

VELA UNIFORM PROGRAM STERLING EVENT

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PRESHOT AND POSTSHOT SAFETY SURVEY OF OIL AND GAS FACILITIES BAXTERVILLE FIELD MISSISSIPPI

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NUCLEAR EXPLOSIONS-PEACEFUL
APPLICATIONS (TID-4500)

PRESHOT AND POSTSHOT SAFETY SURVEY
OF OIL AND GAS FACILITIES
BAXTERVILLE FIELD, MISSISSIPPI
STERLING EVENT

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FRESHOT AND POSTSHOT SAFETY SURVEY OF OIL AND
GAS FACILITIES - BAXTERVILLE FIELD, MISSISSIPPI

STERLING EVENT

I. INTRODUCTION

1.1 Authority

The survey was conducted in accordance with the Operational Safety Plan for the Sterling Event, dated November 1966.

1.2 Purpose and Scope

Oil and gas wells and related facilities of the Baxterville field were surveyed to document any physical changes resulting from the Sterling Event. All such structures within a 5-mile radius of Ground Zero (GZ) were examined and photographed in detail. Other selected wells and facilities within a 6-mile radius of GZ were examined and photographed. ()

1.3 No damage was observed at any of the oil or gas wells or related facilities. Notes and photographic documentation are contained in the appendixes.

1.4 Background

Previous investigation (references 1 and 2) by the U.S. Bureau of Mines (USBM) included a preliminary survey of oil and gas wells and associated facilities of the industry

that lie within 10 miles of the proposed test site at the Tatum Dome, Lamar County, Mississippi. Figure 1 of Appendix A shows locations of such wells and facilities within 5- and 10-mile radii of GZ.

Many test wells were drilled within this area, but only in the Baxterville field have oil and gas been produced in commercial quantities. Figure 2 of Appendix A shows location, status, and ownership of all wells within the Baxterville field. Gulf Oil Corporation is the major operator of the field. On the shot date (December 3, 1966), 147 wells were producing oil from the Lower Tuscaloosa Formation at depths ranging from 8,600 to 8,900 feet. Thirty-three wells were producing gas, two from the Wilcox Formation at a depth of about 5,100 feet and thirty-one from the Upper Tuscaloosa Formation at depths between 7,614 and 7,970 feet. Daily production from the Baxterville field is approximately 15,000 barrels of oil and 25 million cubic feet of gas.

Five gas pipelines, three oil pipelines, and one liquefied petroleum products line cross the area. (See Appendix A.) A dehydration plant (6 miles from GZ), operated by the United Gas Company of Shreveport, Louisiana, and having a daily capacity of about 200 million cubic feet of gas, delivers dry gas to three of the company's pipelines.

The nearest productive well is 4.7 miles from Sterling GZ. The nearest petroleum facility is a 16-inch gas pipeline that passes within 2.8 miles of GZ. Based on predicted peak ground motions and experience from the Salmon Event (reference 3), USBM concluded that no damage to these facilities could be expected.

II. SURVEY

2.1 Preshot

Because of the many and varied structures and facilities (derricks, pumping units, wellhead connections, tank batteries, gathering lines, etc.) within the Baxterville field and in view of only the remote possibility of damage, a detailed survey of the entire field was deemed impractical.

All oil and gas structures within a 5-mile radius of GZ were examined and photographed in detail, but only selected facilities and installations beyond the 5-mile radius were surveyed.

The preshot survey was initiated 12 days before the detonation, November 21, 1966. The above-mentioned facilities were inspected, and photographs were taken to provide documentation of any physical changes.

Representatives of the producing and pipeline companies of the Baxterville area were advised of the scheduled date for detonation and the degree of ground shock that was expected.

2.2 Postshot

The postshot survey began immediately after the detonation at 6:15 a.m., December 3, 1966. The same facilities as documented in the preshot survey were examined and photographed.

Representative samples of the photographs appear in Appendix D. Additional photographs (a total of 330 were taken) are on file at the USBM Bartlesville Petroleum Research Center, Bartlesville, Oklahoma.

The preshot and postshot surveys were performed by personnel of USBM: Don C. Ward, petroleum engineer, and Duell J. Sears, photographic technician.

III. OBSERVATIONS

No damage was observed by either on-the-spot inspection or examination of photographs.

No damage was reported by the producing or pipeline companies.

IV. CONCLUSIONS

The preshot and postshot survey indicated that no damage occurred to any oil or gas well or related facility. Maximum values of ground shock were many times below those values at which structural damage to oilfield construction would be anticipated.

It is concluded that, for future projects, no damage would result to similar structures from comparable yields at comparable ranges. Also, it is concluded that the survey procedures were adequate to accomplish the survey objectives.

REFERENCES

1. Riggs, C. H., and Don C. Ward; Oil and Gas Wells and Associated Facilities in the Tatum Dome Area, Lamar County, Mississippi; U.S. Bureau of Mines--Special Report to AEC, January 1963.
2. Ward, Don C., and C. H. Atkinson; Report of Initial Review of Possible Damage to Petroleum Reservoirs in the Vicinity of the Salmon Nuclear Test Event, Project Dribble; U.S. Bureau of Mines--Special Report to AEC, June 12, 1963.
3. Ward, Don C.; Preshot and Postshot Safety Survey of Oil and Gas Facilities--Baxterville Field, Mississippi; Vela Uniform Program--Project Dribble - Salmon Event - VUF-1022, Final Report; U.S. Atomic Energy Commission Division of Technical Information Extension, Oak Ridge, Tennessee, January 1965.

APPENDIX A

Maps

APPENDIX B
General Notes

APPENDIX B

General Notes

Equipment and construction associated with the Baxterville field were designed for permanent usage and contain safety factors in excess of 2. The function of these heavy-duty installations is the transportation and confinement under pressure of produced fluids. Thorough maintenance is provided to assure that all facilities remain in good working condition.

Empirical threshold values of shock wave acceleration or velocity for damage to residential-type construction are far less than those which would cause structural damage to oil and gas wells or associated facilities.

Oil Wells

Oil wells in the Baxterville field were completed with 600 to 1,600 feet of surface casing (predominantly 10-3/4-inch) cemented to the surface, 5-1/2-inch or 7-inch production casing cemented to a minimum of 2,000 feet above the base of the casing, and 2-1/2-inch or 2-7/8-inch tubing suspended from the wellhead. These wells (except a few that flow naturally) are pumped by individually powered 320,000-pound beam units set on concrete foundation piers, the bases of which extend a minimum of 14 inches below ground surface. All but two of the 96-foot service derricks that were standing over approximately 50 wells at the time of the Salmon detonation have been removed. The corners of these derricks are set on 5-foot-square cement blocks that extend 24 inches into solid earth.

Gas Wells

Gas wells were completed with a minimum of 500 feet of surface casing cemented to the surface and either a 4-1/2-inch, 5-1/2-inch, or 7-inch production casing cemented to at least 1,700 feet above the base of the casing. In many wells, production packers were run on the tubing. Wellhead equipment consists of a casinghead, a master gate, and a composite manifold.

Brine Disposal Systems

The brine disposal systems include settling tanks, pumps, line pipe, and disposal wells. Most disposal wells were completed with from 200 to 300 feet of surface casing and about 2,500 feet of 5-1/2-inch casing. Cement-lined pipes, 4 to 6 inches in diameter, are buried near the surface and connect the settling and brine-storage tanks to the disposal wells.

Lease Batteries

Each oil lease is equipped with from one to eight heater-treaters and has from two to ten stock tanks that range in capacity from 150 to 1,000 barrels each. Tanks, heaters, separators, etc. are of welded-steel construction set on either concrete or steel-ring foundations. Gathering lines from wells to tank batteries range in size from 2-1/2 to 4 inches in diameter; 90 percent of these lines are covered. Feeder pipelines from tank batteries to the main pipeline are 6 inches in diameter and are buried at a depth of about 18 inches. Associated with each gas lease are a separator, compressor, and distillate tanks.

Pipelines

The nine oil and gas transmission lines in the area range in diameter from 6 to 24 inches. These lines are buried 2 to 3 feet below the ground surface and are exposed only at terminal or booster stations. Normal operating pressures are from 500 to 1,000 psi.

APPENDIX C

Photograph Notes

APPENDIX C

Photograph Notes

Preshot and postshot photographs shown in Appendix D are representative of all photographs taken. No damage was detected by either visual observation or photographic documentation. Locations of photographed wells and facilities may be determined from the field map in Appendix A.

Plates 1 through 5: 4.7 miles from GZ--Gammill Green 1--SW SE of Section 33

Plate 1: Gas wellhead.

Plate 2: Oil and gas separator.

Plate 3: Oil-storage tanks.

Plate 4: Concrete blocks supporting flow line.

Plate 5: BS plate and valve on oil-storage tank.

Plates 6 and 7: 4.8 miles from GZ--Gulf Bass 40--NW NE of Section 4

Plate 6: Individually powered beam pumping unit.

Plate 7: Flow line from wellhead.

Plate 8: 4.9 miles from GZ--Gulf Bass 34--NW NE NW of Section 4

Crack in concrete foundation of pumping unit.

Plates 9 and 10: 4.8 miles from GZ--Gulf Bass 39--SW SE SW of Section 33

Plate 9: Individually powered beam pumping unit.

Plate 10: Motor bracket and skids.

Plate 11: 4.8 miles from GZ--Gulf Bass-Bilbo G2--E $\frac{1}{2}$ SW SW of Section 33

Gas wellhead.

Plates 12 through 16: 4.8 miles from GZ--Gulf Bass 49--SE NE SE of Section 32

Plate 12: Individually powered and hydraulic-lift pumping units.

Plate 13: Motor bracket and skids.

Plate 14: Volume tank for hydraulic-lift pump.

Plate 15: Electric motor on pumping unit.

Plate 16: Valve canister on hydraulic-lift pump.

Plate 17: 4.7 miles from GZ--Gulf Bass 38--SW NW SW of Section 33

Rear view of pumping unit.

Plates 18 and 19: 4.9 miles from GZ--Gulf Bass 37--SW SW SW of Section 33

Plate 18: Individually powered beam pumping unit.

Plate 19: Electric motor and brackets.

Plates 20 through 23: 5.0 miles from GZ--Lee and Ladner Bass 2--SE SE SE of Section 32

Plate 20: Crack in foundation of pumping unit.

Plate 21: Indirect heater and piping.

Plate 22: Pipeline connection to oil-storage tanks.

Plate 23: Pipeline pump and line.

Plate 24: 5.0 miles from GZ--adjacent to Gulf Bass-Butler G1--SW NW SE of Section 32

Water tank at compressor station.

Plates 25 through 31: 4.9 miles from GZ--adjacent to Gulf Bass 37--
SW SW SW of Section 33

Plate 25: Heater-treaters and separator.

Plate 26: Brine disposal tank and separator.

Plate 27: Pressure recorder and chart.

Plate 28: Oil-storage tanks.

Plate 29: Gas compressor.

Plate 30: Lubricator tank on brine-disposal pump.

Plate 31: Brine-disposal pump and tanks.

Plate 32: 5.3 miles from GZ--adjacent to Gulf Bass 32--NW NE SW of
Section 4

Heater-treaters and tank battery.

Plate 33: 5.5 miles from GZ--Gulf Andrew 32--W $\frac{1}{2}$ W $\frac{1}{2}$ NE of Section 5

Base of "A" frame on pumping unit.

Plate 34: 5.5 miles from GZ--Gulf Andrew 27--W $\frac{1}{2}$ NW SW of Section 4

Crack in concrete pad for pumping unit.

Plates 35 and 36: 5.2 miles from GZ--Gulf Butler 2--SW SW SE of
Section 32

Plate 35: Base of "A" frame on pumping unit.

Plate 36: Heater-treater.

Plates 37 and 38: 5.1 miles from GZ--Taylor Cameron 2--S $\frac{1}{2}$ S $\frac{1}{2}$ NW of
Section 32

Plate 37: Service derrick and pumping unit.

Plate 38: Bottom of derrick, pumping unit, and barrels.

Plates 39 and 40: 5.2 miles from GZ--Taylor Cameron 1--SW SW NW of
Section 32

Plate 39: Service derrick and pumping unit.

Plate 40: Motor and gear box of pumping unit.

Plate 41: 5.3 miles from GZ--adjacent to Gulf Bass 32--SW SE NW of
Section 4

Indirect heaters and oil-storage tanks.

Plates 42 through 48: 6.0 miles from GZ--United Gas Company Dehydration
Plant--center of Section 9

Plate 42: Indirect heaters and piping.

Plate 43: Dehydration towers.

Plate 44: Subsurface inlet and outlet valves from gas pipelines
to dehydration plant.

Plate 45: Field scrubber.

Plate 46: Lines from compressor.

Plate 47: 1,500-horsepower Ingersoll-Rand compressor.

Plate 48: Compressor house and plant.

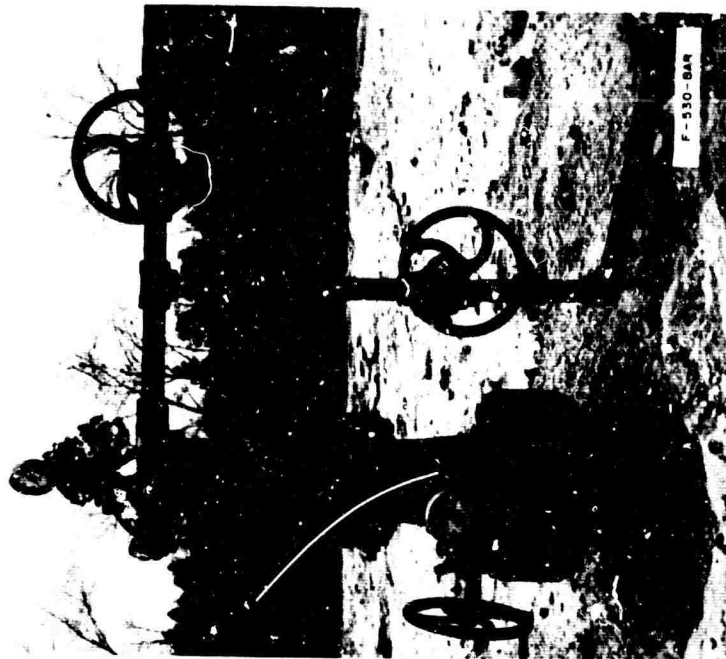
APPENDIX D

Photographs

Plate 1

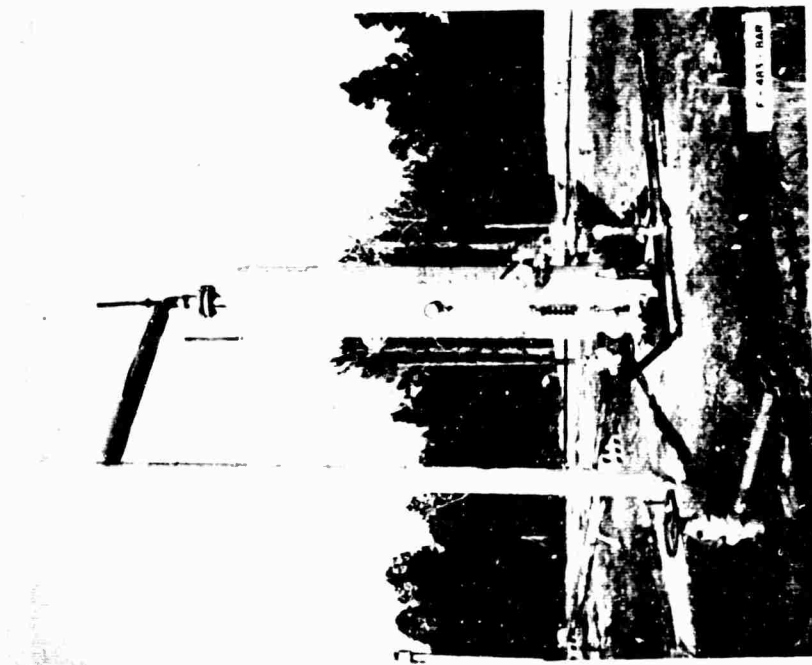


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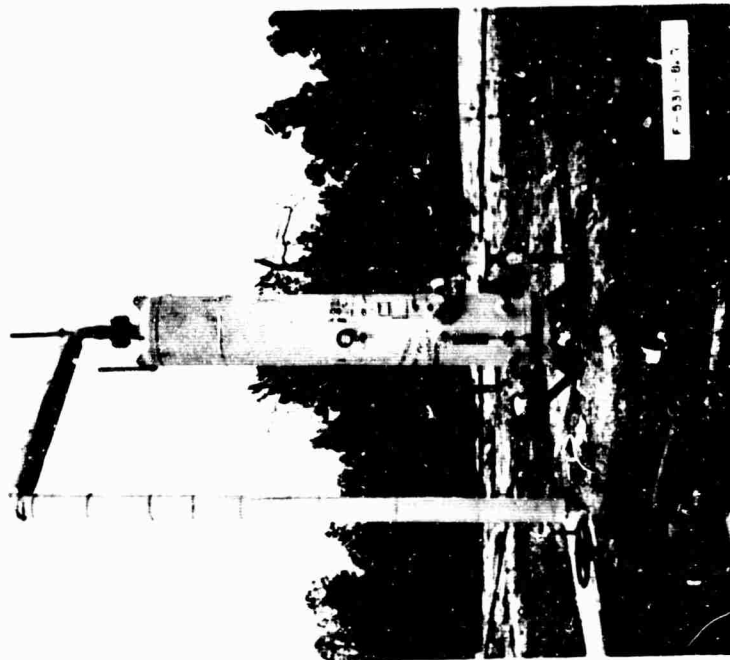


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Plate 2

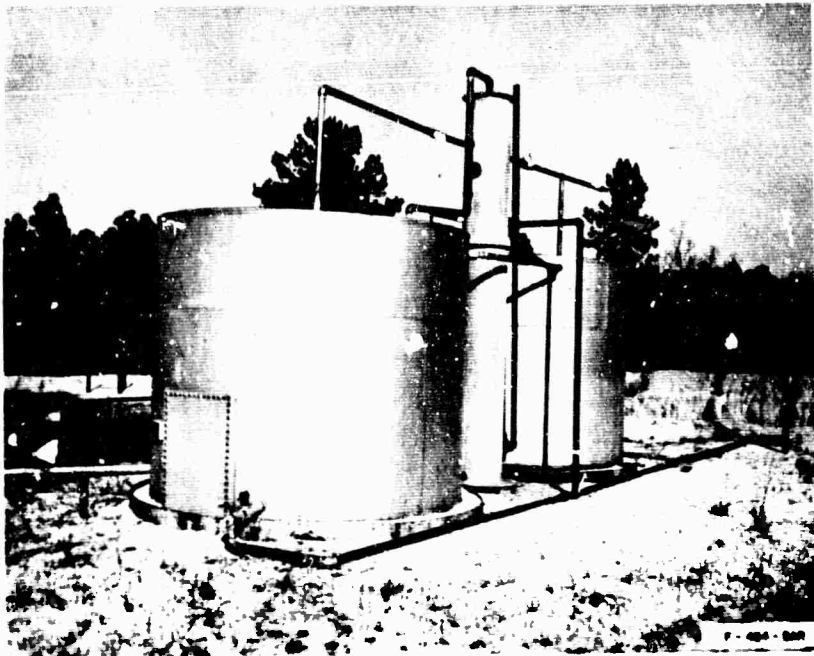


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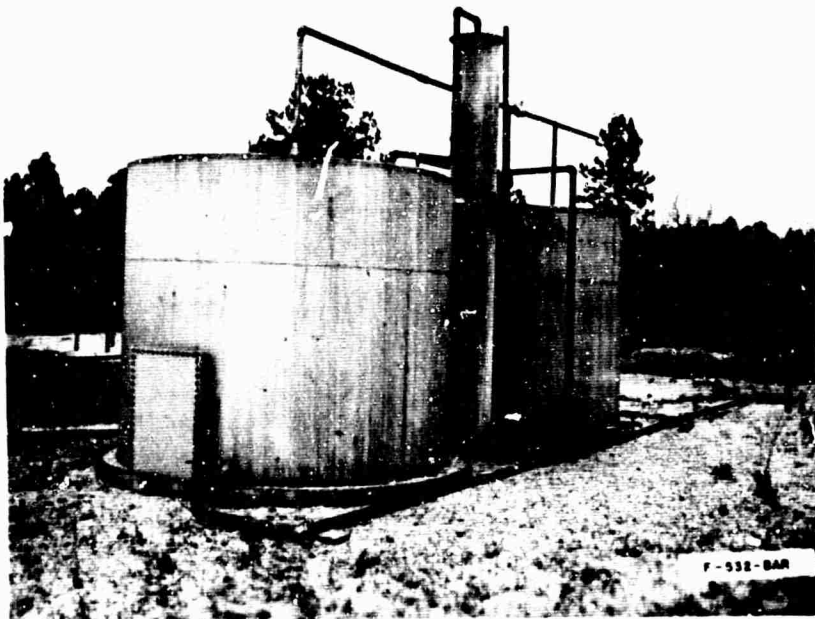


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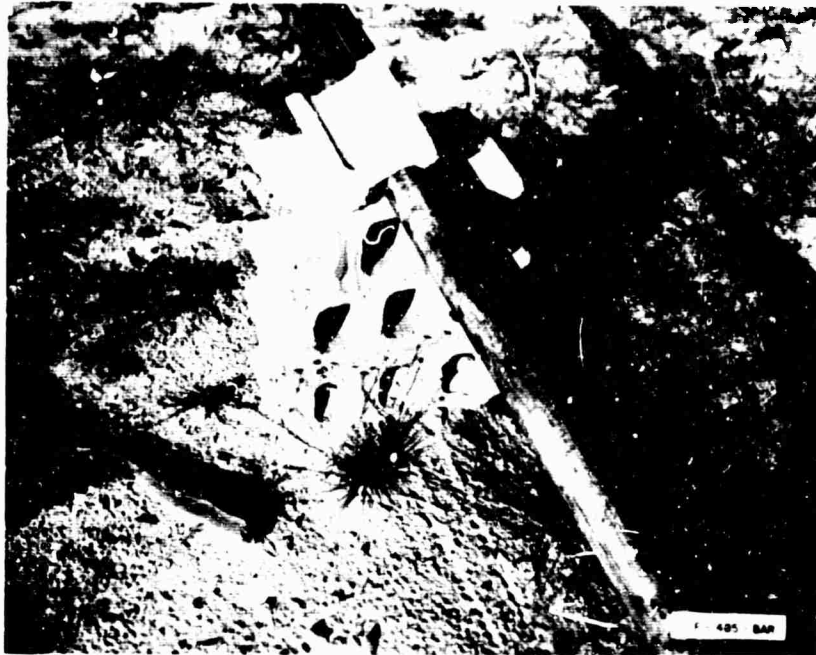


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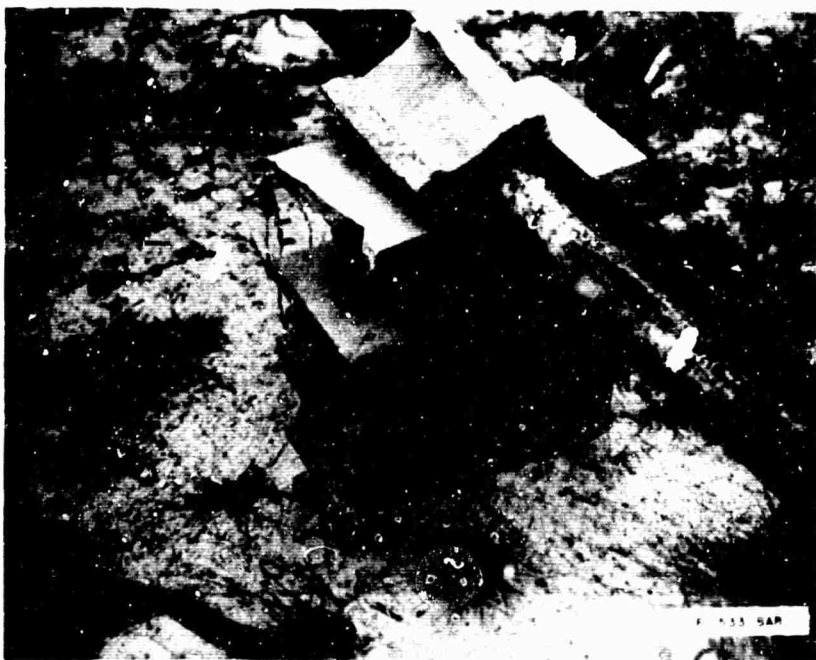


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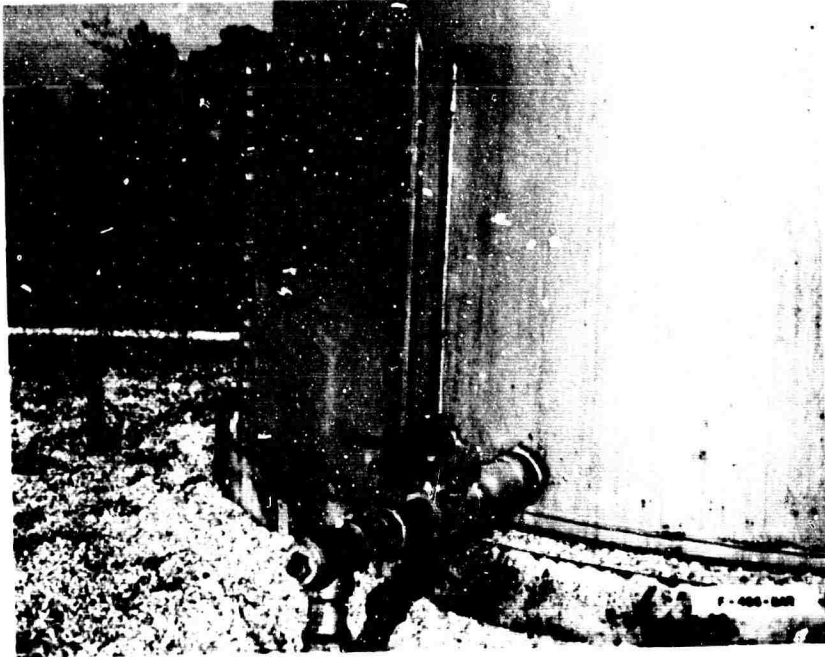


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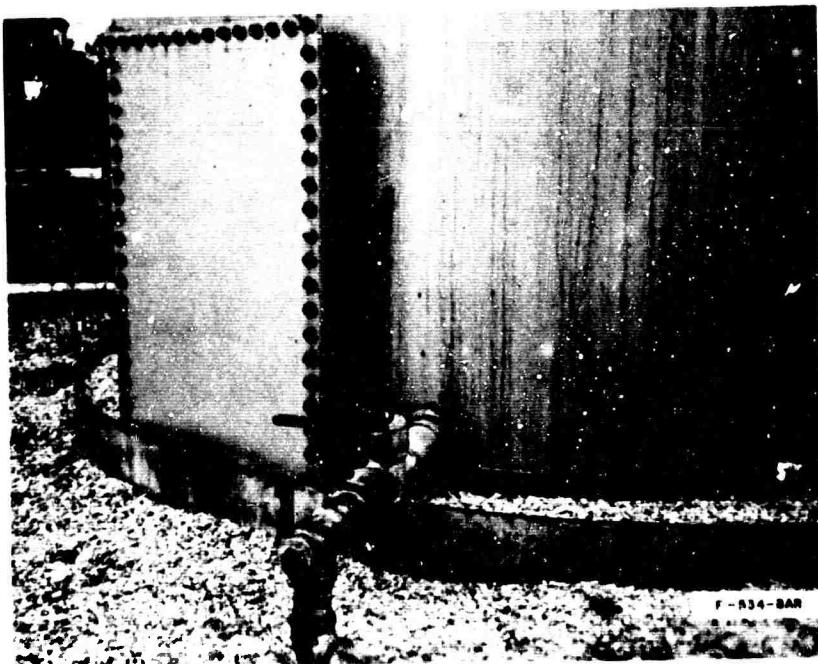


Postshot

Plate 5



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Postshot

Plate 6



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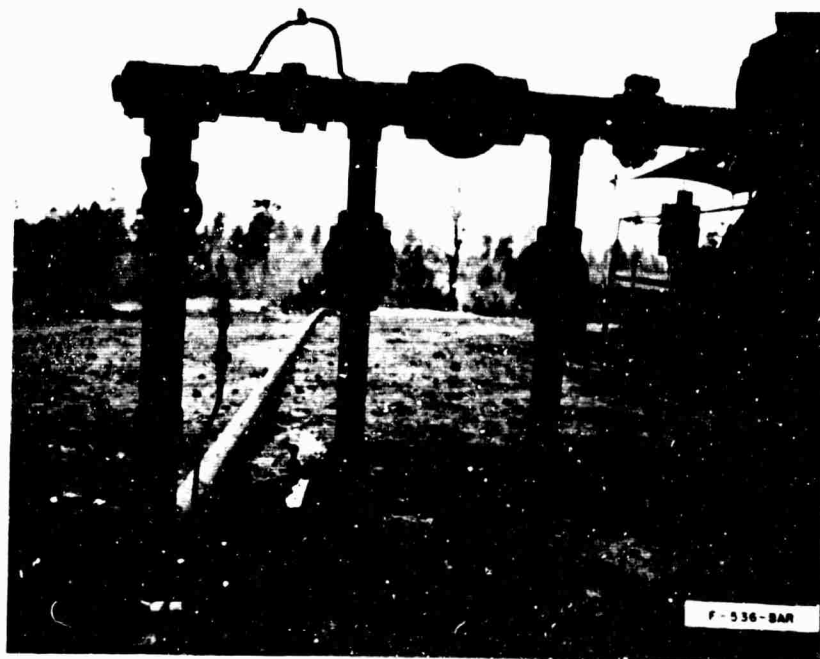


Postshot

Plate 7



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Postshot

Plate 8



Preshot



Postshot

Plate 9

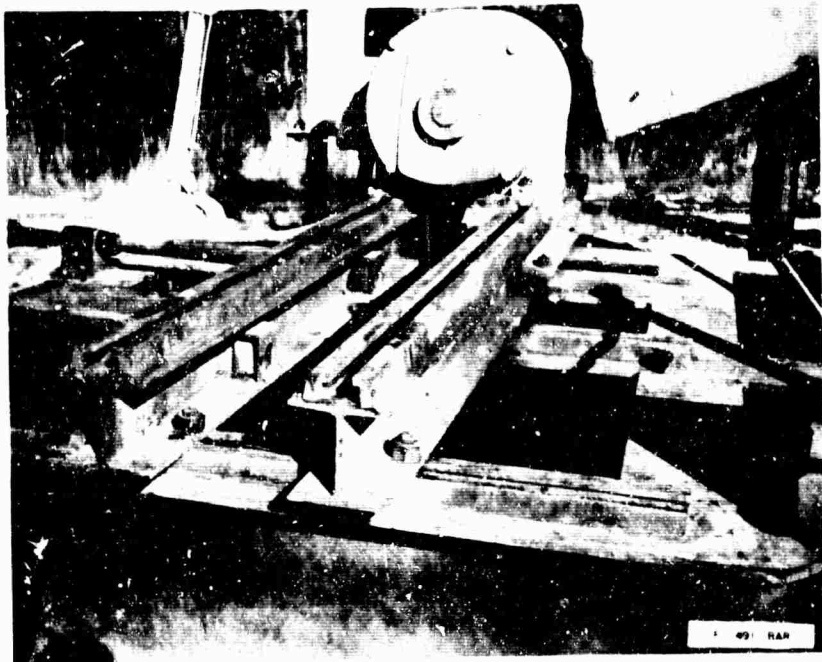


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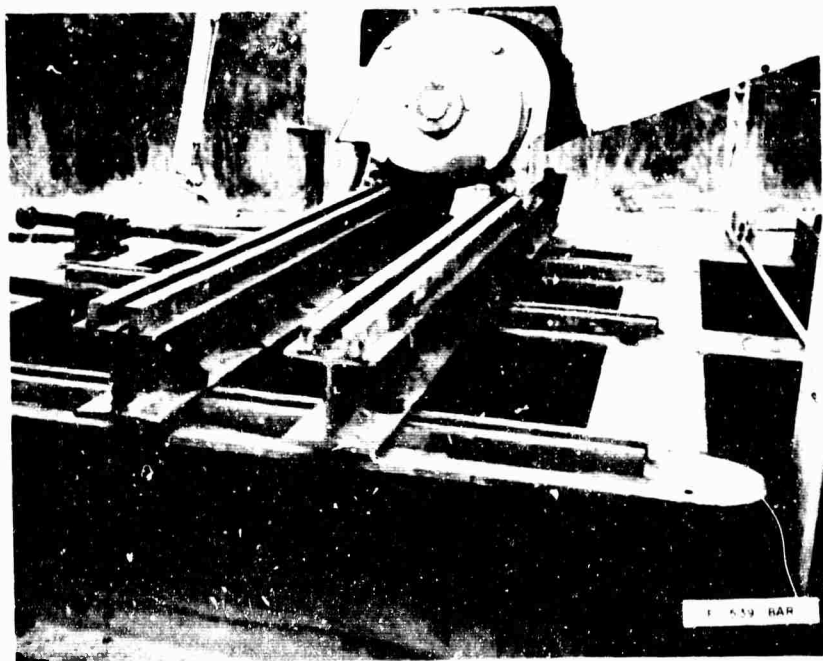


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Plate 10



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Postshot

Plate 11

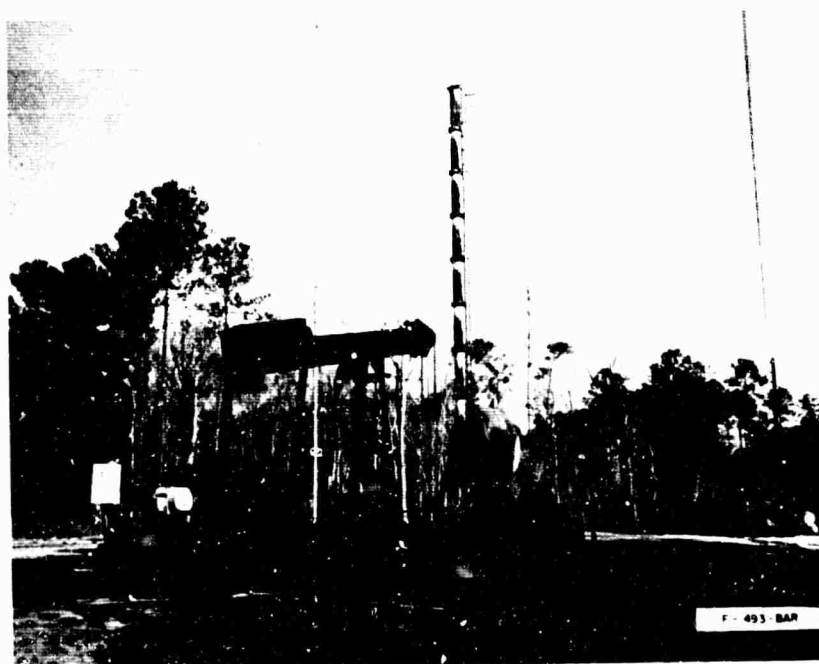


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Plate 12

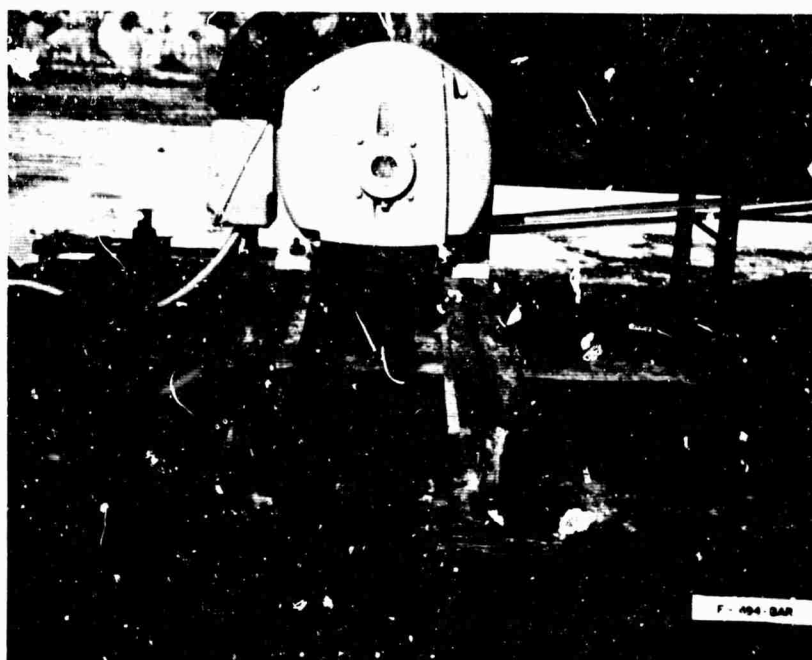


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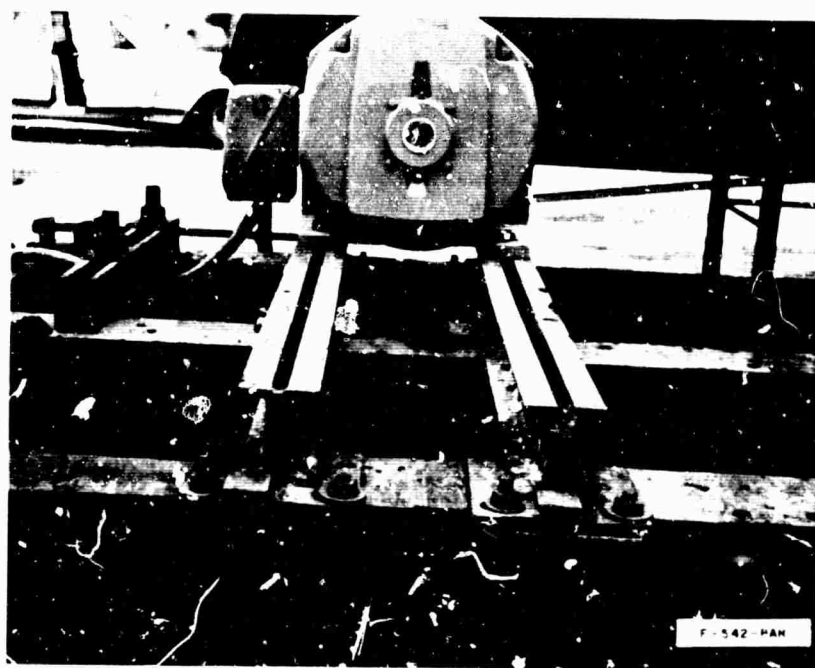


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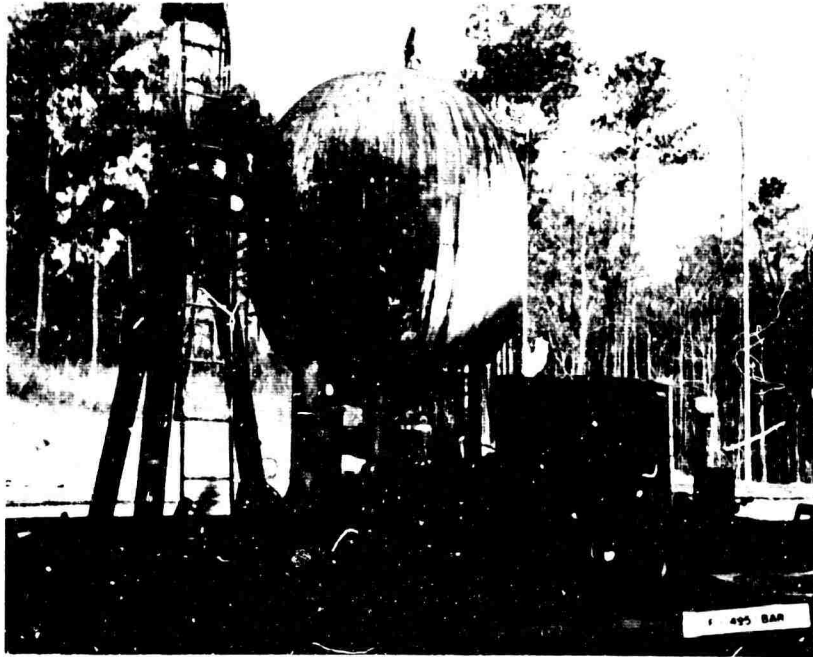


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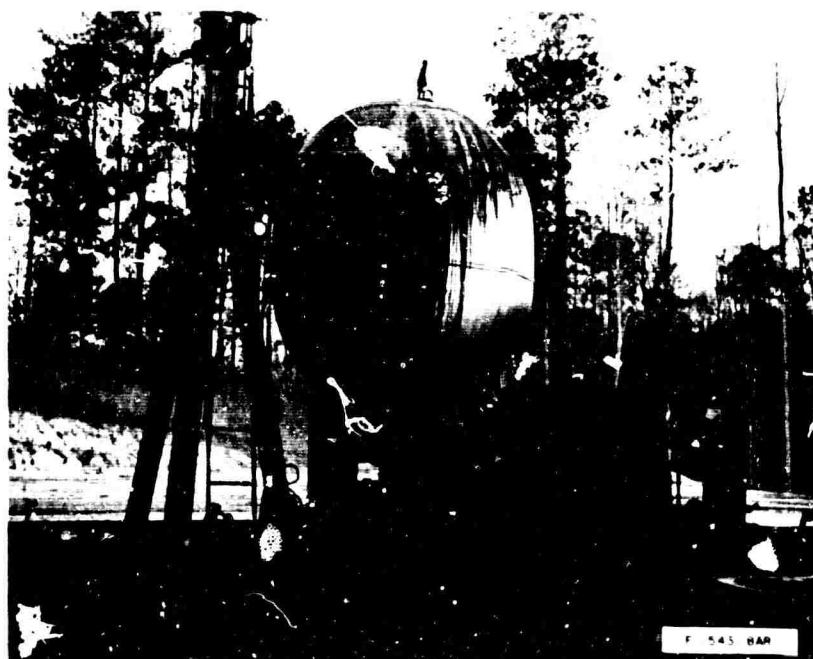


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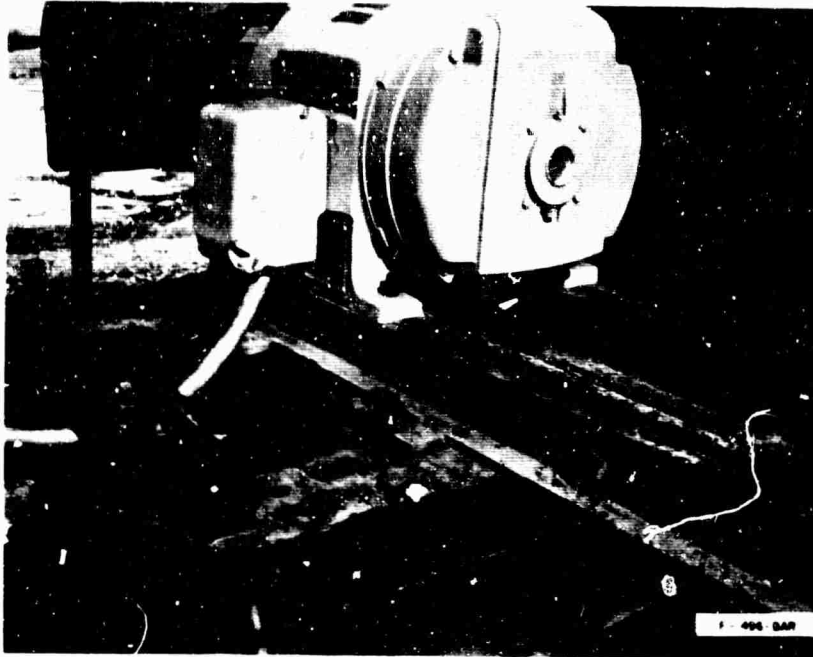


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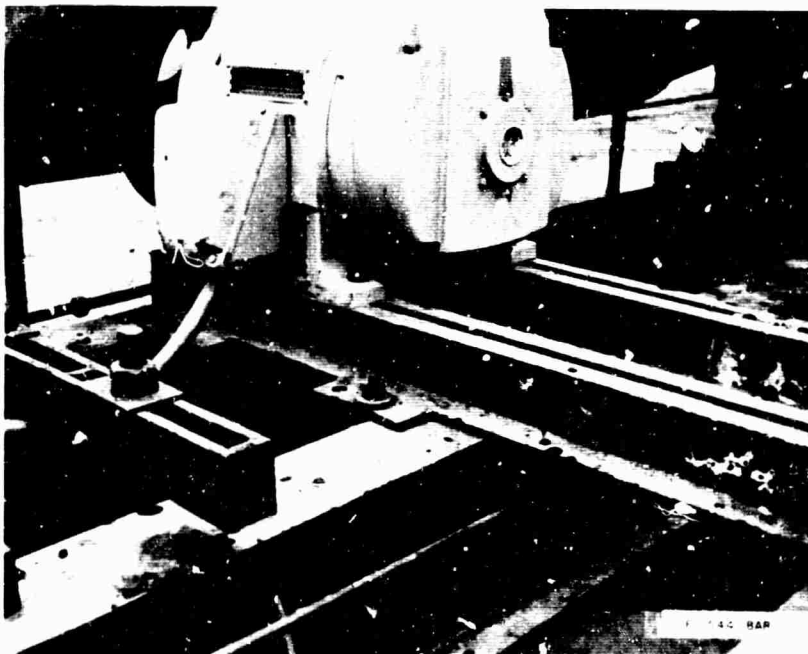


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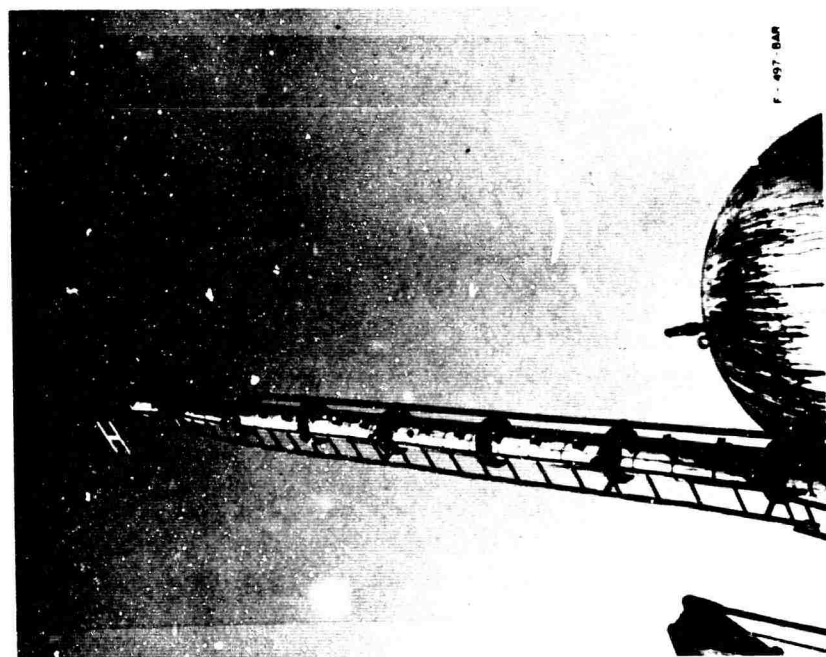


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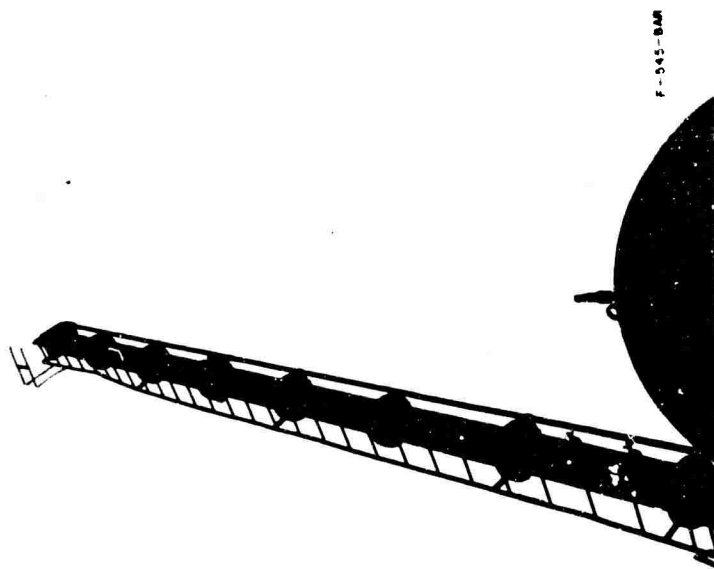


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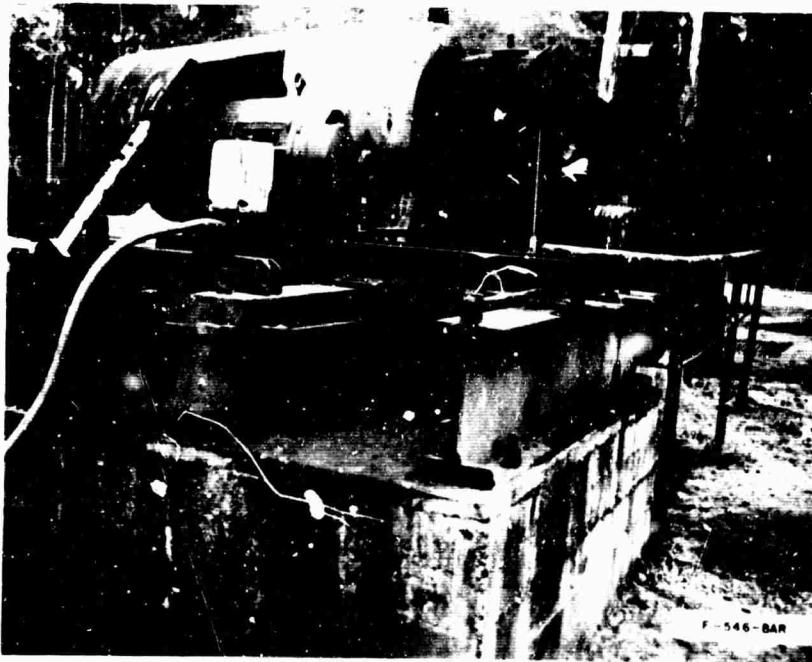


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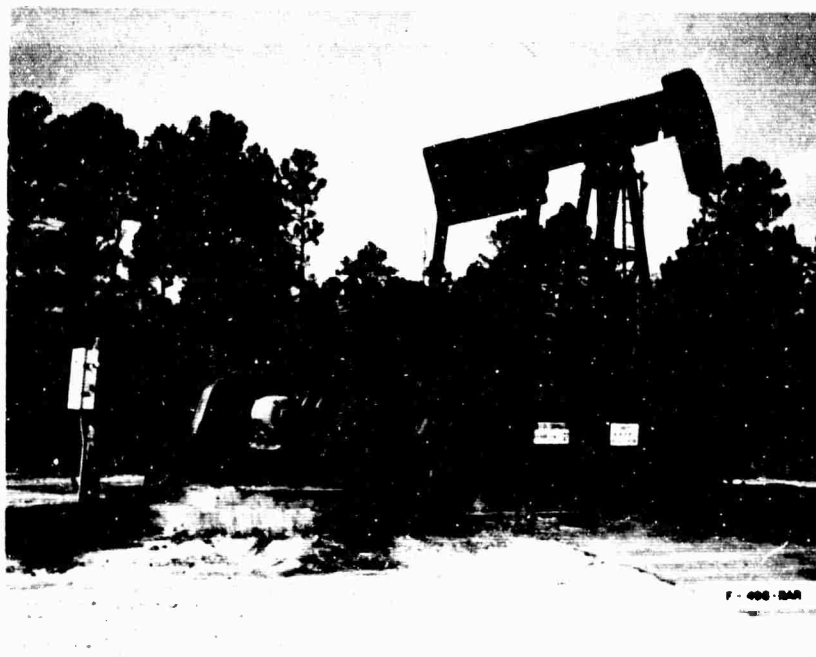


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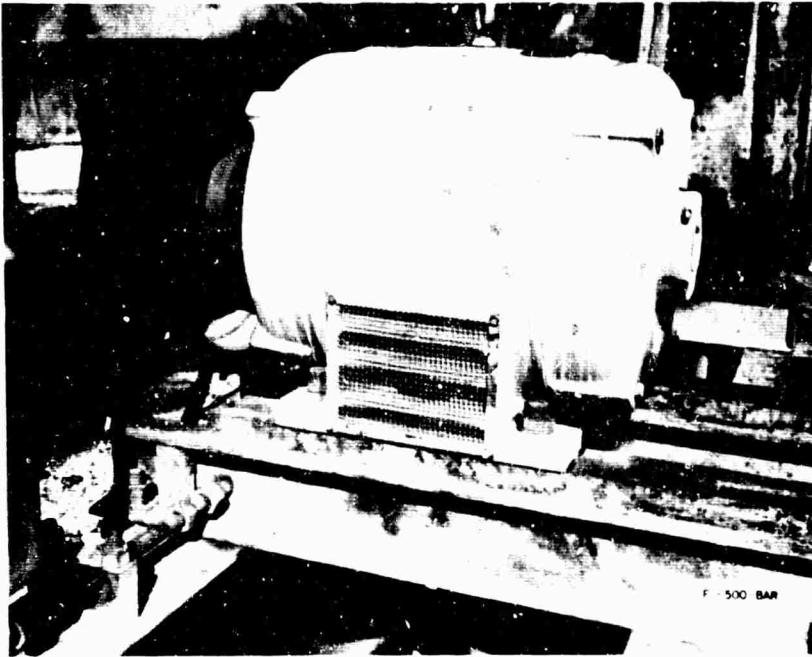


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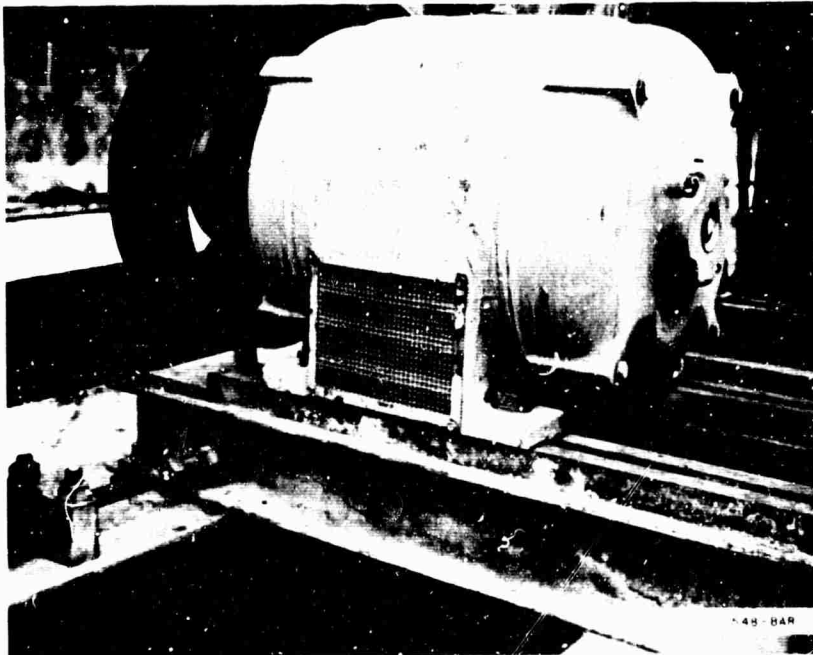


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Plate 19



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Plate 20



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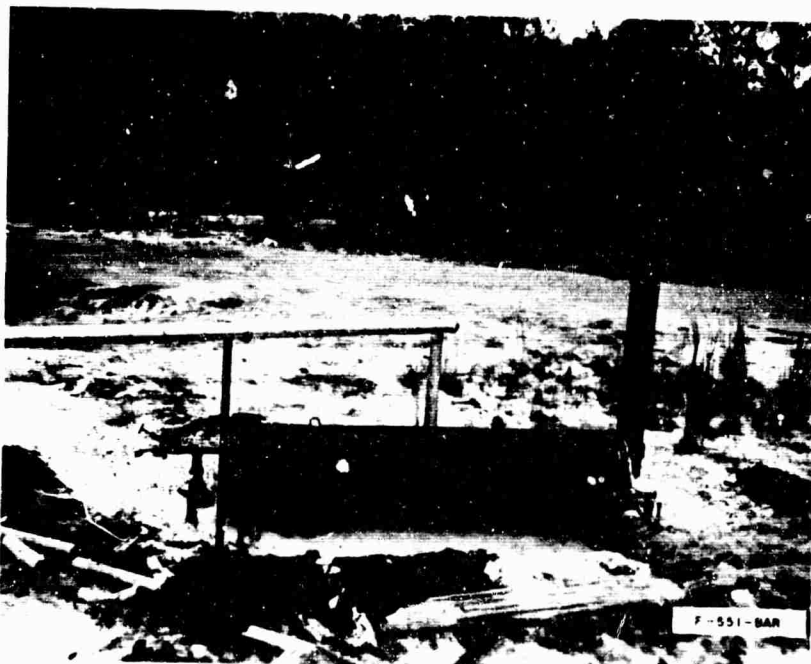


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Plate 21



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Plate 22



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Plate 23

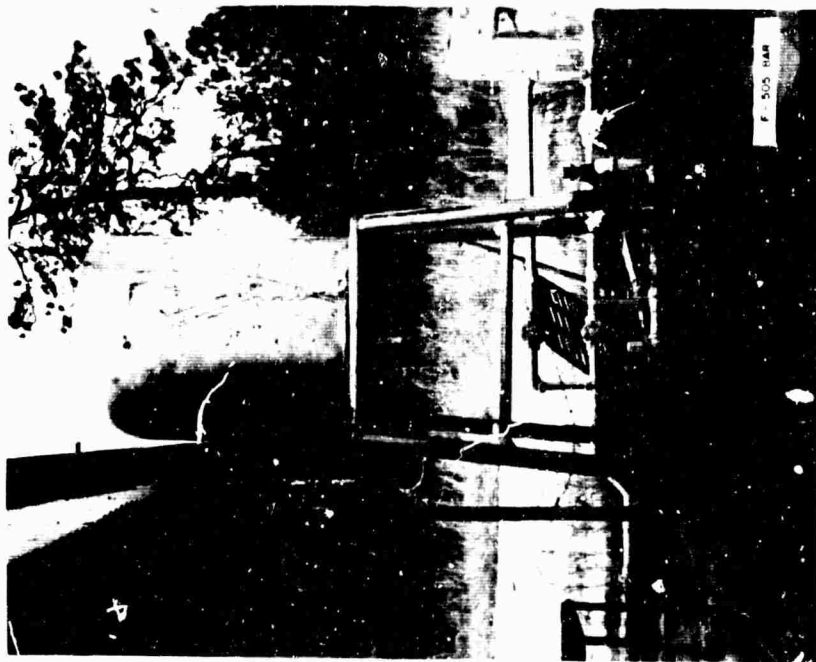


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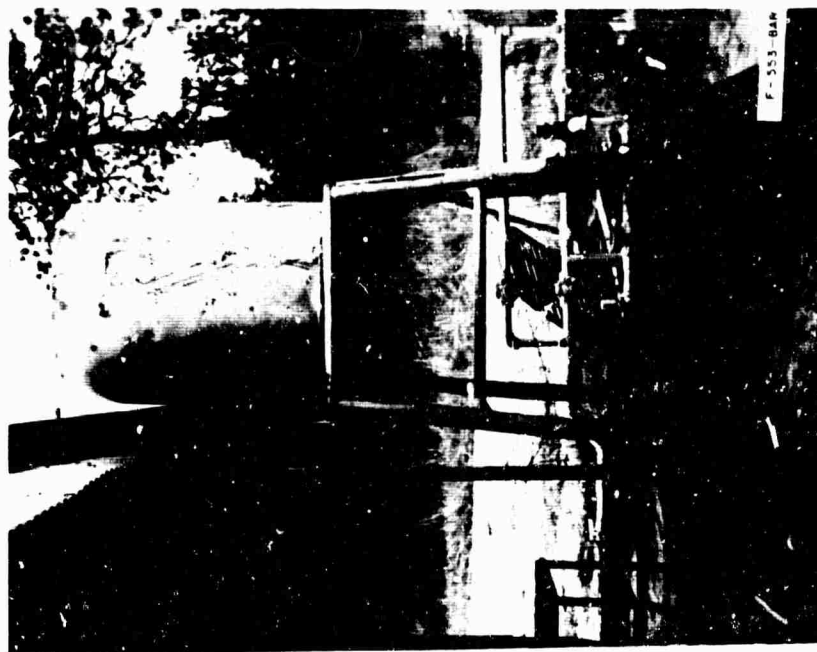


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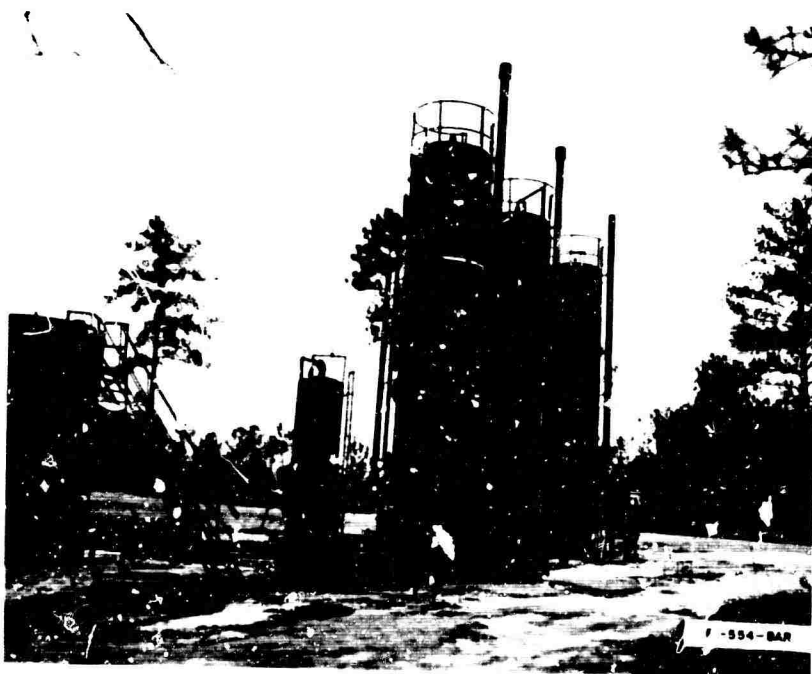


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Plate 25



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Plate 26



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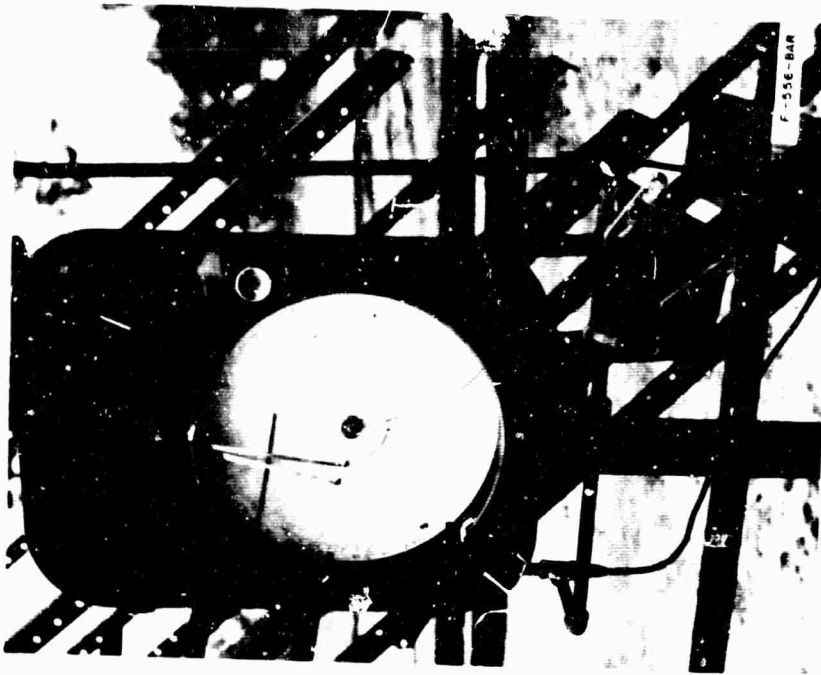


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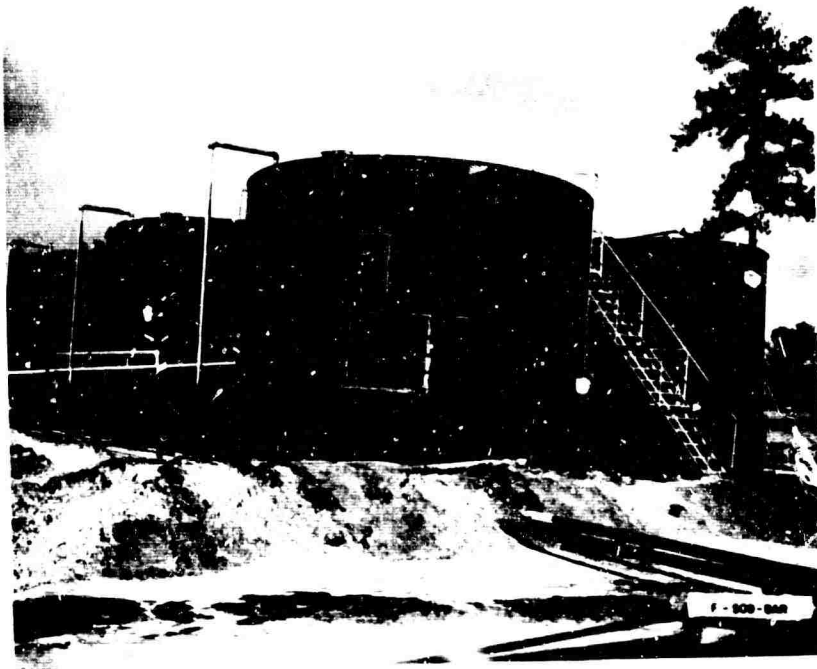


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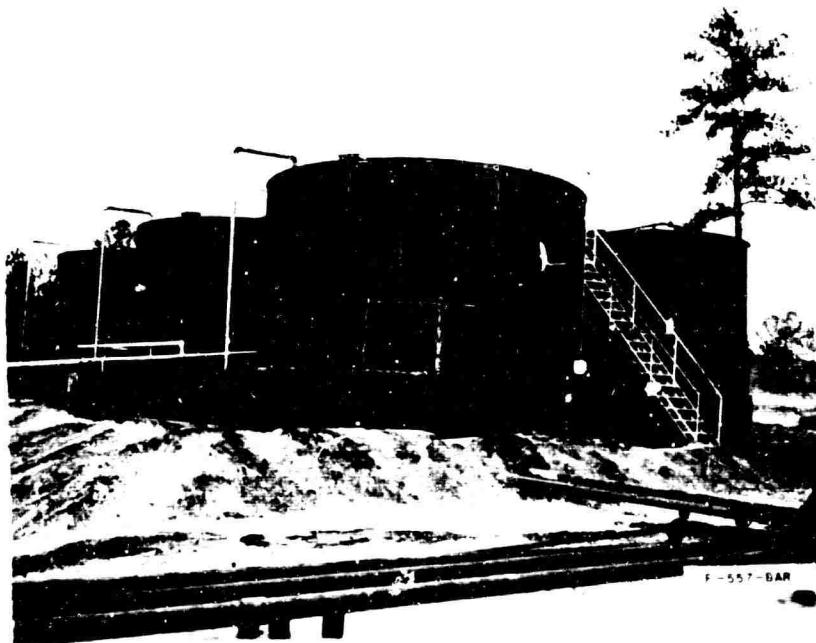


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Plate 28



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Postshot

Plate 29

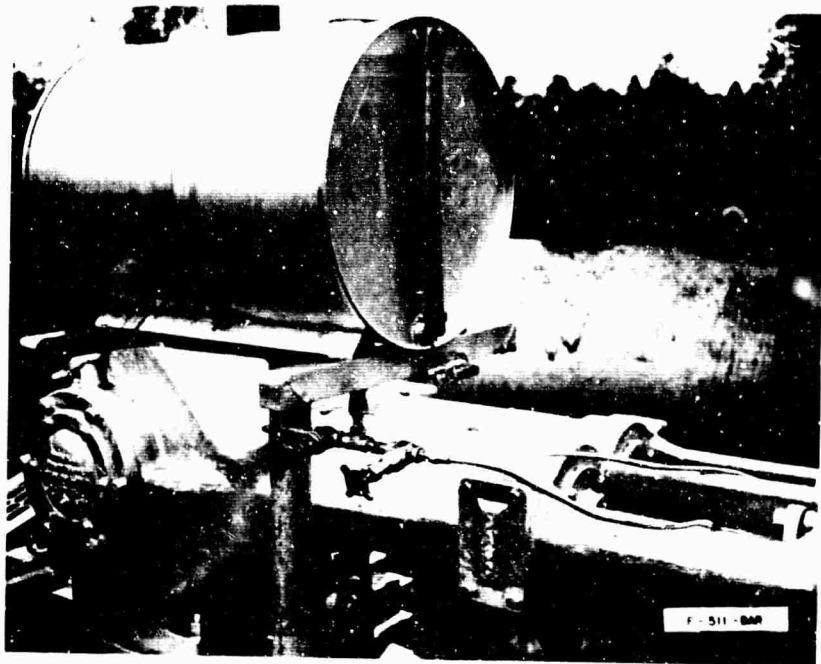


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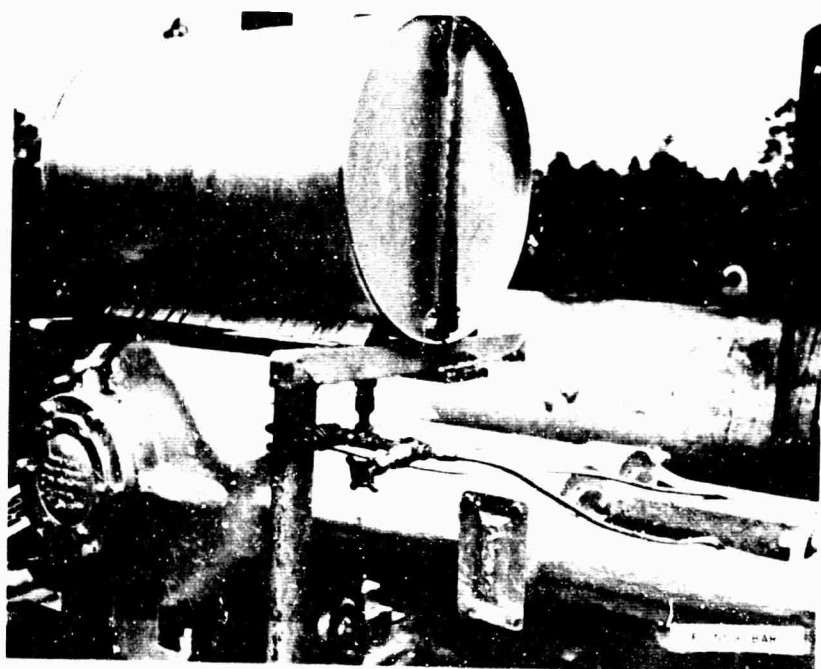


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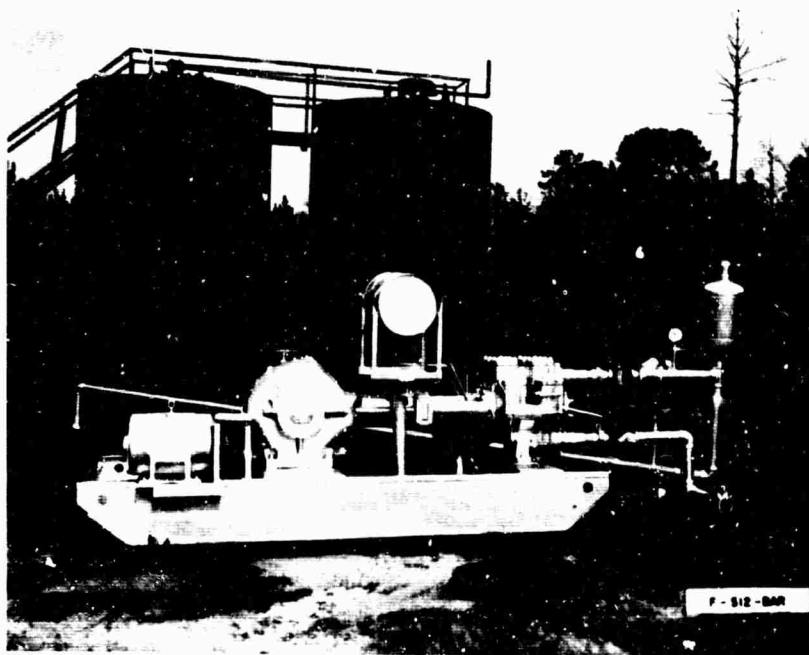


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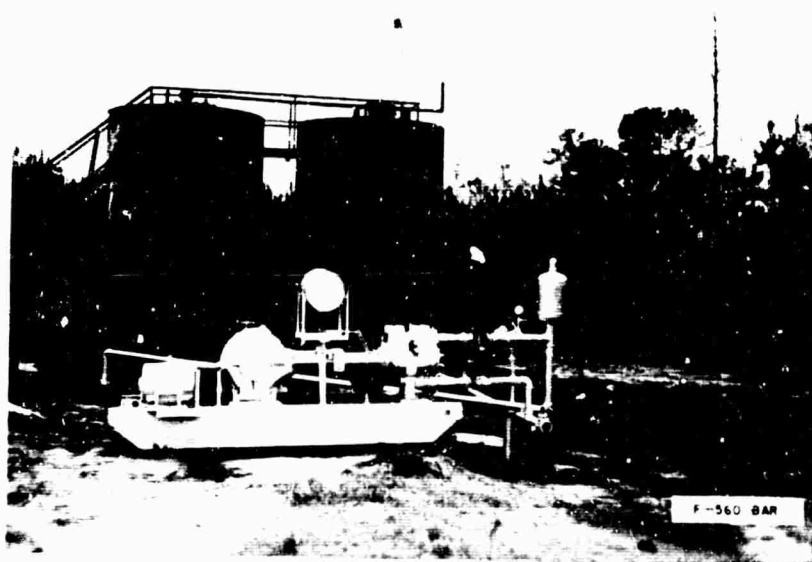


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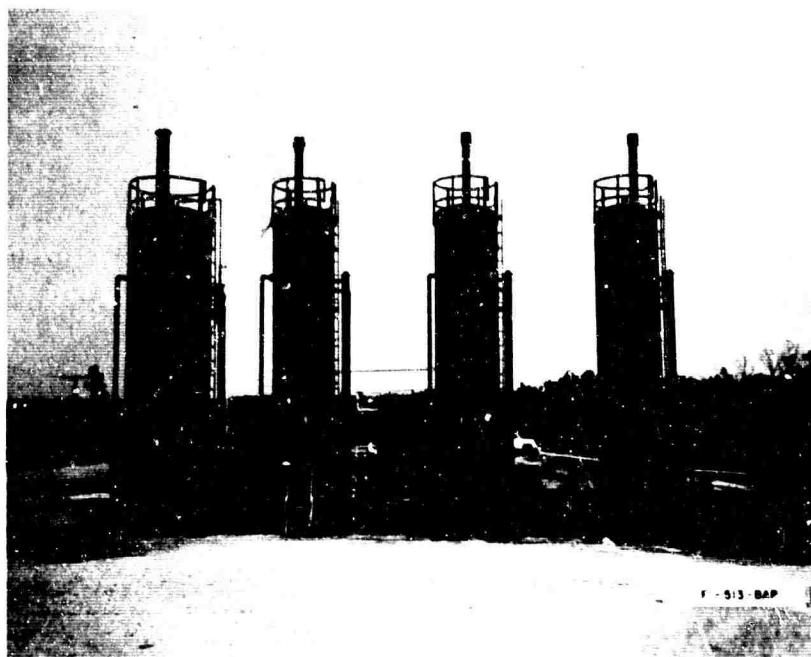


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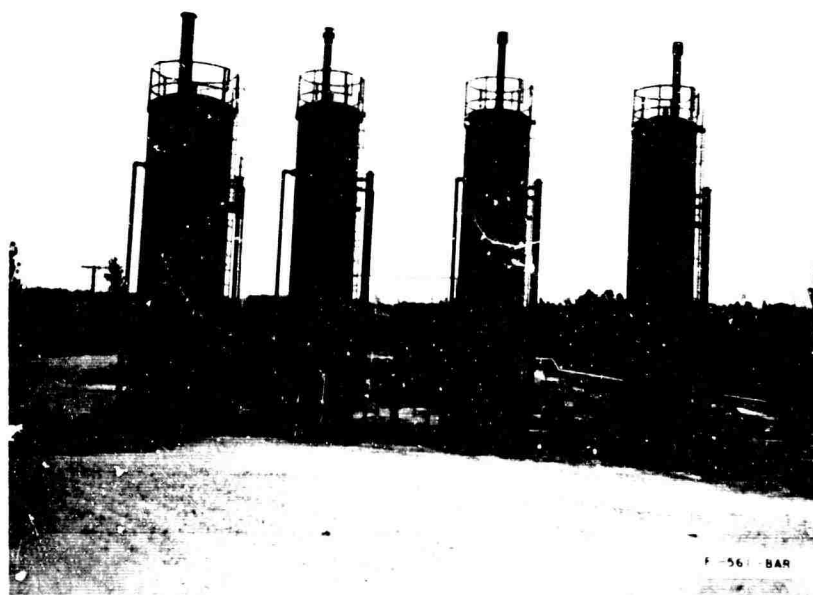


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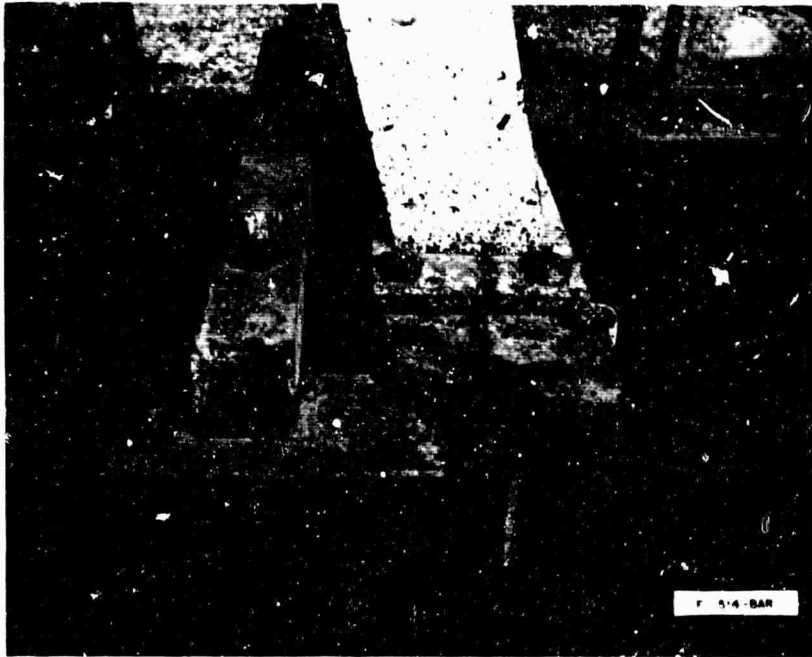


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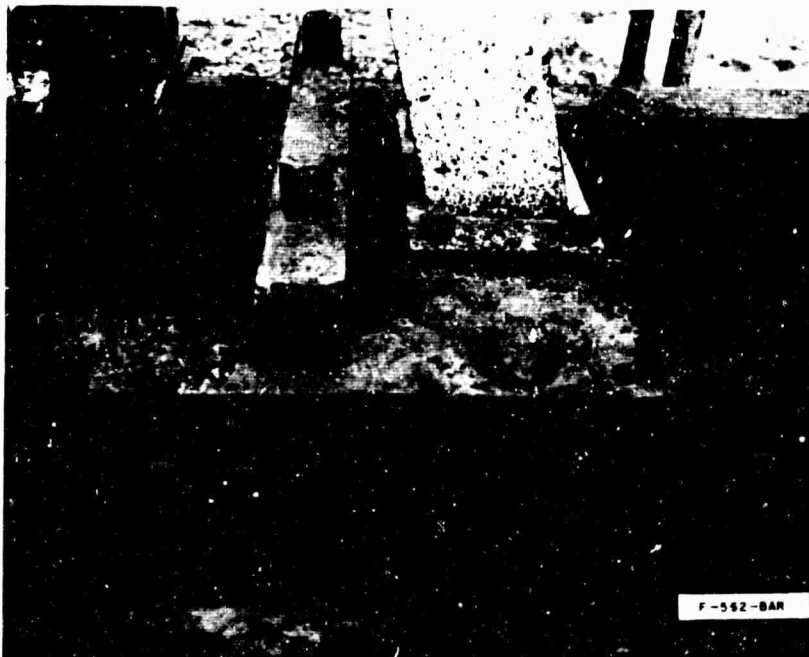


Postshot

Plate 33



Preshot

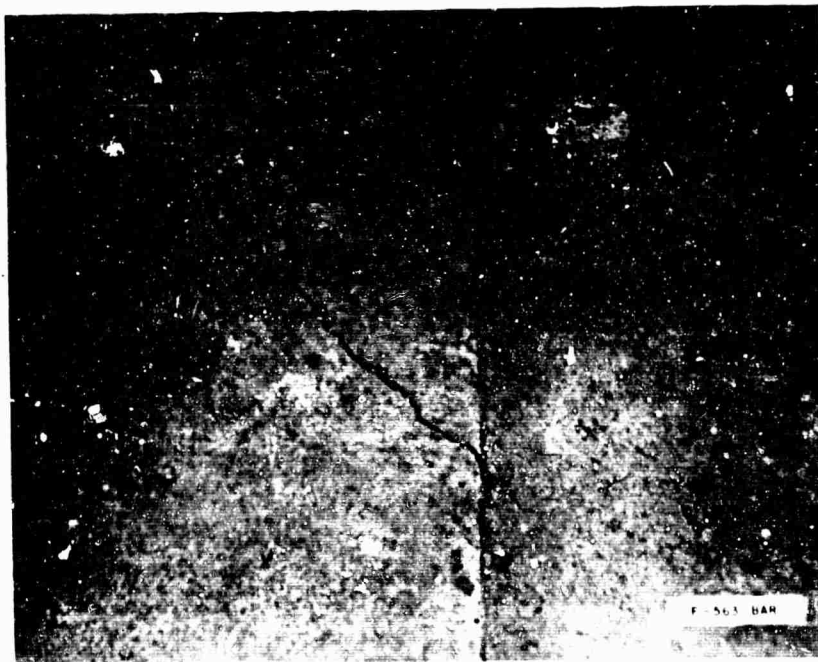


Postshot

Plate 34



Preshot

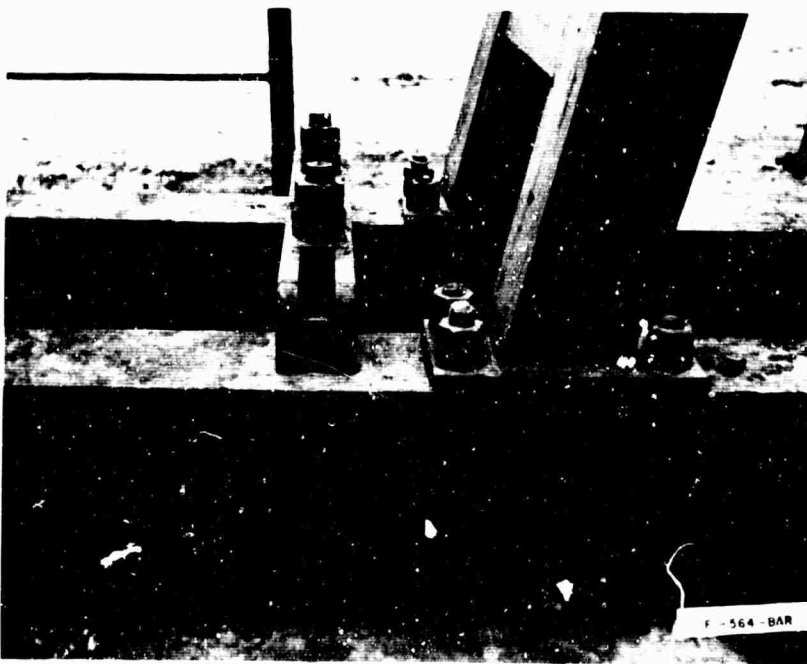


Postshot

Plate 35

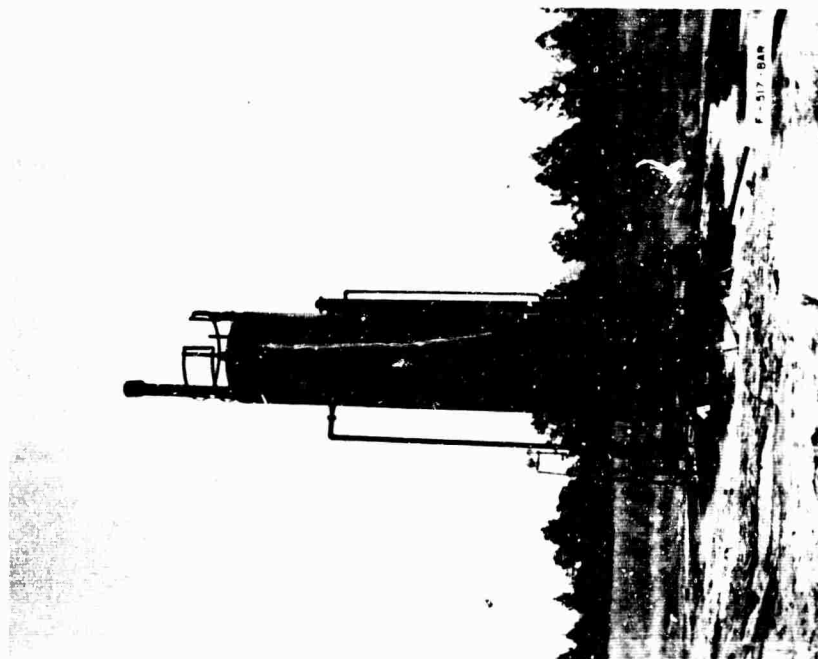


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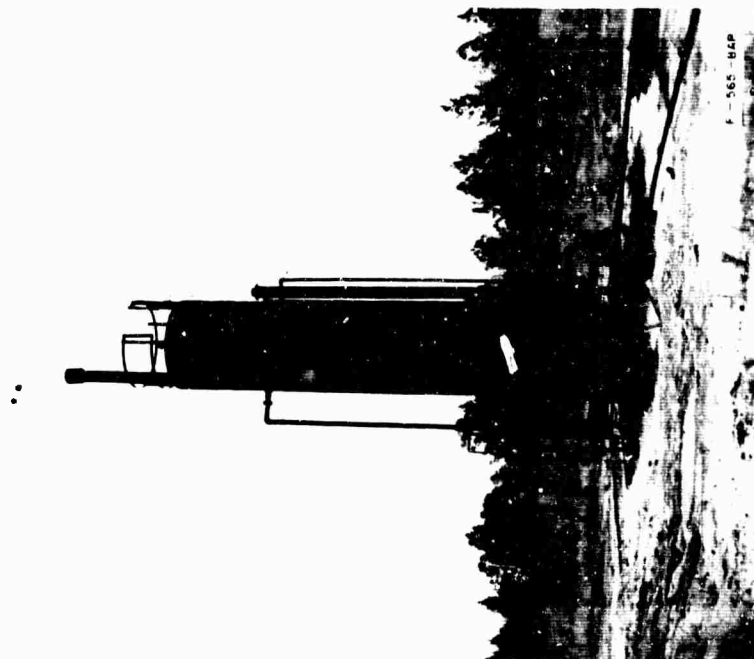


Postshot

Plate 36

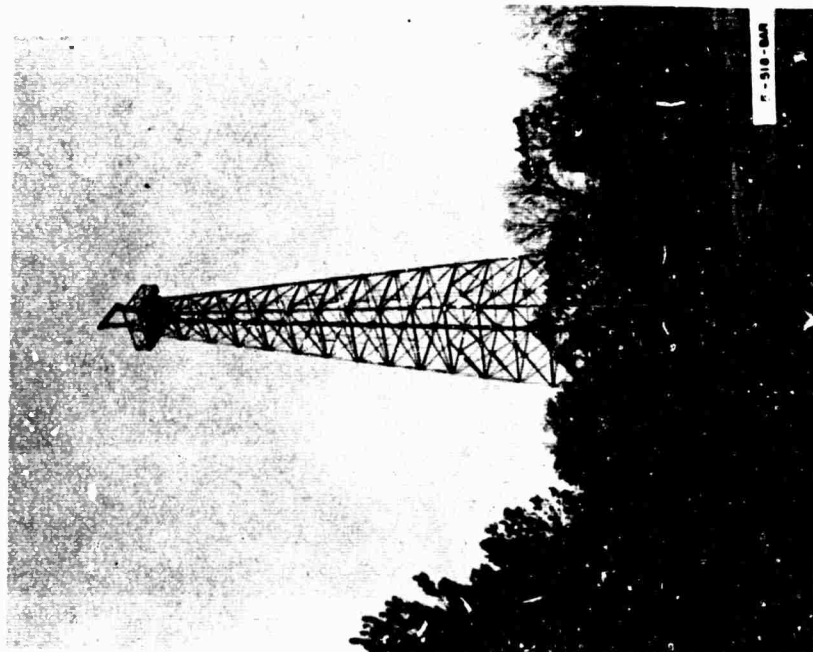


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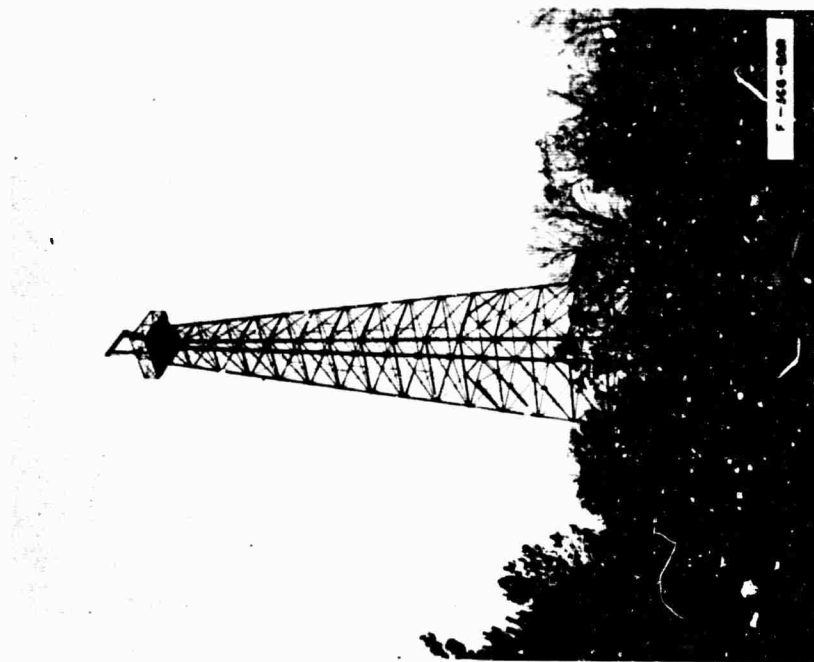


Postshot

Plate 37

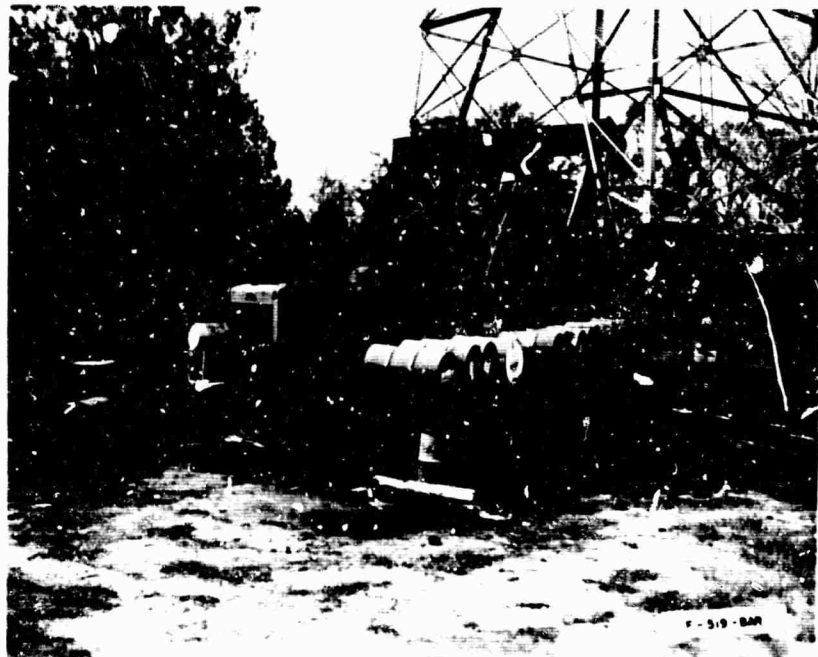


Preshot



Postshot

Plate 38

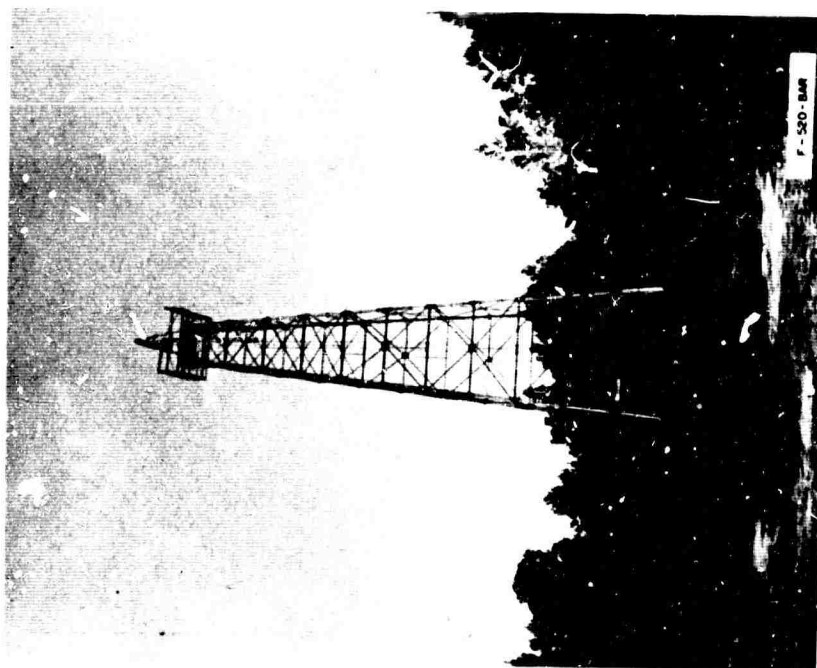


Preshot

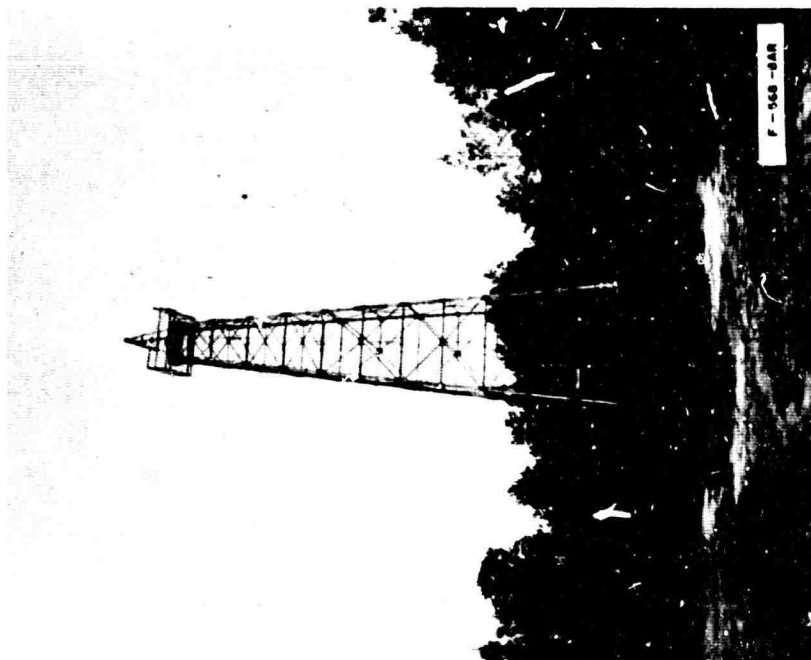


Postshot

Plate 39



Preshot



Postshot

Plate 40



Preshot

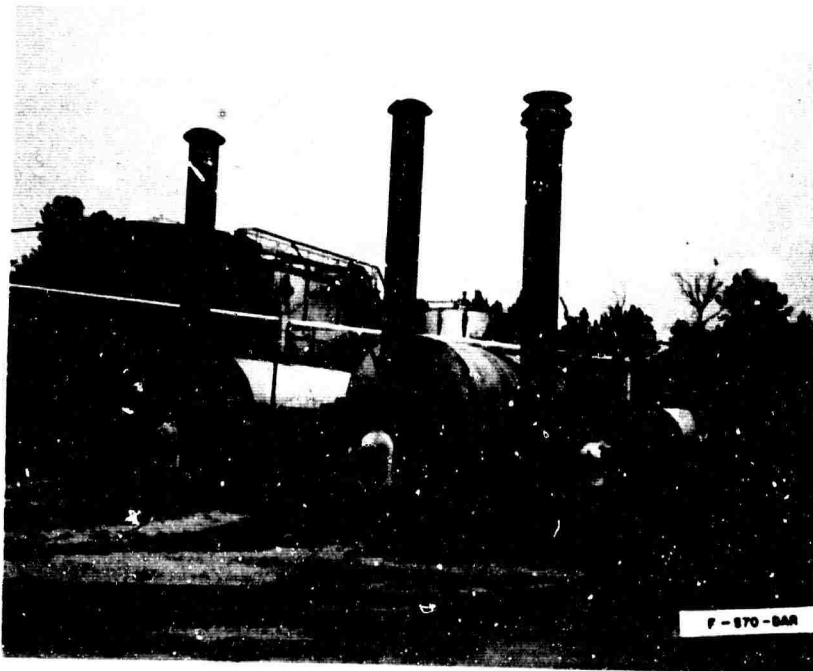


Postshot

Plate 41

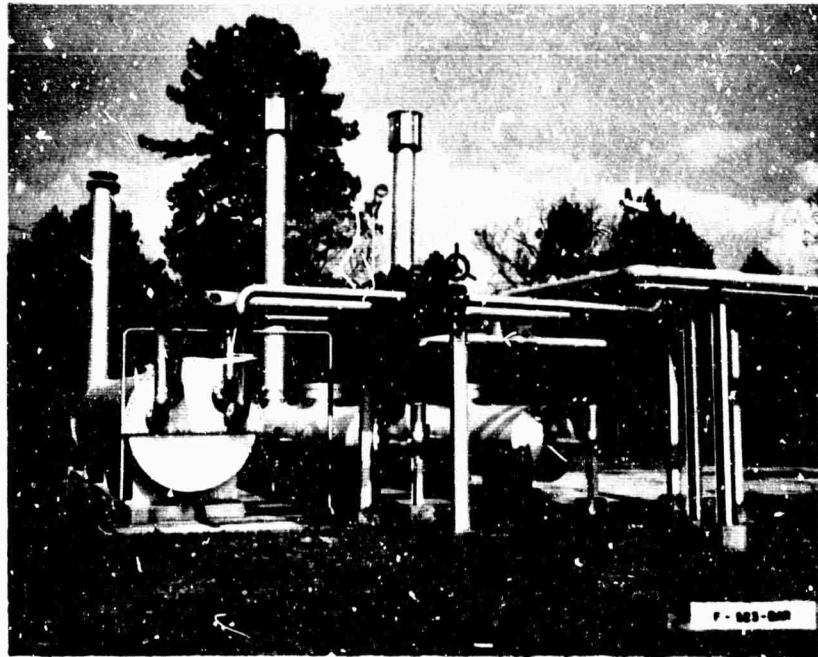


Preshot

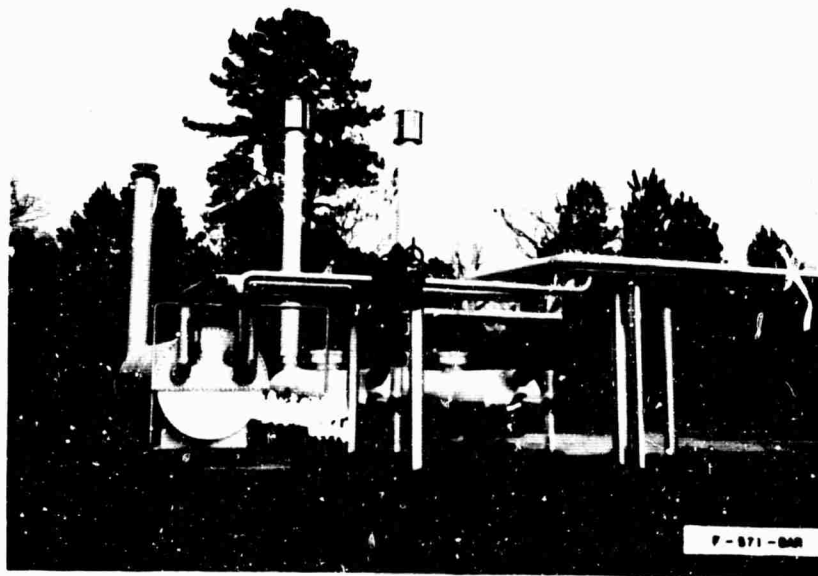


Postshot

Plate 42

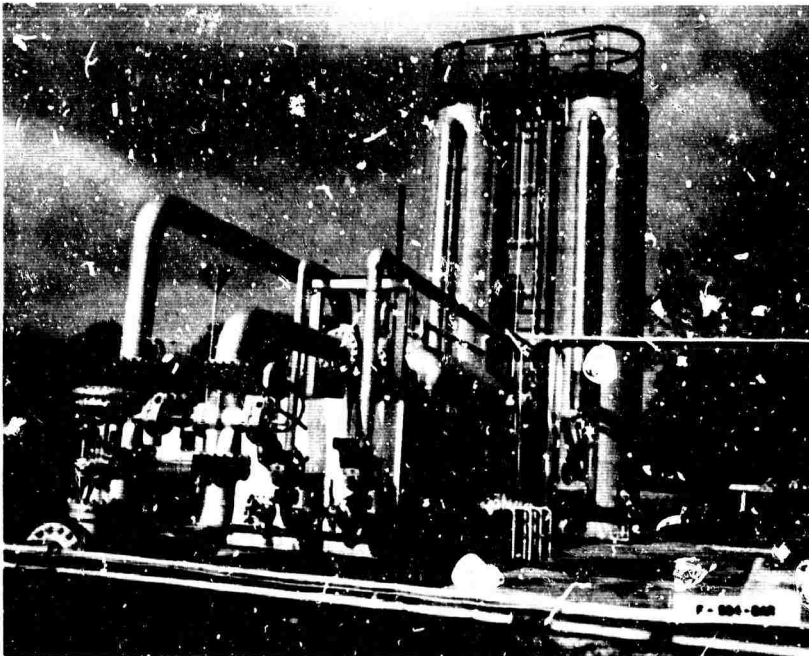


Preshot

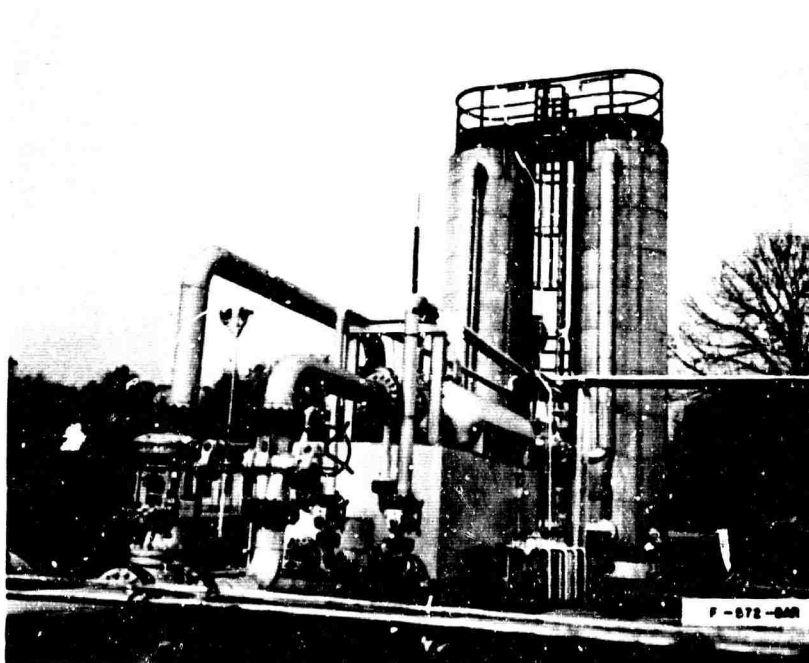


Postshot

Plate 43

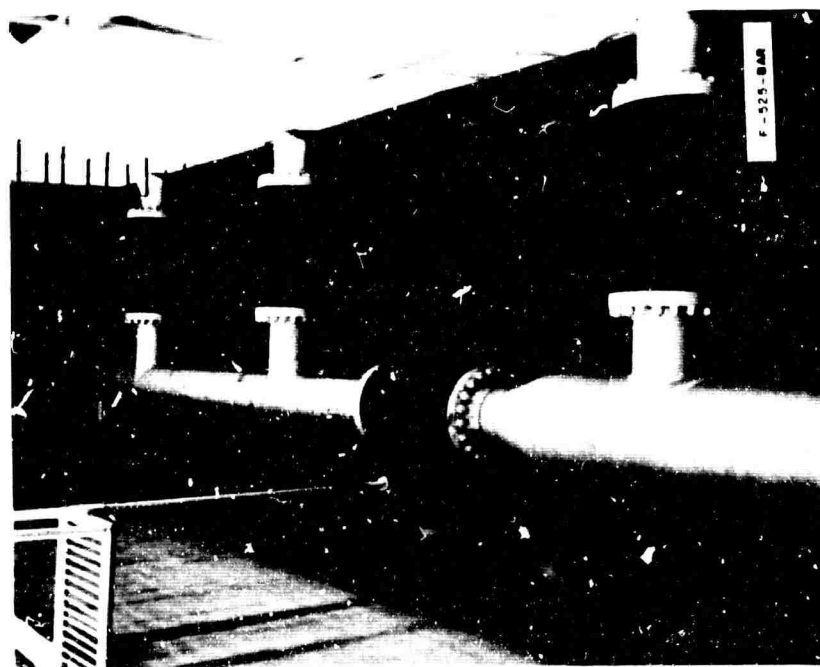


Preshot

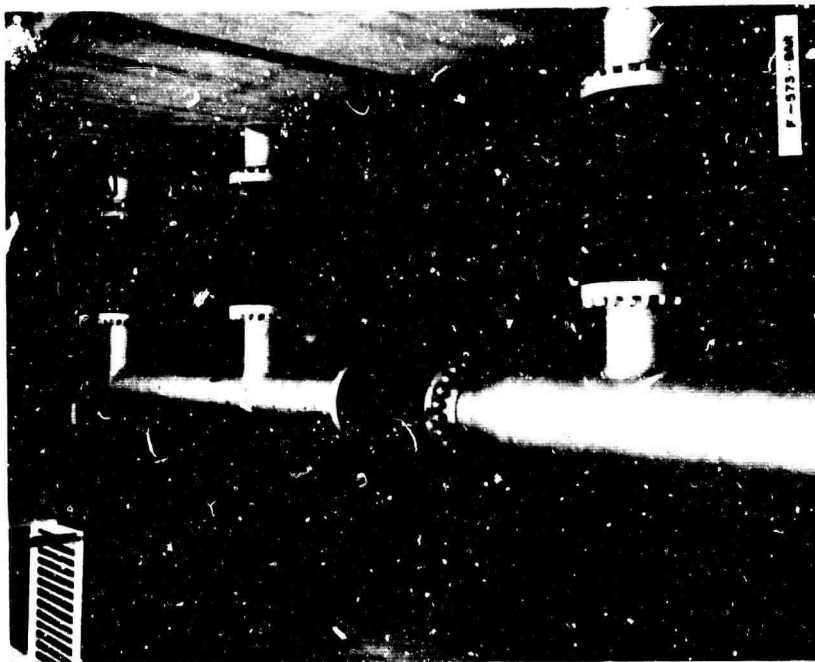


Postshot

Plate 44



Pre-shot

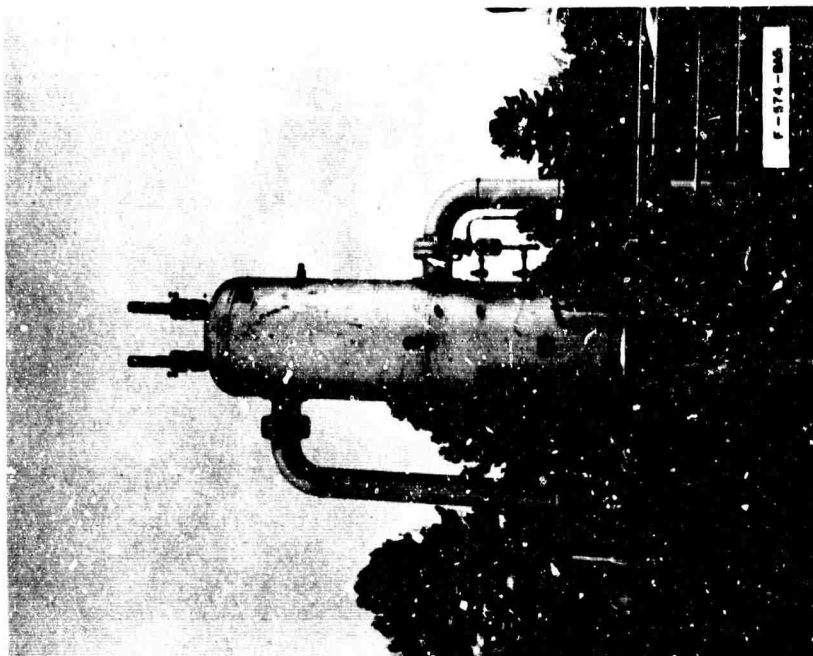


Postshot

Plate 45

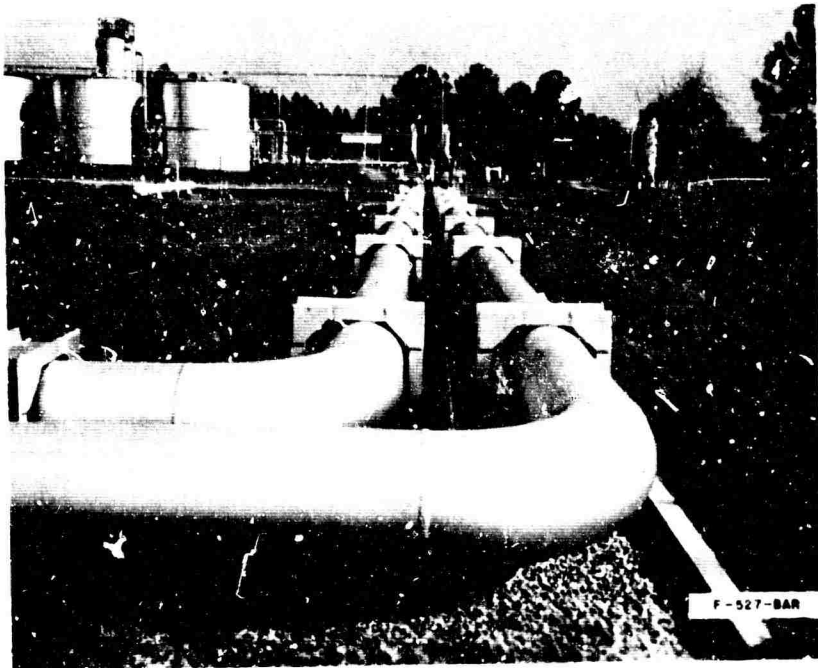


preshot

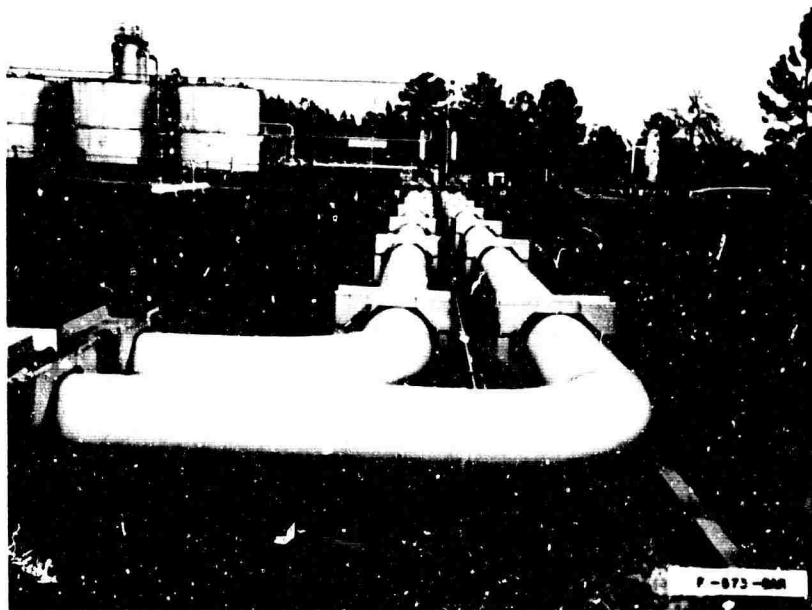


Postshot

Plate 46

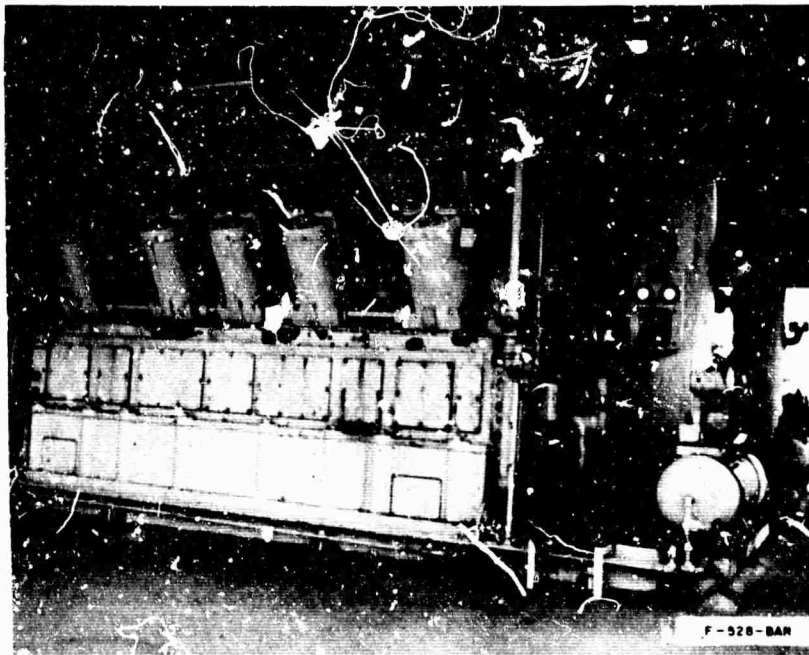


Preshot

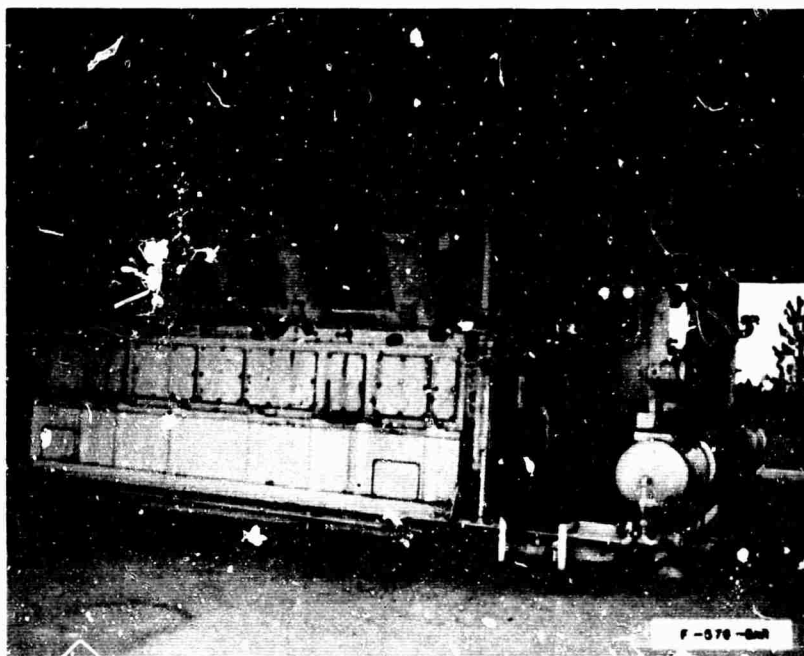


Postshot

Plate 47

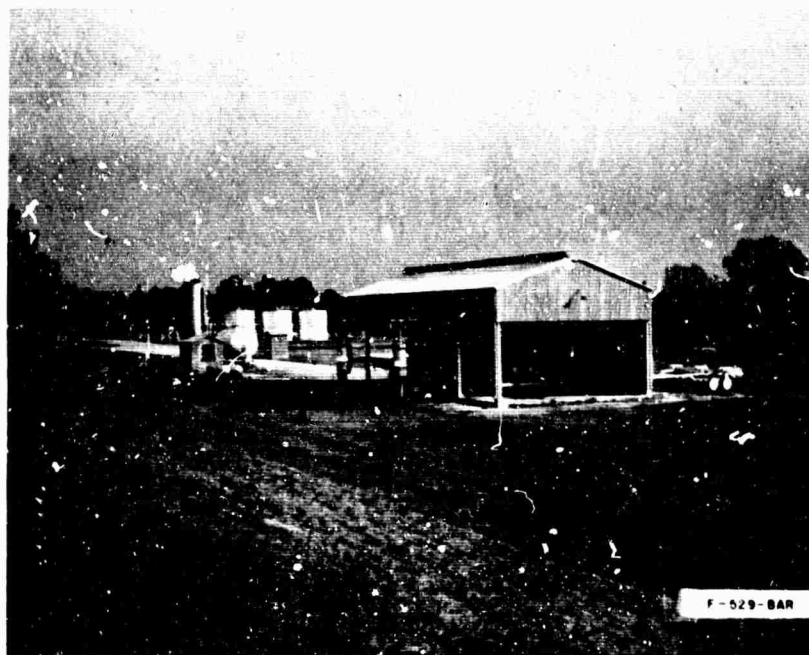


Preshot



Postshot

Plate 48



Preshot



Postshot

PROJECT STERLING REPORTS

SAFETY REPORTS

<u>Report No.</u>	<u>Agency</u>	<u>Title</u>
ERC	VUF-1035	Analyses of Ground Motion and Containment
USPHS	VUF-1036	Off-Site Surveillance
ESSA/ARFRO	VUF-1037	Weather & Radiation Predictions
REECO	VUF-1038	On-Site Health and Safety
FAA	VUF-1039	Federal Aviation Agency Airspace Advisory
H-NSC	VUF-1040	Hydrologic Safety Evaluation
USEM	VUF-1041	Pre- and Post-Shot Safety Inspections of Oil and Gas Facilities
USGS	VUF-1042	Well Aquifer Response to the Sterling Event, Tatum Dome
USGS	VUF-1043	Chemical and Radio-Chemical Quality of Water Following the Sterling Event
JAB	VUF-1044	Structural Response

TECHNICAL REPORTS

LRL, SC	VUF-3025	Subsurface Phenomenology Measurements Near a Decoupled Nuclear Event
USC&GS USGS GEO TECH LRL	VUF-3026	Decoupling of Seismic Waves By a Shot-Generated Cavity
TI	VUF-3027	Radioactive Gas Analysis
II	VUF-3028	Detection of Radionuclides

List of Abbreviations for Technical Agencies
Participating in Project Sterling

ERC	Environmental Research Corporation Alexandria, Virginia
ESSA/ARFRO	Environmental Science Services Administration Air Resources Field Research Office Las Vegas, Nevada
FAA	Federal Aviation Agency Los Angeles, California
GEO TECH	Geotechnical Corporation Garland, Texas
H-NSC	Hazelton-Nuclear Science Corporation Palo Alto, California
II	Isotopes, Inc. Westwood, New Jersey
JAB	John A. Blume San Francisco, California
LRL	Lawrence Radiation Laboratory Livermore, California
REECo	Reynolds Electrical & Engineering Co., Inc. Las Vegas, Nevada
SC	Sandia Corporation Albuquerque, N. M.
TI	Texas Instruments, Inc. Dallas, Texas
USBM	U. S. Bureau of Mines
USC&GS	U. S. Coast & Geodetic Survey Las Vegas, Nevada
USGS	U. S. Geologic Survey Denver, Colorado
USPHS	U. S. Public Health Service Las Vegas, Nevada