command Center. The Command Center shall direct the entry team to evacuate the Reactor Building.

If symptoms are observed by any member of the entry team he shall notify the Command Center. The Command Center shall then notify all members of the entry team and instruct them as to their appropriate action. The Command Center shall then notify the Shift Foreman/Supervisor of the action being taken.

2.5 Slippery Floor Conditions

2.5.1 Hazard Descriptions

The floor inside the Reactor Building may be slippery due to water and chemical solutions on the surfaces. This could cause falls resulting in possible injury to entry team members.

2.5.2 Protective Precautions

2.5.2.1 Equipment

All entry team members shall wear non-skid footwear.

2.5.2.2 Operating Procedure

Extreme caution should be exercised when approaching floor areas that appears to be wet. Should slippery conditions be encountered or if any team member falls, immediately notify the Command Center for appropriate action.

2.6 <u>Structural Damage Hazard</u>

2.6.1 Hazard Description

It is possible that structural damage to the Reactor Building has occurred. Any visible change in configuration of structures, piping, components or equipment including color changes shall be defined as structural damage. Structural damage indicates the potential for falling debris or weakened floors which could result in injury to entry team members.

2.6.2 Protective Precautions

2.6.2.1 Equipment

No protective equipment specific to this hazard is required.

2.6.2.2 Operating Procedure

Should structural damage be encountered, the entry team shall immediately describe its extent and nature to the Command Center, obtain pictures if possible and avoid the area. The Command Center shall determine subsequent actions to be taken.

2.7 Lighting System Failure

2.7.1 Hazard Description

The Reactor Building Lighting System will not be operated during initial entry. The entry team members will use battery operated lighting devices. Malfunction of these devices presents a hazardous condition, therefore, procedural constraints will be used to ensure safety.

2.7.2 Protective Precautions

2.7.2.1 Equipment

Each entry team member will carry a miner's light attached to his suit hood as a primary light source. Each member will also carry a back-up light taped to his suit to be used if the primary light fails.

In addition, upon entry, a beacon light will be placed near the airlock to provide auxiliary lighting.

2.7.2.2 Operating Procedure

The entry team will have independent light sources as indicated in 2.7.2.1.

Failure of any one of the light sources will not abort the entry. However, the Command Center shall be notified immediately.

Failure of any two (2) of the light sources shall constitute a condition for immediate exit by all team members from the Reactor Building.

2.8 Communication System Failure

2.8.1 Hazard Description

All entry team members will be in direct communication with each other and the Command Center. Loss of communication is a potential hazard because the Command Center would be unable to assist team members in the event of unforeseen problems or difficulties. In addition entry team members would not be able to call on each other for assistance.

2.8.2 Protective Precautions

2.8.2.1 Equipment

Each entry team member shall wear a cranial transceiver connected to a belt mounted walkie-talkie. The walkie-talkies communicate with the Command Center via a two channel (primary and back-up) radio link. This system permits simultaneous communication among the team members and the Command Center. Failure of one communication channel will require all entry team members to switch to the back-up channel, if possible. If this is not possible the entry team shall exit the Reactor Building immediately.

2.8.2.2 Operating Procedure

The Command Center shall verify communication system operability by voice contact with each team member at least once every three minutes.

If a communication channel fails, team members shall switch to the back-up channel, if possible.

If the back-up channel fails or is inoperable the entire entry team shall immediately exit the Reactor Building.

2.9 Airlock Door-to-Door Interlock Hazard

2.9.1 Hazard Description

Capability to enter the Reactor Building from the atmosphere side must be maintained throughout the entry to ensure safety of the entry team members.

Under certain circumstances this capability could be lost if the normal door-to-door interlock mechanism is left in force.

2.9.2 Protective Precautions

2.9.2.1 Equipment

No special equipment will be used to mitigate this hazard.

2.9.2.2 Operating Procedure

During the entry, the inner door will be closed but unlatched. While the inner door is unlatched a person shall be stationed inside the airlock to operate the airlock doors in the event of an emergency requiring personnel access to the Reactor Building.

2.10 Airlock Inner Door Seal Failure

2.10.1 Hazard Description

Should the inner airlock door seal fail, double isolation of the Reactor Building would be violated with the possible loss of ability to maintain Reactor Building negative pressure. This would increase the likelihood of uncontrolled leakage.

2.10.2 Protective Precautions

2.10.2.1 Equipment

To make a temporary seal, lint free rags, a caulking gun and caulking compound, and duct tape will be placed in the airlock during the entry.

2.10.2.2 Operating Procedure

If, upon exit from the Reactor Building, the airlock-to-anteroom pressure differential cannot be equalized the inner airlock door seals may be leaking. The entry team will clean the area around the inner door jamb and apply duct tape to form a temporary seal. The team will then exit the airlock. On a future entry the inner airlock door will be sealed and tested.

2.11 Airlock Door Jamming

2.11.1 Hazard Description

Airlock door jamming could delay or prevent entry team members from exiting the Reactor Building.

2.11.2 Protective Precautions

2.11.2.1 Equipment

No special equipment is required.

2.11.2.2 Operating Procedure

The inner door will not be latched during the entry as described in Section 2.9.2.2.

2.12 Telemetered and Alarming Dosimetry System Malfunction

2.12.1 Hazard Description

Partial or total failure of the telemetered and or alarming dosimetry required by the RWP for the entry team would impair the capability to determine their total dose. However, total dose will continuously be determined by the Command Center from survey readings.

2.12.1.2 Protective Precautions

2.12.2.1 Equipment

The telemetered dosimetry system consists of a base station capable of receiving signals from five individual dosimeter/-transmitter units. If required by the RWP dosimeter/transmitter units may be worn by the entry team members.

Dose is measured and transmitted to the base station in 1mR increments by each dosimeter/transmitter. The base station receives the 1mR increment pulses, integrates them and displays the total dose for each dosimeter/transmitter.

If required, each entry team member shall wear at least one dosimeter/ transmitter unit.

In addition to the telemetered dosimetry, each entry team member may be required to carry a self reading, digital dosimeter, equipped with LED display and audible alarm.

2.12.2.2 Operating Procedure

The entry team shall notify the command center if failure of any dosimeter occurs. The failure of telemetered dosimetry shall not preclude the entry from continuing. The Command Center shall determine the need for exit from the Reactor Building. The entry team members should exit the Reactor Building based on the following minimal guidelines:

1. If both self reading dosimeters fail on a team member.
2. If any self reading digital dosimeter reaches its alarm set point.
3. If any team member reaches the dose limit for time into the entry as determined by the Command Center.

2.13 Hand Held Survey Instrument Malfunction

2.13.1 Hazard Description

Malfunction of hand held radiation survey instrumentation may result in overexposure of entry team members.

2.13.2 Protective Precautions

2.13.2.1 Equipment

Multiple survey instruments will be used by the entry team. This will provide redundant capabilities in the event of instrument failure.

2.13.2.2 Operating Procedure

Members of the entry team shall carry hand held beta/gamma radiation detectors. At least one member shall carry an extendable probe detector (Teletector).

Before entering a new area, the entry team shall survey it with the extendable probe radiation detector, and upon entering, entry team members shall survey for β-γ radiation. The entry team shall relay radiation readings to the Command Center for interpretation. The Command Center shall ensure that no team member will exceed dose limits.

Should any hand held radiation survey instrument fail the entry team shall immediately notify the Command Center and return to the airlock for further instructions.

2.14 Radiation Contamination and Overexposure

2.14.1 Hazard Description

Despite all precautions, the possibility exists that entry team members may be overexposed or contaminated during the entry. Overexposure will be defined as given in Reference 2.1, "Three Mile Island Nuclear Station Radiation Protection Manual." Contamination will be defined as given in Reference 2.4, "Monitoring for Personnel Contamination."

2.14.2 Protective Precautions

2.14.2.1 Equipment

Entry team members will be provided with multiple levels of protective equipment to prevent overexposure as required by the RWP. This may include:

a. Self contained breathing apparatus as detailed in 2.2.

b. Telemetered and Alarming Dosimetry as detailed in 2.12.

c. Hand held survey instruments as detailed in 2.13.

d. Protective Clothing as detailed in Attachment 3.

2.14.2.2 Operating Procedure

Should overexposure or contamination be suspected (e.g. loss of suit integrity) or verified during the entry, all team members shall immediately return to Personnel Airlock No. 2 and exit the Reactor Building.

After exiting the Reactor Building, the extent of overexposure or contamination will be evaluated using the telemetering dosimetry, self reading dosimetry, TLD and film badge, whole body counts and bioassay as appropriate.

If contamination or overexposure is found to exist, the affected team member will be decontaminated or treated in accordance with standard HP practices.

NOTE: If gross levels of contamination are encountered, perform the following:

a. Refit the individual with a surgeon's cap and respiratory mask with a particulate filter. If the facial area is contaminated, decon the facial area only to the extent possible before refitting mask.

b. Dress the Individual in paper coveralls, rubber surgeon's gloves and booties.

c. Proceed to decon area and decon in accordance with Radiological Controls requirements.

d. Institute bioassay program in accordance with Reference 2.7.

Should routine decontamination and treatment procedures prove to be ineffective the Radiation Medical Consultant will determine the appropriate course of action.

2.15 Unanticipated Criticality

2.15.1 Hazard Description

Unanticipated criticality may cause high radiation fields.

2.15.2 Protective Precautions

2.15.2.1 Equipment

Source range channel NI-1 on Panel 4 in the Control Room. Reactor coolant hot leg temperature, T_{ha} and T_{hb}, read out on computer points 390 and 391 respectively.

2.15.2.2 Operating Procedure

Symptoms of unanticipated criticality are as follows:

a. Source range channel NI-1 on Panel 4 in the Control Room indicates greater than or equal to 5 counts per second.

b. The Reactor Coolant System hot leg temperature (T_{ha} or T_{hb}) increasing by more than $10^{o}F$ in five minutes or less.

c. A sudden increase in radiation monitor readings encountered by the entry team that cannot be explained by "hot spot" general area radiation level increases.

If symptoms are observed by the Control Room operator, the Shift Foreman/Supervisor shall immediately notify the Command Center. The Command Center shall direct the entry team to evacuate the Reactor Building. The Command Center shall then notify the Shift Foreman/Supervisor of the action being taken. If symptoms are observed by any member of the entry team he shall notify the Command Center. The Command Center shall then notify all members of the entry team and instruct them as to their appropriate action.

2.16 Physical Injury Hazard

2.16.1 Hazard Description

Physical injuries which would impair the entry team from exiting the Reactor Building or increase their potential for internal radiation contamination or overexposure are considered hazardous.

2.16.2 Protective Precautions

2.16.2.1 Equipment

All normal plant equipment, safety systems and special entry equipment described in previous sections of this attachment shall be used to prevent physical injuries.

2.16.2.2 Operating Procedure

In the event of physical injury to an entry team member, the Command Center shall be notified immediately. The Command Center, in conjunction with medical personnel, shall determine if entry team exit from the Reactor Building is required. If the injury is minor and Reactor Building exit is required, an HP shall monitor the injured entry team member as he exits.

Medical personnel outside the airlock shall treat the injury after the HP has completed the necessary decontamination.

If the injury is major, the Command Center shall either instruct the other team members to assist the injured member or instruct the back-up team to enter the Reactor Building to assist the injured member.

Upon exit an HP shall monitor the injury. The HP and medical personnel shall evaluate, stabilize, and, if possible, decontaminate the injury. The injured entry team member, accompanied by an HP and medical personnel, shall then be transported to the Hershey Medical Center. The Hershey Medical Center will complete the decontamination of the injury if it has not been completed on site.

The Command Center shall immediately notify Hershey Medical Center that the injured team member is in transit and provide them with the following information:

a. Name of the injured entry team member.

b. Extent of the injury.

c. Extent of possible contamination.

d. Vital signs and assessment, if available.

e. Description of treatment already administered.

2.17 Unanticipated Hazards

2.17.1 Hazard Description

Unanticipated hazards are those not considered in previous sections of this attachment.

2.17.2 Protective Precautions

2.17.2.1 Equipment

All normal plant equipment, safety systems, and special entry equipment described in previous sections of this attachment shall be used to mitigate the consequences of unanticipated hazards.

2.17.2.2 Operating Procedure

Symptoms, such as, a sudden change in plant operating parameters or erratic performance or failure of equipment may indicate an unanticipated hazard.

If symptoms are observed by the Control Room operator, the Shift Foreman/Supervisor shall immediately notify the Command Center. The Command Center shall direct the entry team to evacuate the Reactor Building.

If symptoms are observed by any member of the entry team he shall notify the Command Center. The Command Center shall then notify all members of the entry team and instruct them as to their appropriate action. The Command Center shall then notify the Shift Foreman/Supervisor of the action being taken.

TMI-2 Reactor Building Entry
August 15, 1980

Administrative Building Exit Criteria

Exit Dose Limit:

625 mR exposure to any individual requires exit from the building by all entry team members.

Communications Failure:

Loss of communications to 3 of 4 available radios will require exit from the building by all entry team members. At least one radio shall function per group when the entry teams are split into groups. If not the groups shall return to a 4man team.

Respiratory Protection Failure:

Loss of breathing air supply to any entry team will require all entry team members to exit building. If breathing apparatus air failure occurs remove mask per HP training; only if unable to breath.

Lighting Failure:

Loss of all (4) primary lights (flood) will require exit from the building by all entry team members. Back-up lights will be available.

Dose Rate Instrument Failure:

At least 2 dose rate instruments telemetered or digital must be functioning at all times.

Hand Held Radiation Measurement Instrument Failure:

At least two instruments must function at all times.

Exit Time Limit:

Exit from the building will commence at 40 minutes.

15.0 ENTRY PROGRAM

APPENDIX G

THREE MILE ISLAND

UNIT 2

REACTOR BUILDING

ENTRY PROGRAM

FEBRUARY 20, 1980

REV. 1 - 2/27/80

REV. 2 - 3/18/80

REV. 3 - 5/20/80

- TECHNICAL INCENTIVES FOR EARLY REACTOR BUILDING ENTRY
- FEASIBILITY OF ENTRY INTO REACTOR BUILDING WITH/ WITHOUT BUILDING PURGE
    - EXPERIMENT RESULTS
    - EQUIPMENT
- DATA GATHERING
    - INITIAL ENTRIES
    - FUTURE ENTRIES
- DOSE ASSESSMENTS
    - MEMBERS
    - ANTE ROOM
    - OFF-SITE
- PROGRAM
    - MEDICAL/PHYSICAL
    - TRAINING
        - CLASSROOM
        - HANDS ON
- CONCLUSION

TECHNICAL INCENTIVE FOR EARLY REACTOR BUILDING ENTRY

- o DECON/RECOVERY PLANNING
- o DETERMINE EXTENT OF REMOTE DECON NEEDED
- o EFFECTIVE USE OF TECHNICAL STAFF
- o ASSESSMENT OF PLANT STATUS
- o DETERMINE ABILITY TO MAKE ADDITIONAL ENTRIES TO COMBAT PLANT CASUALTIES

FEASIBILITY OF ENTRY INTO REACTOR BUILDING WITH/WITHOUT BUILDING PURGE

- o ANALYSIS OF REACTOR BUILDING ENVIRONMENT BY EXPERIMENTAL SAMPLING
  - o ORDER OF MAGNITUDE DOSE RATE AND PHOTON SPECTRUM MEASUREMENTS OUTSIDE EQUIPMENT HATCH
    - o PLATEOUT ON VERTICAL SURFACE OF HATCH LOWER BOUND

      SURFACE ACTIVITY 6.3 μCi/cm^2

      DOSE RATE 177 mR/hr
    - o PLATEOUT ON 305 ELEVATION FLOOR UPPER BOUND

      SURFACE ACTIVITY 17.3 μCi/cm^2

      DOSE RATE 457 mR/hr
  - o CONTAINMENT WATER ACTIVITY FROM GROSS GAMMA MEASUREMENTS IN PENETRATION R-605
    - o SUMP WATER SURFACE DOSE RATE 123 R/hr

- PRELIMINARY MEASUREMENTS OF RADIOLOGICAL CONDITIONS INSIDE PERSONNEL AIR LOCK NO. 2
  - Kr-85
    AIR MONITOR CONCENTRATION 1.67×10^{-3} μCi/cm^3
    GAS SAMPLE CONCENTRATION 1.96×10^{-3} μCi/cm^3
  - Xe-131m
    GAS SAMPLE CONCENTRATION 7.91×10^{-6} μCi/cm^3
  - I-131
    AVERAGE CONCENTRATION 1.49×10^{-8} μCi/cm^3
  - PARTICULATE
    TOTAL CONCENTRATION $< 1.8 \times 10^{-9}$ μCi/cm^3
- THEORETICAL ESTIMATE OF Cs-137 CONCENTRATION IN SUMP WATER BASED ON MEASUREMENT THRU PENETRATION R-605
  - 366 μCi/cm^3
- DEPOSITION ACTIVITY AT THE 347′ ELEVATION ESTIMATED FROM GAMMA MEASUREMENTS IN PENETRATION R-626
  - Cs 134 = 1.53 μCi/cm^2
  - Cs 137 = 5.76 μCi/cm^2
  - Ba/La-140 = 0.14 μCi/cm^2
  - DOSE RATE 300 mR/hr

- REACTOR BUILDING SUMP SAMPLE
  - Cs - 137 176 μCi/ml
  - Cs - 134 40 μCi/ml
  - Sr - 89+90 45 μCi/ml
  - H_3 1.05 μCi/ml
  - Sr - 90 2.8 μCi/ml
  - La - 140 .14 μCi/ml
- PENETRATION-626 CUT OUT ANALYSIS "COOKIE"

  DATA NOT RECEIVED
- HYDROGEN RECOMBINER SPOOL PIECE ANALYSIS

  DATA NOT RECEIVED
- NO. 2 PERSONNEL AIR LOCK HATCH SCAN

  AWAITING NRC APPROVAL TO PROCEED
- REACTOR BUILDING GAS ANALYSIS
  - 14% O_2
  - 85% N_2 AND INERT GASES
  - KR-85 H_2 CONCENTRATION 1.05 μCi/ml

- PENETRATION-626 TLD TREE BETA/GAMMA SCAN, GAS SAMPLE AND SWIPES
  - BETA DOSE RATE 100-350 RAD/HR
  - GAMMA DOSE RATE 300-1000 MR/HR
  - KR-85 CONCENTRATION .4-.7 μCi/ML
  - SWIPE

    Cs 137 2-4.5 X 10^{-1} μCi/SWIPE

    Nb 95 2-9 X 10^{-4} μCi/SWIPE

    Cs 134 4-7 X 10^{-2} μCi/SWIPE
  - TLD TREE PAD/SWIPE

    Sr 90 3-9 X 10^{-2} μCi/SWIPE

    Sr 89 1.5 X 10^{-1} μCi/SWIPE

    Cs 134 5.3 X 10^{-2} μCi/SWIPE

    Cs 137 3.3 X 10^{-1} μCi/SWIPE

    Nb 3 X 10^{-3} μCi/SWIPE

    Co 1 X 10^{-4} μCi/SWIPE

- VIKING SUIT MATERIAL BETA SHIELDING EFFECTIVENESS

  100% EFFECTIVE

- ADDITIONAL EXPERIMENTS ON DIFFUSION OF KR-85 THROUGH VIKING SUIT MATERIAL BEING PERFORMED
  - SHIELDING EFFECTIVENESS
  - DIFFUSION RATES

EXPERIMENT PROGRAM

EQUIPMENT HATCH GAMMA SCAN

PENETRATION R-605 GAMMA SCAN

RB SUMP SAMPLE

AIRLOCK SURVEY

PENETRATION R-626 GAMMA SCAN

PENETRATION R-626 DIRECT MEASUREMENTS

RB AIR SAMPLES

H_2 RECOMBINER SPOOL PIECE ANALYSIS

ADDITIONAL R-626 EXPERIMENTS

EQUIPMENT HATCH GAMMA SCAN

- o ACTIVITY/DOSE RATES ASSUMING THE READINGS ARE DUE SOLELY TO PLATEOUT ON THE VERTICAL HATCH SURFACE

	SURFACE ACTIVITY (μCi/cm^2)		DOSE RATE (mR/hr)	
ISOTOPE	JUNE 1979	FEB. 1980	JUNE 1979	FEB. 1980
I-131	2.29	0	31.4	0
Cs-137	1.59	1.59	38.0	38.0
Cs-134	0.43	0.43	11.6	11.6
Cs-134	0.05	0	1.5	0
La-140	1.93	0	94.3	0
	6.3	2.0	176.8	49.6

- o ACTIVITY/DOSE RATES ASSUMING THE READINGS ARE DUE SOLELY TO PLATEOUT ON THE 305′ FLOOR

	SURFACE ACTIVITY (μCi/cm^2)		DOSE RATE (mR/hr)	
ISOTOPE	JUNE 1979	FEB. 1980	JUNE 1979	FEB. 1980
I-131	6.95	0	81	0
Cs-137	4.12	4.12	98	98
Cs-134	1.12	1.12	30	30
Cs-136	0.13	0	4	0
La-140	5.02	0	244	0
	17.3	5.2	457	128

PENETRATION R-605 GAMMA SCAN
JUNE 1979

- ESTIMATED DOSE RATE AT SURFACE OF WATER = 123 R/HR
- HIGHEST DOSE RATE MEASURED INSIDE R-605 = 31 R/HR
- CALCULATED SUMP CURIE INVENTORY = 1260 μCi/ml
- MAJOR ISOTOPES DETECTED AND CALCULATED CONCENTRATIONS:

Sr-89	297 μCi/ml
Cs-137	154 μCi/ml
Ba-137	145 μCi/ml
Zr-95	128 μCi/ml
Nb-95	102 μCi/ml
Ce-141	69.5 μCi/ml
Ce-144	67.5 μCi/ml
Pr-144	67.5 μCi/ml
Ru-103	56.8 μCi/ml
Cs-134	47.0 μCi/ml
Y-91	28.6 μCi/ml
I-131	25.1 μCi/ml
Pr-143	15.3 μCi/ml

REACTOR BUILDING SUMP SAMPLE RESULTS

AUGUST 1979

- MAJOR ISOTOPES DETECTED:

Cs-137	176 μCi/ml
Cs-134	40 μCi/ml
Sr-89/90	45 μCi/ml
H_3	1 μCi/ml

- URANIUM FOUND IN BOTTOM SAMPLE = 28 PPB

- PLUTONIUM FOUND IN BOTTOM SAMPLE = .033 PPB

- BOTTOM SAMPLE SHOWED GREENISH PRECIPITATE - MAINLY COPPER

PERSONNEL AIRLOCK #2 SURVEY
AUGUST 1979

o MAXIMUM DOSE RATE IN AIRLOCK = 120 mR/HR

o AIRBORNE ACTIVITY MEASUREMENT

	AUGUST 1979	JANUARY 1980
Kr-85	1.67×10^{-3} μCi/ml	2.3×10^{-3} μCi/ml
Xe-131m	8×10^{-6} μCi/ml	0
I-131	1.5×10^{-8} μCi/ml	0
PARTICULATE	1.8×10^{-9} μCi/ml	1.8×10^{-9} μCi/ml

PENETRATION R-626 GAMMA SCAN

SEPTEMBER 1979

- HIGHEST DOSE RATE MEASURED INSIDE R-626 = 50 mR/hr

- CALCULATED DOSE RATE AT 347' FLOOR = 297 mR/hr

- MAJOR ISOTOPES DETECTED AND CALCULATED ACTIVITY ON 347' FLOOR

Cs-137	5.76 μCi/cm^2
Cs-134	1.53 μCi/cm^2
Ba/La-140	0.14 μCi/cm^2

PENETRATION R-626 DIRECT SURFACE ACTIVITY MEASUREMENTS

- SWIPES* ON RB WALL AND R-626 FLANGE

Cs-137	1 ⟶ 3×10^{-2} μCi/cm^2
Cs-134	2 ⟶ 5×10^{-3} μCi/cm^2
Nb- 95	1 ⟶ 6×10^{-5} μCi/cm^2

- FLOOR SWIPES* TAKEN BY TLD TREE

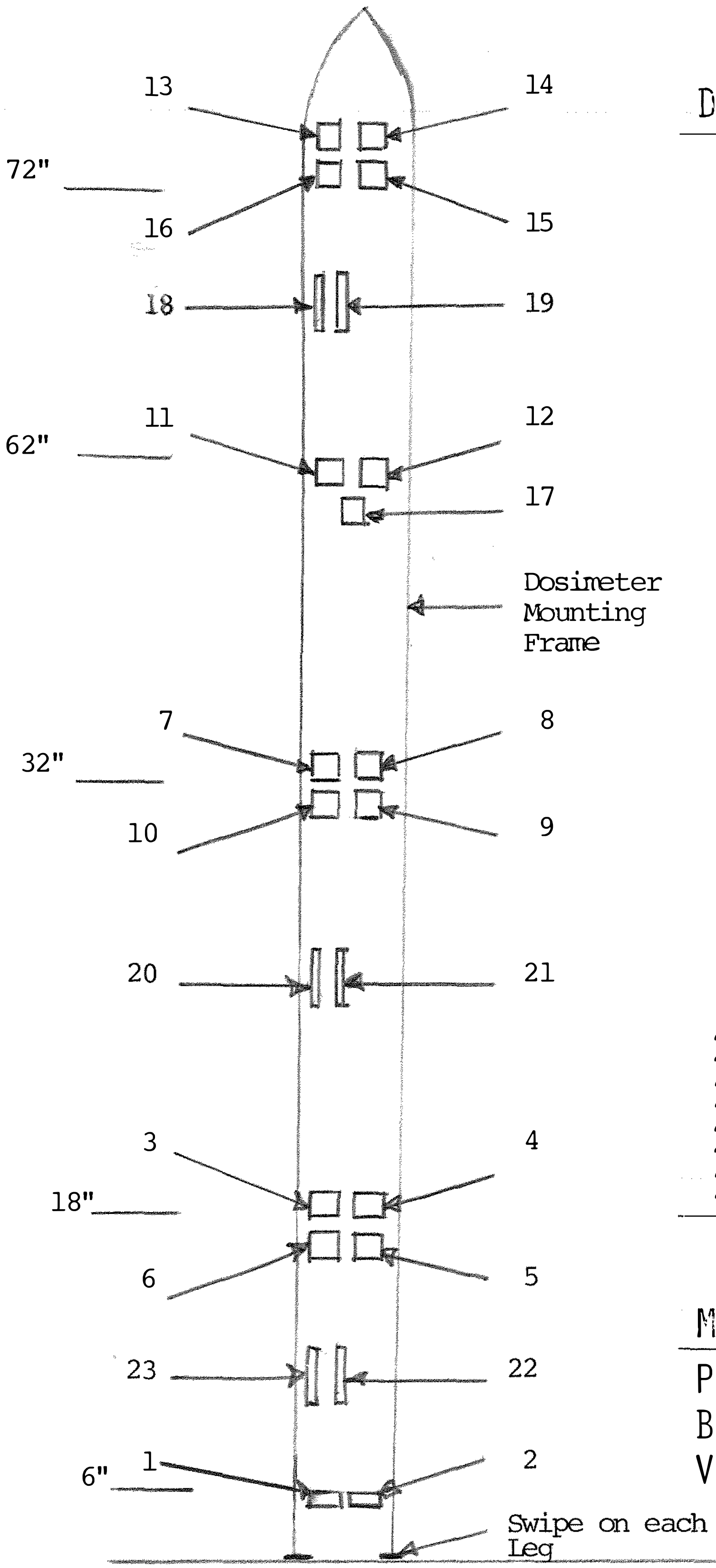
Cs-137	1.1×10^{-1} μCi/cm^2
Sr- 90	3×10^{-2} μCi/cm^2
Cs-134	1.8×10^{-2} μCi/cm^2
Sr- 89	5×10^{-3} μCi/cm^2
Nb- 95	1×10^{-3} μCi/cm^2
Co- 60	3×10^{-5} μCi/cm^2

- ACTIVITY ON R-626 STAINLESS STEEL COOKIE

Cs-137	4×10^{-2} μCi/cm^2
Cs-134	8.4×10^{-3} μCi/cm^2
Co- 60	6.1×10^{-5} μCi/cm^2

*ALL SWIPE AREAS ESTIMATED

CONFIGURATION AND RESULTS OF EXPERIMENT TO DETERMINE BETA/GAMMA DOSE RATE AND PROTECTION FACTOR FOR PROTECTIVE CLOTHING USING PENETRATION R626



RB 347'-6" Elevation

DOSIMETRY	BETA RAD/HR	GAMMA RAD/HR	SHIELD/ SEALANT
1 TLD	20.35	.922	NONE/POLLY
2 FILM	21.15	.510	NONE/POLLY
3 FILM	.339	.351	B G/POLLY
4 TLD	24.89	.727	NONE/POLLY
5 FILM	33.49	.945	NONE/POLLY
6 TLD	34.16	.725	NONE/POLLY
7 TLD	0.00	.849	B G/NONE
8 TLD	43.45	.891	NONE/NONE
9 TLD	27.35	.765	NONE/POLLY
10 TLD	37.07	.870	NONE/RTV
11 FILM	30.78	.555	NONE/POLLY
12 TLD	30.81	.737	NONE/POLLY
13 TLD	0.0	.869	B G/RTV
14 TLD	43.69	.848	NONE/RTV
15 TLD	0.0	.906	B G/RTV
16 TLD	33.19	.905	NONE/RTV
17 TLD	0.0	.612	VIKING/NONE
18 PD	--	.399	NONE/POLLY
19 PD	--	.441	NONE/POLLY
20 PD	--	.525	NONE/POLLY
21 PD	--	.420	NONE/POLLY
22 PD	--	.420	NONE/POLLY
23 PD	--	.378	NONE/POLLY

BETA ATTENUATION

MATERIAL	AVE UNSHIELDED (RAD/HR)	AVE SHIELDED (RAD/HR)	%
POLLY BAG	39.35	29.3	25.[illegible]
BETA GUARD	39.35	0.00	100
VIKING	39.35	0.00	100

PENTETRATION R-626 DIRECT RADIATION MEASUREMENTS

- o GAMMA READINGS
  - TELETECTOR: GAMMA DOSE RATE = 300 mR/HR
  - EBERLINE RMS-2: GAMMA DOSE RATE = 350 mR/HR
  - SELF-READING DOSIMETER: GAMMA DOSE RATE = 375-525 mR/HR
  - FILM BADGE: GAMMA DOSE RATE = 350-950 mR/HR
  - TLD: GAMMA DOSE RATE = 600-900 mR/HR
- o BETA READINGS
  - FILM BADGE: BETA READINGS = 21-33 RADS/HR
  - TLD: BETA READINGS = 20-44 RADS/HR
- o UNSHIELDED BETA DOSE CALCULATIONS
  - BASED ON TLD/FILM BADGE READINGS = 77-217 RADS/HR
  - BATTELLE METHOD = 168 RADS/HR*
  - NCRP-44 METHOD = 215 RADS/HR*
  - NRC. REG. GUIDE METHOD = 290 RADS/HR*

*ASSUMES 1.05 μCI/ML KRYPTON-85

RB AIR SAMPLE RESULTS

- Oxygen ≈ 14-16%
- Nitrogen ≈ 83-85%
- Hydrogen ≈ 0.5-1%
- Krypton 85 ≈ 0.8-104 μCi/ml
- Particulate ≈ 1×10^{-9} μCi/ml

HYDROGEN RECOMBINER SPOOL PIECE

ACTIVITY FOUND ON SPOOL PIECTION SECTIONS[A]

ISOTOPE	TOTAL CI	CI/CM^2
	SECTION 1B (90 CM^2)	
^{95}NB	0.023	2.5×10^{-4}
^{134}CS	5.5	0.060
^{137}CS	27.5	0.30
	SECTION 2B (90 CM^2)	
^{95}NB	0.011	1.2×10^{-4}
^{134}CS	4.1	0.047
^{137}CS	21.	0.24
	SECTION 3B (130 CM^2)	
^{95}NB	0.026	2.0×10^{-4}
^{134}CS	6.50	0.050
^{137}CS	32.	0.25

[A]UNCERTAINTIES ARE 6% FOR $^{134,\ 137}CS$ VALUES AND 20% FOR ^{95}NB

NO. 2 PERSONNEL AIR LOCK GE/LI SCAN

OTHER PENETRATION 626 EXPERIMENTS

DIFFUSION RATES OF KR-85

THRU SUITS	-	30% CONENTRATION/HR
THRU MASK	-	0% CONCENTRATION/HR

EFFECTS OF KR-85 ON INSTRUMENTS

BETA/GAMMA	-	UNITS MUST SEAL OUT KR-85
GAMMA	-	NO MODIFICATIONS

TELEMETERED DOSIMETRY - NO EFFECT

TLD'S

BUILDING ATMOSPHERE SAMPLES

KR-85	-	1.04%
O_2	-	12.8%
H_2	-	1.%
H_2S	-	N.D.
O_3	-	N.D.
CO	-	N.D.
CO_2	-	N.D.

EQUIPMENT

EQUIPMENT

- o CLOTHING
  - Long Underwear
    - Personal Comfort
  - Viking Dry Suit
    - Air/Water Tight
    - Positive Pressure
    - Beta Attenuation - 250 mg/cm^2
  - Rain Gear
    - Moisture Shield
    - Prevent Direct Contamination
  - Multiple Gloves
    - Beta Protection
  - Boots
    - Anti Skid
    - Beta Protection

- LIGHTING EQUIPMENT
  - Airlock Beacon Light
    - 120 Min. Life
    - Dual Filament
      - Spot or Flood
    - 100 Watt Aircraft Landing Light
  - Head Mounted Miners Lamp
    - 60 Min. Life
    - Light Weight
    - 2 - Each (1 Primary, 1 Backup)

- RESPIRATORY EQUIPMENT
  - Primary -

Bio-Pac 60, Bio Marine or	MSA 401 (Alternate)
Light Weight (24 lbs)	Light Weight (25 lbs)
60 Min. Supply	30 Min. Supply
CO_2 Scrubber	Air Supply
O_2 Supplement	Once Trhough

  - Backup
    - Pilot O_2 Bottle
      - 7-12 Min. Supply O_2
      - Supplement Atmosphere

- o COMMUNICATIONS
  - Mobile Units
    - Walkie Talkie 5 Watts
    - 2 Channel (Preselect Entry Channel)
    - 2 Frequency/Channel
      - (1) Send
      - (1) Receive
    - Push to Talk Body Switch
    - Cranial Transmitter
    - Ear Receiver
  - Base Station
    - 75 Watt Transmitter/Repeater
    - Redundant Console/Repeater
    - Transmission Control
      - Containment
      - Ante Room
  - Antenna
    - In Containment
    - In Ante Room/Airlock

- o DOSIMETRY
    - (2) Self Reading Digital Dosimeter
    - Telemetered Dosimetry
        - (1) Unit
            - Antenna in Containment
    - TLD's/Film Badges
        - Multiple Locations
        - Extremities
- o INSTRUMENTATION
    - Teletector
        - Gamma Probe
        - Modified Chamber
    - RO-7
        - Beta/Gamma
        - Modified Chamber
    - Radector - 3
        - Beta/Gamma
        - Pressurized Ionization Chamber
        - Backup Beta Instrument

- SMALL TOOLS
  - Inside Containment
- CAMERA
  - Visual Record
  - 35 MM
  - Underwater

WEIGHTS OF EQUIPMENT
UTILIZED FOR TMI-2
INITIAL REACTOR BUILDING ENTRY
BY TEAM MEMBERS

	ENTRY TEAM		BACKUP TEAM	
EQUIPMENT	A-Behrle	B-Benson	C-Grice	D-Adams
Respirator	24 lbs.	24 lbs.	24 lbs.	24 lbs.
Backup Respirator	8 lbs.	8 lbs.	8 lbs.	8 lbs.
Protective Clothing (Dry Suit)*	17 bls.	17 lbs.	17 lbs.	17 lbs.
Lamp and Battery	7 oz.	7 oz.	7 oz.	7 oz.
Backup Lamp & Battery	7 oz.	7 oz.	7 oz.	7 oz.
Flood Lamp & Battery**	8 lbs.	-----	8 lbs.	-----
Portable Detector	7 lbs.	-----	7 lbs.	-----
Portable Detector	-----	5 lbs. 8 oz.	-----	5 lbs. 8 oz.
Breathing Zone Air Sampler	3 lbs.	3 lbs.	3 lbs.	3 lbs.
Communications	5 lbs. 5 oz.	5 lbs. 5 oz.	5 lbs. 5 oz.	5 lbs. 5 oz.
Telemetered Dosimetry (3 Units)	1 bl. 14 oz.	1 lb. 14 oz.	1 lb. 14 oz.	1 lb. 14 oz.
Camera	-----	4 lbs.	-----	-----
Misc.***	5 lbs.	5 lbs.	5 lbs.	5 lbs.
TOTAL	80 lbs. 1 oz.	74 lbs. 9 oz.	80 lbs. 1 oz.	70 lbs. 9 oz.

*Suit weight varies directly with individual build. Includes boots, gloves, raingear, long underwear.
**One flood lamp will be immediately set down as beacon light on entry by initial entry team.
***Includes multiple dosimetry.

INITIAL

ENTRY

PLAN

DATA GATHERING

- GENERAL AREA BETA GAMMA SURVEY
- SWIPES: LINER - FLOOR 305' ELEVATION, 347' ELEVATION
- HOT SPOT IDENTIFICATION
- RECONNAISSANCE ROUTE
- HEAD AREA SURVEY (FUTURE ENTRY)

RADIOLOGICAL LIMITS

1. Maximum Stay Time For Initial Entry is 20 Minutes with Bio-Pac 60, 15 Minutes MSA 401

2. Entry Team Members Will Commence Exit From Building When Any Radiation Monitoring Device Indicates That A Dose of 625 mRad To Whole Body Is Reached

3. No Radiation Field Will Be Entered Which Will Cause The Whole Body Dose To Exceed 625 mRad

4. Total Expected Dose To Entry Personnel 20 Minute Entry

Whole Body	1.01 Rad
Skin	*1.16 Rem

*Whole Body Dose Is Included

TIME	TEAM MEMBER A	TEAM MEMBER B	COMMAND CENTER CC
0 Min.	In Airlock	In Airlock	Continuously monitor activities and evaluate dose to entrants. Record data. Direct entrants.
1 Min.	Teletector Survey/Enter Transit to Red	Open Door B-γ Survey/Enter	
2 Min. 30 Sec.	Teletector Survey/Place Light (Verify Communications 3 Min.)	Close Door (Verify Communications)	
4 Min.	Survey Area Around Red 360°		
	Survey Swipe Locations	Swipe A Swipe B	
6 Min.	(Verify Communications 6 Min.) Extend Toward Location Orange and Swipe D	(Verify Communications 6 Min.) Swipe C	
	Move to Location Orange	Swipe D	
8 Min. 30 Sec.	360° Teletector at Orange (Verify Communications 9 Min.) Return to Red	360° B-γ at Orange (Verify Communications 9 Min.) Pictures a, b, c, d (180°) From Orange Return to Red Pictures e, f, g, h	
9 Min. 30 Sec.	Transit to Yellow	Transit to Yellow	
	180° Teletector (Mu Line, Covered Hatch, Stairwell) As Making Transit	Open Stairwell Door	
	Teletector Into Stairwell	B-γ at Stairwell Door	
	(Verify Communications 12 Min.)	(Verify Communications 12 Min.)	

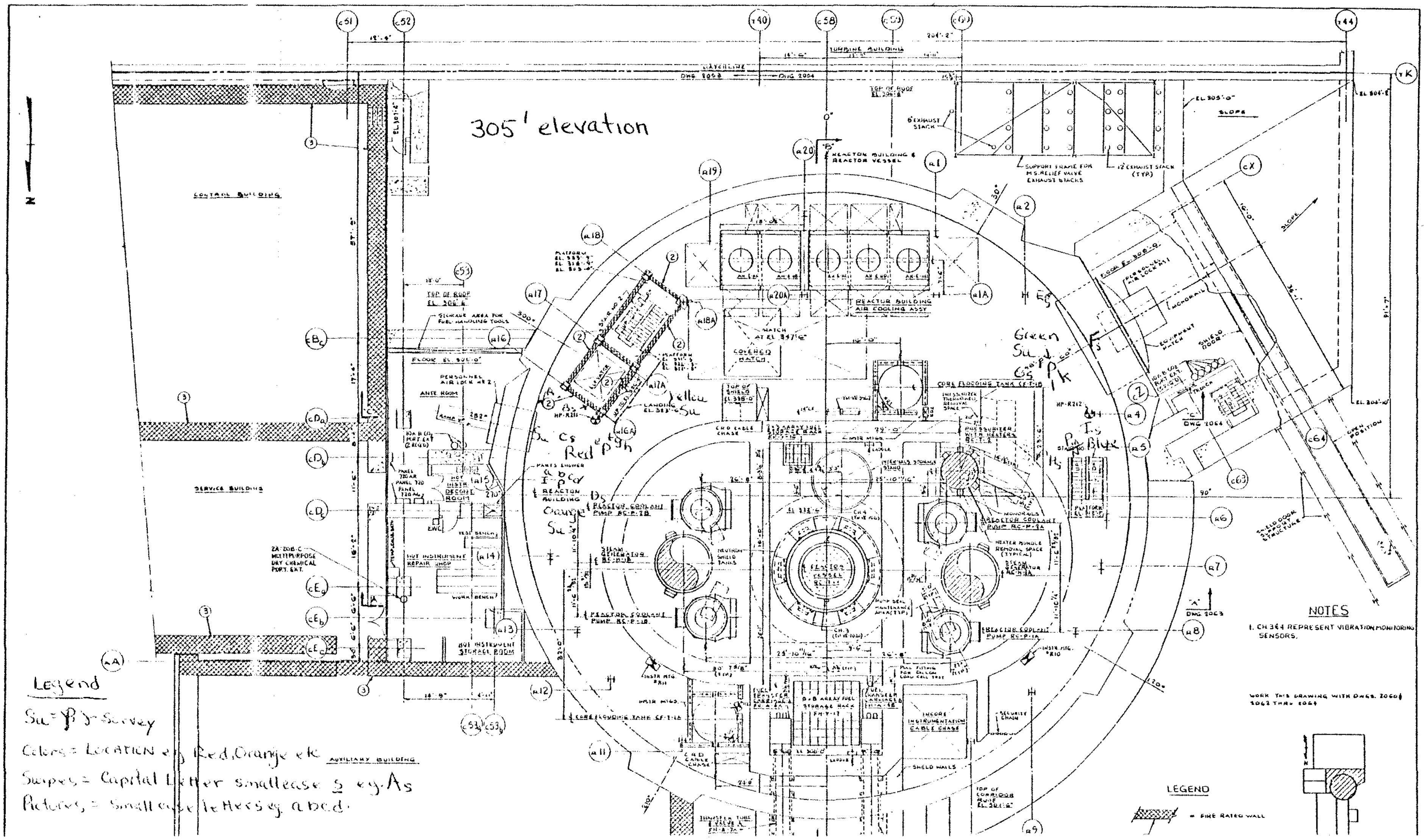
Rev. 1 - 2/27/80

Time	TEAM MEMBER A	TEAM MEMBER B	COMMAND CENTER CC
13 Min. 30 Sec.	Teletector to/and Over Covered Hatch and Air Coolers	B- γ at Covered Hatch	Evaluate Ability To Transit to Blue
USE ALTERNATE PLAN IF UNABLE TO TRANS TO BLUE			
14 Min. 15 Sec.	Transit to Blue (Verify Communications 15 Min.)	Transit to Blue (Verify Communications 15 Min.)	
16 Min. 45 Sec.	360° Survey with Teletector (Including Into Stairwell)	360° Survey Swipe E, F, G Pictures i, j, k, l Swipe H, L Pictures m, n	
18 Min.	Return to Red and Exit Building	Return to Red and Exit Building	
19 Min. 15 Sec.	Enter Airlock	Enter Airlock Pick Up Light at Red	
20 Min. 15 Sec.	Exit Airlock	Exit Airlock	
30 Min. 15 Sec.	Exit Ante Room	Exit Ante Room	

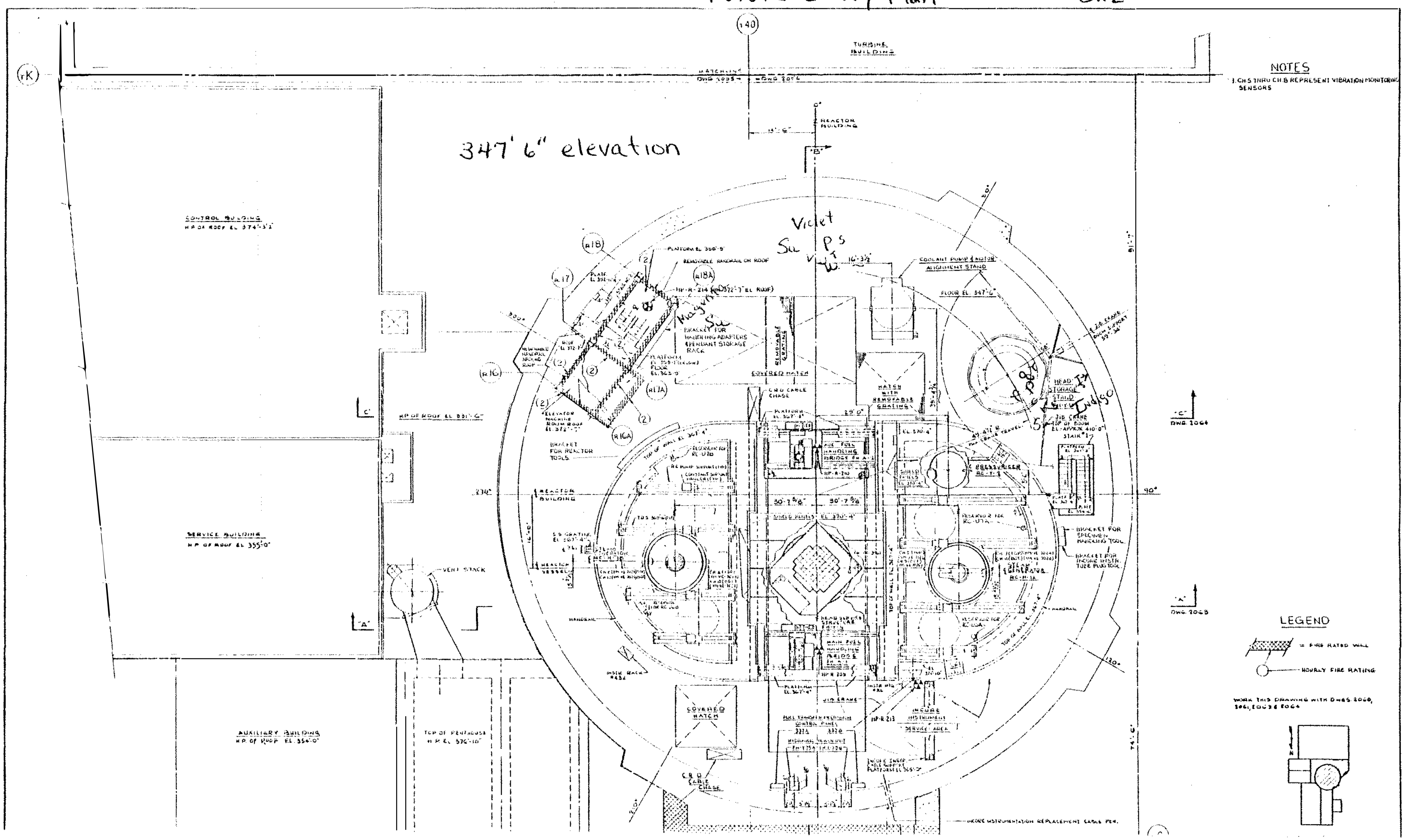
ALTERNATE PLAN - THE ALTERNATE PLAN IS TO SURVEY THE AREA NORTH OF STATION ORANGE TOWARD CORE FLOOD TANK 1A TO GET AS COMPLETE A SURVEY AS IS PERMISSABLE WITHIN THE ALLOWABLE STAY TIME AND DOSE.

INITIAL Entry PLAN

Sh 1



Future Entry Plan Sh2



DOSE ASSESSMENT

- ENTRY TEAM MEMBERS (PROTECTED)

  KR-85
  WHOLE BODY DOSE CONTRIBUTION 1000 mRad/hr

  SUMP
  WHOLE BODY DOSE CONTRIBUTION 1000 mRad/hr

  PLATE OUT 500 mRad/hr

  HOT SPOTS

  TOTAL

- SUPPORT HP's (UNPROTECTED)

  KR-85
  SKIN DOSE BETA 200 mRad/min
  WHOLE BODY DOSE GAMMA 1.68 mRad/min

- OFF-SITE DOSE

  KR-85
  SKIN DOSE BETA .93 mRad
  WHOLE BODY DOSE GAMMA .022 mRad

ENTRY TEAM DOSE ASSESSMENT
305' ELEVATION

	DIRECT GAMMA DOSE RATE (mR/HR)	BREMSSTRAHLUNG DOSE RATE (mR/HR)	DOSE RATE (mR/HR)	TIME (MINUTES)	DOSE (RADS)
KRYPTON	100	800	900	20.0	.300
PLATEOUT	150	50	200	20.0	.067
SUMP WATER	1500	---	1500	20.0	.500
HOT SPOTS			3390	2	.113
TOTAL DOSE					.980

ENTRY TEAM DOSE ASSESSMENT

AIRLOCK

	DIRECT GAMMA DOSE RATE (mR/HR)	BREMSSTRAHLUNG DOSE RATE (mR/HR)	TOTAL DOSE RATE (mR/HR)	TIME (MINUTES)	DOSE (RADS)
KRYPTON	182	759	941	1	.016
PLATEOUT					0
SUMP WATER					0
HOT SPOTS					0
TOTAL DOSE					.016

ANTE ROOM PERSONNEL DOSE ASSESSMENT

	KRYPTON* DOSE RATE (mR/HR)	TIME (MINUTES)	DOSE (RADS)
NUMBER A	101	10	.017
NUMBER B	101	10	.017
HP 1	101	10	.017
HP 2	101	10	.017
HP 3	101	10	.017
		TOTAL PERSON-REM	0.085

*BASED ON 23.8 CURIES IN ANTE ROOM WHICH GIVE MAXIMUM KRYPTON CONCENTRATION OF 5.89×10^{-2} μCI/ML.

ENTRY TEAM TOTAL DOSE

		DOSE (RADS)
305' ELEVATION		.980
AIRLOCK		.016
ANTEROOM		.017
	TOTAL	1.013

WHOLE BODY DOSE RATES*

	WITHOUT PURGE OF RB	WITH PURGE OF RB
o 305' ELEVATION		
- KRYPTON	.900	---
- PLATEOUT	.2	.2
- SUMP WATER	1.500	1.5
	2.6 RAD/HR	1.7 RAD/HR
o 347' ELEVATION		
- KRYPTON	1.2	---
- PLATEOUT	.4	.4
	1.6 RAD/HR	.4 RAD/HR
o STAIR NUMBERS 1 AND 2		
- KRYPTON	1.15	---
- PLATEOUT	.2	.2
- SUMP WATER	9.0	9.0
	10.35 RAD/HR	9.2 RAD/HR
o AIRLOCK (DURING EXIT)		
- KRYPTON	0.941 RAD/HR	0 RAD/HR
o ANTE ROOM (DURING EXIT)		
- KRYPTON	0.101 RAD/HR	0 RAD/HR

*GENERAL AREA ONLY; DOES NOT INCLUDE HOT SPOTS

BETA SKIN DOSE RATES*

	WITHOUT PURGE OF RB	WITH PURGE OF RB
o 305' ELEVATION		
- KRYPTON	9.0	0
- PLATEOUT	1.0	1.0
	10.0 RAD/HR	1.0 RAD/HR
o 347' ELEVATION		
- KRYPTON	9.0	0
- PLATEOUT	1.5	1.5
	10.5 RAD/HR	1.5 RAD/HR
o STAIR NUMBERS 1 AND 2		
- KRYPTON	9.0	0
- PLATEOUT	1.0	1.0
	10.0 RAD/HR	1.0 RAD/HR

*GENERAL AREA ONLY; DOES NOT INCLUDE HOT SPOTS

305' ELEVATION*
DOSE RATE SUMMARY
RADS/HR

SOURCE	DIRECT GAMMA	X-RAY (BREMS)	TOTAL WHOLE BODY	TOTAL SKIN (BETA)
KRYPTON 85	.1	.8	.9	9.0
PLATEOUT	.15	.05	.2	1.0
SUMP	1.5	---	1.5	---
TOTAL WITHOUT PURGE	1.75	.85	2.6	10.0
TOTAL WITH PURGE	1.65	.05	1.7	1.0

347' 6" ELEVATION
DOSE RATE SUMMARY
RADS/HR

SOURCE	DIRECT GAMMA	X-RAY (BREMS)	TOTAL WHOLE BODY	TOTAL SKIN (BETA)
KRYPTON 85	.3	.9	1.2	9.0
PLATEOUT	.3	.1	.4	1.5
SUMP	---	---	---	---
TOTAL WITHOUT PURGE	.6	1.0	1.6	10.5
TOTAL WITH PURGE	.3	.1	.4	1.5

*GENERAL AREA ONLY; DOES NOT INCLUDE HOT SPOTS

OFF-SITE EXPOSURE

- o 23.8 CURIES KRYPTON RELEASE POSSIBLE
- o RELEASE TAKES PLACE OVER 155 MINUTES
- o MAXIMUM KRYPTON RELEASE RATE OF 22241 μCi/sc
- o MAXIMUM SKIN DOSE* = 0.014 MRADS
- o MAXIMUM WHOLE BODY DOSE* = 0.00032 MRADS

*REG. GUIDE 1.24

CONCLUSION

- REACTOR BUILDING ENTRY CAN BE ACCOMPLISHED WITHOUT REACTOR BUILDING PURGE.

- MEANINGFUL DATA CAN BE ACQUIRED WITH TOTAL DOSE TO ENTRY TEAM PERSONNEL OF LESS THAN 3.0 RAD WHOLE BODY AND 7.5 RAD SKIN DOSE.

MEDICAL PROGRAM

- PHYSIOLOGICAL EXAM
- PSYCHOLOGICAL EXAM
- FITNESS EVALUATION

PERFORMED BY HERSHEY MEDICAL CENTER

TRAINING PROGRAM

1 CANDIDATE KNOWLEDGE EVALUATION

2 RADIATION EFFECTS/RISK/LIMITS

3 RADIATION INTERACTION WITH MATTER AND DETECTION THEORY

4 THEORY AND USE OF RADIATION DOSIMETRY AND BIOASSY

5 TASK PLAN - WORK DEFINITION

5A GENERAL SCOPE OF PLAN/TOUR UNIT I

(1) GENERAL OBJECTIVES OF ENTRY

(2) REACTOR BUILDING MODEL FAMILIARIZATION

(3) UNIT I CONTAINMENT FAMILIARIZATION TOUR

(4) DEBRIEF WITH MODEL

5B RADIATION DATA

(1) EXPECTED RADIATION SOURCES DEFINED ON A MAP RELATED TO ENTRY ROUTE

(2) ANTICIPATED NUCLIDES

(3) ANTICIPATED BIOLOGICAL EFFECTS FROM THE NUCLIDES

(4) ANTICIPATED TYPES OF RADIATION HAZARD

(A) POINT

(B) LINE

(C) SUBMERGED

(5) REVIEW OF TV TAPES FROM 626 PENETRATION

5C CASUALTY CONSIDERATION

(1) BASIC CASUALTY CONSIDERATION

(A) COMMUNICATION

(B) LIGHTING

(C) PROTECTIVE CLOTHING

(D) INSTALLED CONTAINMENT EQUIPMENT

(E) RADIOLOGICAL

(2) RESPONSE TO CASUALTIES LISTED ABOVE

6 PHYSIOLOGICAL CONSIDERATION (HERSHEY MEDICAL CENTER)

7 USE OF RADIATION ISNTRUMENTATION (HANDS ON TRAINING)

8 TASK PROCEDURE REVIEW WORKSHOP

9 BREATHING APPARATUS FAMILIARIZATION

OTHER EQUIPMENT FAMILIARIZATION

HANDS ON EQUIPMENT FAMILIARIZATION

REVIEW/CRITIQUE

10 AUXILIARY BUILDING TOUR/BRIEFING (USE CURRENTLY EXISTING PROTECTIVE CLOTHING, STRESS ALARA CONSIDERATIONS IN A RADIOLOGICAL ENVIRONMENT)

11 PROTECTIVE CLOTHING/COMMUNICATION (COMMUNICATION EQUIPMENT AND BREATHING APPARATUS MUST BE AVAILABLE)

12 (1) TASK WALK THROUGH - NO EQUIPMENT

(2) TASK WALK THROUGH CRITIQUE

13 (1) TASK WALK THROUGH NO LIGHTS WITH COMMUNICATION EQUIPMENT

(2) TASK WALK THROUGH CRITIQUE

14 PHYSIOLOGICAL BRIEFING

15 CASUALTY REVIEW WALK THROUGH

16 TIME-MOTION TASK DISCIPLINE CLASSROOM EXERCISE

17 TASK WALK THROUGH REAL TIME - UNIT I, NO LIGHTS WITH COMMUNICATOR AND SKELETON COMMAND POST

CRITIQUE WALK THROUGH

TASK WALK THROUGH REAL TIME - UNIT I, NO LIGHTS, WITH COMMUNICATION AND SKELETON COMMAND POST

18 CASUALTY DRILLS REAL TIME - DARK WITH COMMUNICATION AND SKELETON COMMAND POST

CRITIQUE

CASUALTY DRILLS REAL TIME - DARK WITH COMMUNICATION AND SKELETON COMMAND POST

19 RADIATION DATA UPDATE REVIEW 626 PENETRATION TV TAPES

20 SUIT/COMMUNICATION FAMILIARIZATION CLASSROOM DRESS/ UNDRESS CASUALTIES

21 READINESS EVALUATION CRITIQUE - REFRESHER PLANNING

22 FINAL REHEARSAL REAL TIME - DARK COMMUNICATION

23 OPERATIONAL TURNOVER

24 INITIAL ENTRY DEBRIEF

MANAGEMENT BRIEFING

M1 COMMAND/SUPPORT FAMILIARIZATION

M2 COMMAND/SUPPORT PROCEDURES REVIEW

M3 COMMAND/SUPPORT WALK THROUGH EXERCISE

THREE MILE ISLAND

UNIT 2

REACTOR BUILDING

ENTRY PROGRAM

ATTACHMENTS

FEBRUARY 20, 1980

FEASIBILITY OF ENTRY INTO REACTOR BUILDING WITH/WITHOUT BUILDING PURGE THREE MILE ISLAND UNIT 2

Purpose: It is the intent of this document to identify the technical and practical feasibility of entering the Three Mile Island Unit 2 Reactor Building for Technical Data Acquisition. Entry may be made with or without the Reactor Building atmosphere being purged of the Krypton 85.

Discussion: Having established a technical need to enter the Three Mile Island Unit 2 Reactor Building as soon as reasonably possible, it becomes necessary to determine the feasibility of entering the building with or without the building being purged of the Krypton 85. In order to properly evaluate the environment inside the Three Mile Island Unit 2 Reactor Building, a series of experiments were performed. These experiments are: 1) equipment hatch radiation measurements to determine the isotopic distribution of plateout activity on the 305 elevation; 2) containment sump water activity from gross gamma measurements through penetration R-605; 3) measurements of radiological conditions inside personnel airlock No. 2 to determine leakage of radioactive gases through the airlock door seals; 4) deposition and plateout activity at the 347' 6" elevation estimated from the gamma measurements in penetration R-626; 5) analytical estimate of Cesium 137 concentration in sump water based on measurements through penetration R-605; 6) analysis of Reactor Building sump water sample; 7) analysis of plateout activity on hydrogen recombiner spoolpiece; 8) analysis of plateout on penetration R-626 cut out; 9) No. 2 personnel airlock inner door radiation measurements; 10) periodic sampling of atmosphere inside Unit 2 Reactor Building.

The results of the above experiments, although all are not completed to date, are conclusive and have provided a solid baseline for evaluating the environment inside the Unit 2 Reactor Building. This baseline information provides the basis for calculating general area and hot spot activity inside the Reactor Building and allows for a determination of dose to personnel entering the Reactor Building.

In addition to the above experiments, additional experiments have been performed to determine the shielding capability of the proposed suit material to be worn by the Reactor Building entry team members. The completion of the above experiments has enabled us to determine the environment inside the Reactor Building and has aided us in the selection of protective clothing and equipment to support entry into the building with or without the building being purged.

Conclusion: The Three Mile Island Unit 2 Reactor Building can and should be entered as soon as possible. The entry can be accomplished by two or three people for a period of 10 to 30 minutes without exceeding the quarterly allowable dose rate of 3 rem per quarter. In order to accomplish this and provide adequate safety factors in the initial entry into the Reactor Building, an administrative exposure limit of 1.5 rem or maximum stay time of 30 minutes has been established.

TECHNICAL INCENTIVES FOR EARLY
REACTOR BUILDING ENTRY
THREE MILE ISLAND
UNIT 2

Purpose: It is the intent of this document to identify the technical incentives and demonstrate the need for entering the Three Mile Island Unit 2 Reactor Building as early as possible for the purpose of technical data acquisition and determination of the capability for additional entries into the Reactor Building.

Discussion: It is necessary that technical data be acquired from inside the Three Mile Island Unit 2 Reactor Building as soon as reasonably possible for the purpose of planning the decontamination of the Three Mile Island Unit 2 Reactor Building. To properly plan the decontamination of the Reactor Building, radiological surveys, including isotopic analysis and radiological mapping to identify hot spots, are required. In addition, a determination of the need for a remote decontamination system for general area and hot spot decontamination is required. In order to accomplish the above tasks, a radiological assessment of the status of the various areas of the building is required. The information gathered by a manned entry into the Reactor Building will be invaluable in providing the necessary technical information to the engineering personnel for properly evaluating the alternative methods for decontamination and recovery. Early knowledge of this information will provide the engineering personnel with the information in a timely fashion to support the cleanup and can result in significant cost and schedule savings. Presently there is no available data from direct measurements on the radiological environment at the 305 elevation in the Reactor Building. There is no radiation map of the interior of the Reactor Building other than theoretical extrapolations based on minimal information; information that is insufficient to provide a firm determination of the radiological environment inside the Reactor Building.

An assessment of the status of the integrity of the Reactor Building, the nuclear steam supply system (NSSS) and other equipment inside the Reactor Building is required. This assessment will provide a firm determination of the condition of the various systems and equipment inside the Reactor Building and will aid in assuring that the available technical resources are applied in the areas of the greatest technical need.

An assessment of the functional capability of the various plant components vital in maintaining the integrity of the Reactor Building and reactor systems is necessary, since the possibility of the failure or malfunction of equipment increases as time passes without preventive maintenance.

A determination of the ability or inability of personnel to make future entries into the Reactor Building to correct potential plant casualty conditions and gather additional technical data to support the planning for decontamination and assessment of damage is required. The possibility of failure of the Reactor Building fans which are presently operating in an environment beyond their design criteria exists. Additionally, the possibility of an unsafe core geometry exists.

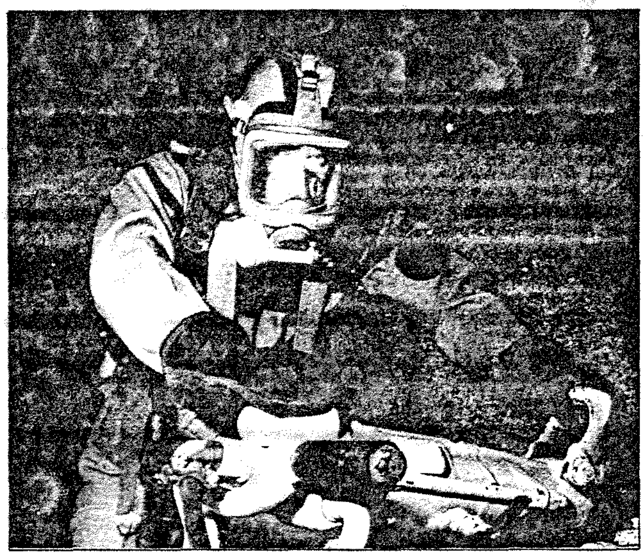
If entry into the building is possible without purge, then the ability to perform emergency maintenance or construction, such as a repair or blanking off of a leaking penetration or seal inside containment, may exist. In order to accomplish this or any other similar task, proof of our ability to enter the building is necessary. The ability to enter the Reactor Building now to perform emergency tasks may tend to lessen the urgency to perform the purge of the Reactor Building, but this should not be the case. The unknown core configuration poses a small but incalculable risk which should be dealt with in a timely manner. The relatively calm and routine atmosphere in plant operation has given Metropolitan Edison and the Nuclear Regulatory Commission a false sense of security. This feeling is not justified. While discussion of the potential environmental impact of the purge of the Kr-85 gas from the building goes on, a far greater risk of uncontrolled releases due to loss of RCS integrity, loss of core cooling and loss of RB integrity, which would be even more dangerous, may exist. Continued operation of the unit in the present status without purge inhibits decontamination and planning even though limited entry may be possible.

Conclusion: The Three Mile Island Unit 2 Reactor Building should be entered as soon as it is determined to be technically feasible and safe. Any delay in entry into the Unit 2 Reactor Building will result in the inefficient use of technical manpower, will increase the cost of the Unit 2 recovery and will lengthen the schedule for recovering the unit due to the lack of sufficient technical information required to properly plan and execute the recovery operation. Any delays in entering the TMI-2 Reactor Building will also result in delays in our ability to cope with any plant or equipment casualty inside the TMI-2 Reactor Building. To perform the desired tasks, the mobility and thought process possessed by man are required. The time frame and work scope does not allow the work to be performed from a remote location. Entry into the Reactor Building by man will determine the ability of the company to cope with working in the present environment. If it is determined that work cannot be performed in the existing environment, it becomes even more apparent that the purge must be performed quickly to ensure that the primary plant is in as safe a condition as is achievable. Establishing the ability to work in the Kr-85 environment may be useful in combating possible casualties in the Reactor Building. It is vital that we have the ability to enter the Reactor Building as soon as possible in order to ensure the safety, health and well being of the public and plant personnel and to restore the unit to its safest possible condition.

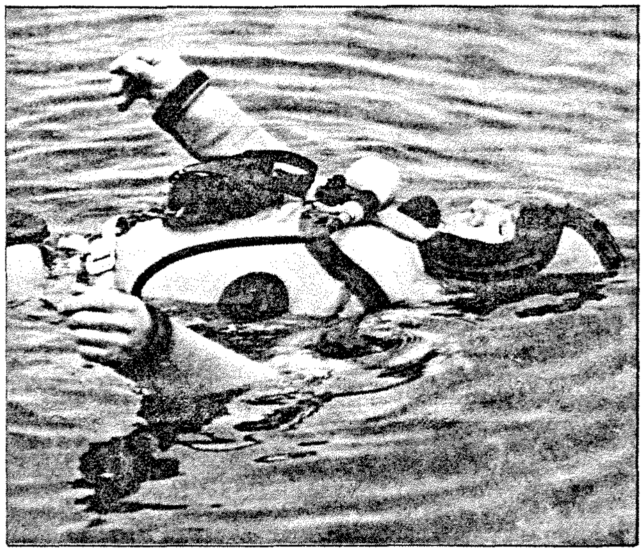
VIKING VARIABLE VOLUME HOOD ZIP

The most advanced suit on the market. Close the back entry zip and you are in a supple, manoevreable suit which keeps you warm and dry. The automatic outlet valve on your left arm provides perfect buoyancy control and prevents uncontrolled ascent. The suit is built with hood attached and is vulcanized "seamless" to one-piece. The suit has a double hood. The inner hood provides a neck seal at the same time as it enables full air insulation over the head due to an overpressure air layer between inner and outer hood. The outlet valve is adjustable for an internal suit pressure from 1-10 inches water column. (2.5-25 cm water column). By maximum overpressure the suit gives approx. 60 lbs (30 kg) extra lifting capacity, good buoyancy aid on the surface and extra safety during emergency ascent. The inlet valve is connected by a low pressure hose from an air or gas supply by a quick disconnect. The suit is easy to dress and undress and simple in use. Press the inlet button and you will be wrapped in a cosy layer of insulating gas. Adjust the outlet valve to the required internal pressure and you are in perfect balance during ascent. Viking Variable Volume Hood Zip gives excellent insulation, extra lifting capacity, keeps you in correct balance and the orange safety colour is easily seen.

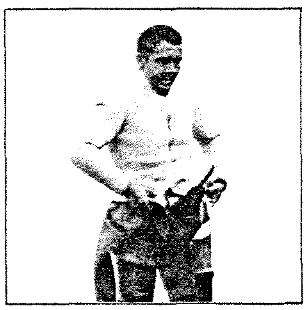
VIKING VARIABLE VOLUME HOOD ZIP



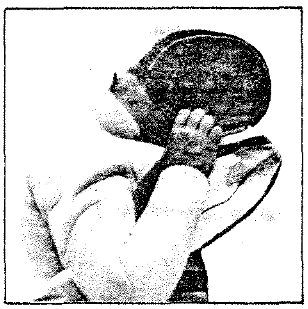
Viking Variable Volume Hood Zip is an all-round suit.



Extra buoyancy on the surface, a large lifting capacity under water when the outlet valve is adjusted to maximum internal pressure.



Easy dressing. Pull the suit up to just above the waist and turn the outer hood inside out.



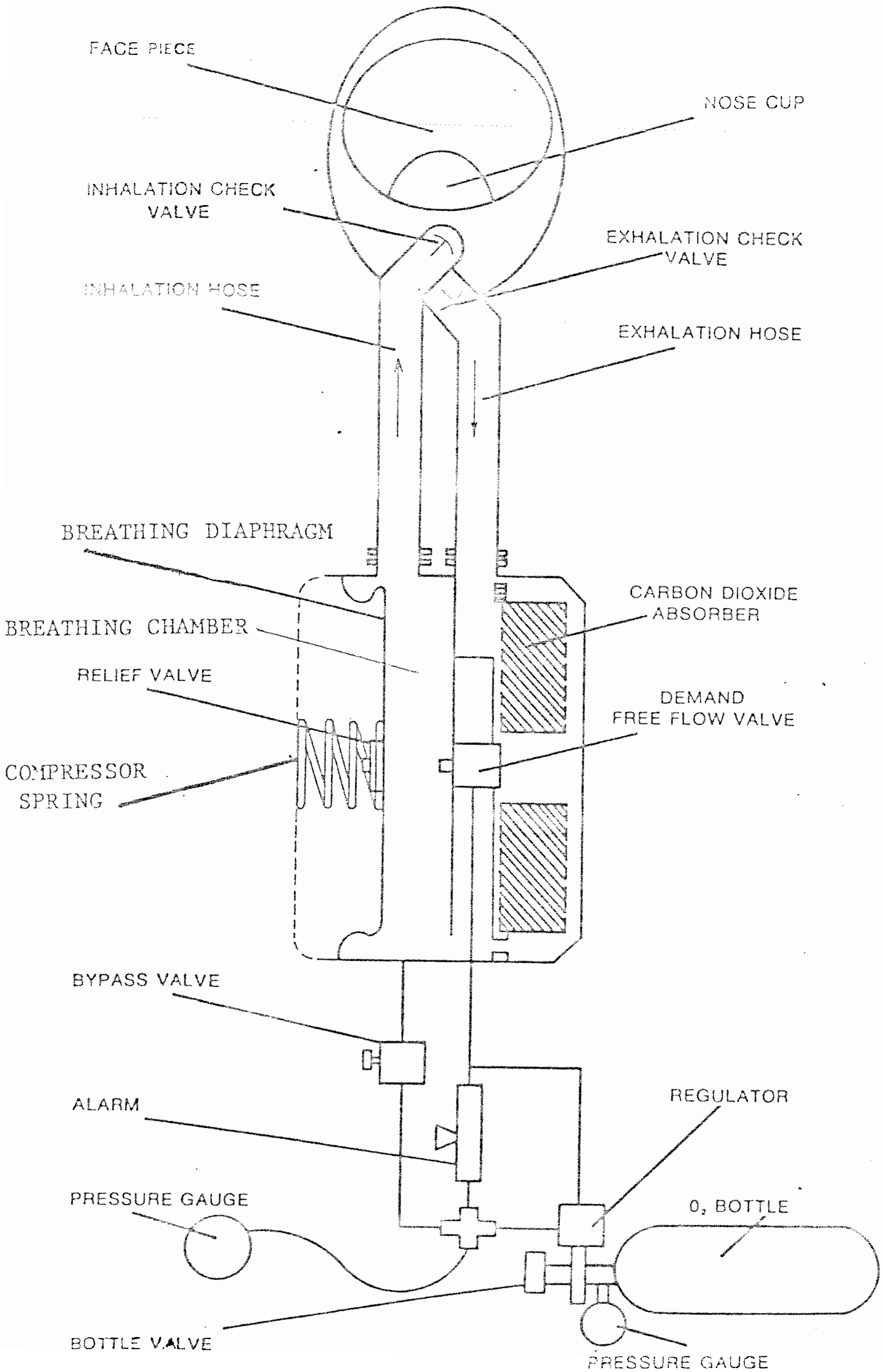
Pull the inner hood over your head and adjust the neck-seal firmly.

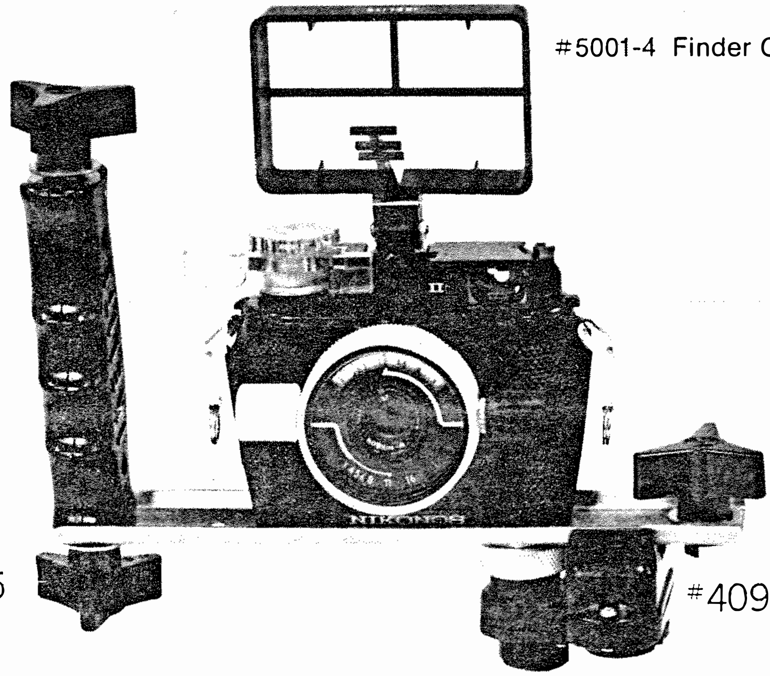
Put in both arms.

Pull the outer hood back over the head, push the rest of your arms through, and then fasten the zip.

VIKING U.S.A.
112 West Main Street
BAYSHORE, NEW YORK 11706

BIO PAC 60

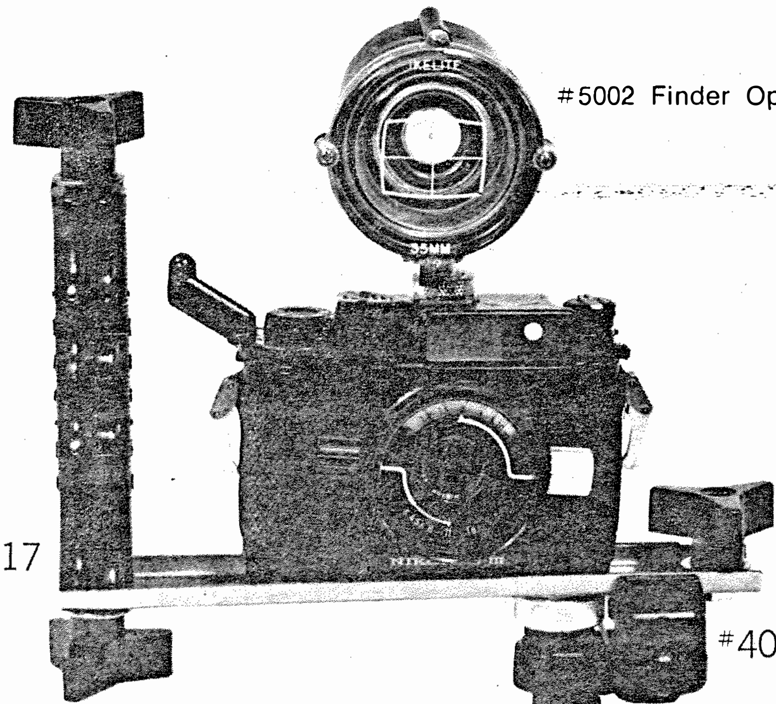

FACE PIECE
NOSE CUP
INHALATION CHECK VALVE
EXHALATION CHECK VALVE
INHALATION HOSE
EXHALATION HOSE
BREATHING DIAPHRAGM
CARBON DIOXIDE ABSORBER
BREATHING CHAMBER
RELIEF VALVE
DEMAND FREE FLOW VALVE
COMPRESSOR SPRING
BYPASS VALVE
REGULATOR
ALARM
PRESSURE GAUGE
O_2 BOTTLE
BOTTLE VALVE
PRESSURE GAUGE



#5001-4 Finder Optional

#4015

#4096



#5002 Finder Optional

#4017

#4097

Power Packs

IKELITE NIKONOS POWER PACK

#4096 for Nikonos 1 & 2 . . . $29.95
#4097 for Nikonos 3 . . . . $29.95

The IKELITE Nikonos Power Pack is a part of the IKELITE Solid State Triggering (SST) system. The Power Pack incorporates a selector switch for X and M synch plus a 22½ volt battery (battery not included). In the X synch it is used to fire IKELITE strobes, (strobes in the IKELITE electronic flash housings with the SST system) or in the M synch it fires the #4023 bulb flash, #4033 cube flash or the #4035 Hand flash. The Power Pack is required to connect the #4101 ICS Plug of IKELITE flash units to the Nikonos camera. Either a #4014 short tray or #4015 or #4017 handle unit is also required to attach an IKELITE flash unit mounting bar to the Nikonos camera.

ICS "T" CONNECTOR

#4109 . . . . $19.95

Connects to ICS Bulkhead on camera housings or our Nikonos Power Packs and provides 2 outlets for dual flash use.

DUAL NIKONOS BAR

#4013 . . . . $2.95

A short bar for attaching two Nikonos Handle Units together, or it can attach the #4014 short tray to one of the Nikonos Handle Units or an SLR Case.

NIKONOS SHORT TRAY

#4014 . . . . $9.95

Required to attach Ikelite electronic flash housings and flash units to the Nikonos camera if a handle unit is not used. Stainless steel construction.

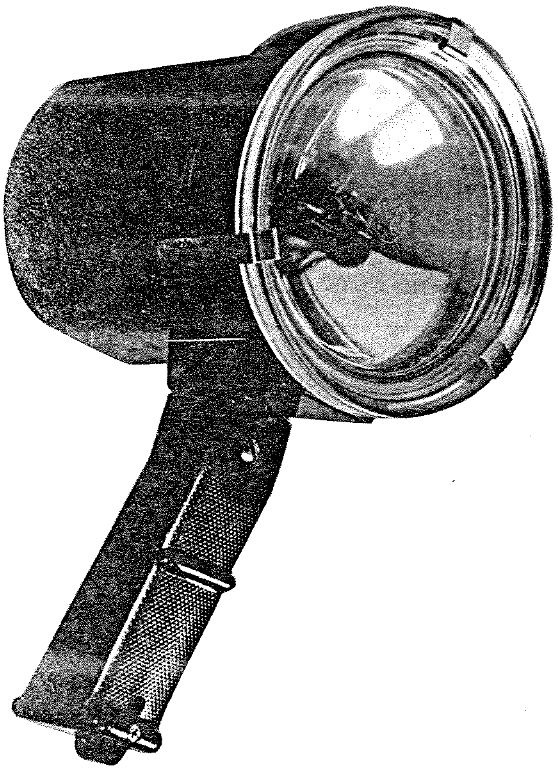
Nikonos Accessories

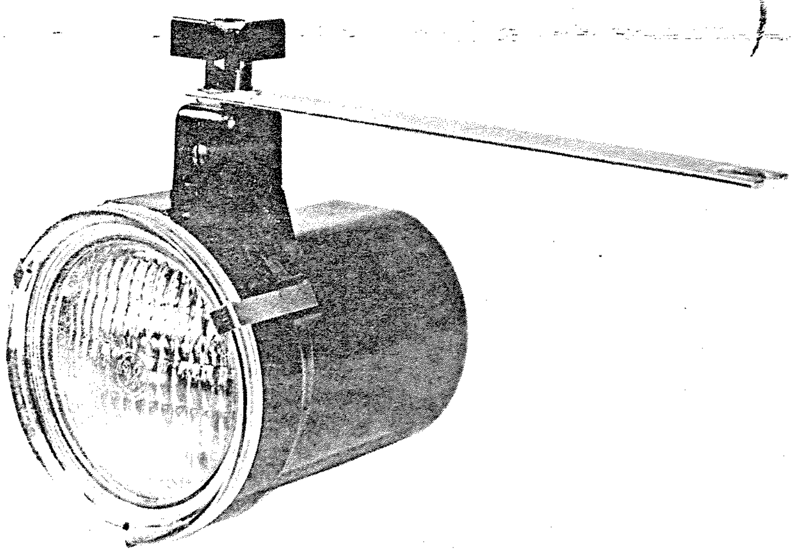
Handle Units

NIKONOS HANDLE UNITS

#4015 for Nikonos 1 & 2 . . . $29.95
#4017 for Nikonos 3 . . . . $29.95

These units add versatility and convenience to the Nikonos cameras by providing a large contour handle for easy grasping. The long tray allows attaching of strobes and meters to either end. The exclusive Ikelite Thumb Release included with these units allows activating the shutter release/film advance with your thumb while holding the handle. Changing of shutter speeds remains easy. Molded of unbreakable plastic.



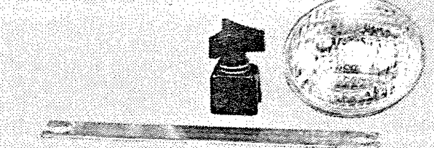


Modular Superlite

#1085 Black $159.95
#1095 Clear $159.95

Unquestionably the world's brightest diving light: plus beam spread equal to six C-LITE II lights. A dual filament bulb provides spot or flood lighting. The spot beam provides almost one hour of intensity equal to a 100 watt aircraft landing light, the flood beam provides almost two hours of lower intensity. The dual filament is an added safety against bulb failure.

Powered by rechargeable ni-cad packs engineered specifically for this light. The ni-cad packs interchange in a matter of seconds, providing easy replacement of an exhausted pack with another fully charged pack. The MODULAR SUPERLITE includes one modular ni-cad pack and 110 volt charger.



MOVIE LIGHT
CONVERSION KIT
#1086 .... $30.00

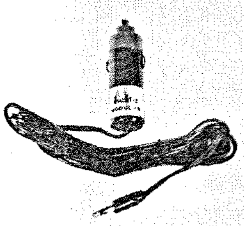
This kit converts the Super Light into a Movie Light. Includes a special 3400°K cinema sealed beam lamp, bracket, and mounting bar to attach to all Ikelite housings. The cinema lamp can only be powered by the rechargeable ni-cad pack.

Modular Movielite

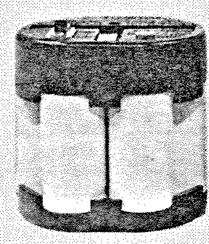
#1089 .... $174.95

The IKELITE MODULAR MOVIE LITE adds the important dimension of color to underwater movies. The light is suited for both 8mm and 16mm filming.

The modular design offers interchangeable battery modules, plus charging the modules in or out of the light body. The ni-cad battery module supplies constant voltage to the 3400° K cinema bulb for about 12 to 14 minutes of filming before recharging or changing the battery module. The light can be mounted to our movie housings or used with either modular light handle for hand holding. The addition of the #4308 bulb and either modular handle converts this light to the worlds brightest diving light, the IKELITE SUPER LITE.



OPTIONAL 12 VOLT CHARGER
#1082 .... $9.95
Plugs into any cigarette lighter receptacle.



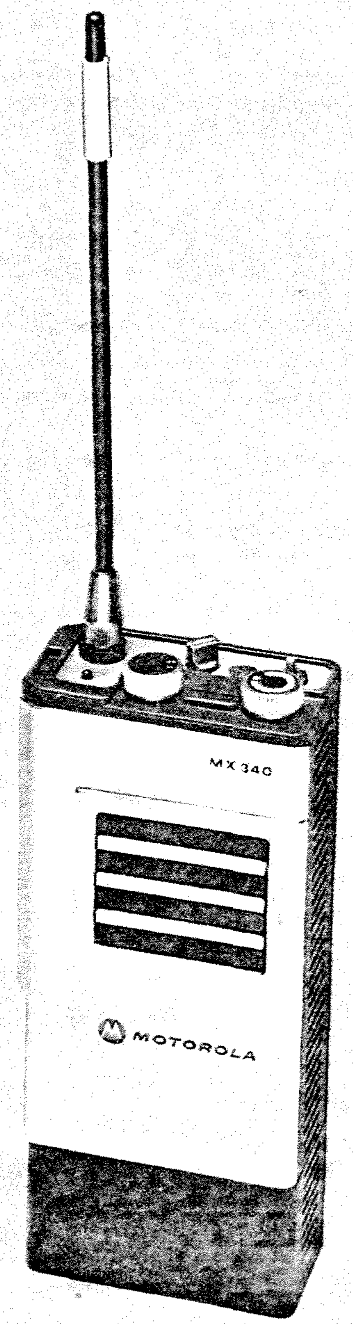
OPTIONAL NI-CAD PACKS
#1084 .... $99.95

MOTOROLA

DVP Digital Voice Protection System

MX 300 Series 2-way FM Portable Radio

136-174 MHz
403-430 MHz
440-512 MHz



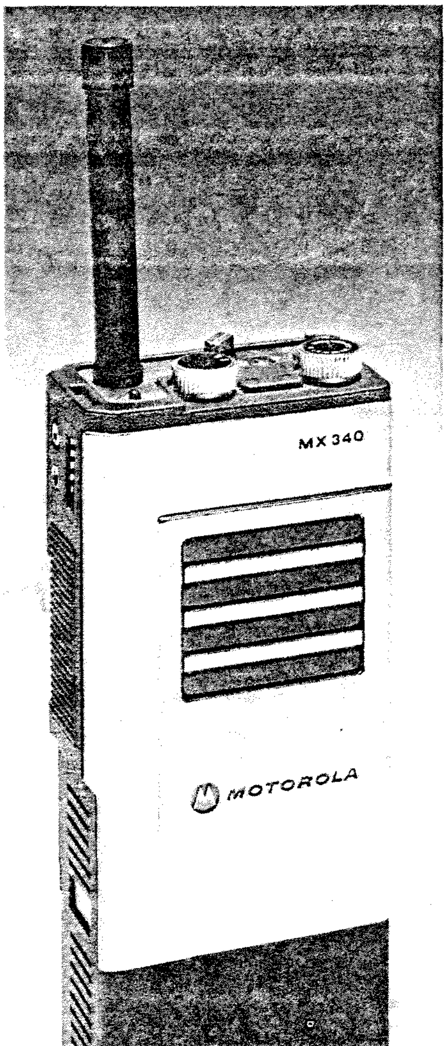
Motorola's DVP Digital Voice Protection System provides the user with the highest level of voice security commercially available today. To an unauthorized listener, a DVP radio transmission is totally unintelligible. Yet when this signal is properly decoded by a DVP receiver, clear audio comes through, providing the user with high intelligibility and excellent voice recognition.

To achieve the Digital Voice Protection System's high level security, a two step technique is utilized. First, regular speech is converted to digital speech using Continuously Variable Slope Delta Modulation (CVSD). This output is then scrambled through a highly sophisticated multi-register non-linear combiner algorithm. The resultant transmission contains no voice components and sounds like constant level random white noise.

Through the use of this digital scrambling technique, a huge number of unique and statistically unrelated codes are made available to the user— 2.36×10^{21} (2,360,000,000,000,000,000,000). Any one of these codes can be electronically loaded into the secure memory of a DVP radio using the external Code Inserter. The code information contained in the memory of each radio and the Code Inserter cannot be recalled for display and these units will not reveal the code which is in use in a system. Thus, the DVP radio system makes it possible to restrict code information to a limited number of authorized individuals.

The MX300 series Digital Voice Protection Handie-Talkie radio belongs to the most advanced portable FM radio family available today. Its modular construction and extensive use of custom hybrid circuitry reflects the latest achievements in microelectronic technology. These techniques assure the ultimate in reliability, ease of maintenance and systems flexibility.

DVP Digital Voice Protection Systems



Security Features

- Digital Voice Scrambler
- Multi-register Non-Linear Combiner Code Algorithm
- 2.36×10^{21} Orthogonal (unique) Codes
- All Codes Are User Programmable
- Random Code Key Initialization
- Self Synchronizing
- Internal Secure Electronic Code Storage
- Automatic Code Destruction With Power Loss
- Continuously Variable Slope Delta (CVSD) Modulation Analog To Digital Conversion

Security Features ● Benefits

Multi-Register Non-Linear Combiner Code Algorithm provides 2.36×10^{21} user programmable codes. ● The coding algorithm and an incredibly large number of unique codes provide a very high level of security against unauthorized listeners, including more technically sophisticated eavesdroppers. All of the codes are unique and statistically unrelated. Only one code out of 2.36×10^{21} possibilities will produce an intelligible output. There are no families of codes which are capable of providing a partially decoded output for similar codes.

Random Code Key Initialization occurs every time the transmitter is keyed. ● This random initialization provides increased security since the system will not reset its coding algorithm to the same place at the beginning of each transmission, but will initiate its coding process at a new starting point instead.

Self Synchronizing decoding eliminates delays at the beginning of transmissions or delays in system recovery after multipath or weak signal fades. ● Since no preamble is required, there are no delays or loss of information at the beginning of a transmission. In addition, a coded message will not be lost because no synchronization signal is received.

Internal Secure Electronic Code Storage within the radio unit eliminates code switches and does not reveal any knowledge of the code key by external visual or electronic probing. ● Consequently, code information is restricted to a limited number of authorized personnel.

Code Insertion into DVP radios is an operation which can be performed quickly and easily. ● The user can insert a new code into a DVP radio in a matter of seconds by connecting a DVP Code Inserter to the radio and pressing the code insert button. There are no mechanical keys required or switches which have to be set manually.

Continuously Variable Slope Delta Modulation, operating at a 12 Kilobit/second voice sample rate, is used to convert normal speech to digitized speech prior to scrambling and then back to normal speech after the receiver signal has been decoded. ● This A/D conversion technique, in combination with a new radio design incorporating optimized circuitry for digital voice transmission, coding and audio response, assures excellent voice recognition and high intelligibility.

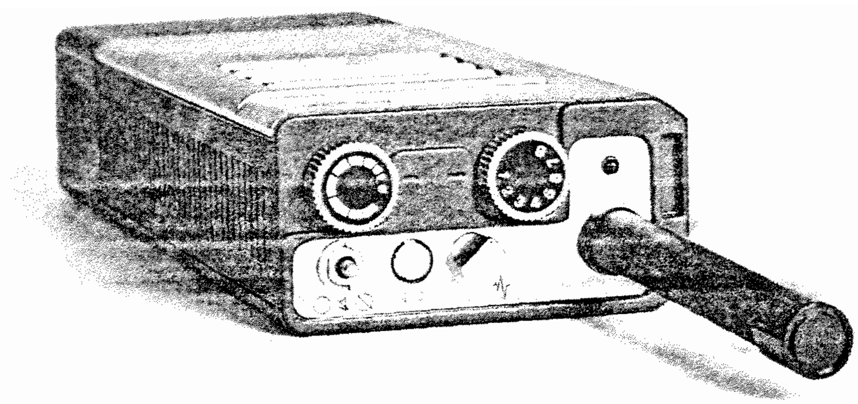
Automatic Code Destruction With Power Loss provides added code security. ● If someone attempts to tamper with a DVP radio and removes the code module, the code which it contains will be destroyed. To allow the user to change portable batteries, a time delay has been incorporated into the design of this feature to preserve code during this operation.

Systems Features

- Complete system design capability
- Clear or coded operation
- Clear voice override (Private-Line Squelch models)
- Automatic or manual transmitter mode selection
- Private-Line Squelch compatible in clear mode
- Squelch tail elimination in the clear mode (Private-Line Squelch models)
- Clear mode alert tone prior to clear transmission
- Utilizes narrow band RF channels

Systems Features ● Benefits

Complete Systems Design Capability— The DVP MX series Handie-Talkie radio has been designed as part of a complete system of security radio which includes mobiles, base/repeater stations, microwave, and Total Area Coverage systems. ● A user can now, for the first time design a complete system



with voice security which includes a truly portable unit.

Clear or Coded Operation allows the user to transmit and receive either clear or coded messages. ● With this 2 mode operation, DVP radios can be used within existing clear radio networks as the user builds a security sub system. As the need arises or as old radios are replaced, the protected portion of the network can be expanded. Or a new all coded (or coded/clear) system can be designed to meet a user's specific communications needs.

Clear Voice Override automatically switches the receiver from the coded mode into the clear mode if an incoming message is clear voice (Private-Line models only). ● When operating in the coded mode the user will always get a message regardless of the mode in which that message was transmitted. Messages will not be lost and coordination problems among field units will be reduced.

Automatic or Manual Transmitter Mode Selection allows the user to manually select his transmission mode with the coded/clear switch or tie the mode selection directly to the channel selector, thus creating dedicated channels (coded only, clear only, or coded and clear). ● A user may thus be prevented from accidentally transmitting a clear message on a coded only channel. Similarly a user may designate a clear only channel in the radio for use on an existing system.

Private-Line Squelch Compatibility (Clear mode only) allows channel sharing among units on the same channel. ● In the clear mode, DVP radio units may access standard Private-Line Squelch equipped stations.

Squelch Tail Elimination is provided through the use of a reverse burst in the clear mode (Private-Line Squelch units only). ● Operators will not be disturbed by any annoying squelch tail or noise burst at the end of a transmission.

Clear Mode Alert Tone is emitted prior to a clear transmission. This tone warns the sender that he is about to transmit non-protected information. ● Thus, he will not mistakenly transmit private information in the wrong mode.

Narrow Band RF Channel Bandwidths permit the use of 25 KHz or 30 KHz channel spacing. ● DVP radio systems do not require extra wide channels or special channel assignments.

Radio Features Options

The DVP Handie-Talkie Radio incorporates the DVP security features with the features and options of the versatile MX300 series portable radios. For a complete list of features and a more detailed discussion of each feature, please refer to the individual MX300 radio series catalog sheets.

Radio Features

- Single integrated unit containing radio and scrambler circuitry.
- Unique phase lock loop transmitter.
- Sensitron single conversion receiver.
- Multiple RF power levels. (1w, 2.5w, 6w in VHF; 1w, 2w, 5w in UHF)
- 8 (6 VHF) frequency capability.
- Transmit/battery status indicator.
- Twist off batteries with 4 available battery sizes.
- Weather sealed push to talk.
- Externally accessible fuse.
- External jacks for antenna and speaker.

Radio Options

- Time out timer.
- Converta-Com compatability for mobiles use.
- RF preamplifier (VHF only).
- Remote speaker microphone.
- Surveillance accessories.

DVP MX-300 Series 2-Way FM Portable Radio

Performance Specifications

Security

Scrambler Type:	Digital
Coding Method:	Multi-Register Non-Linear Combiner
Number of Codes:	2.36 x 10^{21} orthogonal (unique) codes
Synchronization:	Self synchronizing (no preamble required)
Code Key Initialization:	Random
Code Key Generation:	External hand held microprocessor controlled code inserter (Cat. #P1001____X)
Code Storage:	Volatile Electronic Memory
Number of Codes Per Radio:	One
Analog to Digital Conversion:	Continuously Variable Slope Delta Modulation (CVSD)
Voice Sample Rate:	12 Kilo Bits/Sec

Size

2.84" wide x 1.41" deep x (see chart below) high
(72 mm x 36 mm x mm)

	MX340	MX350	MX360
Radio Only:	4.98" (126 mm)	5.76" (146 mm)	6.35" (161 mm)
Radio with battery:		1 Hour Rapid Charge Batteries	
Light Capacity:	6.45" (164 mm)	7.23" (184 mm)	7.82" (109 mm)
Medium Capacity:	6.81" (173 mm)	7.59" (193 mm)	8.18" (208 mm)
High Capacity:	8.38" (212 mm)	9.16" (233 mm)	9.75" (248 mm)

Weight: Radio only (average)
T2-R2 carrier squelch VHF 16.4 oz (465g)
UHF 16.3 oz. (463g)

Additional weight for features/options:
Private-Line Squelch +.2 oz. (6g)
Each additional channel VHF +.4 oz. (11g)
Each additional channel UHF +.2 oz. (6g)
Batteries Only
1 hour radio charge
Light capacity: + 5.2 oz. (147g)
Medium capacity: + 7.3 oz. (207g)
High capacity: +14.1 oz. (399g)

FCC Designations:*

UHF		450-512 MHz	VHF		150.8-174 MHz
1 watt	2 Frequency	CC4228A	1 watt	2 Frequency	CC3256A
1 watt	4 Frequency	CC4229A	1 watt	4 Frequency	CC3257A
1 watt	6 Frequency	CC4230A	1 watt	6 Frequency	CC3258A
1 watt	8 Frequency	CC4230A	2.5 watt	2 Frequency	CC3260A
2 watt	2 Frequency	CC4231A	2.5 watt	4 Frequency	CC3261A
2 watt	4 Frequency	CC4232A	2.5 watt	6 Frequency	CC3262A
2 watt	6 Frequency	CC4233A	6 watt	2 Frequency	CC3264A
2 watt	3 Frequency	CC4233A	6 watt	4 Frequency	CC3265A
5 watt	2 Frequency	CC4234A	All Receivers RC0091		
5 watt	4 Frequency	CC4235A			
5 watt	6 Frequency	CC4236A			
5 watt	3 Frequency	CC4236A			
All Receivers RC0092					

* Licenseable under FCC Rules & Regulations Part 89 for Police and Fire Services.

For international usage, local PTT regulations apply.

Radio

	VHF	UHF
Model Series:	H23, H33, H43AXU	H24, H34, H44AXU
Frequency:	136-174 MHz	403-430, 440-512 MHz
Channel Spacing:	30 KHz	25 KHz
Power Supply:	One rechargeable nickel-cadmium battery.	

Transmitter

	VHF	UHF
RF Power Output:	1W/2.5W/6.0W	1W/2.0W/5.0W
Frequency Stability: (−30°C to +60°C, +25°C Ref):	±.0005%	±.0005%
Modulation—Clear	16F3, 15F2, 16F9	16F3, 15F2, 16F9
Coded:	20F3Y	20F3Y
FM Noise:	−60 dB	−60 dB
Audio Response[1]:	+1, −3 dB from 6 dB/octave pre-emphasis from 300 Hz to 3 KHz	+1, −3 dB from 6 dB/octave pre-emphasis from 300 Hz to 3 KHz
Audio Distortion[1]: (At 1000 Hz, 3 KHz deviation):	3%	3%
Spurious & Harmonics		
1 Watt:	−67 dB	−67 dB
2.5 Watt (2.0W UHF):	−71 dB	−59 dB
60 Watt (5.0W UHF):	−75 dB	−53 dB
Frequency Separation: (No degradation)	12 MHz	6 MHz

Receiver

	VHF		UHF
Modulation Acceptance:		±7.5 KHz	±7.5 KHz
Sensitivity:	W/O PREAMP	WITH PREAMP	
20 dB Quieting[1]:	.5 µV	.25 µV	.5 µV
12 dB SINAD[1]:	.35 µV	.18 µV	.35 µV
Selectivity (EIA SINAD):	90 dB	90 dB	85 dB
Frequency Separation (No degradation):	2 MHz	4 MHz[2]	1 MHz
Intermodulation:	80 dB	75 dB	75 dB
Frequency Stability (−30°C to +60°C; +25°C Ref):	±.0005%	±.0005%	±.0005%
Spurious & Image Rejection:	80 dB	80 dB	80 dB
Audio Output[1]: (@ less than 5% distortion):	500 mV	500 mV	500 mV

[1] Specification applies to clear mode only. Performance in the coded mode has been tailored to deliver optimum intelligibility and voice recognition.

[2] Separation of 10 MHz possible with sensitivity degrading to .35 µV (20 dB Quieting), or 12 MHz separation possible with sensitivity degrading to .5 µV.

MOTOROLA
Communications and Electronics Inc.

A Subsidiary of Motorola, Inc.
1301 East Algonquin Rd., Schaumburg, Illinois 60196
(312) 397-1000

Specifications subject to change without notice.

JWL. JCPL

Monell - GPU

Wilson - GPU

External

All

TMI

GPU Nuclear

TECHNICAL DATA REPORT

TDR NO. 198	REVISION NO. 0
PROJECT NO. 3739	PAGE 1 OF 22
PROJECT: TMI-2 Containment Assessment	DEPARTMENT/SECTION Engineering Management
	RELEASE DATE 10/24/80 REVISION DATE

DOCUMENT TITLE: Three Mile Island Unit 2 Reactor Building Entry Program Summary

ORIGINATOR SIGNATURE	DATE	APPROVAL(S) SIGNATURE	DATE
James W. Langenbach	10/17/80	R F Wilson	10/24/80
		APPROVAL FOR EXTERNAL DISTRIBUTION	DATE
		R F Wilson	10/24/80

*	DISTRIBUTION
TMI	C. Adams
TMI	J.J. Barton
TMI	W.H. Behrle
TMI	M.L. Benson
TMI	J. Brasher
TMI	J.C. DeVine
TMI	F. Grice
Bldg	R.W. Heward
TMI	G.K. Hovey
JCP&L	J.W. Langenbach
TMI	S. Levin
TMI	R. McGoey
TMI	T.C. Menzel
Bldg.	M.P. Morrell
TMI	J. Renshaw
Bldg	R.F. Wilson
	External
TMI	T. Fritz - Bechtel/TMI
TMI	R. Rider - Bechtel
TMI	J. Tate - GAI
	E. Walker - Bechtel San Francisco Calif

COMPLETED

ABSTRACT:

In May of 1979 following the March 28, 1979 accident at Three Mile Island Unit 2 (TMI-2), Metropolitan Edison Company (Met-Ed) established the Containment Assessment Task Force (CATF). The overall goal and object of the Containment Assessment Task Force was to establish, using external measurements, the reentry environment inside the Reactor Building. The specific function of the Assessment Task Force was to gather data as necessary to ensure that containment atmosphere cleanup could be accomplished, that an initial entry into the building could be accomplished, and that planning for Reactor Building decontamination and recovery could proceed. The cleanup of the containment atmosphere and the initial entry were considered to be the initial vital steps in beginning the recovery of the TMI-2 Reactor Building. Entry was required to gather data by visual inspection and radiological survey to support planning for the decontamination of the Reactor Building.

To accomplish the assigned duties, the Containment Assessment Task Force established a number of experiments and measurements which could be run without benefit of building entry. These experiments were designed to determine as much as possible what the airborne contamination, contamination plated out on the various surfaces of the containment, and contamination contained in the water in the basement of the Reactor Building were. The experiments and measurements were specifically designed to obtain detailed technical data on the magnitude, identity, distribution, and chemical forms of the existing airborne, surface, and sump water activity and the resulting radiation levels. The final step of the Containment Assessment Task Force would be

*COVER PAGE ONLY

TDR-198

TECHNICAL DATA REPORT

		Accountable Copies
1.	DDCC, Parsippany	Original
2.	DDCC, TMI Site	1
3.	GAI Proj. Mgr., R. M. Rogers	1

Information Copies

Additional information copies shall be specified by the author of the TDR.

26 ~~24~~ Full

4 extra

TDR-198

The negative of The photographs shown in This TDR are in the TMI-2 Project Files "Reactor Building Entry Program" GPN Parsippany.

ORDER NO. 10-27-01

REPRODUCTION ORDER - GPUSC

100 INTERPACE PARKWAY, PARSIPPANY, N.J.

DATE 10-27-80

ACCOUNT NO. 76-323-481.1160-60-014005

TO: Reproduction BLDG

DELIVER THE FOLLOWING TO THE DDCC Harriet Wiedeman

ORIGINAL	REV.	TYPE & QUANTITY REQUIRED										SPECIAL INSTRUCTIONS OR REMARKS
		XEROX	BLUE LINE PRINT		SEPIA	MYLAR		MICROFILM		OTHER	
			FULL SIZE	REDUCE TO		WASH-OFF	FIXED	SILVER	DIAZO		
TDR-198	0	26									
											① USE
											Colored
											Sheets to
											seperate
											② Colate
											+ Clip

Thank You

[signature]

SEND INVOICE TO ORIGINATOR G. Perez ACCOUNT NUMBER MUST APPEAR ON INVOICE.

... MUST ACCOMPANY DELIVERY.

GPU Service

GPU SERVICE CORPORATION
INTRA OFFICE MEMORANDUM

No.

TO: K. Blauer - TMI

DATE: May 1, 1981

SUBJECT: TDR Copies

I am enclosing the following TDR copies which you requested —

TDR - 116 Rev 0
TDR - 169 Rev 0
~~TDR - 184~~ Rev 0
TDR - 198 Rev 0
TDR - 241 Rev 0

CC:

BY: Harriet Wiedeman
EDCC - 2129

A000 0018 rev 3-79

GPU Service

GPU SERVICE CORPORATION
INTRA OFFICE MEMORANDUM

No.

TO: Linda Chaplin

DATE: 1-16-81

SUBJECT: TDR-198

I am enclosing copy of the above TDR as you requested —

CC:

BY: Harriet Wiedeman

DDCC Ext - 6472