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FEB 1 1 1959
Case No. 853.00
Ref. Sym: 1612 (855)
Project No. TM-899
File: TX-28, 3-2

MR. A. V. ENGLE, JR. - 1215

Attn: Mr. R. E. Howell - 1215-1

Re: Static Test of TX-28/X2 Rear Case Assembly

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
1st Review Date: 8/18/98
Authority: ADD
Name: R Blaner
2nd Review Date: 9-10-98
Authority: ADD
Name: W Layne
Determination (Circle Numbers):
1. Classification Retained
2. Classification Changed to: U
3. Contains No DOE Classified Information
4. Coordinate With:
5. Contains UCAI?
6. Comments: Declassify

Summary of Results

The aft section of a TX-28/X2 rear case assembly was statically tested with shear and moment loads simulating parachute deployment loads. The section failed by buckling at approximately 170 per cent design limit.

Two forward sections were tested with simulated shear and moment loads plus a longitudinal load corresponding to shroud line tension. One section failed at 112 per cent design limit load; the second failed at slightly under 80 per cent. Both failures consisted of a fracture along the base of a machined shoulder retaining the threaded mounting ring.

Object of Test

The object of the test was to determine the structural adequacy of the TX-28/X2 rear case assembly subjected to statically simulated parachute deployment loads. The first part of the test was a test of the aft section subjected to only shear and moment loads; the second part was a test of the forward section subjected to these loads plus a longitudinal load simulating shroud line tension.

Authorization for Test

The test was performed in accordance with a Work Order Authorization from A. V. Engle, Jr., 1215, to P. H. Adams, 1612, dated August 25, 1958. R. E. Howell and B. C. Caskey, 1215-1, were the consultants.

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Function of Object Tested

The TX-28/X2 rear case assembly contains the parachutes and parachute release mechanisms for the TX-28/X2 weapon.

Summary of Past Tests

No previous static tests on the TX-28/X2 rear case assembly have been performed by Organization 1612.

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
DOWNGRADING OR DECLASSIFICATION STAMP
CLASSIFICATION CHANGED TO: U
AUTHORITY: W C Layne
Emelda Selph 9/28/98
PERSON CHANGING MARKING & DATE
RECORD ID: 985N3924
Carmela D. Gallegos 9/23/98
PERSON VERIFYING MARKING & DATE
DATED: 9/10/98

CENTRAL RECORD FILE
ACCOUNTABLE CARD
FILE No. TX-28 X-2 3-2

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Setup for Test

The object tested was the TX-28/X2 rear case assembly. The forward and aft sections are defined on Dwg. Nos. 145833 and 145832, respectively, and the assembly is shown on Dwg. No. 310894.

The following equipment was used in the test:

1 - 5,000-pound load cell, Serial No. 2127.
1 - 50,000-pound load cell, Serial No. 1118.
1 - Two-inch calibrated pull bar, Serial No. 7.
1 - Calibrated link, Serial No. F.
2 - Square pull bars, Serial Nos. 4 and 5.
3 - Baldwin strain indicators, Serial Nos. J-92499, 391904, and J-59101.
1 - Blackhawk hydraulic pump.
1 - Sprague air-operated hydraulic pump.
3 - Simplex 30-ton jacks.
1 - Patheon hydraulic jack.
1 - Hydraulic pump console.

The following instrumentation was used:

12 - SR-4 strain gages, Type A-18, resistance of 120 ± 0.3 ohms, gage factor of 1.73 ± 2%, Lot No. B-32.
Stresscoat No. 1206, average sensitivity of 575 microinches per inch during test.

Procedure

Stresscoat was applied to the forward section of the TX-28/X2 rear case assembly and to the portion of the aft section immediately adjacent to the forward section. The assembly was then mounted in the test jig by attaching the threaded ring in the forward section to a mounting ring and plate on the jig. Loads were applied through a loading fixture bolted to the rear of the assembly. Figures 1 thru 3 show the setup, and Fig. 4 is a sketch showing the location of the loads.

Loads were applied in increments of 5 per cent of design limit until the first Stresscoat cracks were detected, after which larger increments were applied. After each increment was reached, the load was returned to zero, and a search made for Stresscoat crack patterns. Loading continued until the section failed, but no Stresscoat patterns were marked for loads above 125 per cent design limit (100 per cent design ultimate).

The forward section was removed from the assembly and mounted in the jig as shown in Figs. 5 and 6. Two loads were applied: a side (or shear) load, and a longitudinal load located 10 inches off-center. The loads were increased in increments until failure.

Another forward section, instrumented with strain gages, was tested using a different loading arrangement. Figures 7 and 8 show this test setup, and Fig. 9 shows the strain gage locations. Loads were applied in increments until failure, with strain gage readings taken at each increment.

Results

Results of the Stresscoat test on the TX-28/X2 rear case assembly are given in Table I. Figures 10 thru 12 show the crack patterns formed. It will be noted that no appreciable stresses were developed in the aft section below 100 per cent design limit load.

The aft section failed at approximately 170 per cent design limit load. Failure was by buckling, as shown in Fig. 13. The load on the forward section was considerably less than 170 per cent of its design limit since no axial load was applied to simulate shroud line tension.

In the tests of the two forward sections, the first failed at approximately 112 per cent design limit (longitudinal load of 85,180 pounds plus a side load of 4800 pounds), and the second failed at slightly under 80 per cent design limit. Failure in both cases consisted of a fracture along the base of a machined shoulder retaining the mounting ring. Figure 14 shows the first section after failure; the appearance of the second was identical. Table II gives strain gage readings and calculated principal stresses for the second section test.

Tensile test specimens cut from the forward sections were pulled to failure to determine ultimate strength of the material. Results are given in Table III.

Conclusions

The two forward sections tested failed at loads below design ultimate; therefore, the TX-28/X2 rear case assembly cannot be considered structurally adequate to withstand design parachute deployment loads. The probable cause of the premature failures was thought to be stress concentrations produced by the sharp corner at the base of the machined shoulder. The use of a radius at the base of this shoulder should improve strength.

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Project No. TM-899

Mr. A. V. Engle, Jr. - 1215 -4-

W. M. Sigmon

W. M. SIGMON - 1612-2

Approved by: Paul H. Adams

PAUL H. ADAMS - 1612

WMS:1612-2:as

Copy to:
W. A. Gardner, 1610
D. M. Bruce, 1282
C. L. Gomel, 5523
R. K. Smeltzer, 4721-3

#1078

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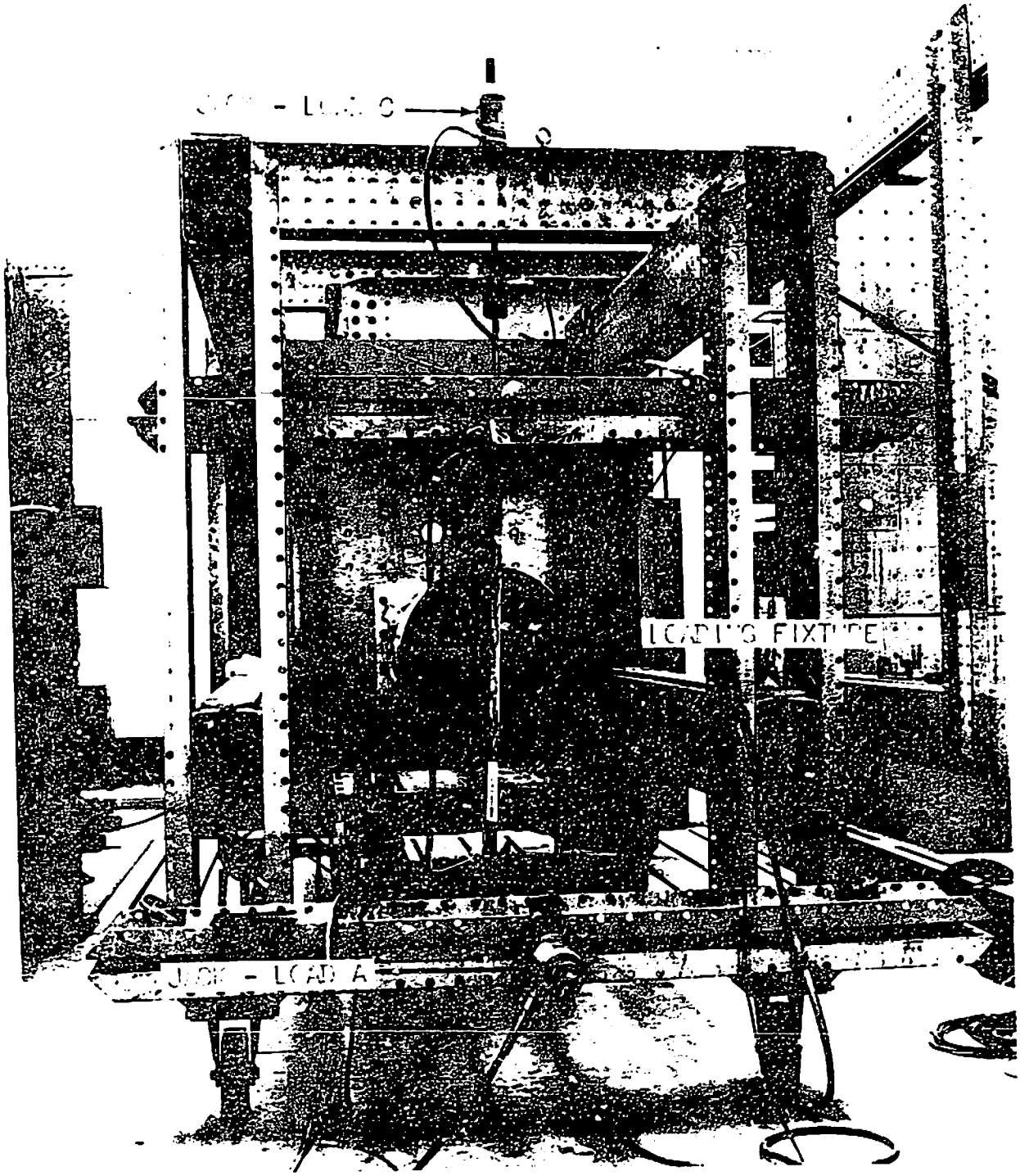

FIG. 1 -- AFT VIEW OF SETUP FOR STRESSCOAT TEST -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

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D# 9-1585

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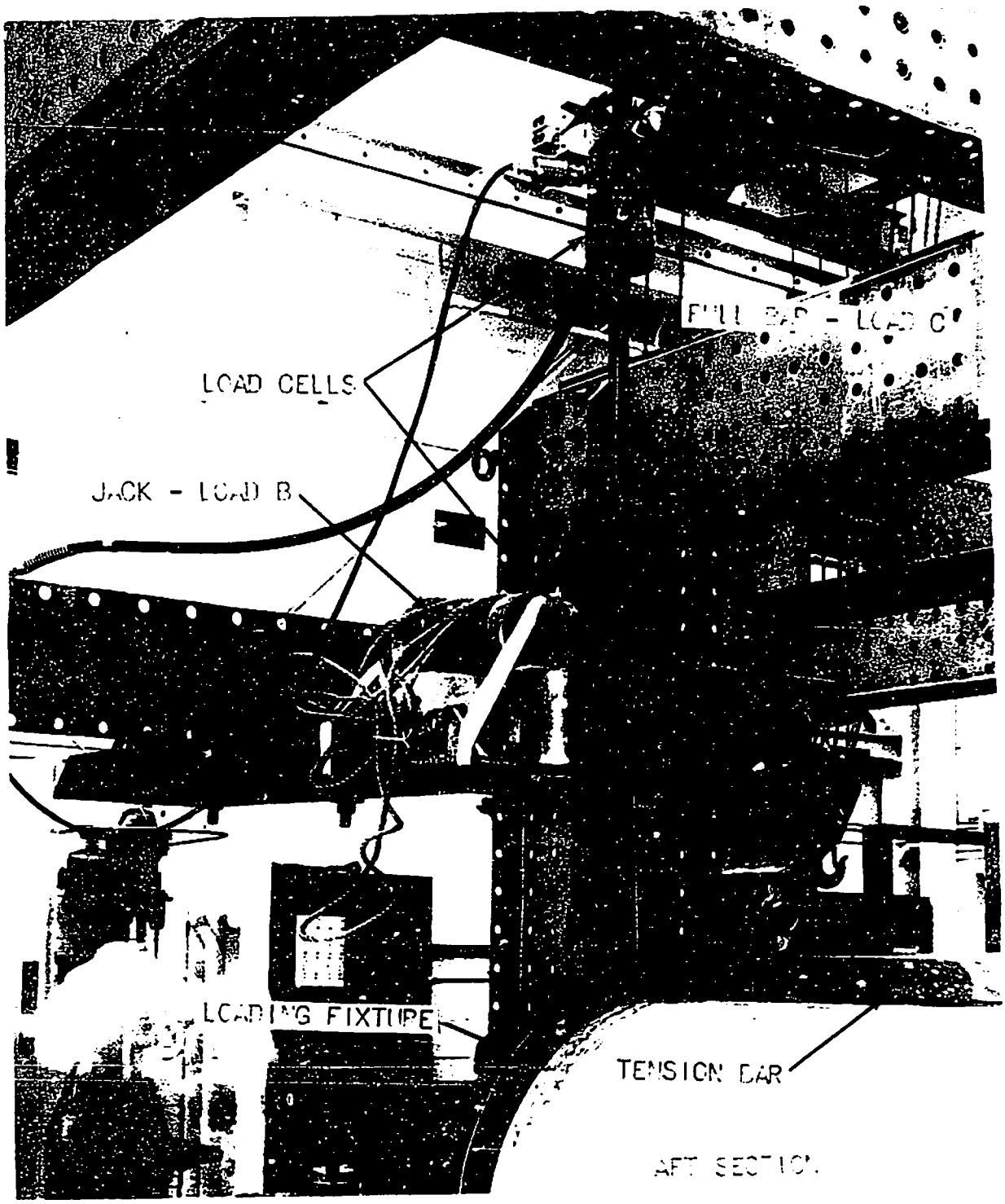

FIG. 2 -- PARTIAL VIEW OF LOADING ARRANGEMENT IN SETUP FOR STRESS-COAT TEST -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

D # 9-1 SEC

REF. SYM: 1612 (855)
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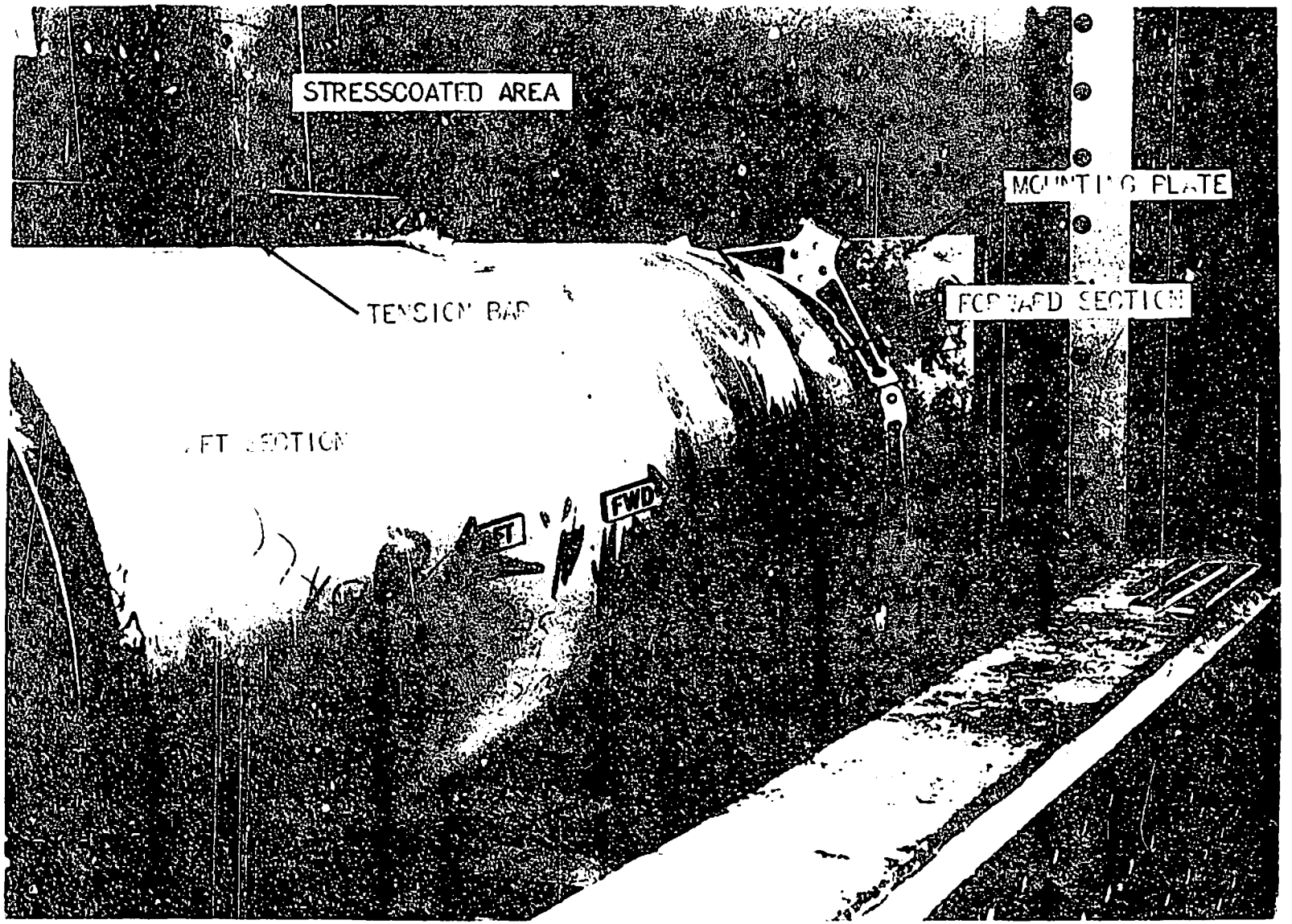

FIG. 3 -- CASE ASSEMBLY MOUNTED IN JIG FOR STRESSCOAT TEST -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

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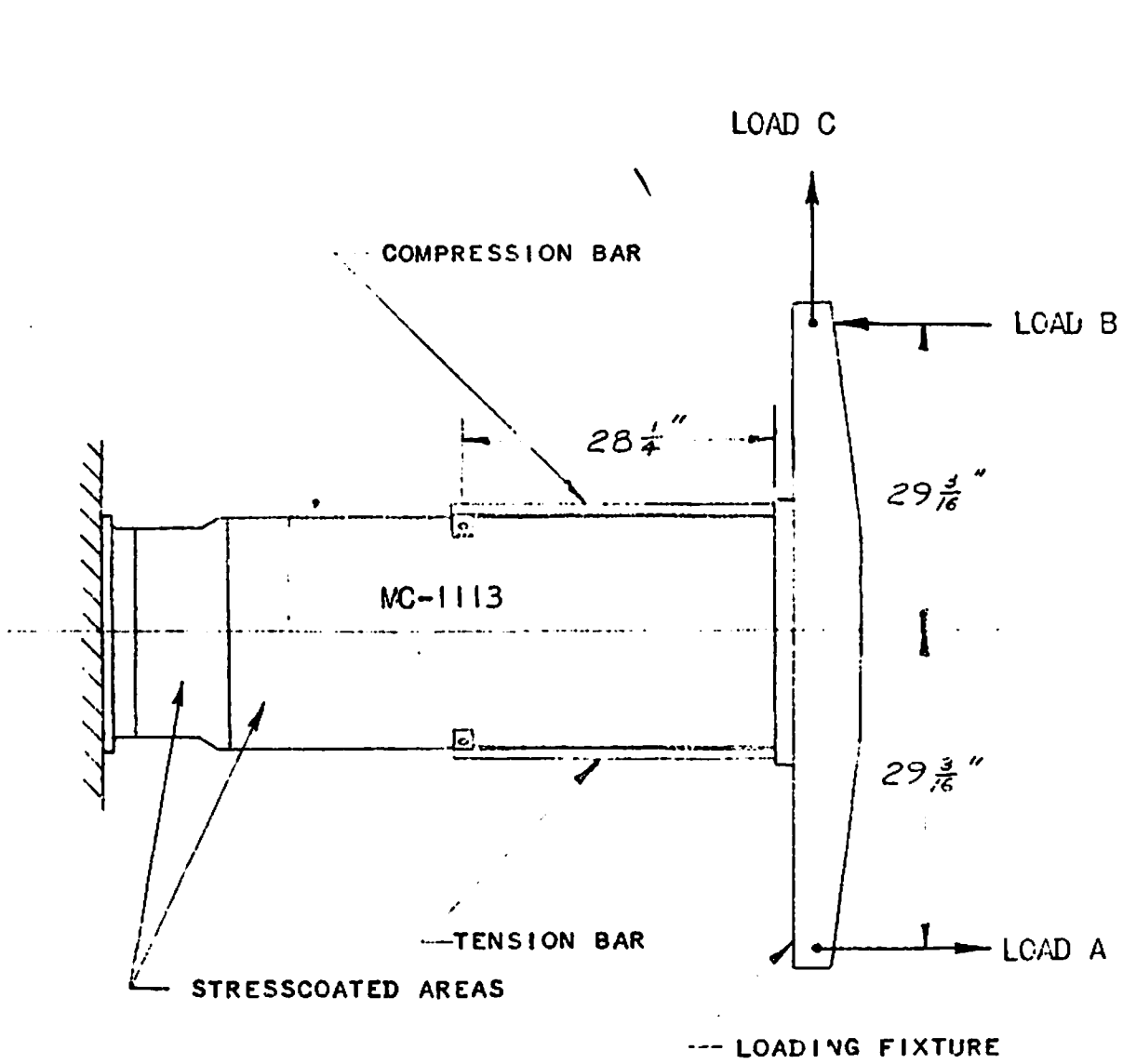

FIG. 4 -- LOCATION OF LOADS IN STRESSCOAT TEST OF CASE ASSEMBLY -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

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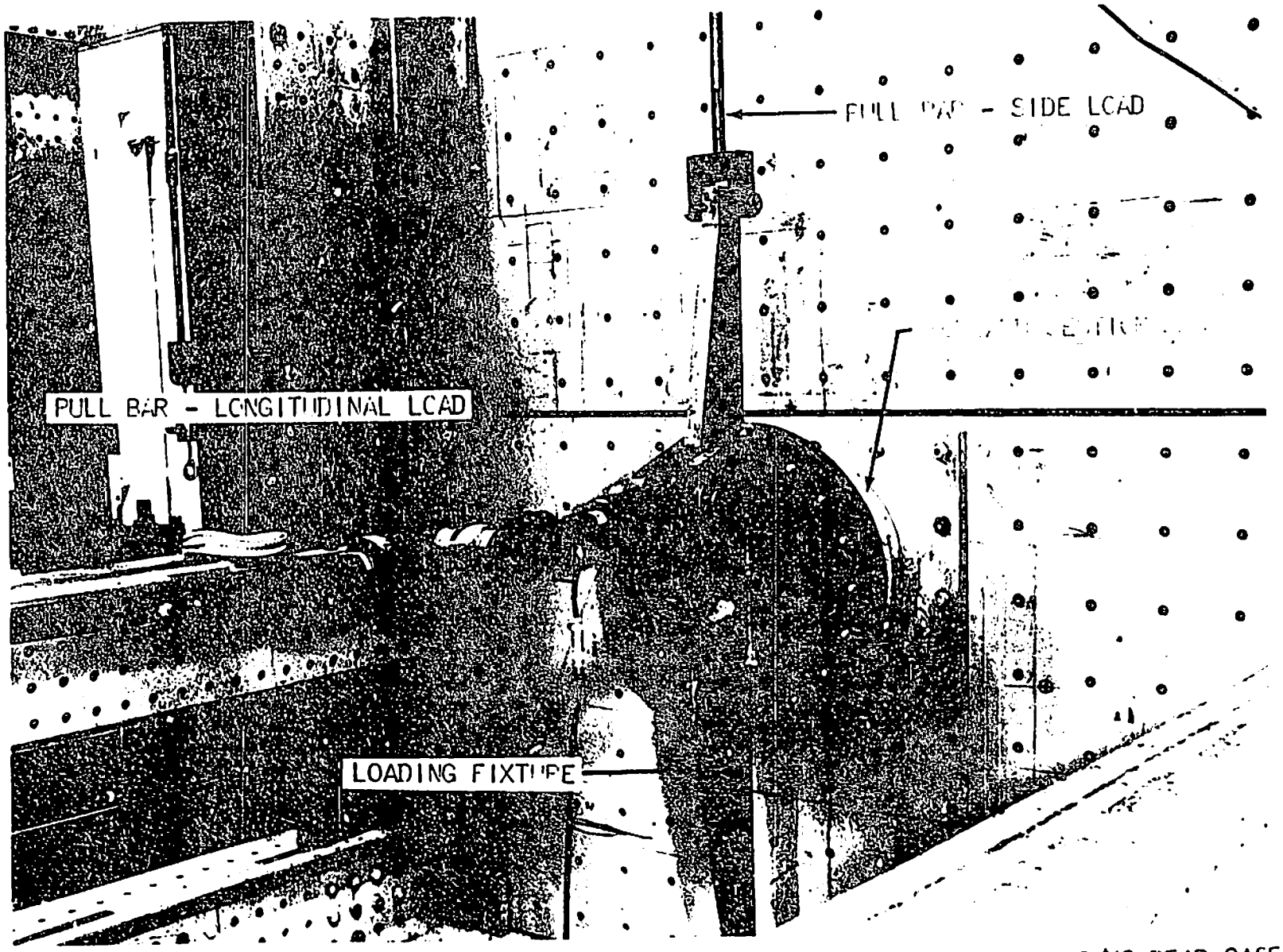

FIG. 5 -- SETUP FOR TEST OF FORWARD SECTION NO. 1 -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

D-9-1588

REF. SYM: 1612 (855)
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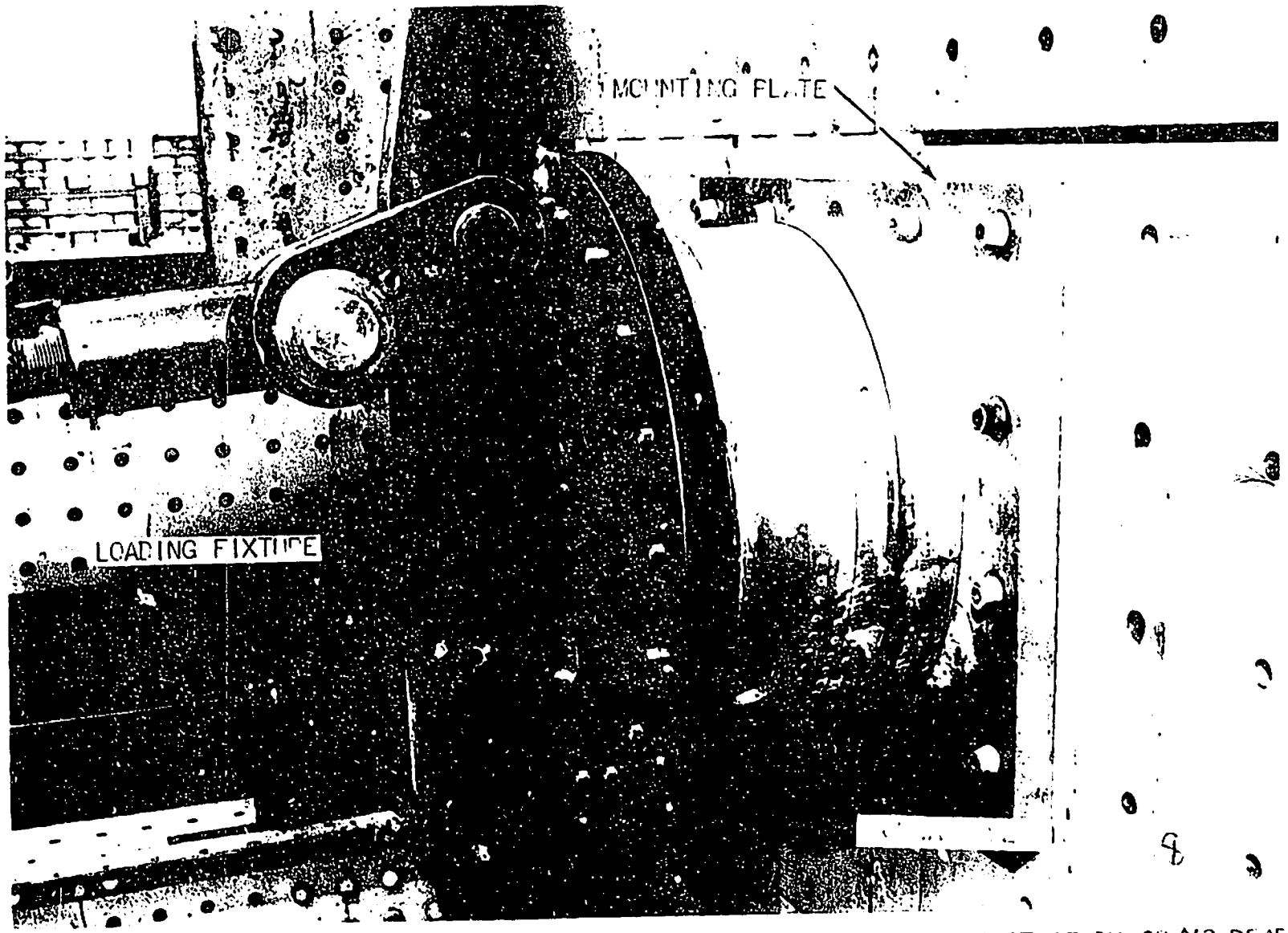

FIG. 6 -- SETUP FOR TEST OF FORWARD CASE SECTION NO. 1 -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

REF. SYM: 1612 (855)
PROJECT NO. TM-999

D# 9-1589

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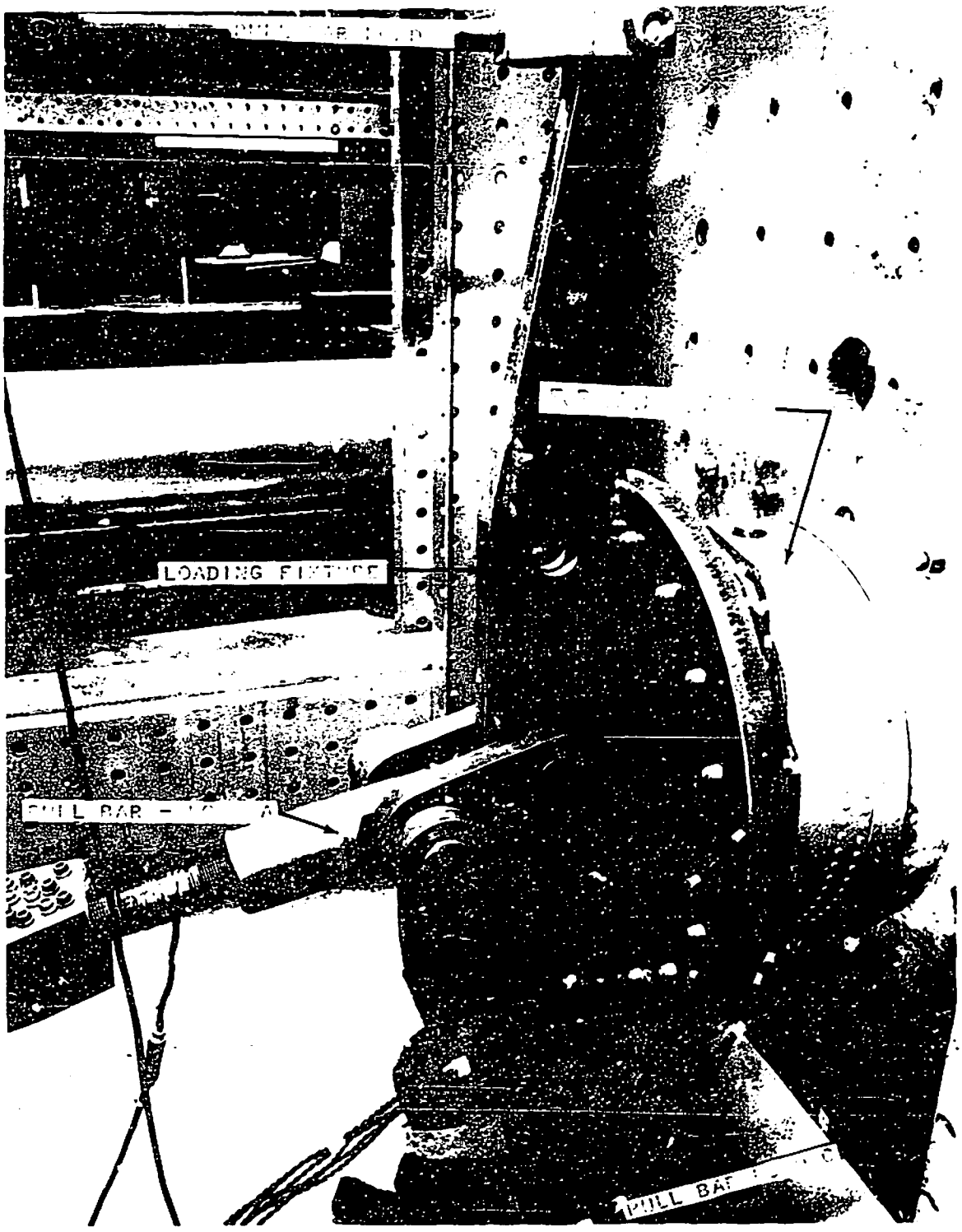

FIG. 7 -- SETUP FOR TEST OF FORWARD CASE SECTION NO. 2 -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

D#9-1590

REF. SYM: 1612 (855)
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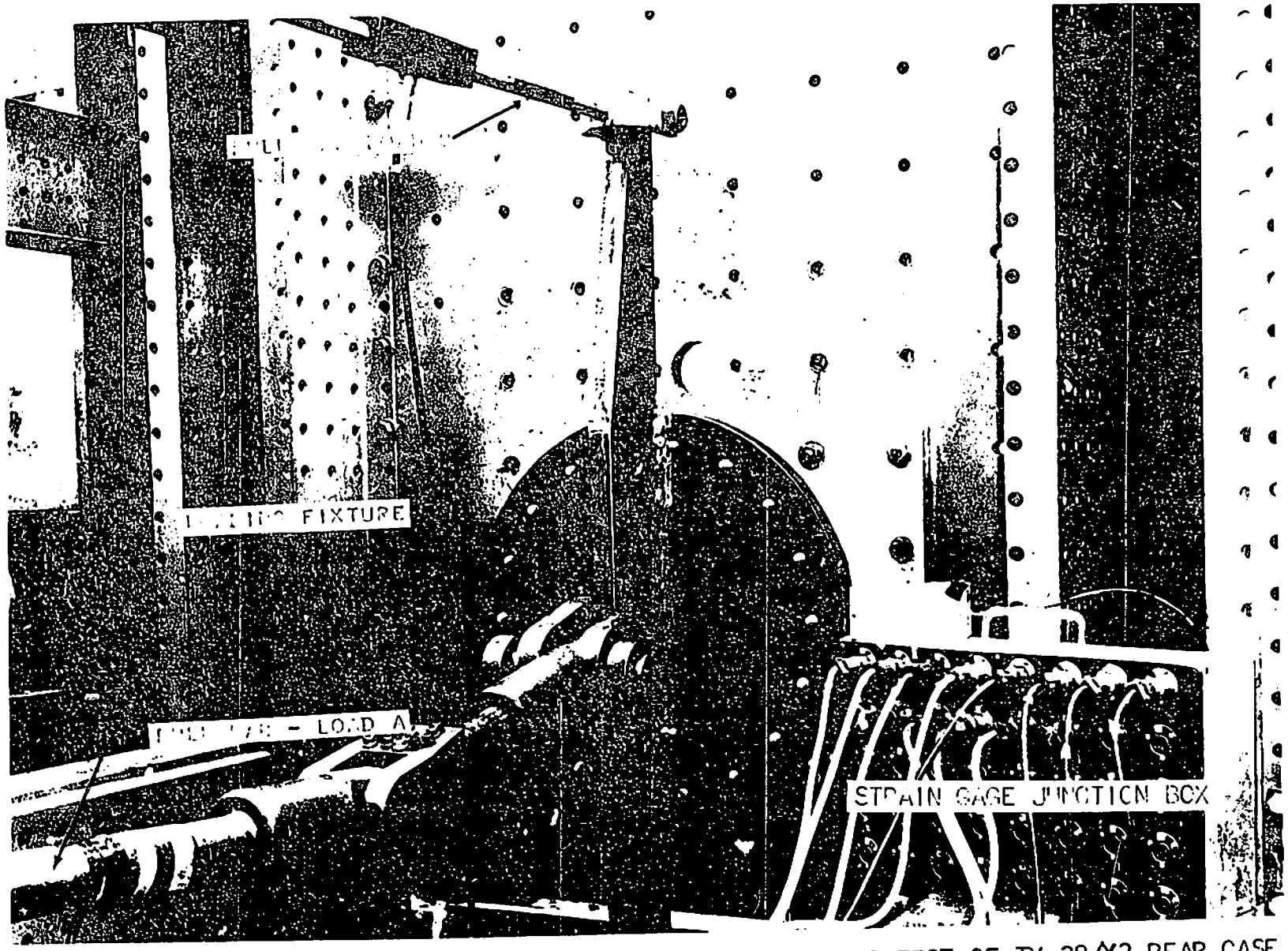

FIG. 8 -- SETUP FOR TEST OF FORWARD SECTION NO. 2 -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

REF. SYM: 1612 (855)
PROJECT NO. TM-899

D#9-1591

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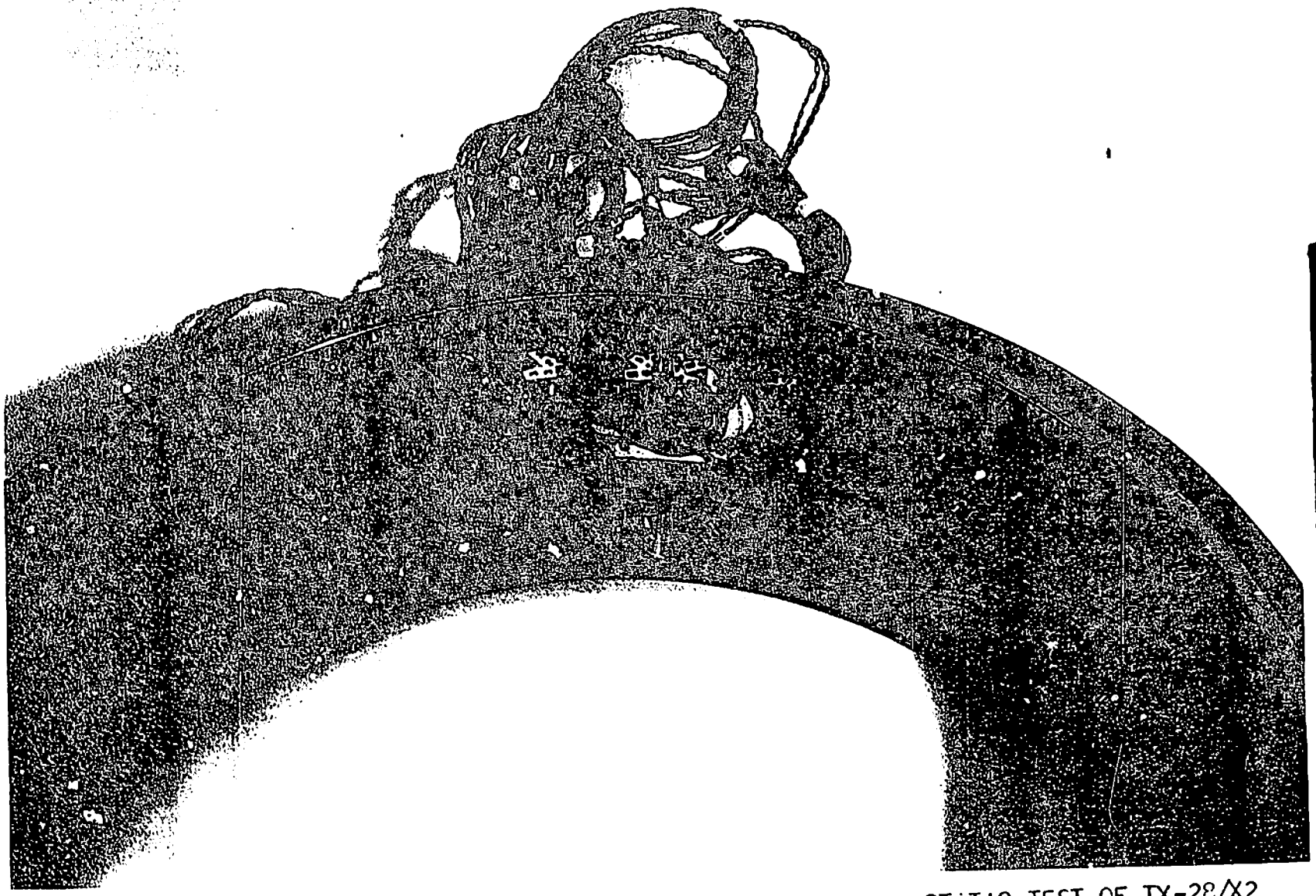

FIG. 9 -- STRAIN GAGE LOCATIONS ON FORWARD SECTION NO. 2 -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

REF. SYM: 1612 (855)
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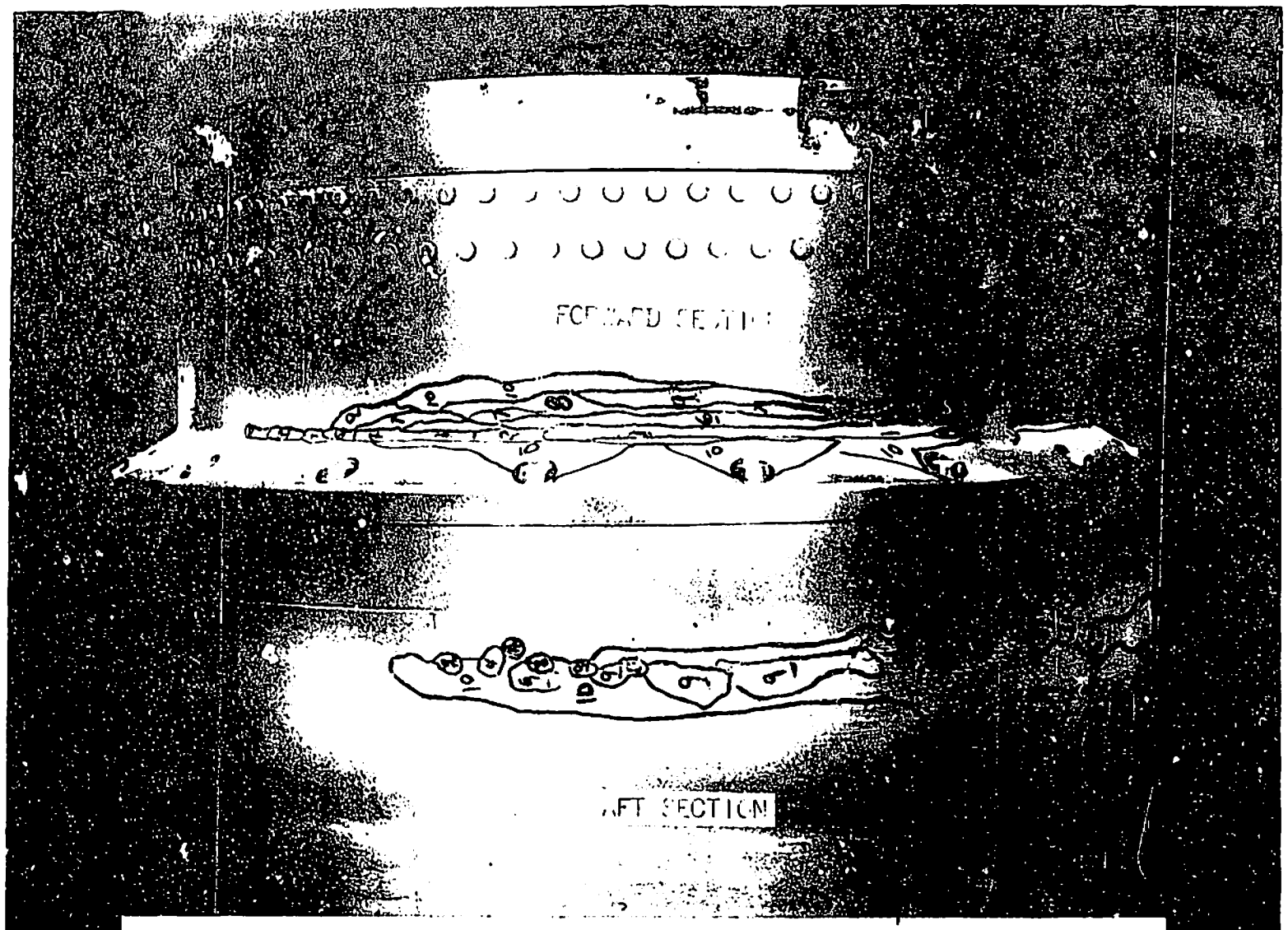

FIG. 10 -- STRESSCOAT CRACK PATTERNS OBTAINED ON REAR CASE ASSEMBLY -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

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REF. SYM: 1612 (855)
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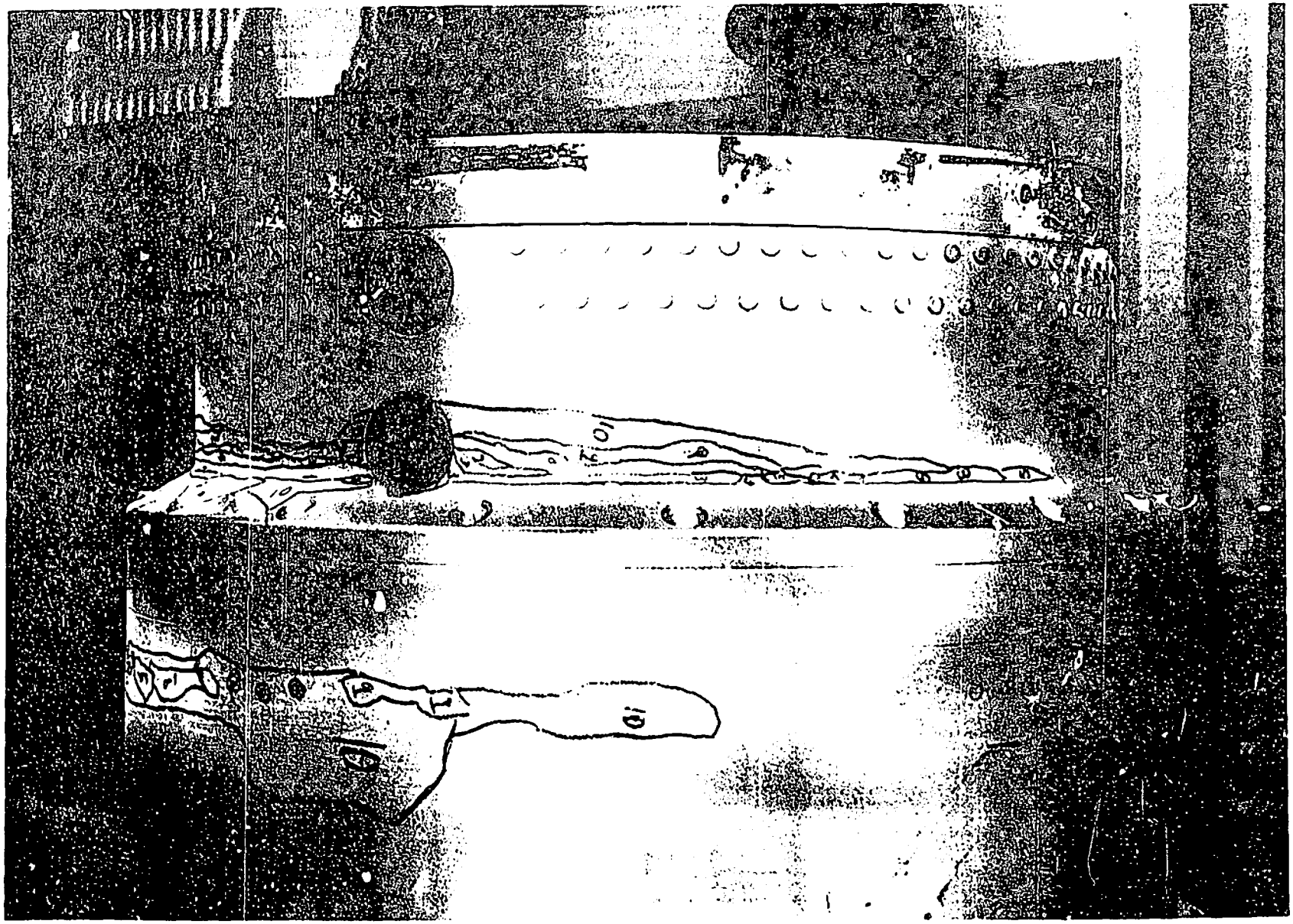

FIG. 11 -- STRESSCOAT CRACK PATTERNS OBTAINED ON REAR CASE ASSEMBLY -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

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REF. SYM: 1612 (855)
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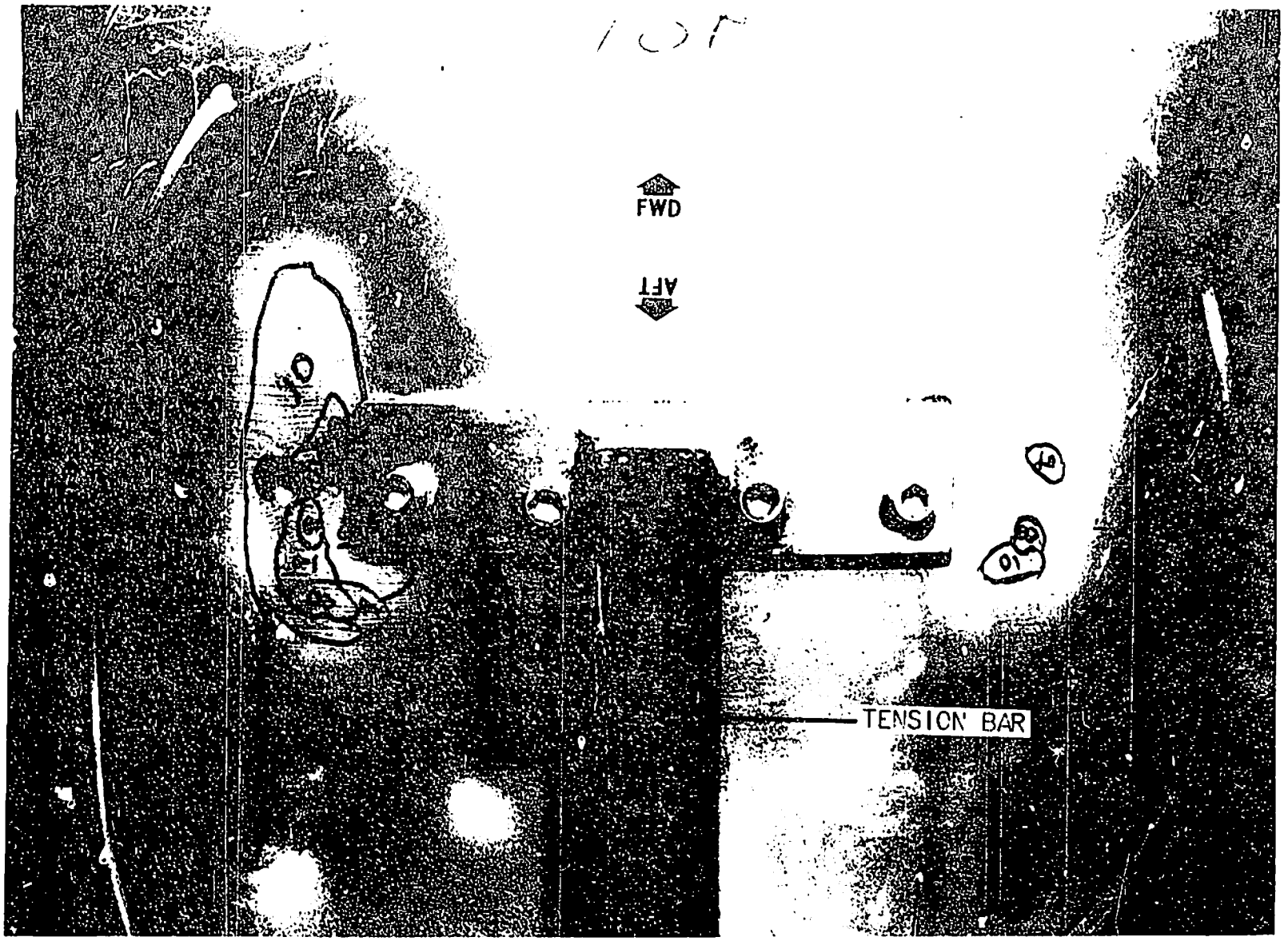

FIG. 12 -- STRESSCOAT CRACK PATTERNS OBTAINED ON AFT SECTION -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

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REF. SYM: 1612 (855)
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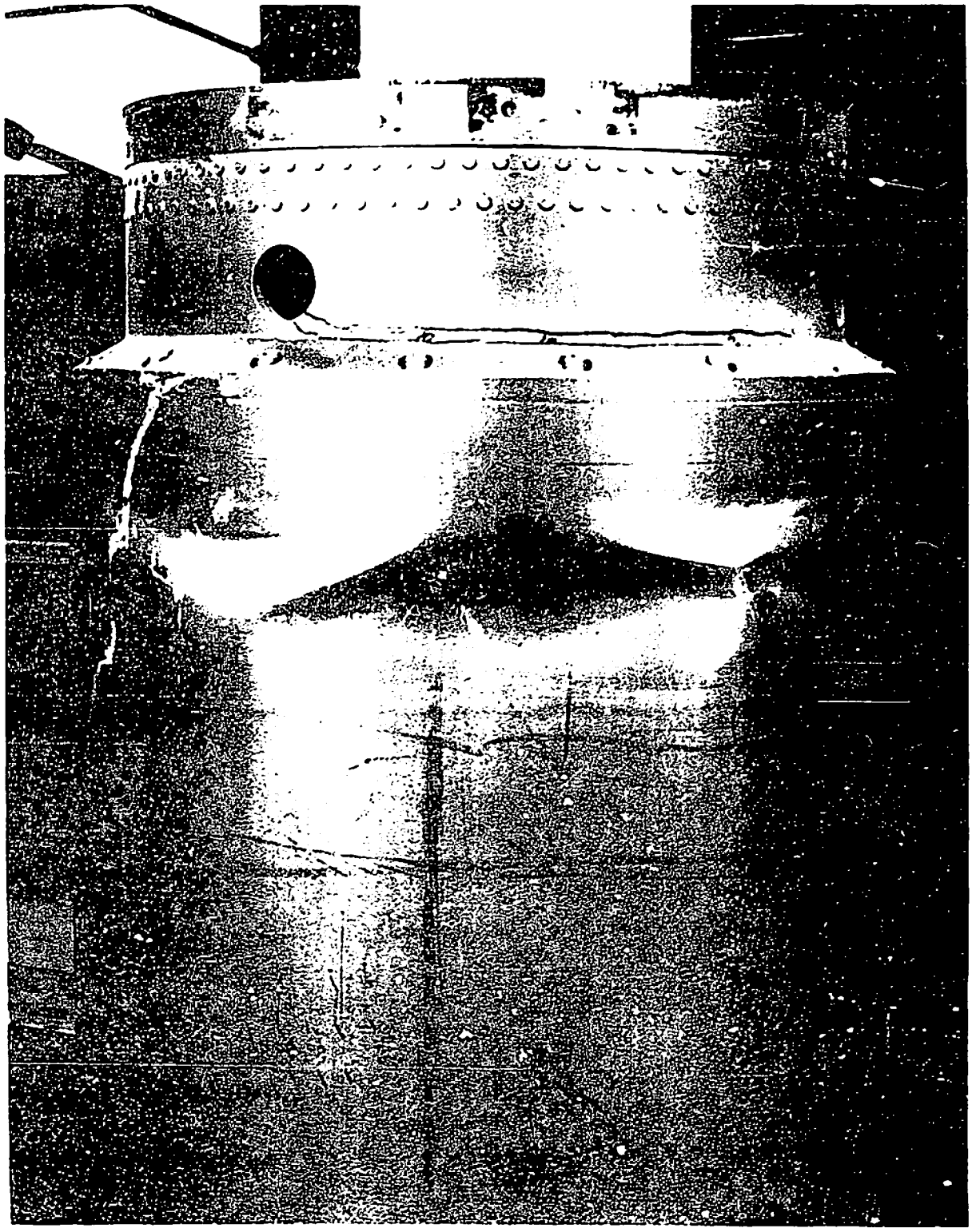

FIG. 13 -- REAR CASE ASSEMBLY AFTER FAILURE -- STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY.

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TABLE I

STRESSCOAT TEST RESULTS
STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY

Per Cent Design Limit Load	Loads (Pounds) A	B	C	Stresscoat Pattern No.	Apparent Stress at Design Ultimate Load (psi)
5	500	500	190	--	--
10	1,000	1,000	380	--	--
15	1,500	1,500	570	--	--
20	2,000	2,000	760	--	--
25	2,500	2,500	950	1	30,200
30	3,000	3,000	1,140	2	25,200
35	3,500	3,500	1,330	3	21,600
40	4,000	4,000	1,520	4	18,900
50	5,000	5,000	1,900	5	15,100
60	6,000	6,000	2,280	6	12,600
70	7,000	7,000	2,660	7	10,800
80	8,000	8,000	3,040	8	9,400
100	10,000	10,000	3,800	9	7,500
125	12,220	12,220	4,750	10	6,000
170	16,800	16,800	6,500	Failure	

Stresscoat sensitivity averaged 575 microinches per inch during test.

Modulus of elasticity of aluminum taken as 10.5×10^6 psi.

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TABLE II

STRAIN READINGS AND CALCULATED PRINCIPAL STRESSES TEST OF FORWARD SECTION NO. 2
STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY

Strain Readings - Microinches per Inch

Per Cent Design Limit Load	Loads (Pounds) A	B	C	Strain Gage Element No. 1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	*	0	0	0	0	0	0	0	0
25	18,850	3,375	3,375	-760	-390	70	--	90	220	-290	30	260	-1010	-690	150
50	37,700	6,750	6,750	-1260	-680	220	--	120	550	-370	120	520	-1610	-1120	310
60	42,420	8,100	8,100	-1610	-870	290	--	120	710	-450	160	650	-1880	-1300	370
70	52,780	9,450	9,450	-1720	-970	330	--	100	840	-510	200	730	-2060	-1460	410
**	60,320	10,000	10,000	- Failure -											

Calculated Principal Stresses

Per Cent Design Limit Load	Loads (Pounds) A	B	C	Strain Gage Element No. 1, 2, and 3 Su psi	Sv psi	θ Deg.	4, 5, and 6 Su psi	Sv psi	θ Deg.	7, 8, and 9 Su psi	Sv psi	θ Deg.	10, 11, and 12 Su psi	Sv psi	θ Deg.
25	18,850	3,375	3,375	-2320	-8760	273.1	*	*	*	2260	-1290	90.0	140	-11380	76.4
50	37,700	6,750	6,750	-2510	-14190	276.1	--	--	--	4670	-2260	87.1	-2190	-18680	77.0
60	42,420	8,100	8,100	-3060	-18140	276.2	--	--	--	5880	-2670	86.9	-2460	-21790	77.1
70	52,780	9,450	9,450	-2970	-19350	277.5	--	--	--	6600	-3060	85.9	-2550	-23950	74.8

* Gage No. 4 defective - no strain readings or stress calculations possible.
** Failed at 80 per cent load A plus 75 per cent each loads B and C.

(+) indicates a tensile strain or stress.
(-) indicates a compressive strain or stress.
Angle θ is the angle between Su and the longitudinal direction, measured clockwise.

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TABLE III

RESULTS OF TENSILE TESTS ON SPECIMENS CUT FROM FORWARD SECTIONS
STATIC TEST OF TX-28/X2 REAR CASE ASSEMBLY

Specimen No.	Forward Section No.	Direction of Specimen	Ultimate Strength (psi)
1	1	Circumferential	80,100
2	1	Circumferential	80,200
3	1	Circumferential	80,100
			Average = 80,133 psi
4	1	Longitudinal	72,600
5	1	Longitudinal	72,100
6	1	Longitudinal	71,600
			Average = 72,100 psi
7	2	Circumferential	82,400
8	2	Circumferential	82,200
9	2	Circumferential	83,200
			Average = 82,600 psi

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