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MAR 3 1958

Case No. 771.00
Ref. Sym: 1612 (689) & 713)
Project No. TM-738 and TM-762
File: TX-28, 3-2

CDL No.
ACCOUNTABILITY
CARD
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TX-28
3-2

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SEP 14 '65
3428-3

MR. W. J. DENISON - 1224

Re: Drop Tests of TX-28-X1 Impact Fuze System on Soft Earth and Water Entry Impacts

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R & D FILES

Summary of Results

To evaluate the impact fuzing system of the TX-28-X1, two test drops were performed, with impact velocities of 100 fps. One test drop was made into an excavated basin containing water approximately 10 ft. deep; the other onto an earth target composed of one foot of loose soil placed on top of firm earth.

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During the water entry impact, no fuzing voltage was recorded from any of the four fuzing crystals monitored on the oscillograph. Two of these crystals were mounted on the forward bulkhead of the nose section; two were on the aft ring. The Fastax film taken during the drop likewise showed no output from either of two photo flash lamps which were connected respectively to a modified MC-810 fuzing crystal and a regular MC-810 fuzing crystal, both mounted on the forward bulkhead of the nose section.

On the XMC-691 baroswitch, during the water-entry test, contact closure was recorded on the oscillograph at 0.043 sec. after initial impact. Maximum pressures recorded on the XMC-934 pressure port were -2.1 psig. on the aft port and in excess of 30.3 psig on the forward port.

During the drop test onto a soft earth target, two crystal networks were monitored on the oscillograph. Each network contained three fuzing crystals in parallel, one network consisting of MC-810 regular crystals and the other of modified MC-810 fuzing crystals. One crystal of each network was mounted on the forward bulkhead and two were mounted on the aft ring of the nose section. In addition, one crystal of each type, mounted on the aft ring of the TX-28-X1 nose section, was connected to a photo-flash unit biased to fire at 300 volts, for visual monitoring on Fastax film.

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The oscillograph record of this drop showed a fuzing voltage of 420 volts developed by the modified crystal network approximately 0.0154 sec. after initial impact. 310 volts was recorded from the regular crystal network at 0.0206 sec. after impact. Both crystal networks later developed over 1000 volts. The Fastax film showed that the regular fuzing crystal and the modified crystal discharged the photo-flash bulbs at 0.038 and 0.040 sec. after impact, respectively.

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
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Emelda Selph 8/25/98	RECORD ID: 98SN3773
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W C Layne 8/25/98	DATED: 8/19/98
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Object of Test

The object of this test was to evaluate the impact fuzing system of the TX-28-X1 during impacts into water and soft earth at 100 fps.

Reason for Test

These tests were requested in two Work Order Authorizations from W. R. Hoagland, 1224-1, to P. H. Adams, 1612, dated November 29, 1957 and January 8, 1958.

Summary of Past Tests

A drop test with the unit impacting at 100 fps on a steel target was performed by Division 1224 on November 5, 1956. No test report was written, but test results are available in Division 1224 files. During this test, Fastax coverage indicated that the fuzing crystals operated properly.

A test entitled, TX-28-X1 Impact Fuzing System Drop Tower Test, was reported in a memorandum to Mr. W. J. Denison, 1224, from G. M. Willson, 1612, dated November 16, 1957. Two test drops were made; one impacting onto dirt and the other onto concrete. Impact velocity in both cases was 100 fps.

During the drop onto dirt, the oscillograph record showed no indication of fuzing voltage output; however, the Fastax film showed that the flash unit connected to the forward fuzing crystal discharged at 0.011 seconds after impact. This flash unit was biased to discharge with a 300-volt pulse. The x-unit discharged 0.017 second after impact.

During the drop onto concrete, the fuzing crystals operated properly and the x-unit discharged 0.0014 seconds after impact.

Setup for Test

Figure 1 shows the method of suspending the test unit from the drop tower for both drops.

Figure 2 shows the test vehicle suspended ready for dropping into water.

Table I lists the components tested during both drop tests.

Test equipment used for both tests consisted of one Consolidated amplifier, 20 KC carrier, Type 1-127, Serial No. 2017, and one William Miller, Type CR-1A recording oscillograph, Serial No. 12. Camera coverage consisted of two 16 mm Fastax cameras, 4000 frames per second; one 8 mm Fastax camera, 8000 frames per second; and one Bell and Howell 16 mm tracking camera, 200 frames per second.

One accelerometer, No. A-1, was mounted on the aft side of the adapter plate (Fig. 1) for both drop tests. The accelerometer was a Statham Model A5A-200-2500 with Serial No. 3860, range of ± 200 g, and natural frequency of 1000 cps.

Two Statham pressure transducers were mounted as shown in Fig. 3 for the water entry drop only. These gages were model P-160-100A-350, range 0-100 psia. Gage No. P-1, Serial No. 360 monitored the pressure in the forward port of the XMC-934, and gage No. P-2, Serial No. 355 monitored pressure in the aft port of the XMC-934.

Two cathode followers and two battery packs used to supply power to the flash units and cathode followers were mounted in the aft end of the dummy ballistic case.

Procedure

For both drop tests, the nose section of a TX-28-X1 was bolted through an adapter plate to a 20-inch diameter dummy ballistic case (Fig. 1) to simulate the ballistic shape of a complete weapon.

During the water-entry drop, the outputs of four fuzing crystals were monitored on the oscillograph. Two of these fuzing crystals, one modified and one regular type, were mounted on the forward bulkhead of the unit, and one of each type was mounted on the aft ring. The fuzing crystal outputs were fed to cathode followers with input impedences simulating the fuzing load during actual operation. The output of the cathode followers was recorded on the Miller CR-1A recording oscillograph.

Two photoflash bulbs biased to fire with 210 volts input were mounted on the test vehicle (Fig. 1); one connected to a modified MC-810 fuzing crystal and one to a regular fuzing crystal, both mounted on the forward bulkhead of the TX-28-X1 nose section.

The switch in the XMC-691 baroswitch was monitored for closure, and the dynamic pressures on both ports of the XMC-934 (Fig. 3) were recorded on the oscillograph during the drop.

Time of impact was recorded on the oscillograph by a sync switch on the nose of the TX-28-X1, and on the Fastax film by a flash bulb which discharged as the test vehicle touched the water.

One test drop was made into an excavated basin containing water approximately 10 feet deep. Drop height was 155 ft., giving an impact velocity of approximately 100 fps. Three Fastax cameras and one tracking camera were used to photograph the test drop.

For the soft earth impact test, instrumentation was changed somewhat. Two fuzing crystal networks were monitored on the oscillograph, each network consisting of three crystals in parallel. One network contained MC-810 regular crystals; the other contained MC-810 modified crystals. In each case, one crystal of the network was mounted on the forward bulkhead and two on the aft ring of the TX-28-X1 nose section. A continuity loop in each crystal network was monitored to tell when the cables were broken.

Flash bulbs biased to fire with 300 volts input (Fig. 1) were connected to the outputs of two fuzing crystals, one regular and one modified, mounted on the aft ring of the nose section.

Time of impact was recorded on the oscillograph by a sync switch on the nose of the TX-28-X1.

One test drop was made from a height of 155 feet. Impact velocity was approximately 100 fps onto a target prepared by placing one foot of soft soil on top of firm earth.

Results

During the water entry impact test, no fuzing voltage was recorded on the oscillograph from any of the four crystals monitored. Inspection of the Fastax film disclosed that neither of the flash bulbs, which were connected respectively to a regular MC-810 and a modified MC-810 fuzing crystal, had fired.

Contact closure was recorded on the XMC-691 baroswitch 0.043 sec. after initial impact on the water. Pressures recorded on the XMC-934 pressure port were -2.1 psig. on the aft port and over 30.3 psig. on the forward port. Maximum faired acceleration pulse recorded by accelerometer A-1 during the drop was 4.3 g at 0.04 sec. from impact.

During the drop test onto a soft earth target, the fuzing crystal network containing three modified crystals in parallel developed 420 volts 0.0154 sec. after impact, and over 1000 volts at 0.0252 seconds. 310 volts was developed by the regular crystal network at 0.0206 sec., and over 1000 volts at 0.0238 seconds. No discontinuity in either crystal network was recorded until 17 milliseconds after maximum fuzing voltages were developed. The Fastax film showed that the flash bulbs hooked to the regular MC-810 crystal and the modified MC-810 crystal discharged at 0.038 sec. and 0.040 sec., respectively. Maximum faired acceleration recorded during impact was 22.1 g, with the pulse beginning at 0.021 seconds after initial impact.

Figure 4 shows the TX-28-X1 nose section damaged from the soft earth impact.

Conclusions

The proposed impact fuzing system for the TX-28-X1 is apparently inadequate for x-unit fuzing during water entry at 100 fps. Fuzing voltage during impact on soft earth at 100 fps was of sufficient magnitude to trigger the x-unit.

Proper functioning of the complete fuzing system would be contingent upon the amount of damage sustained by other components in the circuit during the time interval required for sufficient fuzing voltage to develop.

G. M. WILLSON - 1612-1

Approved by: PAUL H. ADAMS - 1612

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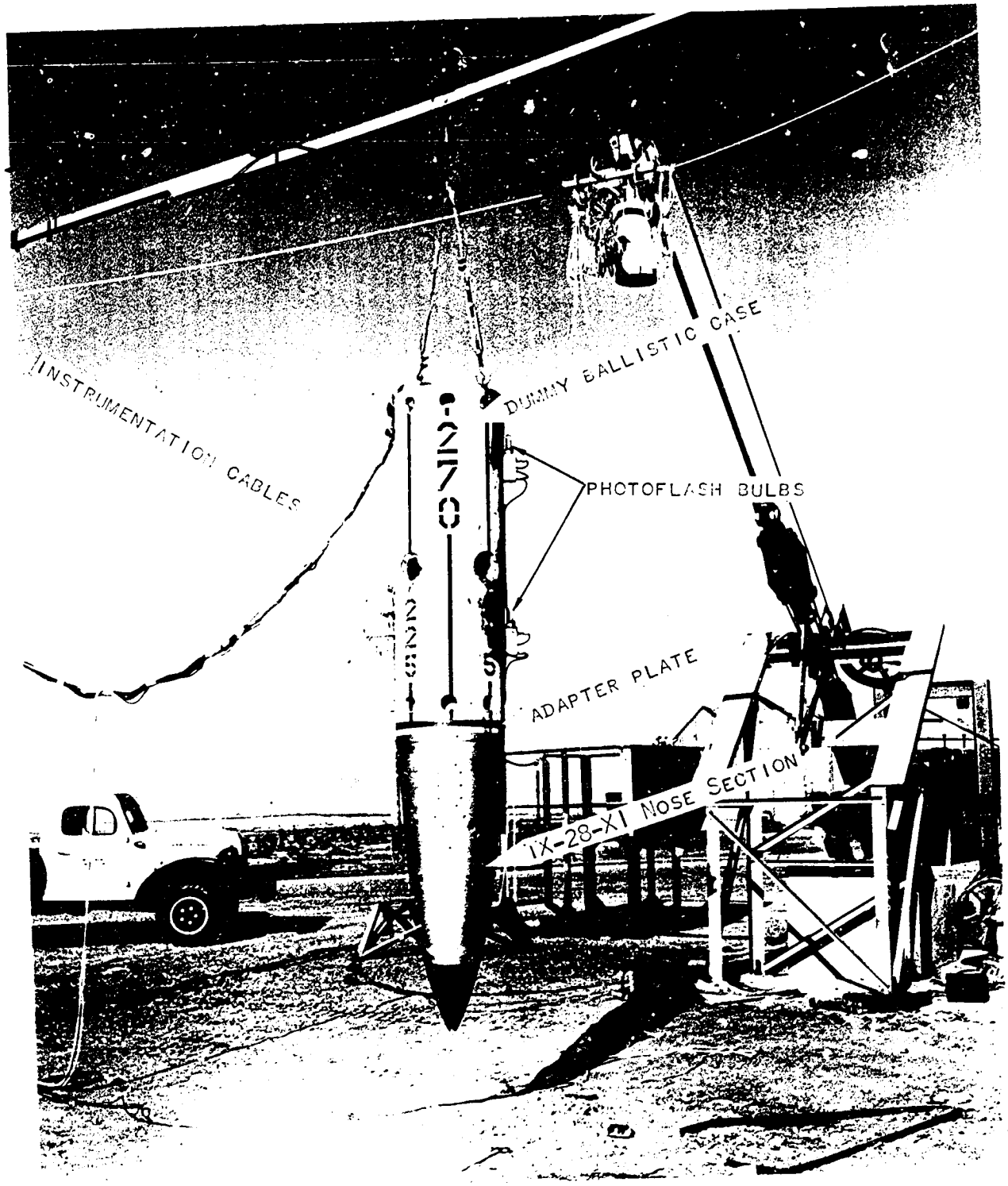

FIG. 1 -- VIEW SHOWING THE METHOD OF SUSPENSION OF THE TEST VEHICLE FOR BOTH DROPS — DROP TEST OF TX-28-XI IMPACT FUZE SYSTEM ON SOFT EARTH AND WATER ENTRY IMPACTS.

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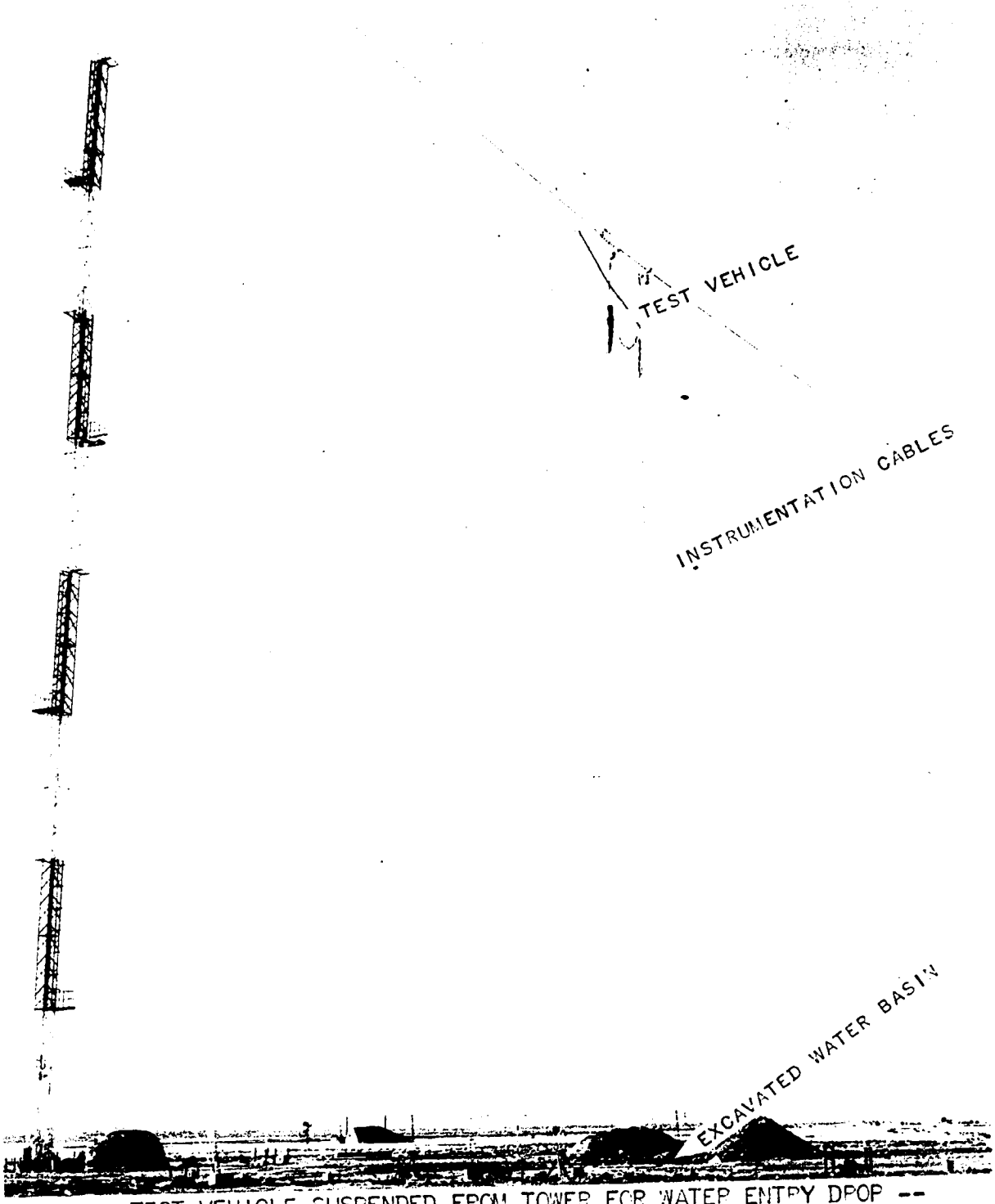

FIG. 2 -- TEST VEHICLE SUSPENDED FROM TOWER FOR WATER ENTRY DROP -- DROP TEST OF TX-28-X1 IMPACT FUZE SYSTEM ON SOFT EARTH AND WATER ENTRY IMPACTS.

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REF. SYM: 1612 (689 & 713)
PROJECT NO. TM-738 & 762

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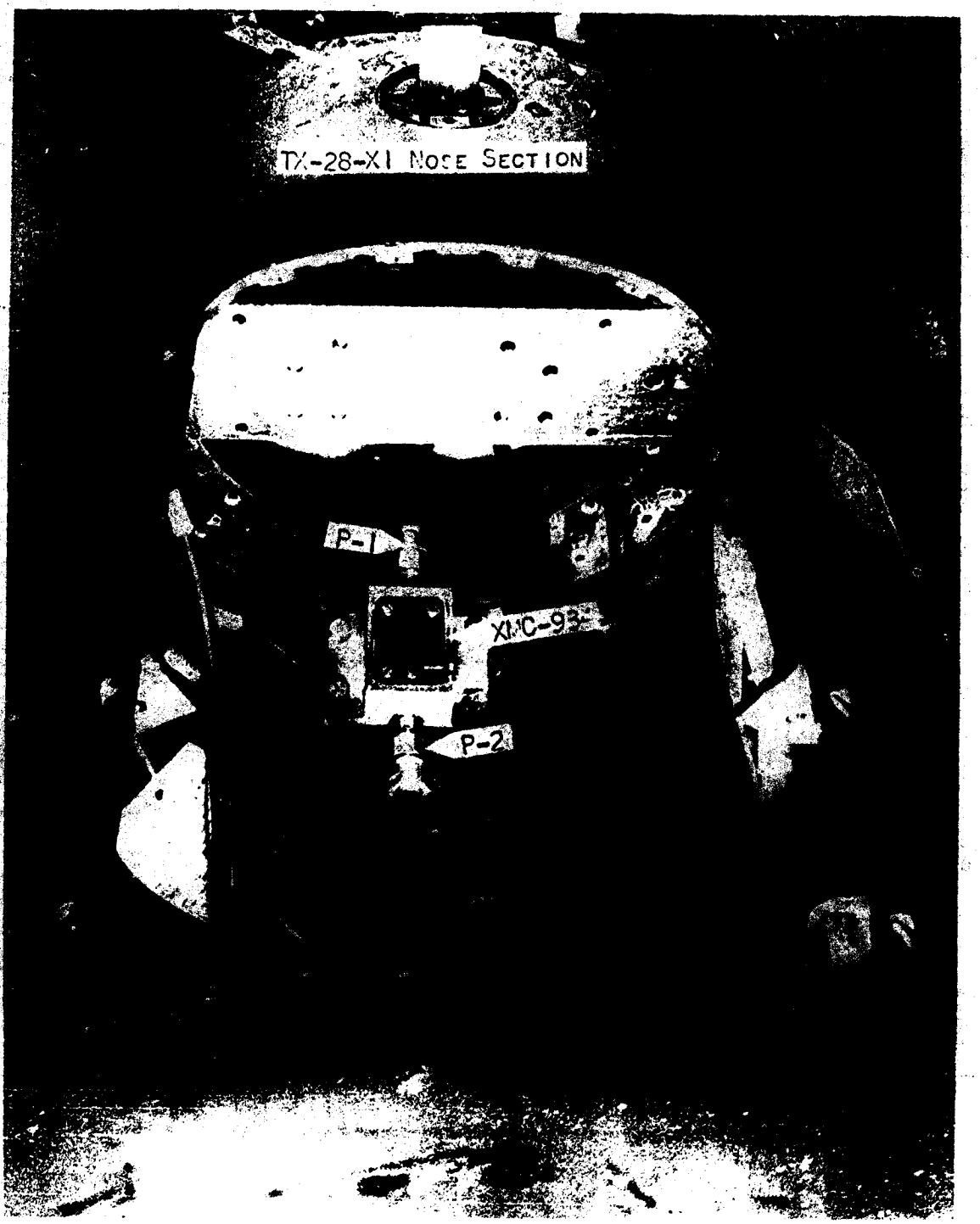

FIG. 3 -- VIEW SHOWING MOUNTING OF PRESSURE TRANSDUCERS P-1 AND P-2 FOR THE WATER ENTRY DROP -- DROP TEST OF TX-28-X1 IMPACT FUZE SYSTEM ON SOFT EARTH AND WATER ENTRY IMPACTS.

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REF. SYM: 1612 (689 & 713)
PROJECT NO. TM-738 & 762

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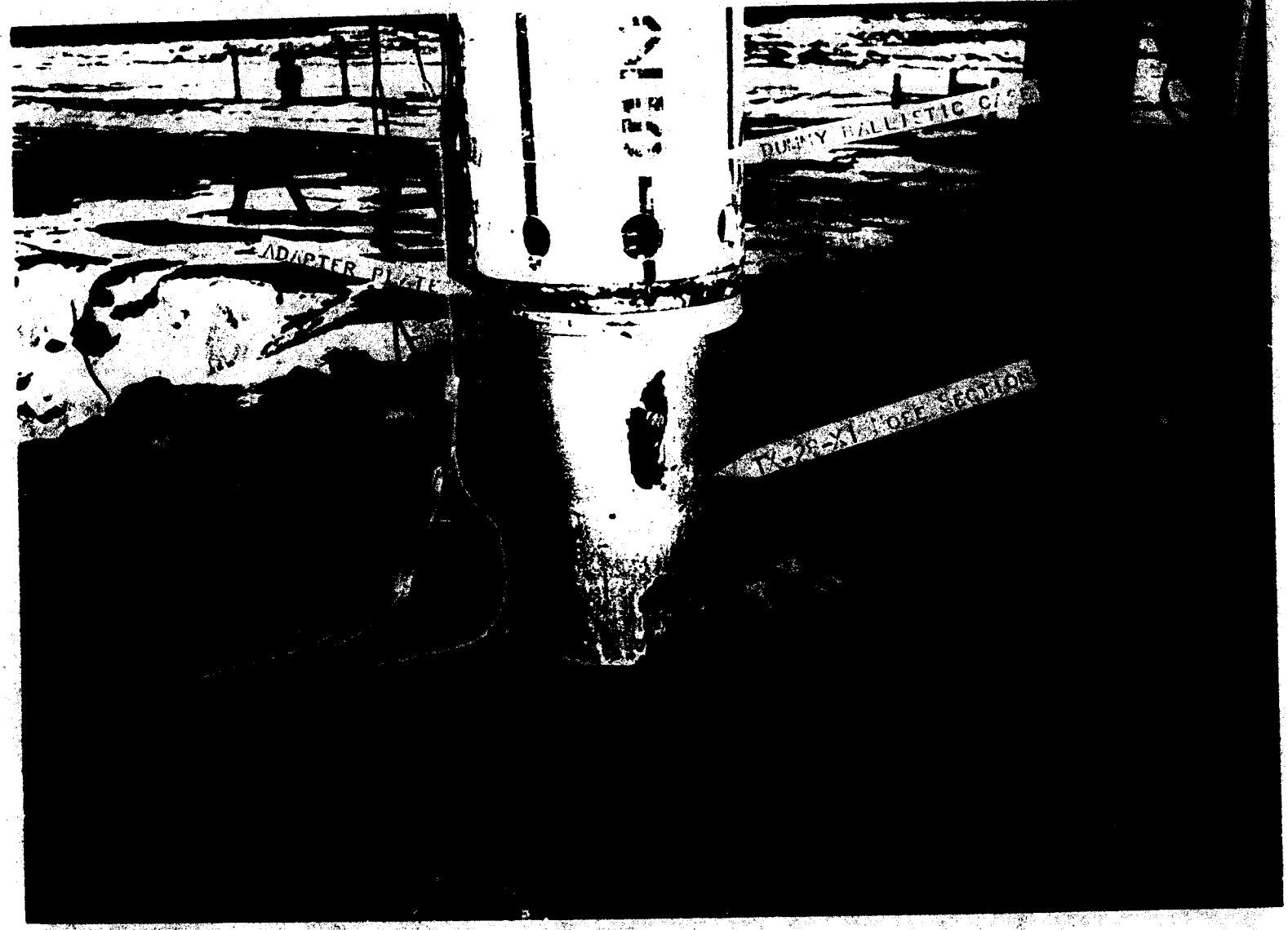

FIG. 4 -- TX-28-X1 NOSE SECTION DAMAGED DURING SOFT EARTH IMPACT -- DROP TEST OF TX-28-X1 IMPACT FUZE SYSTEM ON SOFT EARTH AND WATER IMPACTS.

D# 102481

REF. BY: 1612 (C[illegible] [illegible]13)
PROJECT NO. [illegible]-73[illegible] 762

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TABLE I

COMPONENTS TESTED DURING DROP TEST OF TX-28-X1 IMPACT FUZE SYSTEM ON SOFT EARTH AND WATER ENTRY IMPACTS

Component and MC No.	Drawing No.	Serial No.	Test Used
XMC-691 Baroswitch	310263-00	BL-11A-K6	Water Entry Impact
MC-810 Fuze, Impact, Modified (3 ea.)	310416	--	Water Entry Impact
MC-810 Fuze, Impact, Regular (3 ea.)	310416	--	Water Entry Impact
XMC-934 Pressure Port	310653	--	Water Entry Impact
XMC-627 Radar Unit, Fuzing	310188-00	AA-1039-K6	Both Tests
XMC-628 Radar Unit, Fuzing	310189-00	AA-1038-K6	Both Tests
XMC-852 Motor-Generator	310498-00	MP-1010-K6	Soft Earth Impact
XMC-852 Motor-Generator	310498-00	MP-1011-K6	Soft Earth Impact
XMC-691 Baroswitch	310263-00	BL-6A-J6	Soft Earth Impact
MC-810 Fuze, Impact, Modified (4 ea.)	310416	--	Soft Earth Impact
MC-810 Fuze, Impact, Regular (4 ea.)	310416	--	Soft Earth Impact