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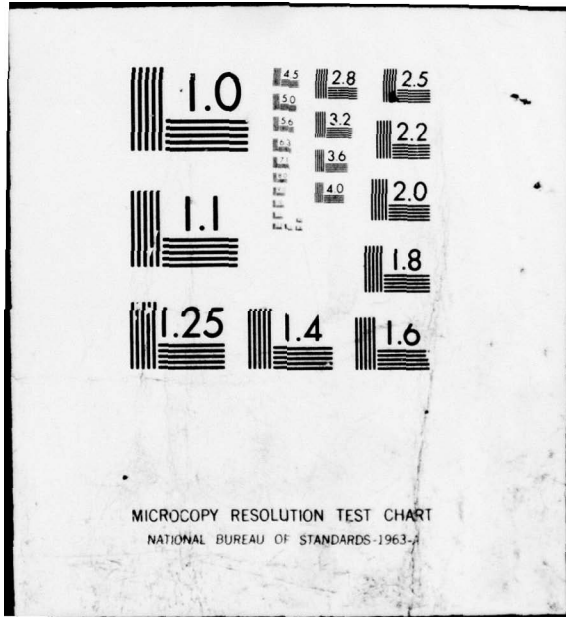
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NAVAL WEAPONS STATION EARLE
NAVAL WEAPONS HANDLING CENTER

TEST AND EVALUATION OF
UNIT LOAD SKIDDED FOR
ARMY 155MM PROJECTILES

ABSTRACT

This report details the test and evaluation of an improved version of the Army's 18 Round 155MM Projectile Skidded Unit Load. Test results indicate that the unit load is suitable for its intended purpose.

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INTRODUCTION

The Naval Weapons Handling Center, WPNSTA Earle was requested to test and evaluate a newly developed 18-155MM Projectile Skidded Unit Load for the Department of the Army. The purpose of this newly developed unit load was to provide an increased capacity unit load that would also eliminate the instability and nose ring dunnaging requirement inherent to the old Projectile Skidded Unit Load.

The unit load was tested in accordance with the applicable requirements of MIL-STD-1660 and was also subjected to a double pallet handling interface test. The tested unit load is an improved version of a similar Army unit load previously proved unsatisfactory for double pallet handling because of a weak bottom adapter.

ITEM DESCRIPTION

The unit load consists of top and bottom wooden adapters fabricated to accept the circular base and circular nose with lifting eye for the 18 Rounds of 155MM Ammunition. The unit load is banded together using 4 pieces of 1-1/4" steel strapping, 3 pieces of strapping are the width of the load while the remaining strap encircles the load lengthwise.

The overall dimensions of the unit load are: 35" long by 25-1/4" wide by 32-1/2" high. See Figures 1 through 5 for specific details. The overall unit load weight of 1,889 lbs. is comprised of 18/100 lb. projectiles (inert loaded), a top adapter of 31 lbs. and a bottom adapter of 58 lbs.

TEST PROCEDURES AND RESULTS

Testing was conducted in the sequence presented.

1. Repetitive Shock Test (Superimposed Load)

This test was conducted in accordance with paragraph 5.4.2.1 of MIL-STD-1660.

The unit load was placed down on a vibration table, Lab Model 8000 SLVMC-10, having a vertical linear motion of 1" double amplitude. A second unit load, weight 1,866 lbs., was stacked on top of the first unit load and the frequency of the table motion was increased until the top load left the bottom load by 1/16" at some instant during the cycle, Figure 6. This test was run at a table frequency of 3.4 Hz for a period of 2 hours.

RESULTS: The test load sustained no damage as a result of this test.

2. Stacking Test

This test was conducted in accordance with paragraph 5.4.1 of MIL-STD-1660.

The unit load was placed base down on a hydraulic compression test machine and with the use of a "spacer" a force of 9720 lbs. was applied for a period of 1 hour. The force of 9720 lbs. is equal to the weight of 5 identical unit loads and was chosen to simulate a stack of unit loads approximately 16" high, Figure 7.

RESULTS: The test load sustained no damage as a result of this test.

3. Forklift Truck Test (Before Impact Tests)

This test was conducted in accordance with paragraph 5.4.6 of MIL-STD-1660.

The unit load was engaged by a 4000 lbs. capacity electric forklift truck and maneuvered over a hazard course from each end at a speed of approximately 5 MPH, Figure 8. The fork pocket openings and spacing dimensions are as follows (all dimensions refer to inside openings): Forkpockets - 9" wide by 2" high, centerline distance between pockets - 12-1/2", and the edge to edge distance between the forkpockets - 3-1/2".

RESULTS: The test load sustained no damage as a result of this test.

4. Tipover Test

This test was conducted in accordance with paragraph 5.4.5 of MIL-STD-1660.

One edge of the unit load was lifted sufficiently high to form a 20° angle with the deck and held in this position for a period of 5 minutes.

RESULTS: The unit load remained stable when tilted to an angle of 20°.

5. Edgewise Drop Test

This test was conducted in accordance with paragraph 5.4.3.1 of MIL-STD-1660.

The test load was placed on its bottom with one end of the base of the load supported on a sill nominally 6" high. The opposite end of the base of the load was raised to a height of 12" and allowed to free fall impact onto an unyielding concrete surface, Figure 9. Both edges of the unit load were dropped in this manner.

RESULTS: The test load sustained no damage as a result of this test.

6. End Impact Test

This test was conducted in accordance with paragraph 5.4.4 of MIL-STD-1660.

The test load was placed base down on the carriage of the Conbur Impact Ramp and released from a predetermined point on the 10° track that had been calibrated to obtain an impact velocity of 10'/sec. Optional timber was used. Both ends (25" dimension) were impacted in this manner, Figures 10 and 11.

RESULTS: On both impacts the load racked in the direction of the impact. The 3/4" plywood on the top of the pallet base cracked and splintered allowing for minimal movement of the ammunition within the unit load, Figures 12 and 13. The nails holding the 3/4" plywood to the base came loose, minimal damage was sustained to the top pallet adapter.

7. Side Impact Test

This test was conducted in accordance with the same procedures utilized for the End Impact Test except that both sides (35" dimension) of the unit load were impacted in that manner, Figures 14 and 15.

RESULTS: The unit load sustained additional minor damage similar to that discussed on the End Impact Test.

8. Forklift Truck Test (After Impact Tests)

This test was conducted in accordance with the procedures discussed in paragraph 3.

Again the unit load was engaged by a 4000 lb. capacity electric forklift truck and maneuvered over the hazard course from each end at a speed of approximately 5 MPH.

RESULTS: The unit load was easily handled by the forklift truck and remained intact as a result of this test.

9. Sling Compatibility Test (Double Pallet Handling)

This test was conducted in accordance with paragraph 5.4.8 of MIL-STD-1660.

Two unit loads, positioned end to end, were lifted, swung, lowered and otherwise handled using a 25' wire rope basket sling (experimental), safe working load 8,000 lbs., Figures 16 and 17.

RESULTS: The sling was easily attached and removed. The unit loads were satisfactorily lifted, swung, lowered and otherwise handled by the sling with no danger of slippage or disengagement with the loads suspended in mid-air.

CONCLUSIONS AND RECOMMENDATIONS

The results of this evaluation indicate that the subject unit load satisfactorily meets the requirements imposed by MIL-STD-1660 and therefore is suitable for its intended purpose as a shipping configuration for a quantity of 18 Army 155MM Projectiles.

Based on the results from the end and side impact tests it is recommended that the unit load be made more secure with the use of pallet nails in the fabrication of the top and bottom wooden adapters and 1-1/4" (vice 3/4") plywood be utilized for the base of the bottom adapter. The use of the pallet nails and the thicker plywood would reduce the damage to the adapters in the event of impacts during handling operations. Also recommended is that by increasing both the depth of the top adapter and the diameter of the holes cut in the top adapter a more secure engagement of the projectiles will result further deterring racking/movement of the projectiles during impacts.

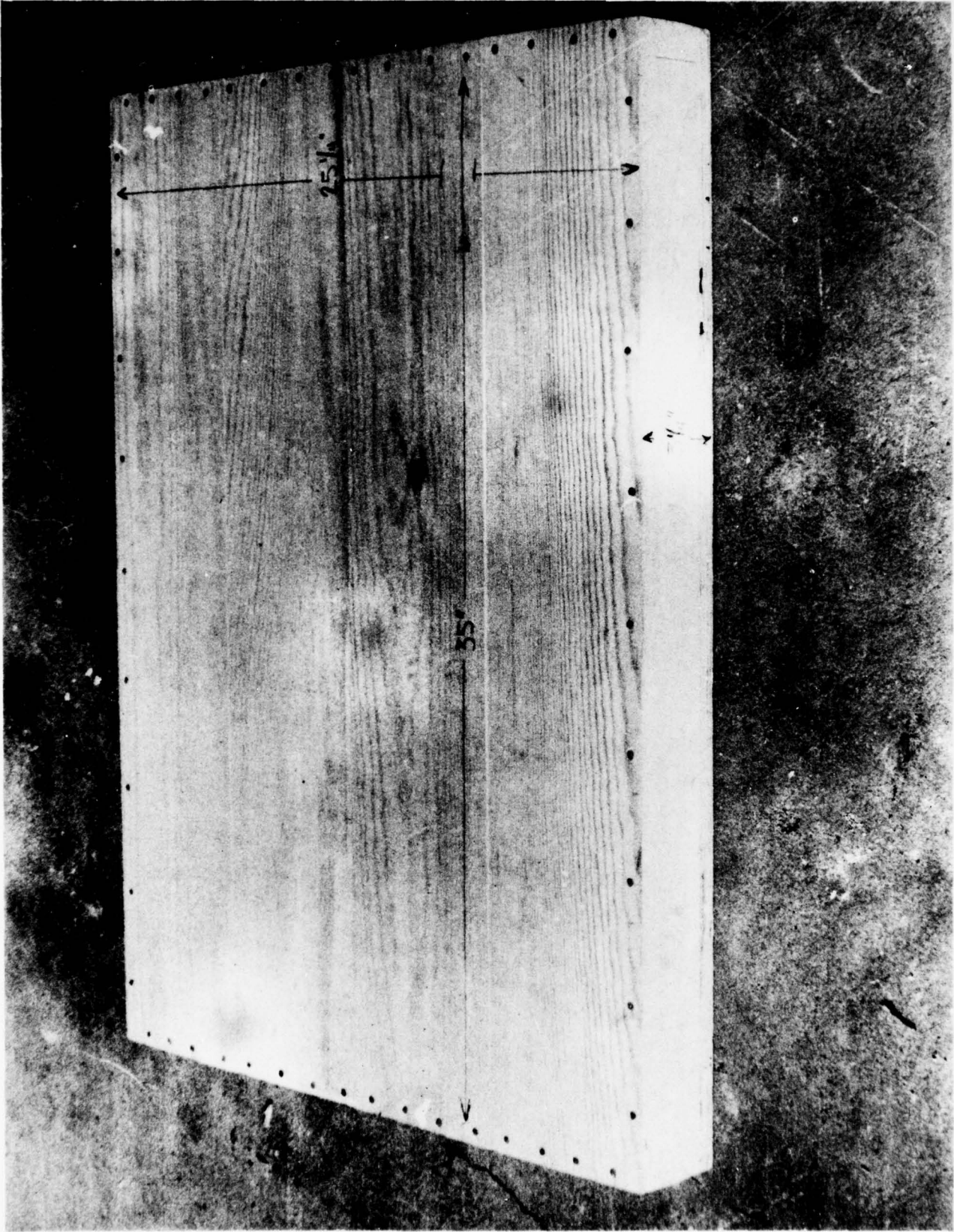


FIG. 1 ARMY 155 mm UNIT LOAD TOP ADAPTER DETAIL

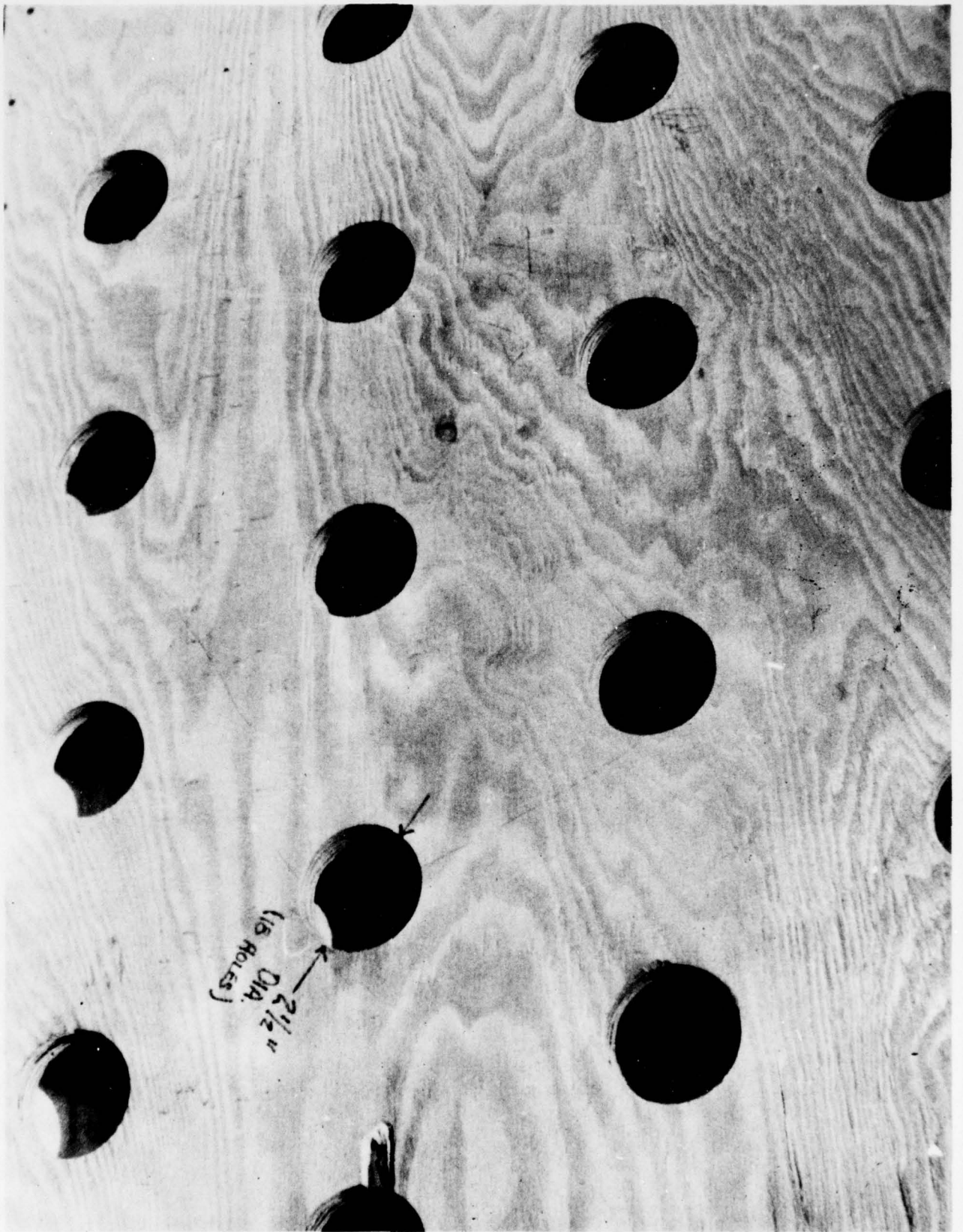


FIG. 2 ARMY 155 mm UNIT LOAD TOP ADAPTER PROJECTILE NOSE HOLES

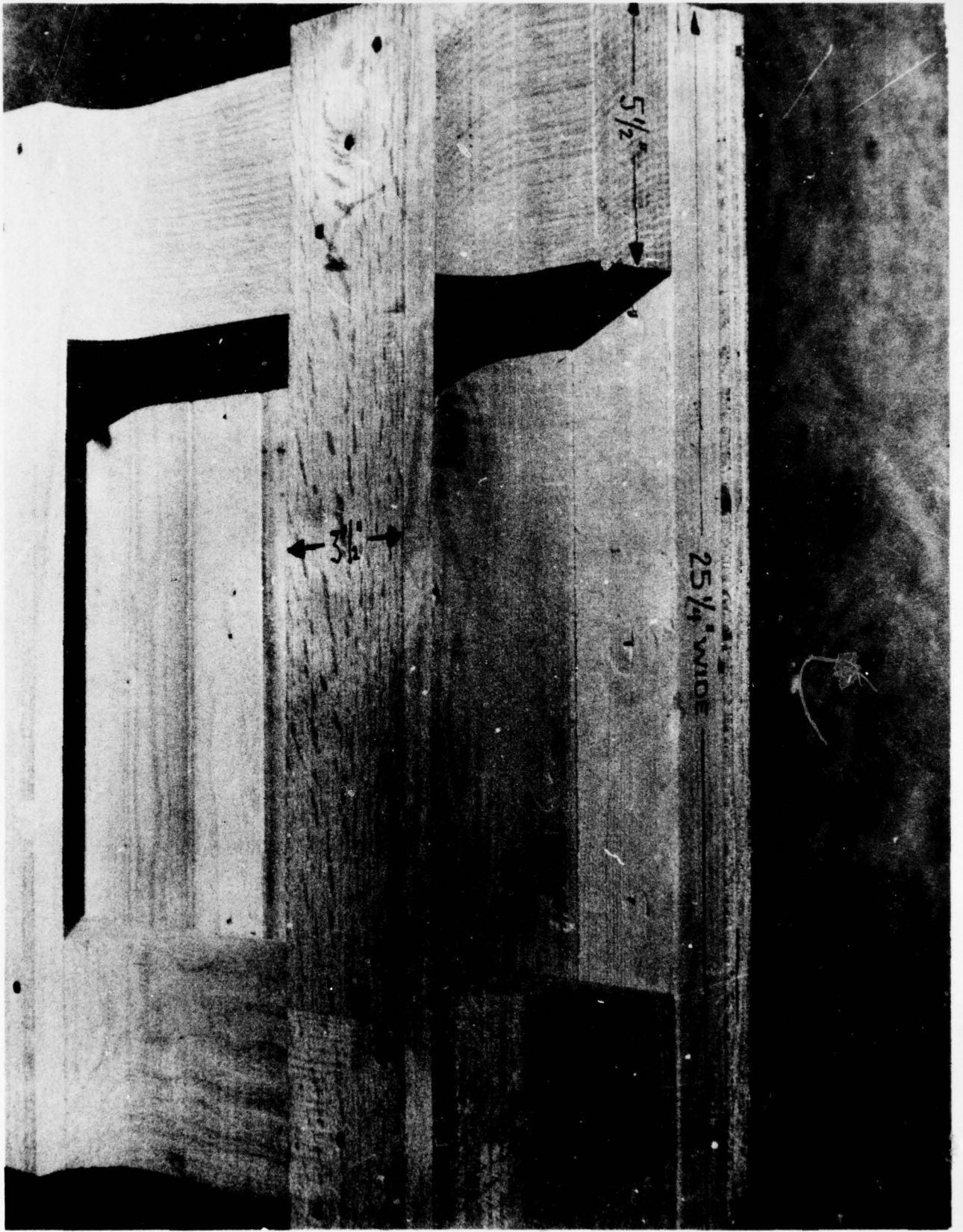


FIG. 4 ARMY 155mm UNIT LOAD BOTTOM ADAPTER DETAIL

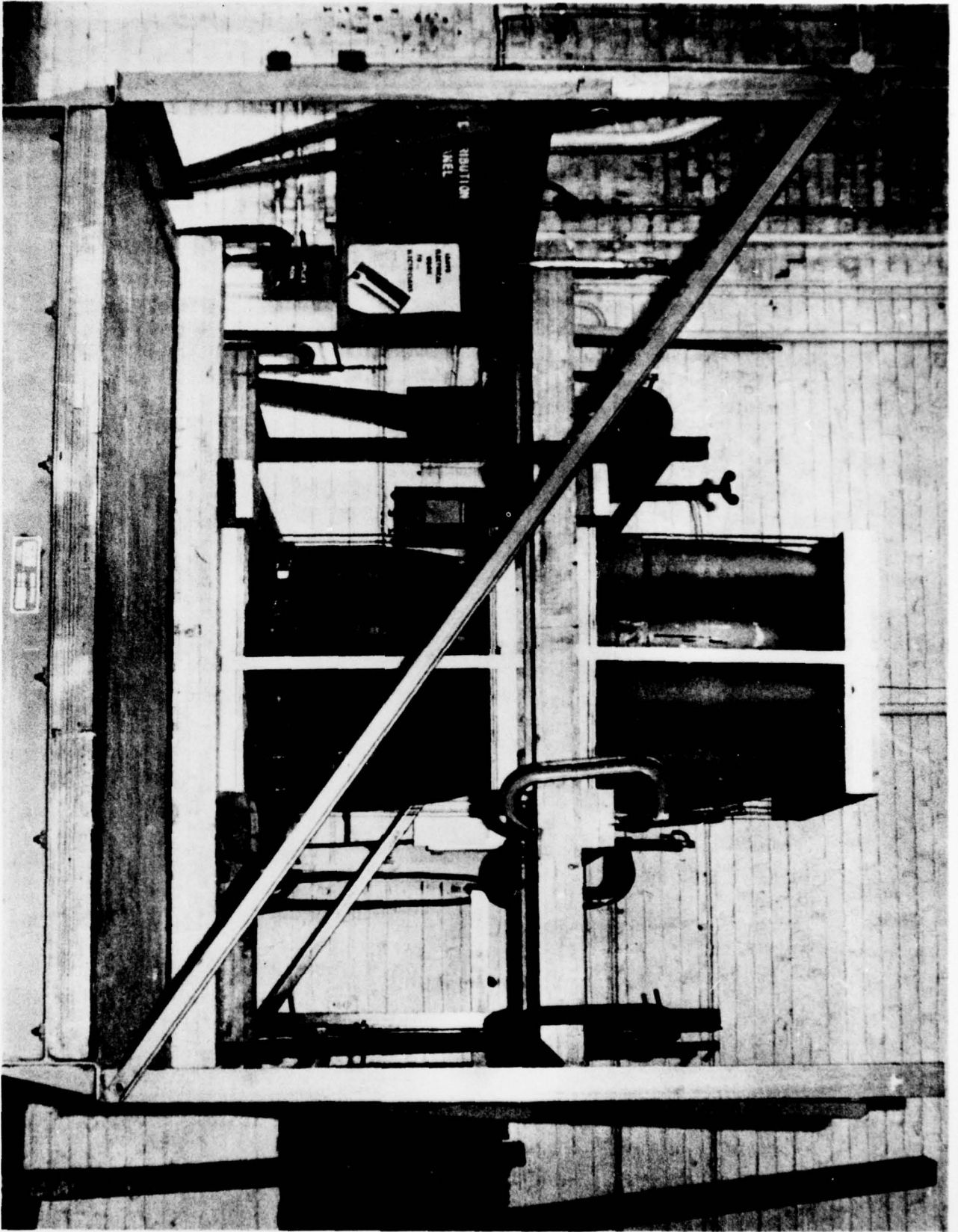


FIG. 6 ARMY 155mm UNIT LOAD REPETITIVE SHOCK TEST

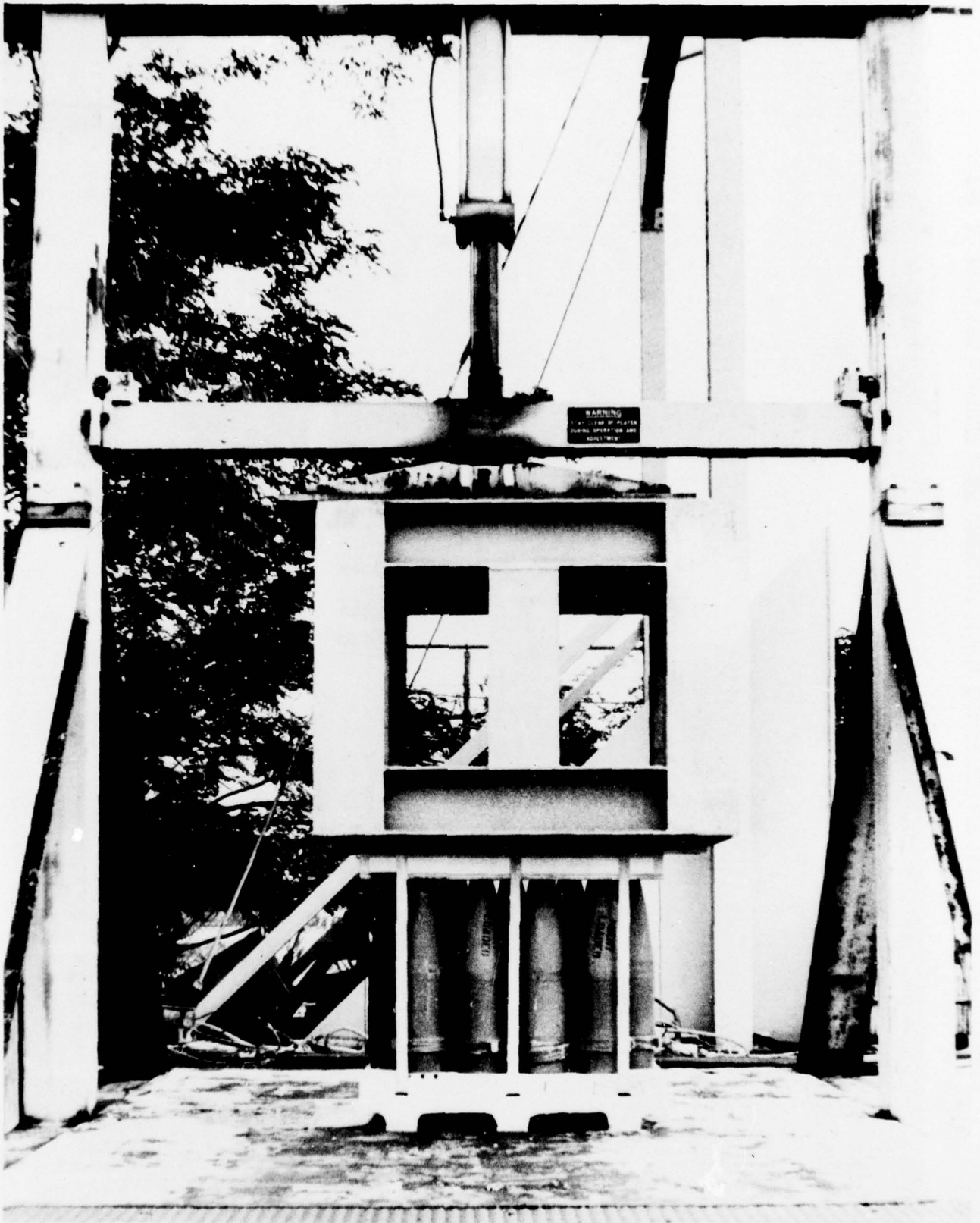


FIG. 7 ARMY 155 mm UNIT LOAD STACKABILITY TEST



FIG. 8 ARMY 155 mm UNIT LOAD FORKLIFT TRUCK COMPATIBILITY TEST ON HAZARD COURSE

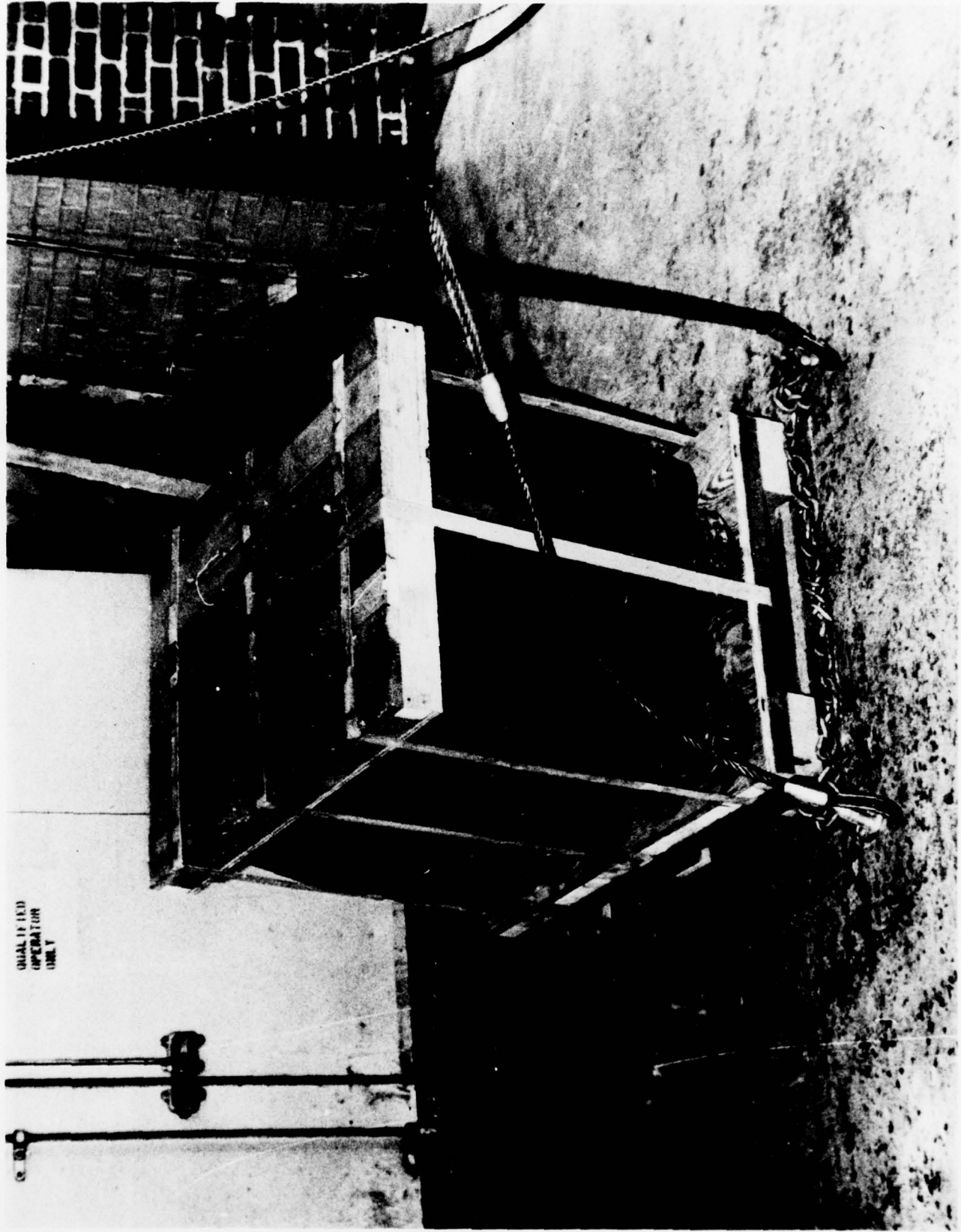


FIG. 9 ARMY 155 mm UNIT LOAD EDGE DROP TEST



FIG. 10 ARMY 155 mm UNIT LOAD 1st END IMPACT ON 25 " SIDE



FIG. 11 ARMY 155 mm UNIT LOAD 2nd END IMPACT ON OPPOSITE 25" SIDE



FIG. 12 mm UNIT LOAD END IMPACT BASE DAMAGE



FIG. 13 ARMY 155 mm UNIT LOAD END IMPACT NAIL WITHDRAWAL

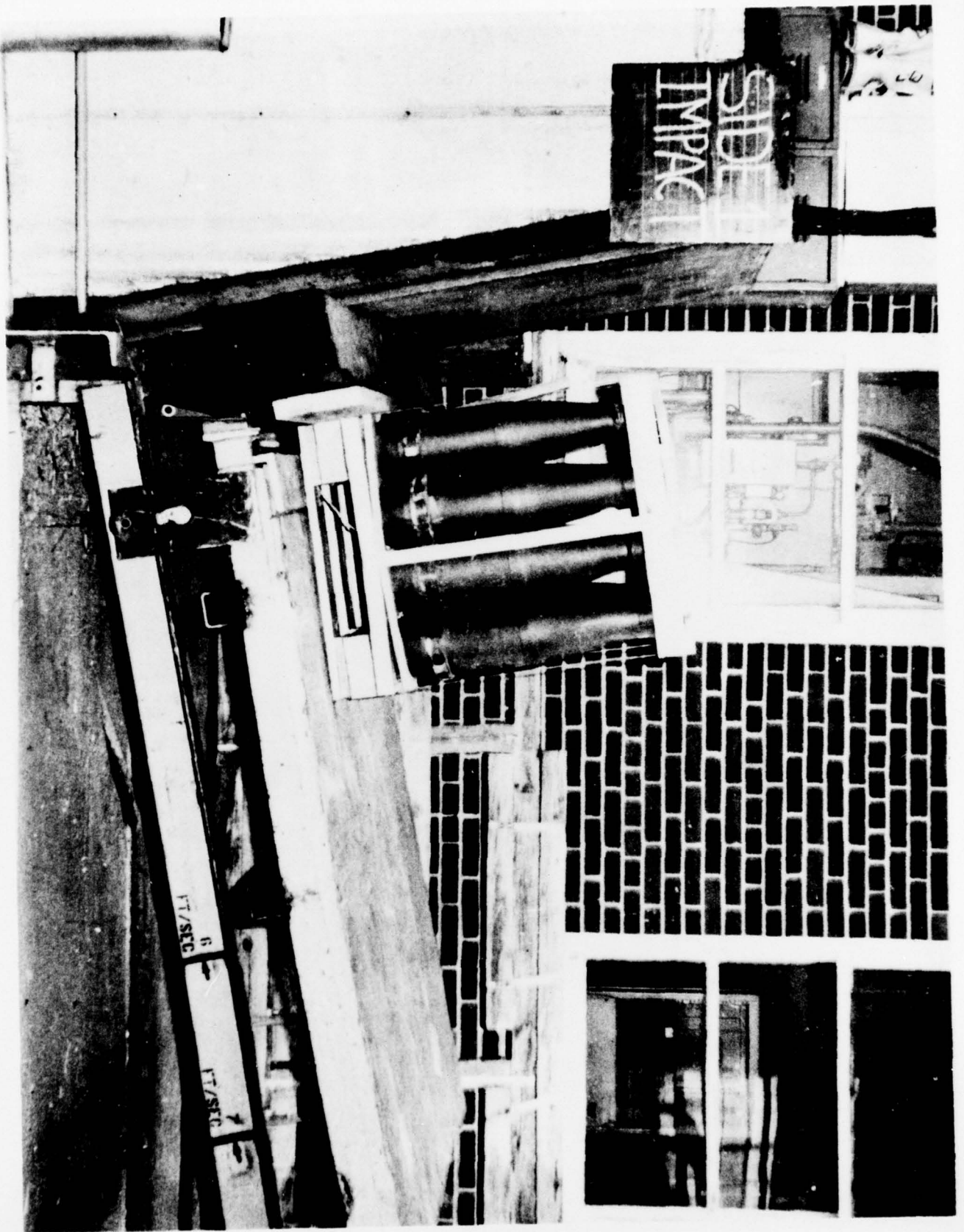


FIG. 14 ARMY 155 mm UNIT LOAD 1st SIDE (35") IMPACT



FIG. 15 ARMY 155 mm UNIT LOAD 2nd SIDE IMPACT

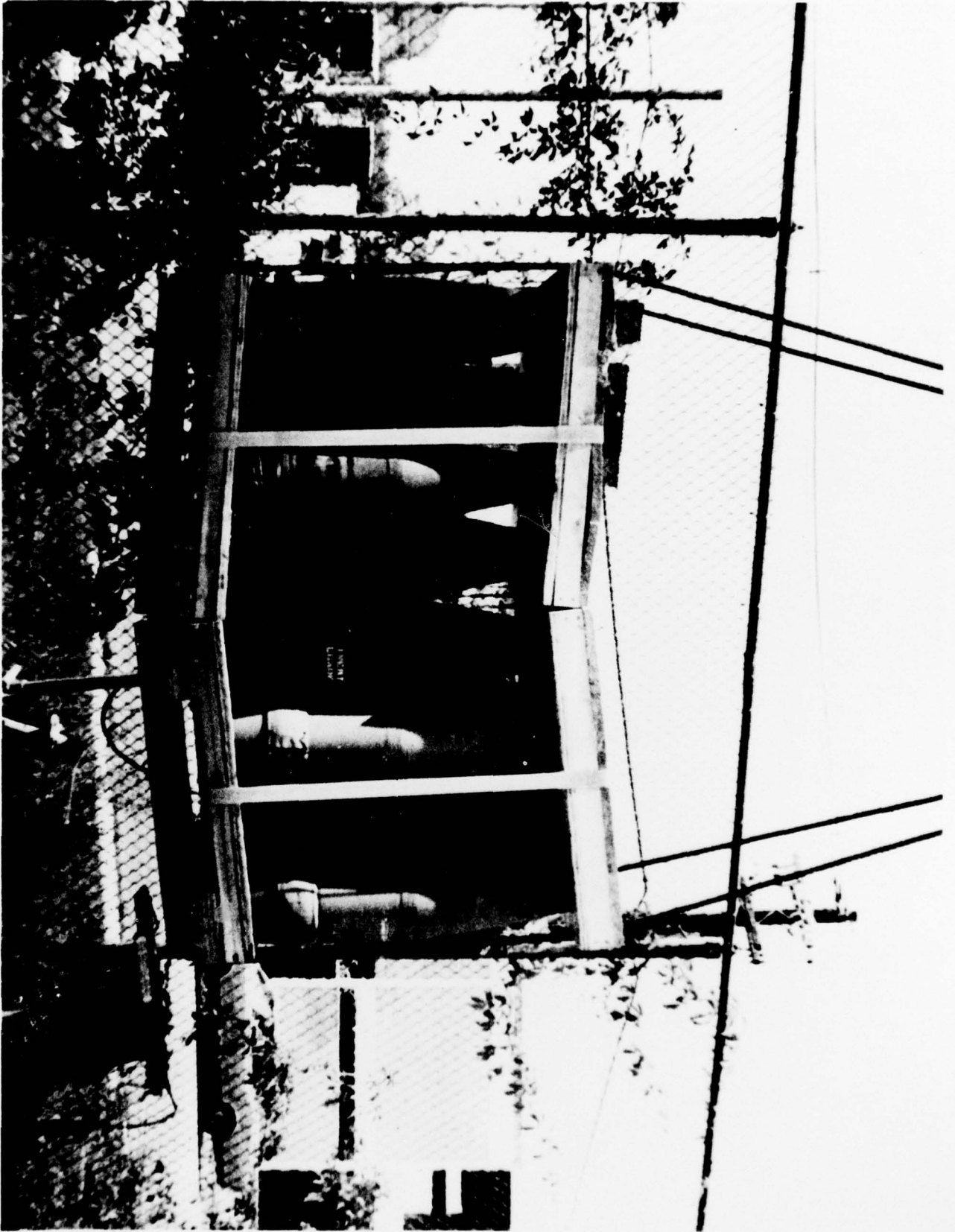


FIG. 16 ARMY 155 mm UNIT LOAD SIDE-BY-SIDE DOUBLE PALLET LIFT



FIG. 17 ARMY 155 mm UNIT LOAD WIRE ROPE SLING ATTACHMENT DETAIL

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