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⑨ BUREAU OF SHIPS GROUP
TECHNICAL INSPECTION REPORT

Classification (~~Confidential~~) (Changed to **CONFIDENTIAL**)

By Authority of Joint Chiefs of Staff (Action 15 APR 64)

John R. King Capt Date *1 May 61*

AFOW P

⑥ OPERATION CROSSROADS
U.S.S. SARATOGA (CV3)

TEST ABLE

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OPERATION CROSSROADS

Director
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BUREAU OF SHIPS GROUPS
TECHNICAL INSPECTION REPORT

Classification (~~Confidential~~) (Changed to **CONFIDENTIAL**)
By Authority of Joint Chiefs of Staff (Action 16 Apr 51)
By John Beggs Capt Date 1 May 51
AFSWP

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Washington, D. C. 20301

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APPROVED:

F.X. Forest,
Captain, U.S.N.

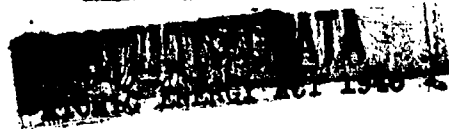
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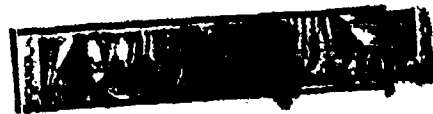
USS SARATOGA (CV3)

Page 1 of 87 Pages

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USS SARATOGA (CV3)

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U.S.S. SARATOGA (CV 3)

SHIP CHARACTERISTICS

Building Yard: New York Shipbuilding Corporation.

Commissioned: 16 November 1927.

HULL

Length Overall: 901 feet 2 inches.

Length on Waterline: 850 feet 0 inches.

Beam (extreme, at or below waterline): 111 feet 9 inches.

Beam (extreme, above main deck): 130 feet 1 inch.

Depth (molded at side, to upper deck, amidships):
74 feet 0 inches.

Drafts at time of test: Fwd. 28 feet 2 inches.

Aft. 31 feet 0 inches.

Standard displacement: 33,003 tons.

Displacement at time of test: 43,620 tons.

MAIN PROPULSION PLANT

Main Engines: Four sets of main general electric turbines connected to main propulsion generators. Four main propulsion motors, one per shaft.

Main Condensers: Four installed in ship.

Boilers: Sixteen installed in ship. Type: White - Foster.
300 psi - gauge, 522° F.

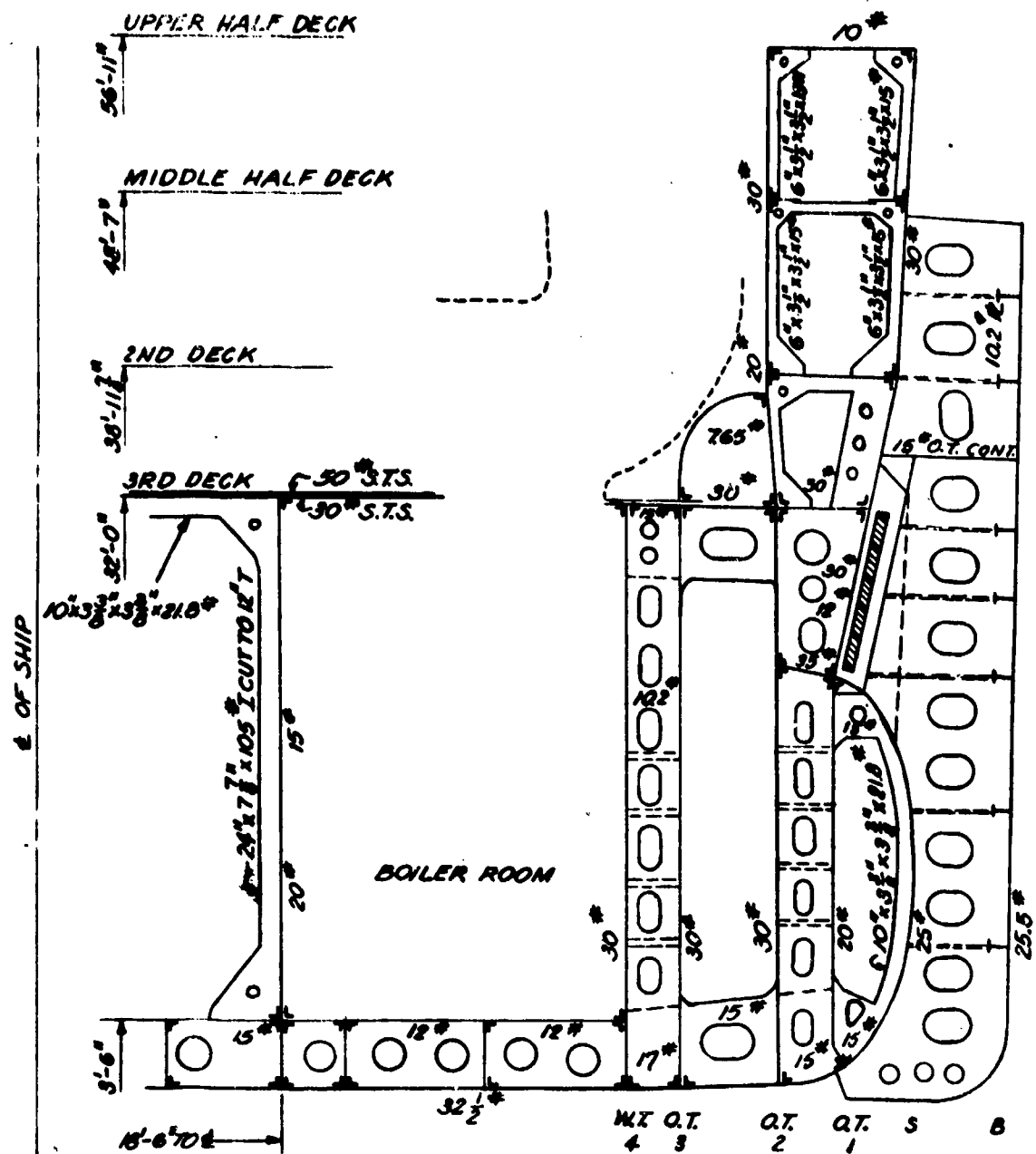
Propellers: Four installed in ship.

Main Shafts: Four installed in ship.

Ships Service Generators: Six installed in ship. 750 -
K.W. each.

SECRET

USS SARATOGA (CV 3)



MIDSHIP SECTION
STBD SIDE
MIDSHIP SECTION
TEST A

SECRET

USS SARATOGA (CV 3)

TECHNICAL INSPECTION REPORT

OVERALL SUMMARY

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

There is no flooding, hence no change in drafts or list.

(b) Structural damage.

HULL

This vessel has suffered minor structural damage to the elevator platform which was in the locked position at the flight deck level during test A. The pressure incident to the burst caused downward deflection of the platform with a resulting permanent set of 1 5/8 inches at the center. The deflection is accompanied by minor distortion of some of the structural members which support the platform. The damage is not of itself sufficient to interfere with normal operation. However, the deflection caused misalignment of the equalizing system which prevented operation of the elevator until ships force repairs requiring two hours were affected. Upon completion of these repairs the elevator was operable under manual, but not under automatic, control.

MACHINERY

The elevator platform was pushed downward by the blast pressure, damaging it structurally and damaging the equalizing and automatic control mechanisms underneath it.

ELECTRICAL

No comment.

SECRET

USS SARATOGA (CV3)

(c) Other damage.

HULL

Damage to the elevator equalizing system is discussed in section II - Machinery.

MACHINERY

The equalizing mechanism and automatic control mechanism were considerably deranged and damaged by deflection of the elevator platform. There was no other damage to machinery of this vessel during test A.

ELECTRICAL

There was no damage to electrical equipment.

II. Forces Evidenced and Effects Noted.

(a) Heat.

HULL

There is slight scorching of painted vertical surfaces normal to the burst. No scorching of the wood flight deck occurred.

MACHINERY

No evidence.

ELECTRICAL

Heat effects were not noted in detail, but blackening of paint work by radiant heat was observed. No electrical equipment was affected by heat.

SECRET

USS SARATOGA (CV3)

(b) Fires.

HULL

The only fire aboard this ship started in Army Quartermaster equipment stowed on the flight deck, frames 105-113, port, for special test. The fire destroyed nearly all the test equipment and burned the flight deck underneath to about half depth.

The test equipment consisted of clothing, messing and outing gear, battle helmets, field stoves, etc. Much of this equipment had metal parts, having a large surface-mass ratio, which were insulated by packing from any ground connection. The theory that this fire may have resulted from heat induced in the insulated metallic objects is supported by the fact that exposed lines and halyards on or near the flight deck were not scorched.

MACHINERY

No evidence.

ELECTRICAL

The blast started a fire in Army quartermaster equipment on flight deck. No other fires and no explosions occurred. Reference 11, page 2.

(c) Shock.

HULL

None.

MACHINERY

No evidence.

ELECTRICAL

There was no evidence of shock found in any electrical equipment.

SECRET

USS SARATOGA (CV3)

(d) Pressure.

HULL

The pressure wave was from a relative bearing of about 180 degrees. It caused distortion of light metal bulkheads aft under the flight deck and deflection of the elevator platform.

MACHINERY

Blast pressure pushed in the elevator platform near its center. The blast pressure appears to have come from near the starboard beam.

ELECTRICAL

No pressure effects in any electrical equipment occurred.

(e) Any effects apparently peculiar to the atom bomb.

HULL

None.

MACHINERY

A blast pressure sufficiently high to cause damage at the range of the SARATOGA from the explosion is apparently peculiar to the atom bomb.

ELECTRICAL

No effects peculiar to the atom bomb were found in any electrical equipment.

II. Effects of Damage.

(a) Effects on machinery, electrical and ship control.

HULL

Not observed.

SECRET

USS SARATOGA (CV3)

MACHINERY

The airplane elevator was made inoperable by damage to the equalizing and automatic control mechanism. Very limited operation could be restored by the ship's force in about 2 hours. The elevator would be of little or no value for handling airplanes until after complete repairs. It is estimated that these would require approximately 6 days work by a tender. There was no other damage affecting machinery.

ELECTRICAL

None due to damaged electrical equipment.

(b) Effect on gunnery and fire control.

HULL

Not observed.

MACHINERY

No comment.

ELECTRICAL

None due to damaged electrical equipment.

(c) Effect on watertight integrity and stability.

HULL

None.

MACHINERY

No comment.

ELECTRICAL

None due to damaged electrical equipment.

(d) Effect on personnel and habitability.

HULL

None.

SECRET

USS SARATOGA (CV3)

MACHINERY

No casualties would have occurred among personnel below decks. Habitability was not affected.

ELECTRICAL

None due to damaged electrical equipment.

(e) Total effect on fighting efficiency.

HULL

This vessel has one elevator which was made completely inoperable until the cause of the failure was determined and corrected. It was then operable only under manual control. This would have seriously reduced the military effectiveness of the ship under conditions which require maximum use of plane servicing facilities and rapid movement of planes between the flight and hangar decks.

MACHINERY

The fighting efficiency of the SARATOGA as an aircraft carrier was reduced out of proportion to the total damage by inoperability of the airplane elevator. As far as machinery is concerned, the test had no other effect on fighting efficiency.

ELECTRICAL

None due to damaged electrical equipment.

IV. General Summary of Observers Impressions and Conclusions.

HULL

Structural damage to this ship was minor.

SECRET

USS SARATOGA (CV3)

MACHINERY

The arrangement of the equalizing and automatic control mechanisms of the airplane elevator on this vessel is an obvious point of weakness with regard to an attack of this nature.

ELECTRICAL

Blistering due to radiant heat, a fire caused by the heat and minor blast pressure damage were the only effects of the atomic bomb.

V. Preliminary Recommendations.

HULL

Study should be given to the design of elevators which will remain operable when moderately distorted.

MACHINERY

The design of elevators of carriers now in service and in reserve should be studied to determine whether they would be made inoperable by moderate deflection of the platform. If so, this condition should be rectified.

ELECTRICAL

No recommendations are warranted by the conditions observed on this ship.

SECRET

USS SARATOGA (CV3)

TECHNICAL INSPECTION REPORT

SECTION I - HULL

GENERAL SUMMARY OF HULL DAMAGE .

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

There is no flooding, hence no change in drafts or list.

(b) Structural damage.

This vessel has suffered minor structural damage to the elevator platform which was in the locked position at the flight deck level during test A. The pressure incident to the burst caused downward deflection of the platform with a resulting permanent set of 1 5/8 inches at the center. The deflection is accompanied by minor distortion of some of the structural members which support the platform. The damage is not of itself sufficient to interfere with normal operation. However, the deflection caused misalignment of the equalizing system which prevented operation of the elevator until ship's force repairs requiring two hours were affected. Upon completion of these repairs the elevator was operable under manual, but not under automatic, control.

(c) Other damage.

Damage to the elevator equalizing system is discussed in section II - Machinery.

II. Forces Evidenced and Effects Noted.

(a) Heat.

There is slight scorching of painted vertical surfaces normal to the burst. No scorching of the wood flight deck occurred.

SECRET

U.S.S. SARATOGA (CV3)

(b) Fires.

The only fire aboard this ship started in Army Quarter-master equipment stowed on the flight deck, frames 105-113, port, for special test. The fire destroyed nearly all the test equipment and burned the flight deck underneath to about half depth.

The test equipment consisted of clothing, messing and outfitting gear, battle helmets, field stoves, etc. Much of this equipment had metal parts, having a large surface-mass ratio, which were insulated by packing from any ground connection. The theory that this fire may have resulted from heat induced in the insulated metallic objects is supported by the fact that exposed lines and halyards on or near the flight deck were not scorched.

(c) Shock.

None.

(d) Pressure.

The pressure wave was from a relative bearing of about 180 degrees. It caused distortion of light metal bulkheads aft under the flight deck and deflection of the elevator platform.

(e) Any effects apparently peculiar to the atom bomb.

None.

III. Effects of damage.

(a) Effects on machinery, electrical and ship control.

Not observed.

(b) Effect on gunnery and fire control.

Not observed.

SECRET

U.S.S. SARATOGA (CV3)

(c) Effect on watertight integrity and stability.

None.

(d) Effect on personnel and habitability.

None.

(e) Total effect on fighting efficiency.

This vessel has one elevator which was made completely inoperable until the cause of the failure was determined and corrected. It was then operable only under manual control. This would have seriously reduced the military effectiveness of the ship under conditions which require maximum use of plane servicing facilities and rapid movement of planes between the flight and hangar decks.

IV. General Summary of Observers' Impressions and Conclusions.

Structural damage to this ship was minor.

V. Preliminary recommendations.

Study should be given to the design of elevators which will remain operable when moderately distorted.

VI. Instructions for Loading the Vessel Specified the Following.

ITEM	LOADING
Fuel oil	10%
Diesel oil	15 tons
Gasoline	minimum
Ammunition	67%
Potable and reserve feed water	95%
Salt water ballast	4650 tons

SECRET

U.S.S. SARATOGA (CV3)

Details of the actual quantities of the various items aboard are included in Report 7, Stability Inspection Report, submitted by the ship's force in accordance with "Instructions to Target Vessels for Tests and Observations by Ship's Force" issued by the Director of Ship Material. This report is available for inspection in the Bureau of Ships Crossroads Files.

SECRET

U.S.S. SARATOGA (CV3)

Page 15 of 87 Pages

DETAILED DESCRIPTION OF HULL DAMAGE

A. General Description of Hull Damage.

(a) Overall condition.

The damage sustained by the U.S.S. SARATOGA (CV3) is of a minor nature but would prevent the transfer of planes between the flight and hangar decks until repairs to the elevator could be effected. There is no noticeable damage to other hull structural members. There is no flooding, and the residual strength and buoyancy are not affected. Except for damage to the elevator, the ability of the ship to operate is unaffected.

(b) General areas of hull damage.

Permanent deflection of the forward elevator platform caused misalignment of the equalizing mechanism and damage to the follow-up mechanism. This prevents the automatic operation of the elevator. Repairs to permit manual operation of the elevator could be accomplished by the ship's force in about two hours. Several metal joiner bulkheads between the flight and hangar decks are dished and ruptured. Paint on certain exposed parts of the superstructure and shell is slightly scorched. Windows in the superstructure are broken. Flight deck planking is slightly damaged locally by a fire in Army Quartermaster material especially installed for the test.

(c) Apparent causes of hull damage in each area.

The damage can be primarily attributed to the air blast with secondary damage as a result of the fire in the exposed material on the flight deck.

(d) Principal areas of flooding with sources.

No flooding occurred.

SECRET

U.S.S. SARATOGA (CV3)

- (e) Residual strength, buoyancy, and effect of general condition of hull on operability.

The residual strength and buoyancy are unaffected. Operability is slightly affected by the damage to the elevator and by the breakage of superstructure windows opening compartments to the weather.

Photographs on pages 44 to 51 show general exterior views of the ship.

B. Superstructure.

The superstructure has been affected only by blast damage to glass windshields and to equipment fabricated from light sheet metal and by heat damage in the form of scorched paint on exposed surfaces.

On the Navigating Bridge glass windshields are broken as shown in photographs 1727-9, page 52 and 1727-10, page 53. On the Signal Bridge the flag stowages are dished 3 inches. On the Flag Bridge a gear locker is dished 1 inch.

On the after side of the stack the outside layer of paint is scorched and blistered as is shown in photograph 1851-7, page 54. The second layer is blistered but not scorched, and the third layer is intact. The port side of the stack is scorched with the intensity decreasing from aft forward. Photograph 1851-8, page 55, shows paint damage to a bulwark on the O6 level, which is typical of the paint scorching in this area.

C. Guns, Mounts, Directors.

(a) All enclosed 5"/53 mounts are operable with the exception of mount 7. The elevation motor of this mount is out of commission. The mount still can be elevated manually, but it cannot be depressed manually. The sight deflection transmission mechanism is overloaded and the sight deflection crank slips when trained clockwise. Mount 7 was the only twin mount directly exposed to the burst.

SECRET

U.S.S. SARATOGA (CV3)

(b) All exposed 5'' guns are operable and in good condition. Casualties to 40mm guns will be found in the Commanding Officer's Report 11 which is attached as Appendix, page 82.

(c) The fire control system has been damaged slightly. Sight deflection transmission of 5''/38 mount 7 is inoperable as explained above. Mk. 51 directors for 40mm mounts 3 and 5 are out of alignment and Mk. 14 sights for 20mm guns 12 and 14 have bubbled ray filters.

(d) The damage to guns and directors is the result of mechanical failures of the units involved. The fire power of the ship has been reduced not more than 10%.

D. Torpedo Mounts and Depth Charge Gear.

Not applicable.

E. Flight Deck.

Damage to the flight deck is limited to deflection of the forward elevator platform and to secondary fire damage to the wood planking. There is evidence from deck deflection gages and damaged sheet metal bulkheads on the hangar deck that the flight deck deflected elastically about one inch. From all indications it returned to its original shape and position. Locations and readings of deck deflection scratch gages are tabulated on page 81. There is no damage to other deck fittings or equipment, (photographs 1727-4, page 56, 1727-5, page 57, 1727-12 page 58).

At the time of the test the elevator platform was locked in the up position at the flight deck level by the six platform locks; two starboard, two port, one forward, one aft. The platform apparently deflected considerably more than the permanent set of 1 5/8 inches shown in photograph 2202-1, page 59. The forward equalizing shaft is pulled about 1/4 inch out of a shrunk and keyed connection to a flanged coupling (photograph 2202-2, page 60).

SECRET

U.S.S. SARATOGA (CV3)

Upon partial recovery of the platform, the pinion on the forward end of the equalizing shaft remained forward of its proper position with the result that it gauged the auxiliary or follow-up rack (photograph 2199-9, page 61) and prevented operation of the elevator. Manual operation of the elevator was possible after removal of the auxiliary rack, which required approximately two hours work by the ship's force. Details of the mechanical failures which resulted from the deflection of the platform are described in the Section II - Machinery. Photograph 575-6, page 62 , shows the effect of misalignment of the equalizing system.

The permanent deflection of the platform is accompanied by numerous minor failures of the structural framing. This damage is not sufficient to interfere with normal operation of the elevator. The platform is supported by 14 longitudinal 11" x 3" I beams, 7 on each side of a longitudinal centerline built-up 38" girder. These are connected to 38" built-up girders around the edges of the platform. Running between the edge girders and the center longitudinal are four transverse 27" girders supporting the longitudinals. In way of the support by the transverse girders, the longitudinals are given additional support on one side by 11" x 6" x 10" triangular brackets. Photographs 2199-7, page 63 , 2199-8, page 64 , 2202-7, page 65 , 2202-8, page 66 , are general views showing the supporting structure. See sketch, page 20.

Strength members supporting the platform were damaged as described below.

(a) Some of the longitudinals show evidence of distortion of the lower flange at approximately mid-length of the span between transverses 3 and 4, both port and starboard. Photographs 2202-6, page 67 .

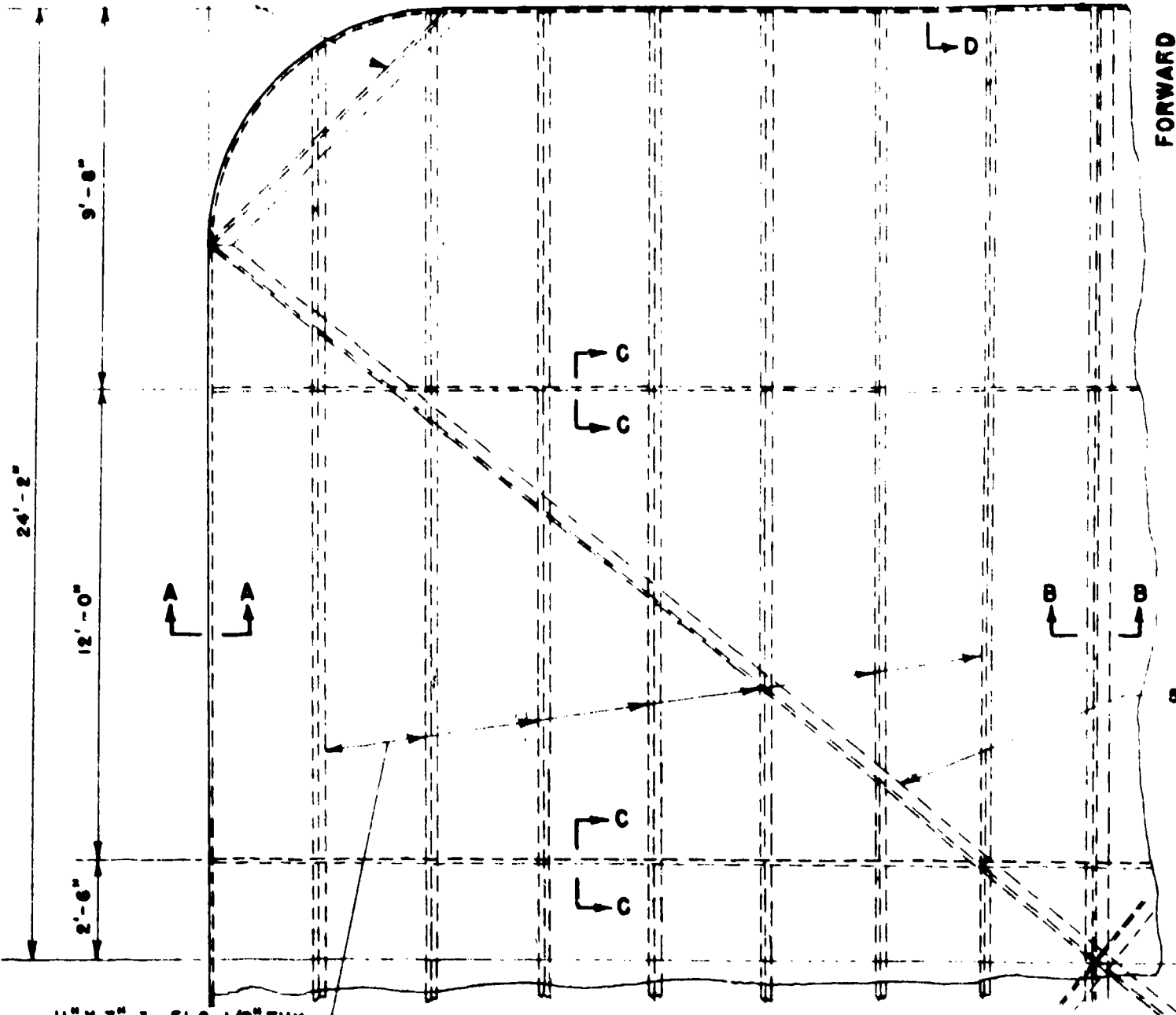
(b) Some of the triangular brackets supporting the longitudinals at all transverse, but particularly at transverses 2 and 3, are slightly distorted. Others show, by cracking of paint, evidence of having been highly strained. Photograph 2202-5, page 68 .

SECRET

USS SARATOGA (CV3)

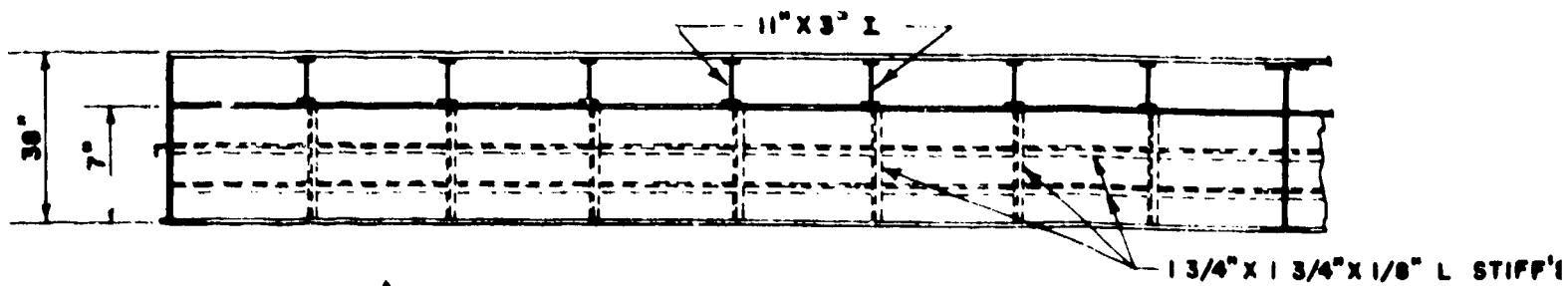
5" x 5" x 3/8" L

ATHWARTSHIP



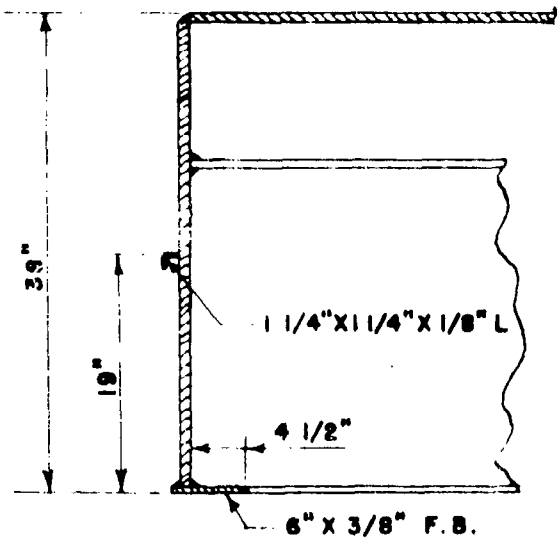
11" x 3" I FLG. 1/8" THK.

QUARTER PLAN
OF
ELEVATOR FRAMING



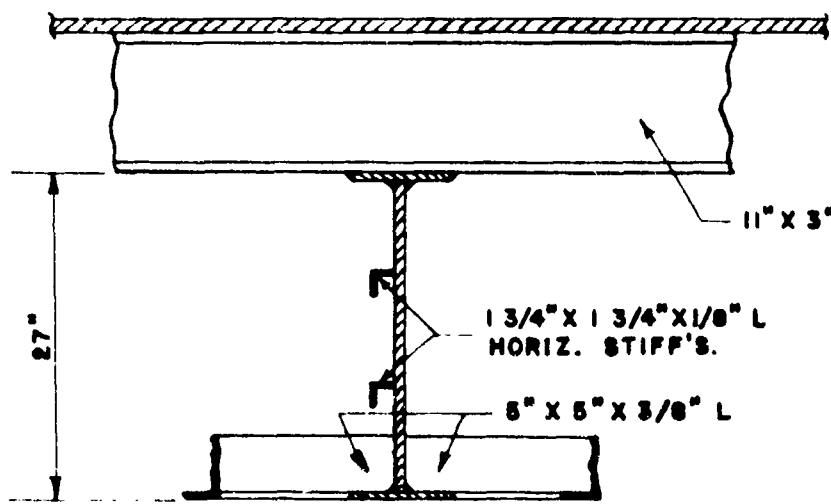
ELEVATION

FORWARD



11" X 3" I FLG. 1/8" THK.

SECT. A-A



11" X 3" I FLG. 1/8" THK.

1 3/4" X 1 3/4" X 1/8" L
HORIZ. STIFF'S.

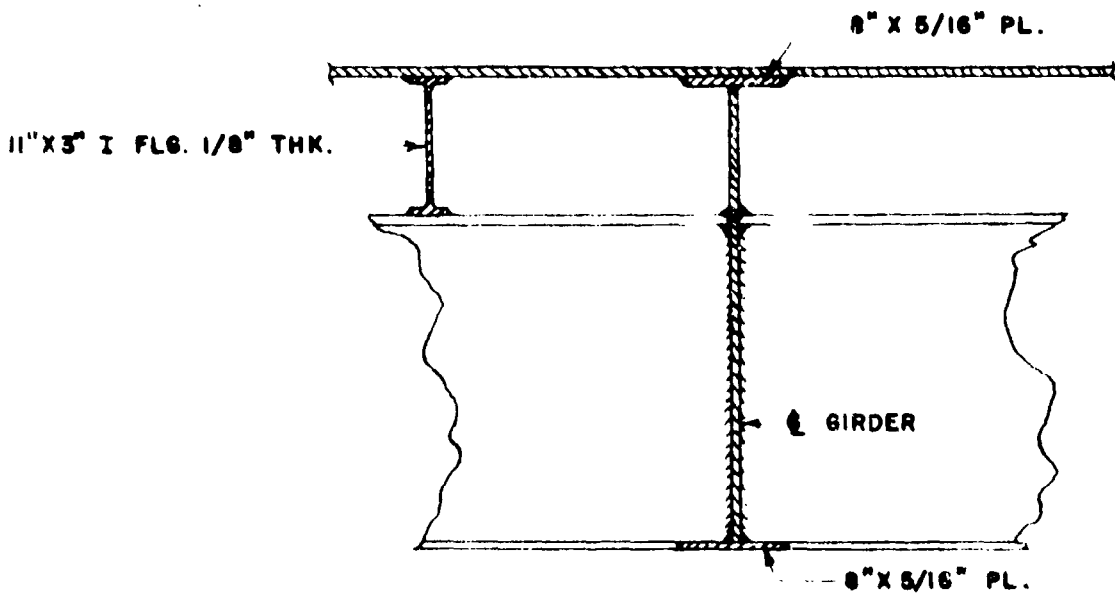
5" X 5" X 3/8" L

SECT. C-C

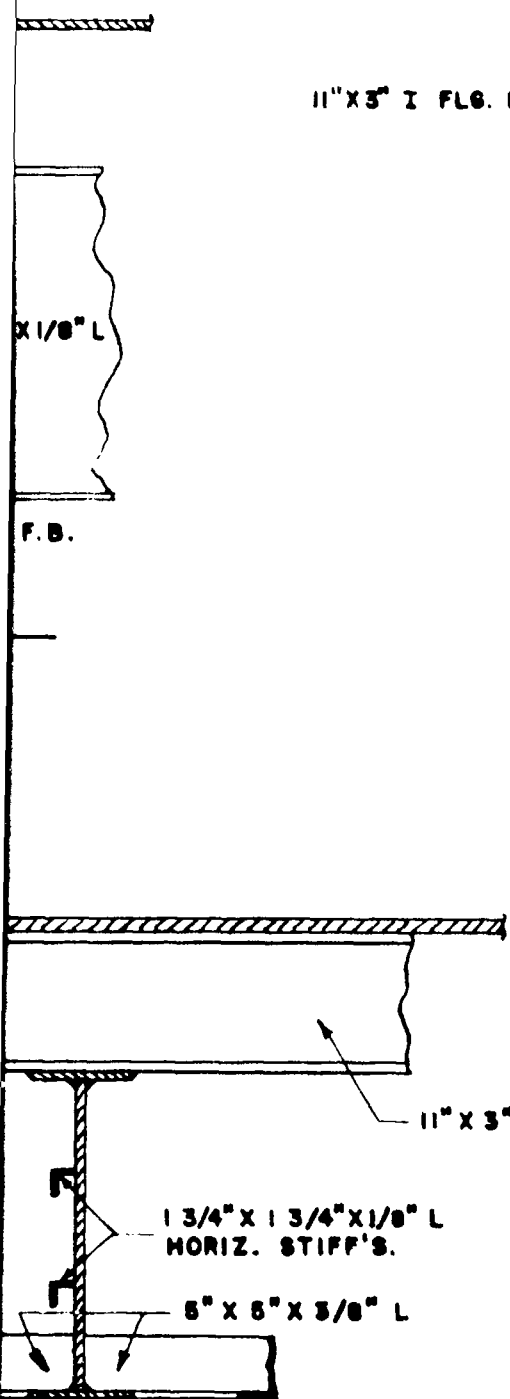
5" X 5" X 3/8" L

3/4" X 1/8" L STIFF'S.

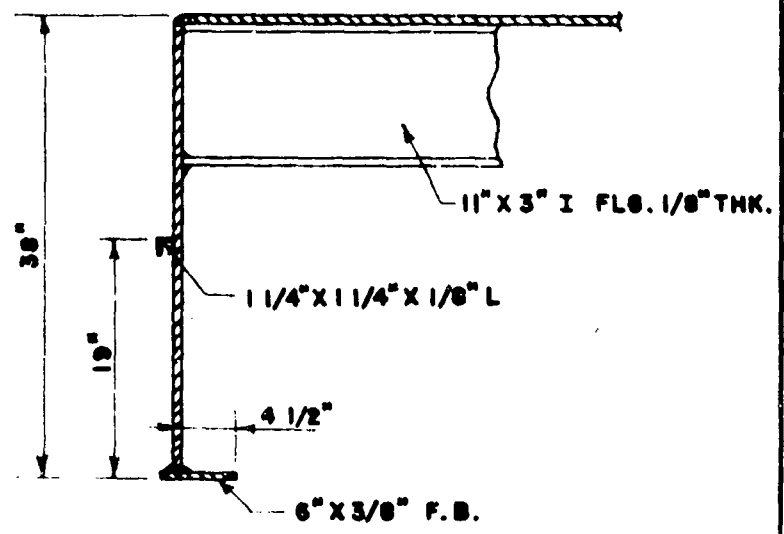
2



SECT. B-B



SECT. C-C



SECT. D-D

SECRET

3

NAVY DEPT.

BUREAU OF SHIPS

ELEVATOR PLATFORM
 PRINCIPAL FRAMING
 TEST A

U.S.S. SARATOGA

CV 3

2

(c) The weld of the flange of transverse 2, port, to the centerline girder is cracked over half its length . Photograph 575-9, page 69 .

(d) Both the upper and lower flanges of transverse 1, port, are slightly wrinkled at mid-span. Photographs 575-12, page 70 .

(e) A weld on one of the 1 1/2" x 1 1/2" angle stiffeners of the web of the centerline girder is cracked. Photographs 575-10, page 71 .

(f) Between transverses 1 and 2, the flange of the centerline girder, as indicated by cracked paint, has been subjected to high strain. The girder web in this area has been slightly distorted. Photograph 575-11, page 72 .

A fire caused secondary damage to the deck itself, burning through about half the thickness of the wood. This fire originated in and was confined to Army Quartermaster gear stowed in an exposed position on racks between frames 105 and 114, port. (Photographs 1727-4, page 56 and 1727-5, page 57). This gear consisted of various types of clothing, messing, and outing equipment. The equipment was essentially insulated from the deck and the metal parts had a high surface-mass ratio. The theory that the fire was caused by heat energy induced into the insulated metallic parts of the equipment is further substantiated by the fact that exposed lines and halyards on or near the flight deck were not even slightly scorched. It was one of the first fires observed by aircraft following the burst and had considerable time to burn before salvage crews could extinguish it. The heat from this material burning over the deck was sufficiently intense to burn the wood deck.

F. Exterior Hull.

The only damage to the exterior hull is the scorching of paint along the port side. ~~This effect is heavy near the stern and decreases progressively forward.~~

SECRET

U.S.S. SARATOGA (CV3)

G. Interior Spaces Above Waterline.

There is no damage to structural members in these spaces. Pressure incident to the burst has distorted a light metal house under the flight deck aft and has dished two 5# mild steel non-structural bulkheads at frame 214. One of these is dished about 3 inches, the other is dished about 6 inches and a vertical weld is ruptured as shown in photograph 1913-1, page 73 . Vertical movement incident to elastic deflection of the flight deck has buckled two transverse metal joiner bulkheads on the main deck. One of these is in way of an unsupported door at frame 104; the other is in way of an unsupported window at frame 108. No other damage has been incurred.

H. Armored Decks.

Not applicable.

I. Interior Compartments below waterline.

No damage.

J. Underwater Hull.

No evidence of damage.

K. Tanks.

No damage.

L. Flooding.

No flooding.

M. Ventilation.

No damage.

SECRET

U.S.S. SARATOGA (CV3)

N. Ship Control.

No damage.

O. Fire Control.

No damage except to units discussed in Item C.

P. Ammunition Behavior.

Normal.

Q. Ammunition Handling.

No damage.

R. Strength.

The strength of the ship girders not affected. There is no indication of permanent hog or sag or any other permanent deformation of the hull, nor is there any indication of the ship being subjected to any abnormal strain.

SECRET

U.S.S. SARATOGA (CV3)

TECHNICAL INSPECTION REPORT

SECTION II - MACHINERY

GENERAL SUMMARY OF MACHINERY DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

No data taken by machinery group.

(b) Structural damage.

The elevator platform was pushed downward by the blast pressure, damaging it structurally and damaging the equalizing and automatic control mechanisms underneath it.

(c) Other Damage.

The equalizing mechanism and automatic control mechanism were considerably deranged and damaged by deflection of the elevator platform. There was no other damage to machinery of this vessel during Test A.

II. Forces Evidenced and Effects Noted.

(a) Heat.

No evidence.

(b) Fires and explosions.

No evidence.

(c) Shock.

No evidence.

SECRET

USS SARATOGA (CV3)

(d) Pressure.

Blast pressure pushed in the elevator platform near its center. The blast pressure appears to have come from near the starboard beam.

(e) Effects apparently peculiar to the atom bomb.

A blast pressure sufficiently high to cause damage at the range of the SARATOGA from the explosion is apparently peculiar to the atom bomb.

III. Effects of Damage.

(a) Effect on machinery and ship control.

The airplane elevator was made inoperable by damage to the equalizing and automatic control mechanisms. Very limited operation could be restored by the ship's force in about 2 hours. The elevator would be of little or no value for handling airplanes until after complete repairs. It is estimated that these would require approximately 6 days' work by a tender. There was no other damage affecting machinery.

(b) Effect on gunnery and fire control.

No comment.

(c) Effect on water-tight integrity and stability.

No comment.

(d) Effect on personnel and habitability.

No casualties would have occurred among personnel below decks. Habitability was not affected.

SECRET

USS SARATOGA (CV3)

(e) Total effect on fighting efficiency.

The fighting efficiency of the SARATOGA as an aircraft carrier was reduced out of proportion to the total damage by inoperability of the airplane elevator. As far as machinery is concerned, the test had no other effect on fighting efficiency.

IV. General Summary.

The arrangement of the equalizing and automatic control mechanisms of the airplane elevator on this vessel is an obvious point of weakness with regard to an attack of this nature.

V. Preliminary Recommendations.

The design of elevators of carriers now in service and in reserve should be studied to determine whether they would be made inoperable by moderate deflection of the platform. If so, this condition should be rectified.

SECRET

USS SARATOGA (CV3)

DETAILED DESCRIPTION OF MACHINERY DAMAGE

A. General Description of Machinery Damage.

(a) Overall condition.

The airplane elevator was moderately damaged by blast pressure pushing down on the platform, deranging the equalizing mechanism and automatic control mechanism directly below. There was no other damage to machinery of this vessel during Test A.

(b) Areas of major damage.

There is no area of major damage. Moderate damage was sustained by the airplane elevator.

(b) Primary Causes of damage.

Blast pressure caused the damage to the airplane elevator.

(d) Effect of target test on overall operation of machinery plant.

The overall operation of the machinery plant was not affected by the test. Limited operation of the airplane elevator could be restored by the ship's force in about 2 hours, but the elevator would be of little value for handling airplanes until after complete repairs. It is estimated that approximately 6 days' work by a tender would be required for complete repairs.

NOTE: This ship has been underway for 3 1/2 hours since Test A, at speeds up to 10 knots.

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USS SARATOGA (CV3)

B. Boilers.

Undamaged. Boiler No. 2 was inoperable before Test A, but its condition was not changed by the test. All other boilers were tested hydrostatically after Test A. Results indicate no change in the tightness of the boilers. Boilers 4, 5, 12, 13, 14, and 15 were steamed after Test A, and functioned normally.

HYDROSTATIC TESTS

Boiler #1

	Before Test A	After Test A
Initial Pressure	295 lb/sq. in.	305 lb/sq. in.
Pressure remaining after 24 hours	190 lb/sq. in.	230 lb/sq. in.

Boiler #16

Initial Pressure	295 lb/sq. in.	305 lb/sq. in.
Pressure remaining after 24 hours	180 lb/sq. in.	270 lb/sq. in.

BLOWER R.P.M. vs AIR PRESSURE

#1 Fireroom

Blower R.P.M.	Before Test A	After Test A
500	1.0 inches of water	1.1 inches of water
1000	3.6 " " "	3.8 " " "
1200	5.4 " " "	5.3 " " "
1500	9.0 " " "	8.4 " " "
1700	11.8 " " "	10.5 " " "

C. Blowers.

Undamaged. All blowers were operated for at least 30 minutes after Test A, and functioned normally.

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D. Fuel Oil Equipment.

Undamaged. Approximately half of the fuel oil equipment was used in service after Test A, and functioned normally. The remaining fuel oil equipment was carefully inspected and is undamaged.

E. Boiler Feedwater Equipment.

Undamaged. All boiler feedwater equipment has been tested at 400 lbs/sq. in. pressure, and approximately half of it has been used in service since Test A.

F. Main Turbines.

1. Undamaged. The main turbines were used in service for approximately 3-1/2 hours after Test A, at speeds up to 10 knots. Performance was normal.

2. Leads left in the bearings of No. 1 main generator turbine during Test A indicate no motion of the rotor during the test.

G. Reduction Gears.

Not applicable.

H. Shafting and Bearings.

Undamaged. Shafting and bearings were checked while the ship was underway, and functioned normally.

I. Lubricating System.

Undamaged. The lubrication system was checked while the ship was underway, and functioned normally.

J. Condensers and Air Ejectors.

Undamaged. All condensers were thoroughly checked while the ship was underway. Performance was satisfactory, with normal vacuum.

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K. Pumps.

Undamaged. All pumps were operated under service conditions after Test A, and functioned normally.

L. Main Generators (Turbines & Gears).

Undamaged. Each ship's service generator was operated under load for at least two hours after Test A. Performance was normal.

M. Propellers.

Undamaged. The propellers were not accessible for inspection. They were checked while the ship was underway, and functioned normally.

N. Distilling Plant.

Undamaged. The distilling plant was placed in operation immediately after Test A, and functioned normally.

O. Refrigerating Plant.

Undamaged. The refrigerating plant was placed in service immediately after Test A, and functioned normally.

P. Winches, Windlasses, and Capstans.

Undamaged. All equipment under this heading was operated after Test A, and functioned normally.

Q. Steering Engine.

Undamaged. All steering equipment was operated while the ship was underway, and functioned normally.

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R. Elevators, Ammunition Hoists, and Cranes.

Airplane Elevator.

1. The elevator platform was slightly dished downward at its center. It appears that the elevator had been pushed downward considerably by the blast pressure, and had sprung back almost to its original position.

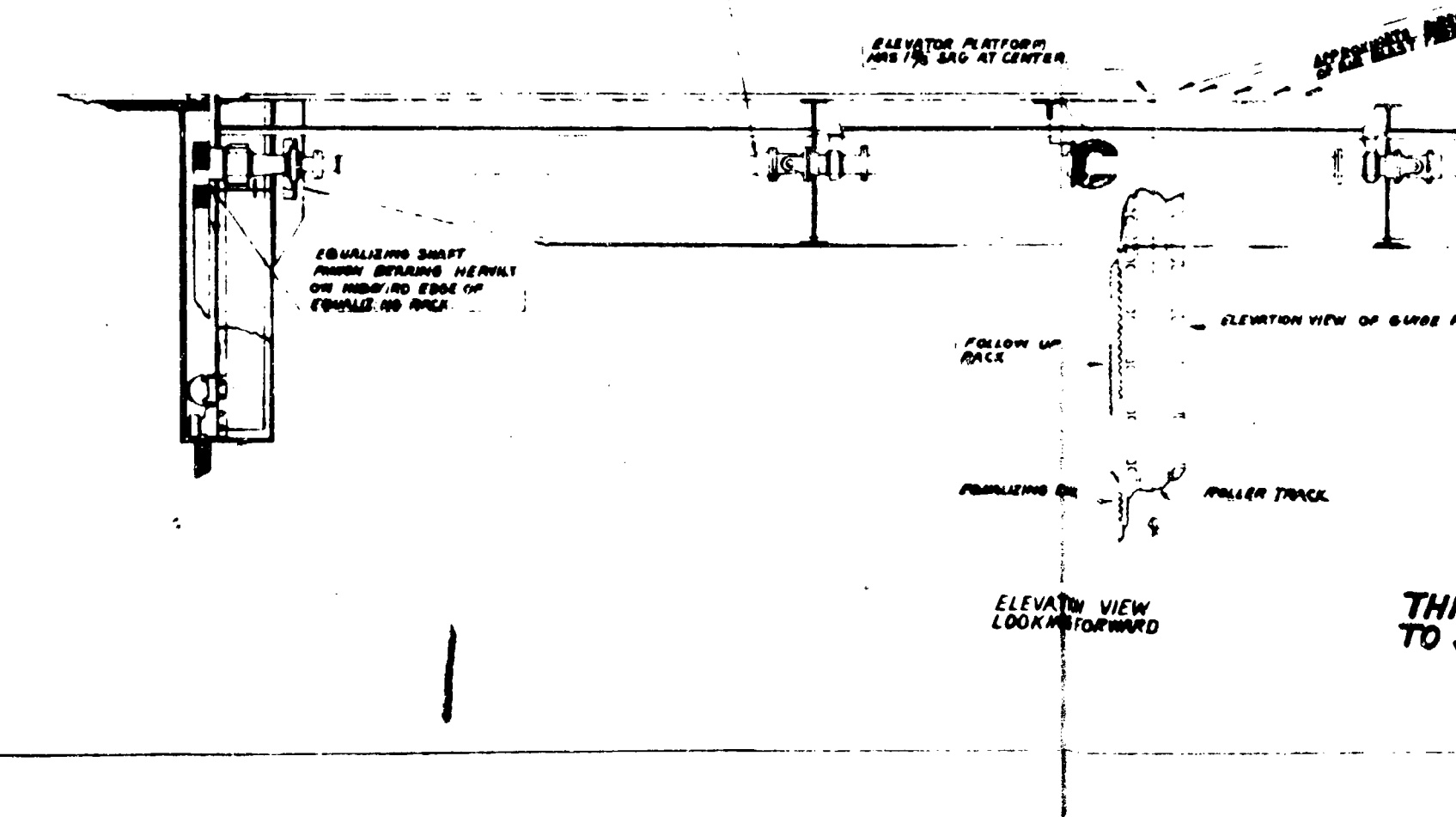
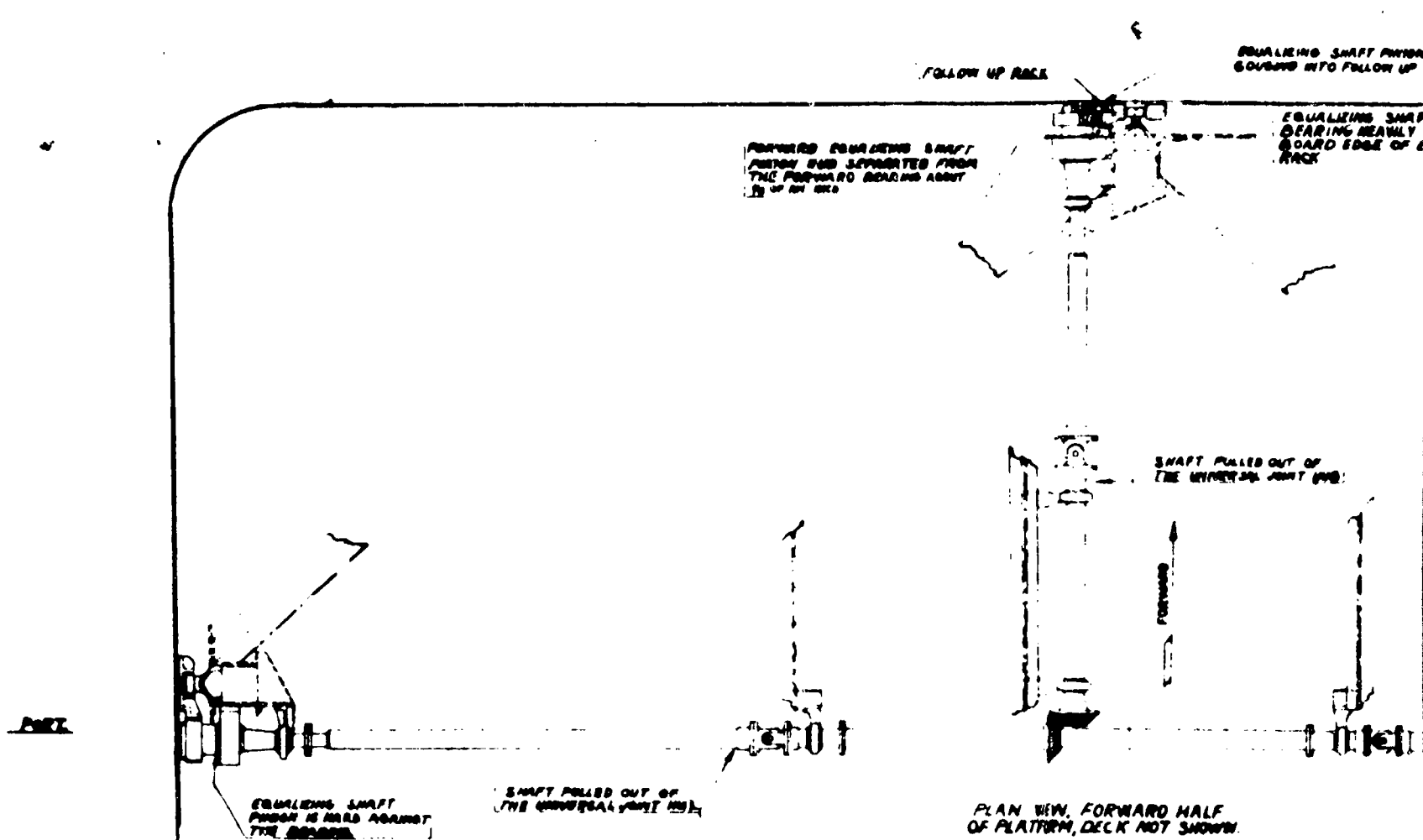
2. A complicated system of gears, racks, and shafting, called the equalizing mechanism, is installed directly beneath the platform and supported from it by bearing brackets. (See Photo 2199-7 and 8; pages 63, and 64). The function of this mechanism is to keep the platform level while it is being hoisted and lowered. Pinions on the ends of the shafts engage stationary racks secured to the ship's structure at the sides of the elevator well. (See Photos 2199-4 and 5, and 1915-11; pages 74 , 75 , and 76). Since the bearing pedestals and mechanism are only a few inches below the elevator platform, any appreciable distortion of the platform affects the mechanism, causing misalignment, disarrangement of gearing, etc.

3. After Test A the equalizing mechanism was found to be considerably damaged and inoperable. The pinion hub of the fore and aft shaft is separated from its bearing by about 1/8 inch (See Photo No. 1915-11, page 76). The other end of this shaft pulled out of the universal joint hub near the center of the platform (Photo No. 1915-10, page 77). The athwartships shaft is displaced from port to starboard. The pinion at the starboard end of this shaft is about 1/8 inch out of its bearing and coupling, (See Photograph 2199-6, page 78) while the pinion on the port end of the shaft is jammed against its bearing. Both of these pinions are slightly to starboard of their normal position relative to the racks with which they mesh.

4. The position of the pinions and shafts indicates that the elevator platform sprung downward considerably near its center, pushing the platform downward and somewhat to port (See drawing, page 32). There is some structural damage to the elevator platform not covered in detail here (See Section I - Hull).

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EQUALIZING SHAFT PINION
BOUNDS INTO FOLLOW UP RACK.

EQUALIZING SHAFT PINION
BEARING HEAVILY ON IN-
BOARD EDGE OF EQUALIZING
RACK

SHAFT PALED OUT OF
THE MINERVA JOINT (MS).

STARBOARD

EQUALIZING PINION IS SEPARATED
FROM THE BEARING ABOUT 1/4 INCH

N. FORWARD HALF
M. DECK NOT SHOWN

APPROXIMATE POSITION
OF AIR BAST PRESSURE

ELEVATION VIEW OF GUIDE FRAME.

EQUALIZING SHAFT PINION
BEARING HEAVILY ON
INBOARD EDGE OF
EQUALIZING RACK

ROLLER TRACK

VIEW
FORWARD

**THIS DRAWING IS NOT
TO SCALE.**

U.S.S. SARDOGA/CVS.

TESTABLE
FORD ELEVATOR EQUALIZING
GEAR & FOLLOW UP RACK.

DAMAGE TO BORE TRAW INDICATED
BY NOTES, POINTING TO PLACE OF
FAILURE.

DIRECTION OF AIR BLAST PRESSURE
HITTING PLATFORM INDICATED BY
STRIKED LINE & ARROWS.

CROSS-SECTION - MACHINE BY SECTION.
DRAWING FROM FILE - BURRO-C/R -
FILE NUMBER 390368.

NOTE

THIS DRAWING SHOWS ALTERA-
TIONS THAT HAVE BEEN MADE AND
ARE NOT SHOWN ON BURRO-
C/R DRAWING NO 390368.
STRUCTURAL FEATURES
ARE DIAGRAMMATIC &
ARE NOT ACCURATE.

SECRET

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5. There is an auxiliary mechanism, called the automatic control mechanism, geared to and actuated by the forward equalizing shaft. A follow-up rack is geared to the forward equalizing shaft by a pinion at the forward edge of the platform. The function of this mechanism is to enable the elevator to be brought to a stop automatically at the desired point.

6. After Test A this mechanism was deranged. The forward equalizing pinion was gouging into the follow-up rack (See Photo 2199-9, page 61) and its bronze guides, which are bolted to the main (stationary) rack.

7. Limited operation of the elevator was restored by the ship's force by removing the follow-up (automatic control) rack. This could have been done in approximately 2 hours under emergency conditions. The elevator can now be used for light loads for a limited time, using hand control to bring it to rest at the desired point. As the equalizing gear is inoperable and badly out of alignment, operation for an extended period or any operation with heavy loads under these conditions would result in additional damage.

8. Repairs to the equalizing gear are beyond the capacity of the ship's force. It is estimated that complete repairs to the elevator could be made by a tender in about 6 days.

9. The overall effect of the damage to elevator machinery is to make it of little or no value for airplane handling until the equalizing gear is repaired.

Airplane Crane.

The airplane crane is undamaged and was operated satisfactorily after Test A.

Ammunition hoists.

Ammunition hoists under the cognizance of the Bureau of Ships are undamaged and have been operated satisfactorily since Test A.

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S. Ventilation (Machinery).

Undamaged. All ventilation machinery was operated after Test A, and functioned normally.

T. Air Compressors.

Undamaged. All air compressors were operated after Test A, and functioned normally.

U. Diesels (Generators and Boats).

Undamaged. Both 300 KW diesel generators and all three 60 KW (casualty power) diesel generators were operated after Test A, and functioned normally.

V. Piping.

Undamaged. All piping has been tested at normal working pressures, and functions normally.

W. Miscellaneous.

Undamaged. All equipment under this heading (galley, laundry, machine shop, etc.) was operated after Test A, and functioned normally.

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TECHNICAL INSPECTION REPORT
SECTION III - ELECTRICAL
GENERAL SUMMARY OF ELECTRICAL DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

Drafts and list were not observed. There was no flooding.

(b) Structural damage.

Not observed.

(c) Other damage.

There was no damage to electrical equipment.

II. Forces Evidenced and Effects Noted.

(a) Heat.

Heat effects were not noted in detail, but blackening of paint work by radiant heat was observed. No electrical equipment was affected by heat.

(b) Fires and explosions.

The blast started a fire in Army quartermaster equipment on flight deck. No other fires and no explosions occurred.

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(c) Shock.

There was no evidence of shock found in any electrical equipment.

(d) Pressure.

No pressure effects in any electrical equipment occurred.

(e) Any effects apparently peculiar to the atom bomb.

No effects peculiar to the atom bomb were found in any electrical equipment.

III. Effects of Damage.

(a) Effect on propulsion and ship control.

None due to damaged electrical equipment.

(b) Effect on gunnery and fire control.

None due to damaged electrical equipment.

(c) Effect on water-tight integrity and stability.

None due to damaged electrical equipment.

(d) Effect on personnel and habitability.

None due to damaged electrical equipment.

(e) Total effect on fighting efficiency.

None due to damaged electrical equipment.

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IV. General Summary of Observer's Impressions and Conclusions.

Blistering due to radiant heat, a fire caused by the heat and minor blast pressure damage were the only effects of the atomic bomb.

V. Any Preliminary General or Specific Recommendations of the Inspecting Group.

No recommendations are warranted by the conditions observed on this ship.

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DETAILED DESCRIPTION OF ELECTRICAL DAMAGE

A. General Description of Electrical Damage.

(a) Overall condition.

The overall condition of the electrical plant was unchanged by the test.

(b) Areas of major damage.

There were no areas of major damage.

(c) Primary causes of damage in each area of major damage.

There was no damage.

(d) Operability of electric plant.

1. Ship's service generator plant.

Not affected.

2. Engine and boiler auxiliaries.

Not affected.

3. Electrical propulsion.

Not affected.

4. Communications.

Not affected.

5. Fire control circuits.

Not affected.

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6. Ventilation.

Not affected.

7. Lighting.

Not affected.

(e) Types of equipment most affected by the test.

No equipment was affected by the test.

B. Electric Propulsion Rotating Equipment.

No damage was found on inspection. The equipment was operated for two hours and in all combinations during an underway period following the test.

C. Electric Propulsion Control Equipment.

No damage was found on inspection. The controls were operated during a two-hour underway period, and were tried in all combinations.

D. Ship's Service Generators.

No damage was found by inspection. All machines operated satisfactorily to supply ship's power.

E. Emergency Generators.

No damage was found by inspection. The three generators operated properly on load test.

A burned out bearing on a 5" gun elevating motor left running for the test, indicated that the emergency generator, left running for the test, functioned for at least a short period after being started.

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F. Switchboards and Distribution Panels.

There was no damage found in any switchboard or panel. All units operated satisfactorily in normal service.

G. Wiring, Wiring Equipment and Wireways.

No damage to any wiring or equipment was found by inspection, nor did any appear during normal energizing.

H. Transformers.

No damage was found in any transformer.

I. Submarine Propelling Batteries.

This item does not apply to the vessel.

J. Portable Batteries.

No damaged batteries were found. All batteries functioned normally after the test.

K. Motors, Motor Generators and Motor Controllers.

There was no damage to any motor, motor-generators or motor controller.

L. Lighting Equipment.

There was no breakage of lamps and no damage to any lighting equipment.

M. Searchlights.

There was no visible damage to searchlights. All lights operated properly.

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N. Degaussing Equipment.

There was no visible damage to the degaussing gear. The system operated properly on test.

O. Gyro Compass Equipment.

The master gyros, repeaters and associated equipment had no visible damage. The system worked satisfactorily for navigation during under-way operation.

P. Sound Powered Telephones.

No damage was found in any sound powered telephone equipment.

Q. Ship's Service Telephones.

No ship's service phones or switchboard equipment was damaged.

R. Announcing Systems.

There was no visible damage. All systems operated satisfactorily.

S. Telegraphs.

All telegraphs operated satisfactorily and showed no visible damage.

T. Indicating Systems.

There was no damage found in any system. All systems functioned as before.

U. I.C. and A.C.O. Switchboards.

All boards operated satisfactorily. No board had any visible damage.

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V. F.C. Switchboards.

No damage was found in any F.C. switchboard. All boards operated satisfactorily.

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SECTION IV

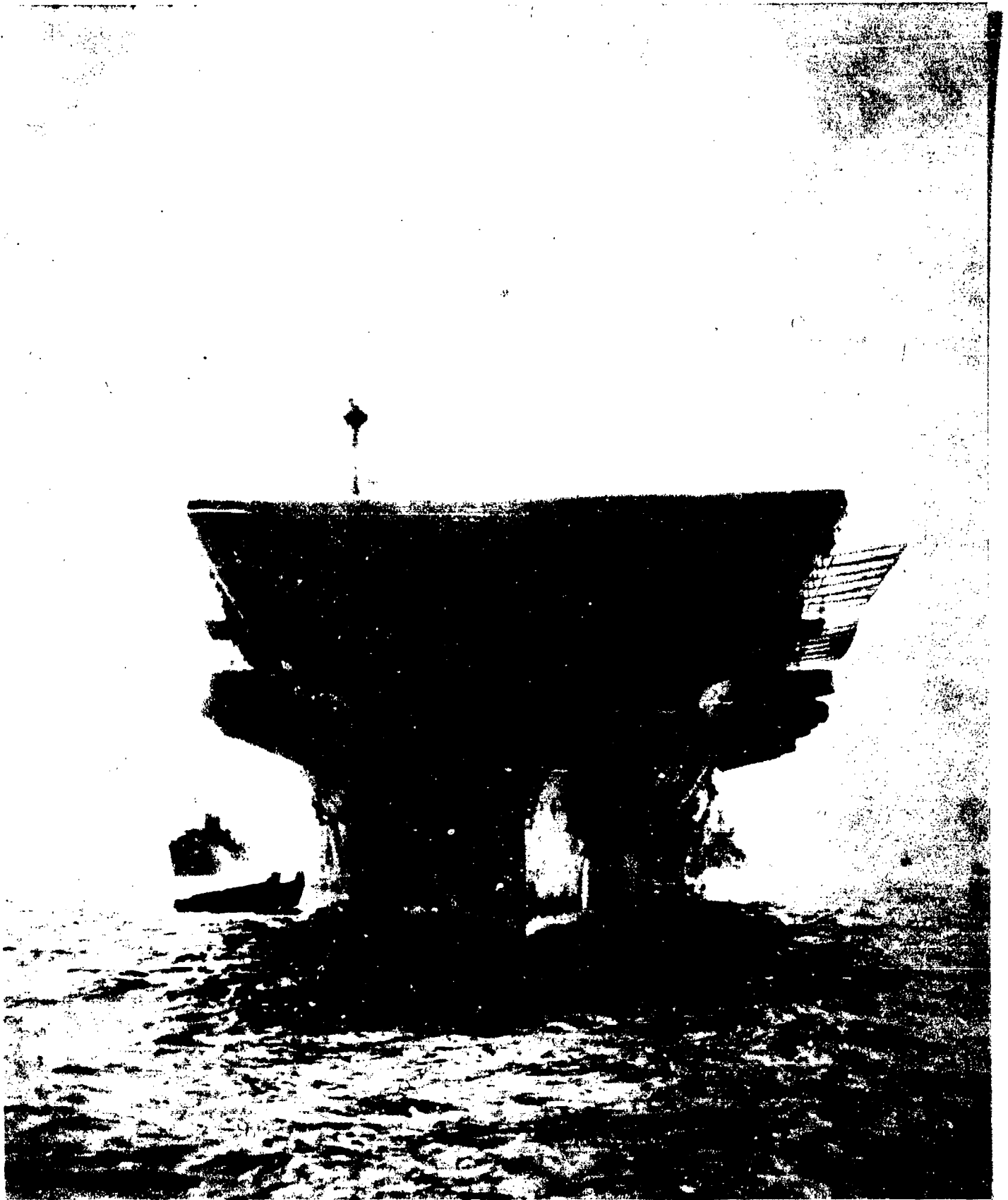
PHOTOGRAPHS

TEST ABLE

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AA-CR-227-50-107. Bow after Test A.

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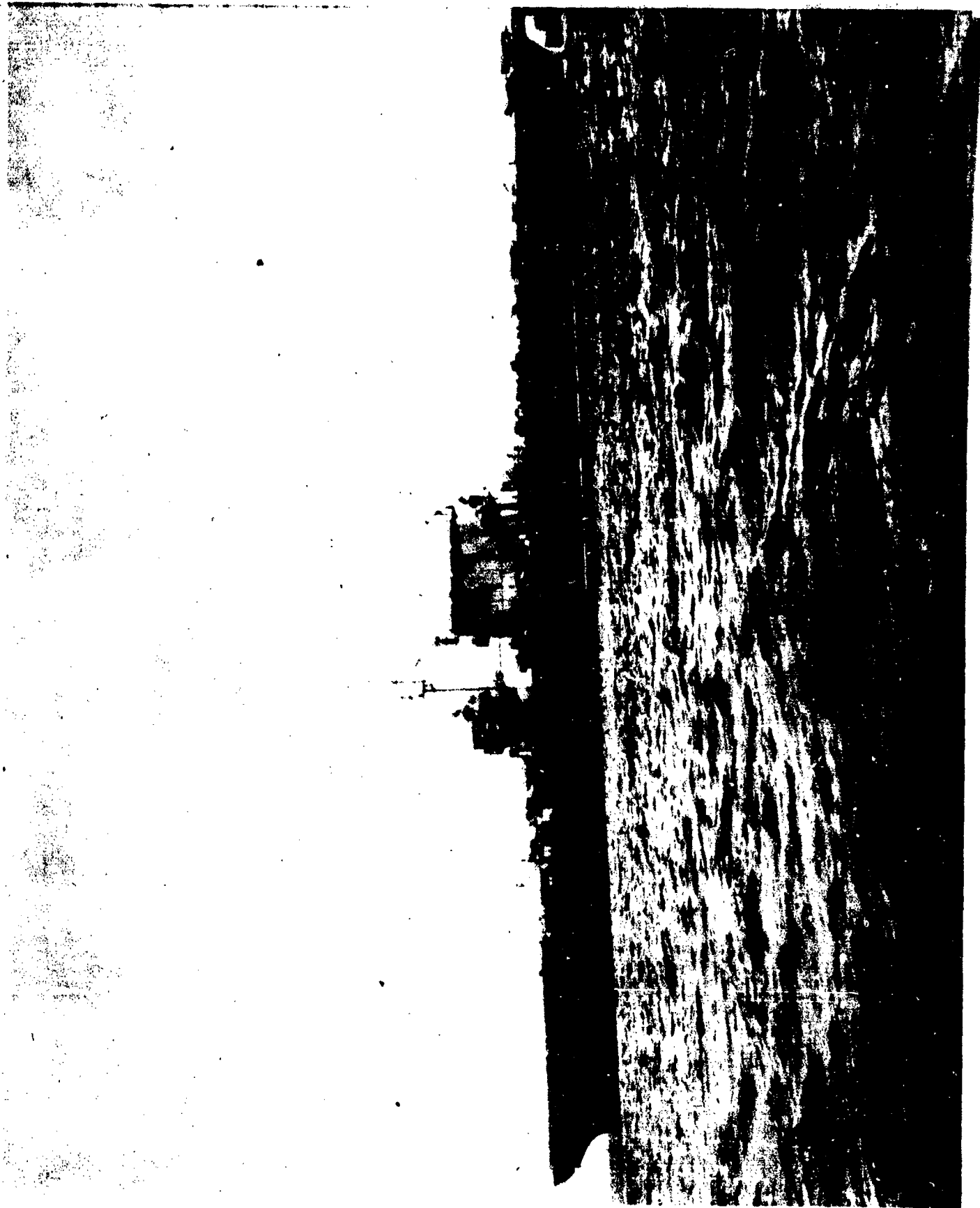
AA-CR-227-50-108. Port bow after Test A.

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AA-CR-227-50-109. Port beam after Test A.

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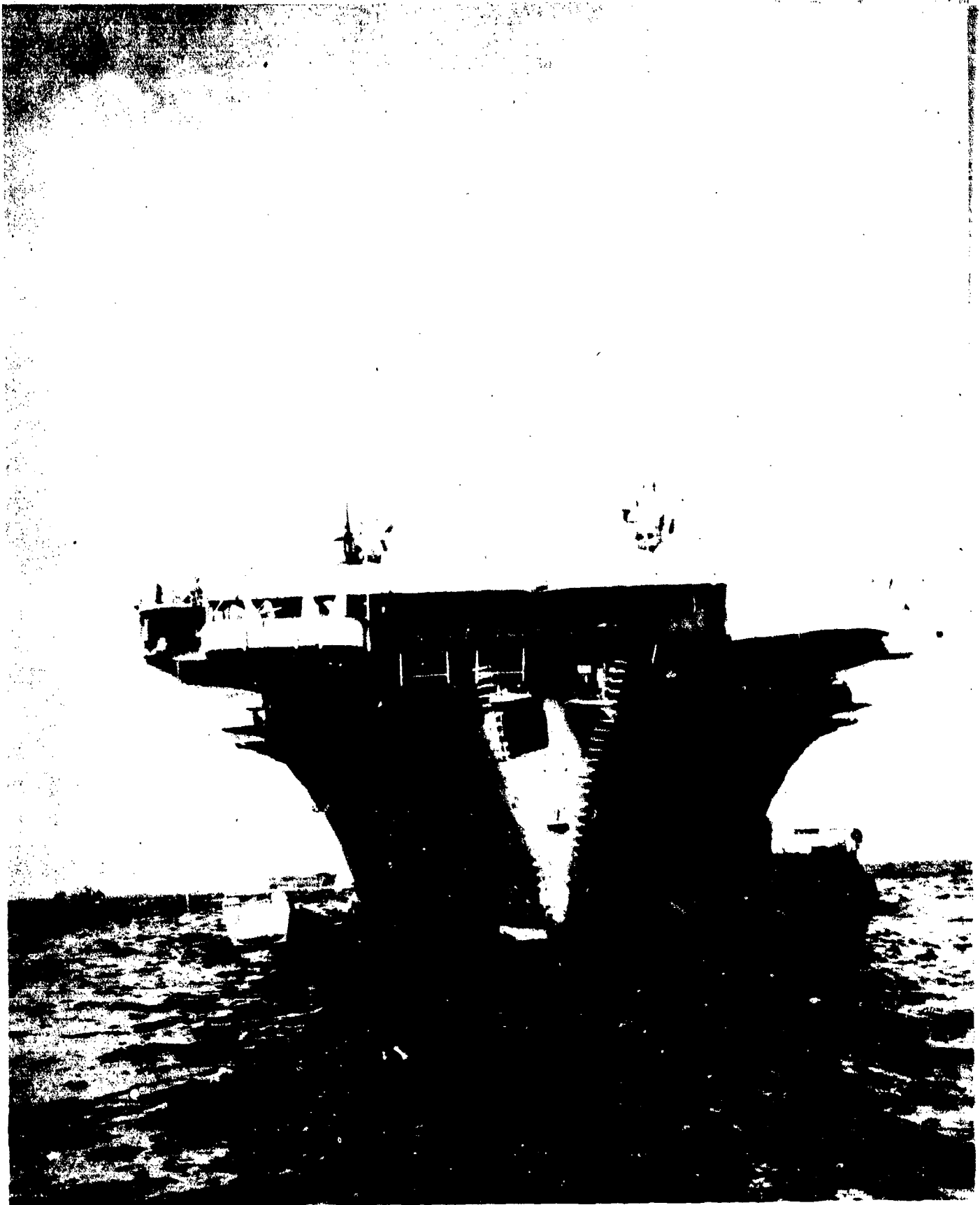
AA-CR-227-50-110. Port quarter after Test A.

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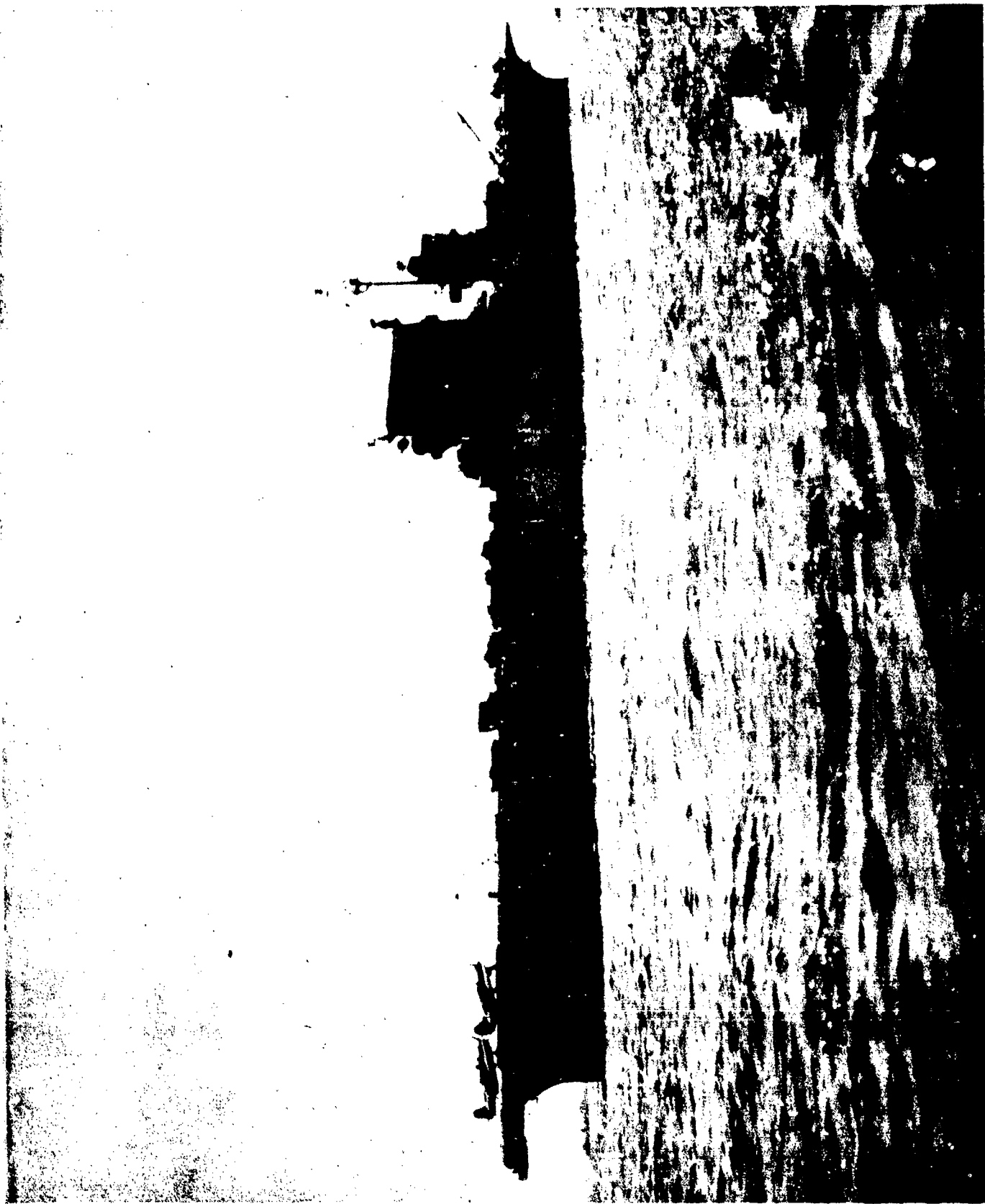
AA-CR-227-50-103. Stern after Test A.

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AA-CR-225-91-72. Starboard quarter after Test A.

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AA-CR-227-50-105. Starboard beam after Test A.

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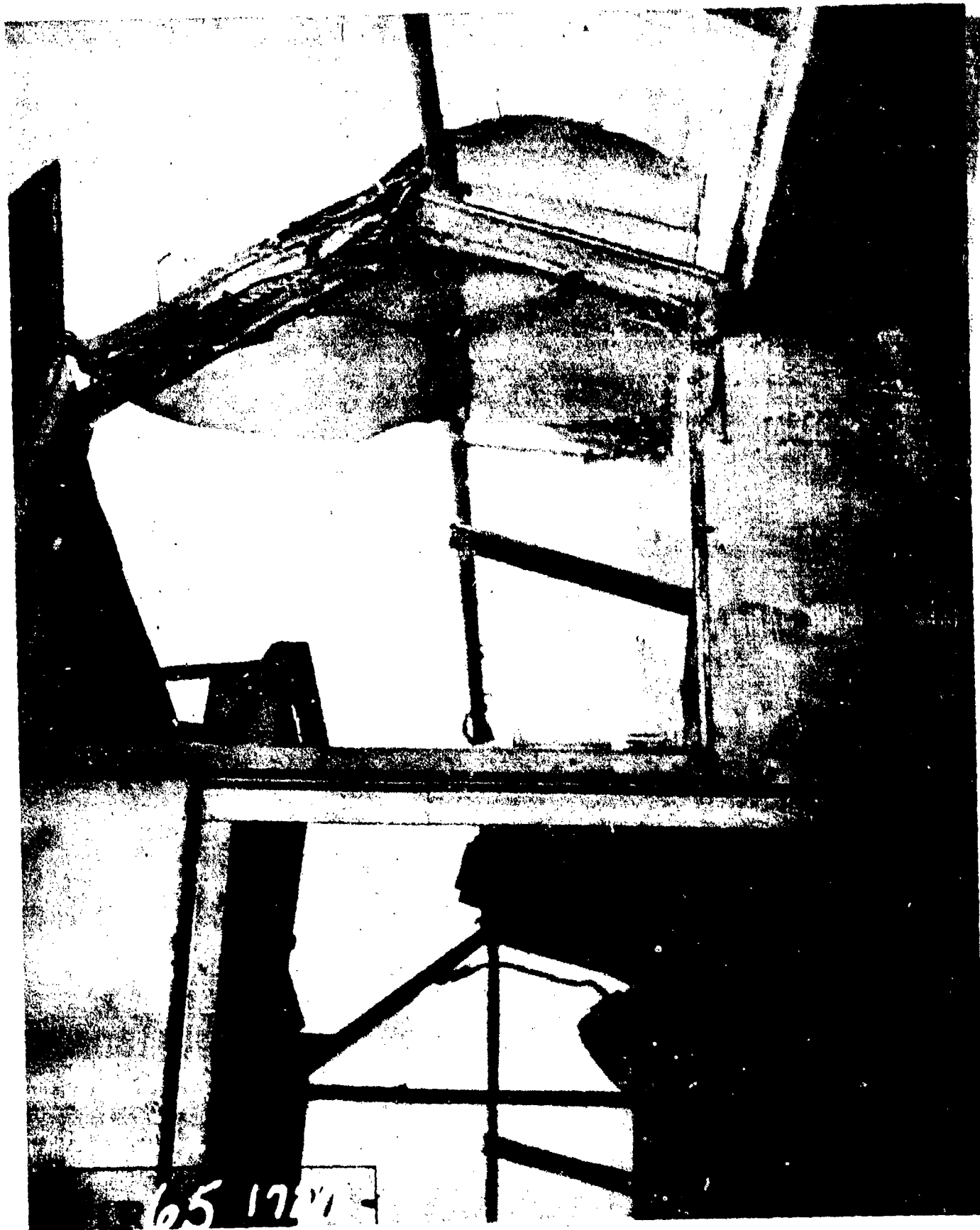


AA-CR-62-1831-6. Starboard bow after Test A.

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AA-CR-65-1727-9. View of broken glass on open bridge looking to port.

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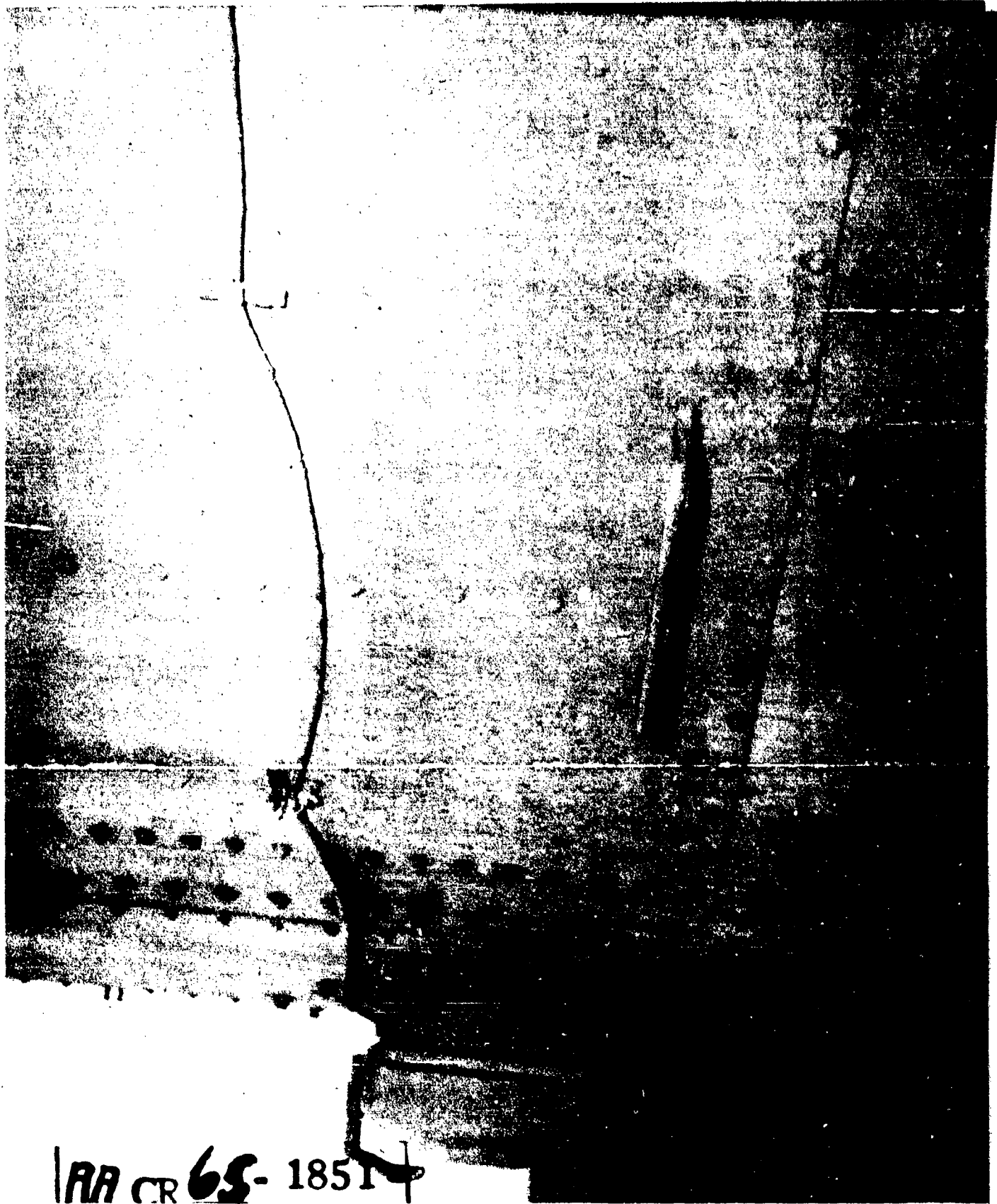
AA-CR-65-1727-10. View of broken glass on open bridge looking toward starboard bow.

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AA CR 65-1851-7

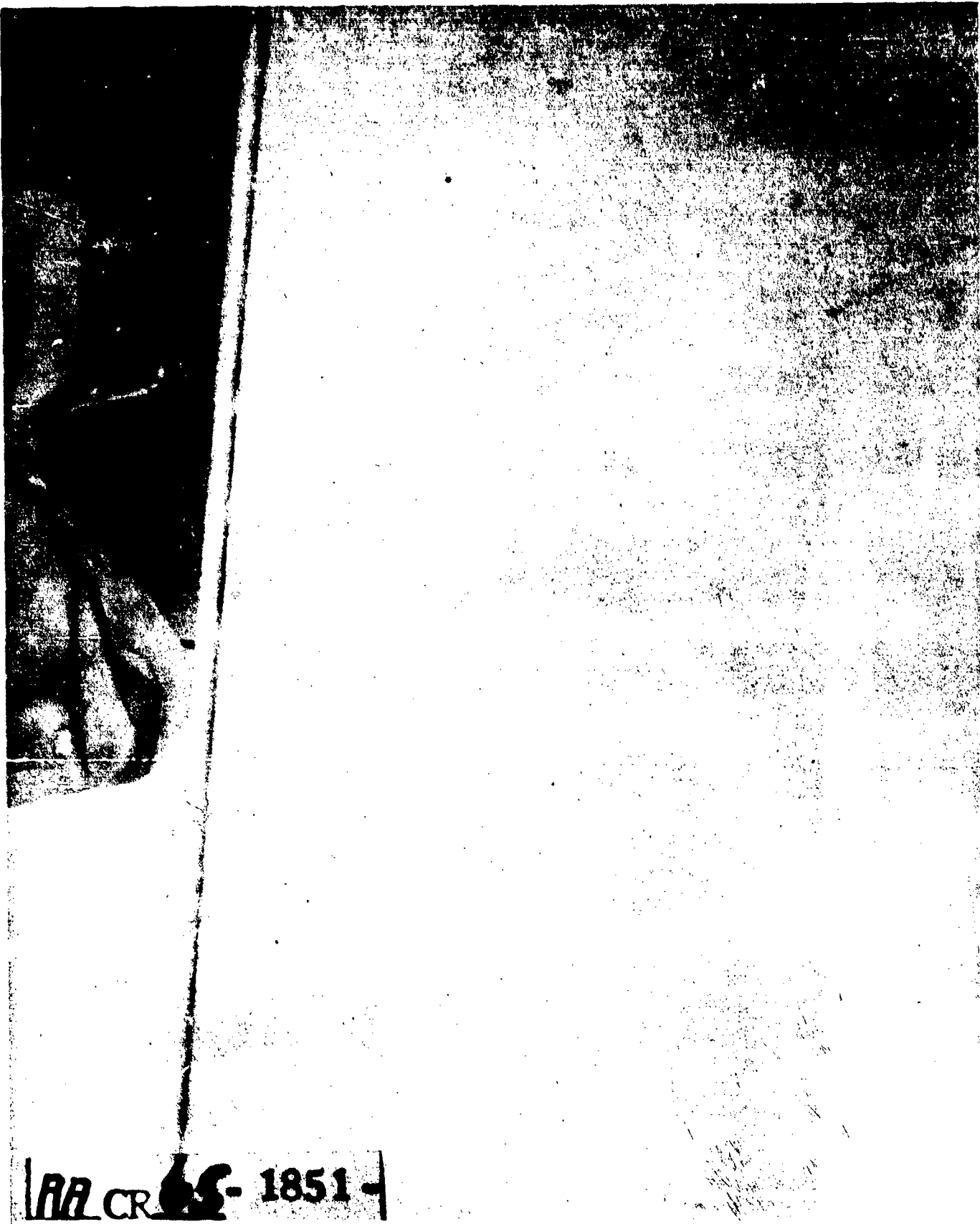
AA-CR-65-1851-7. Scorched paint on after part of stack.

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AA-CR-65-1851-8. Scorched paint on bulwark in superstructure, 06 level.

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AA-CR-65-1727-4. View looking forward and to port on flight deck showing burned and charred deck in way of Army Quartermaster gear fire, frames 105-114.

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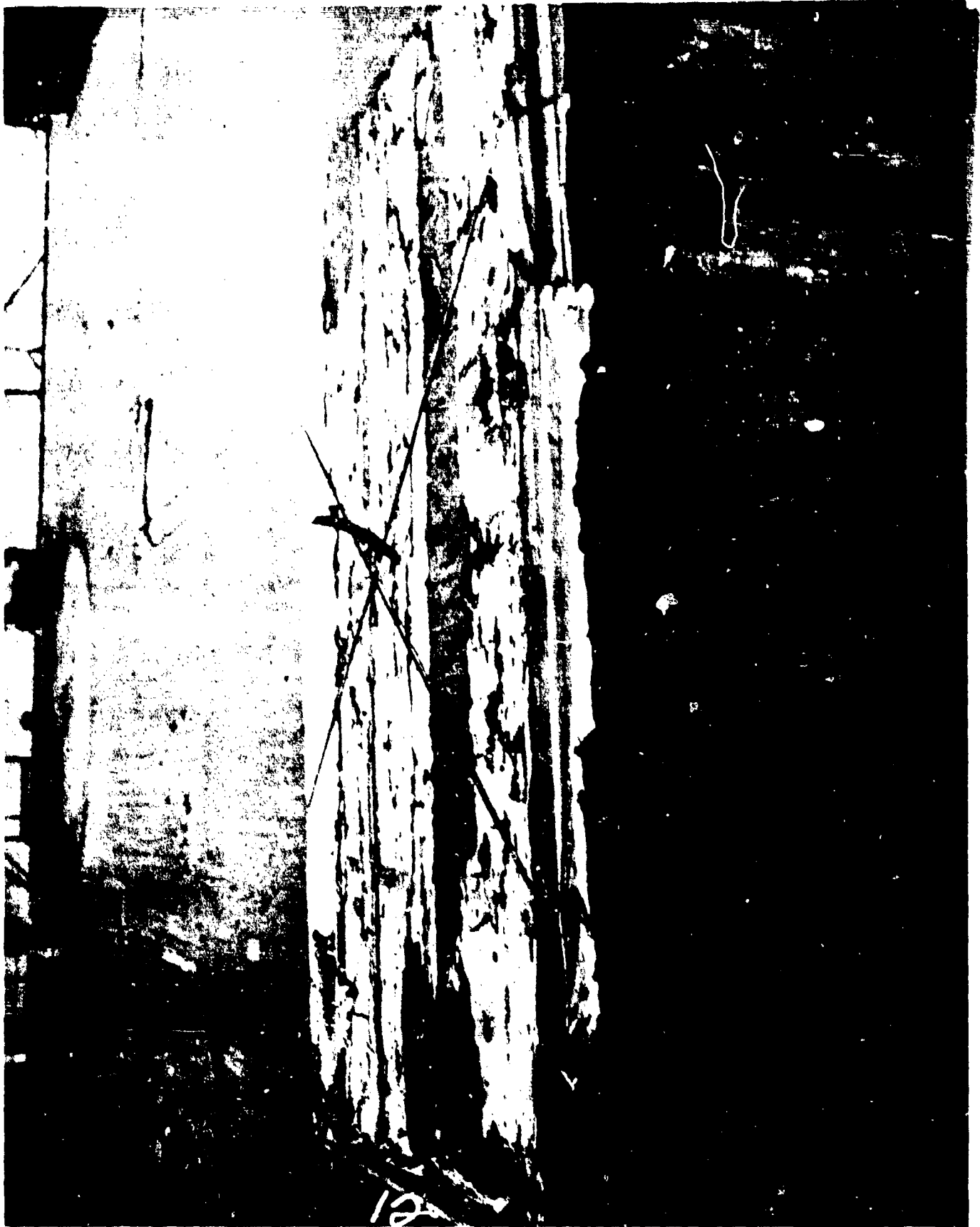
AA-CR-65-1727-5. View looking forward on flight deck showing burned and charred deck in way of Army Quartermaster gear fire, frames 105-114, Port.

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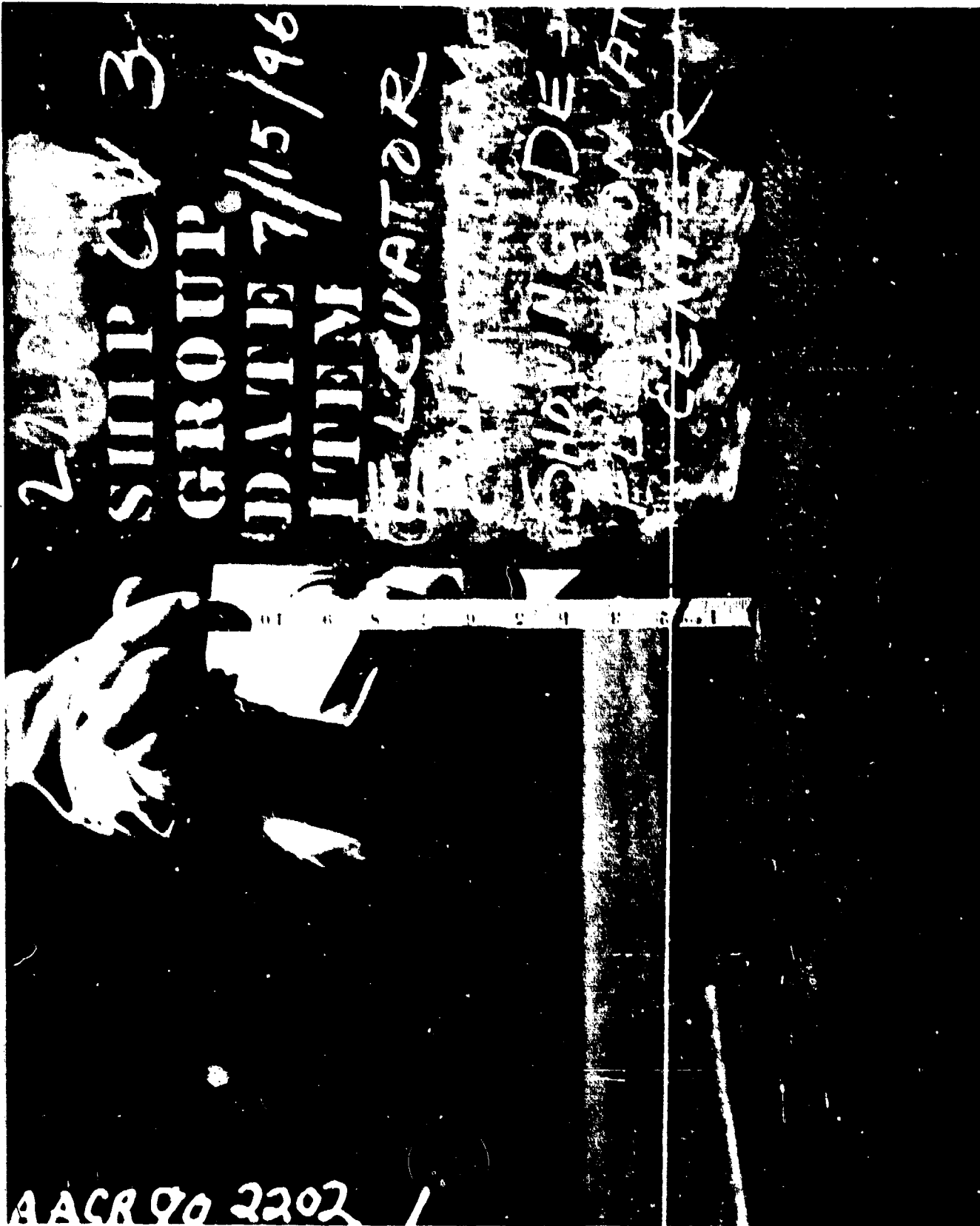
AA-CR-65-1727-12. Flight deck looking to port aft of island in way of #8 5" twin mount.

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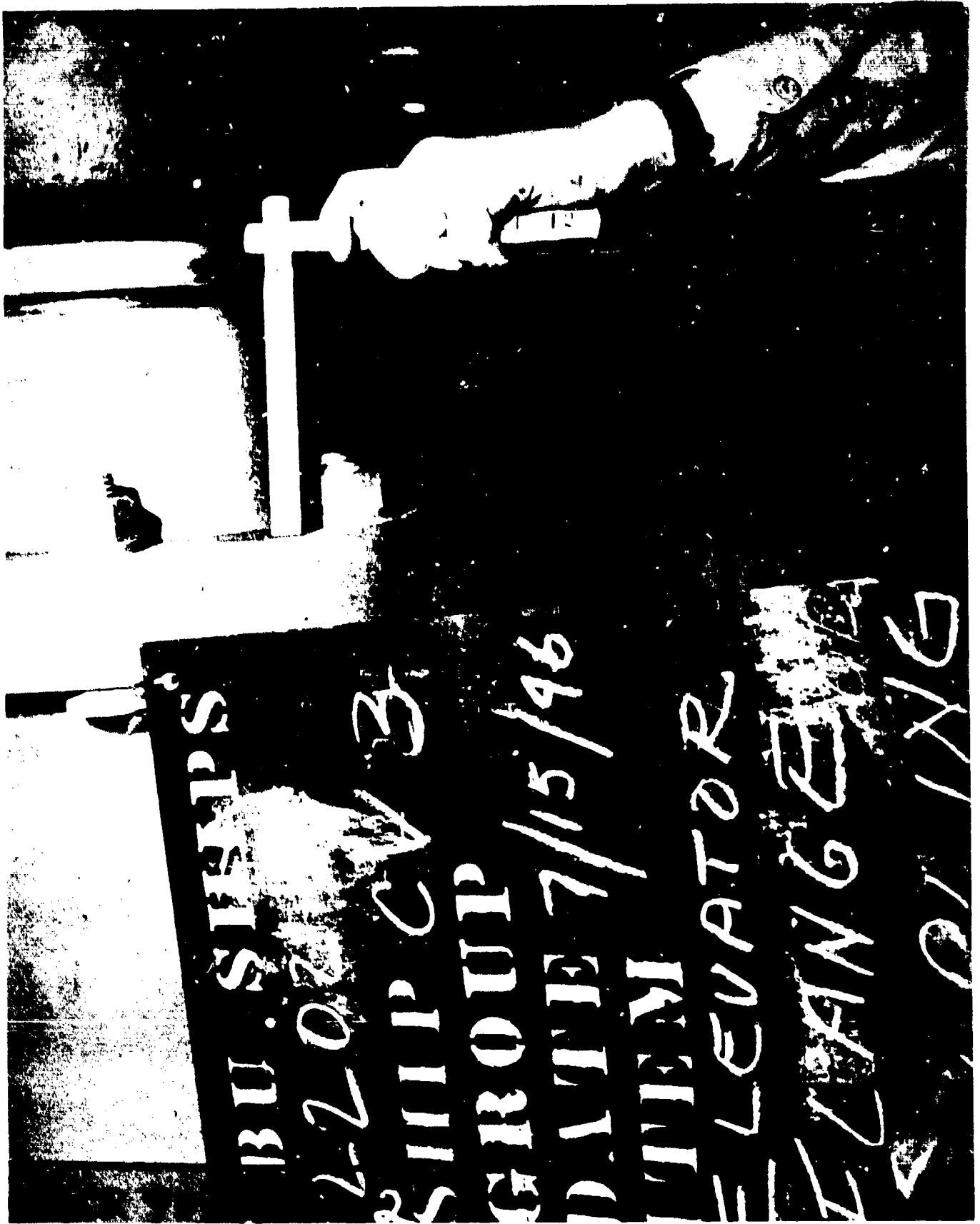


AA-CR-90-2202-1. View of forward elevator platform showing permanent deflection at center of platform.

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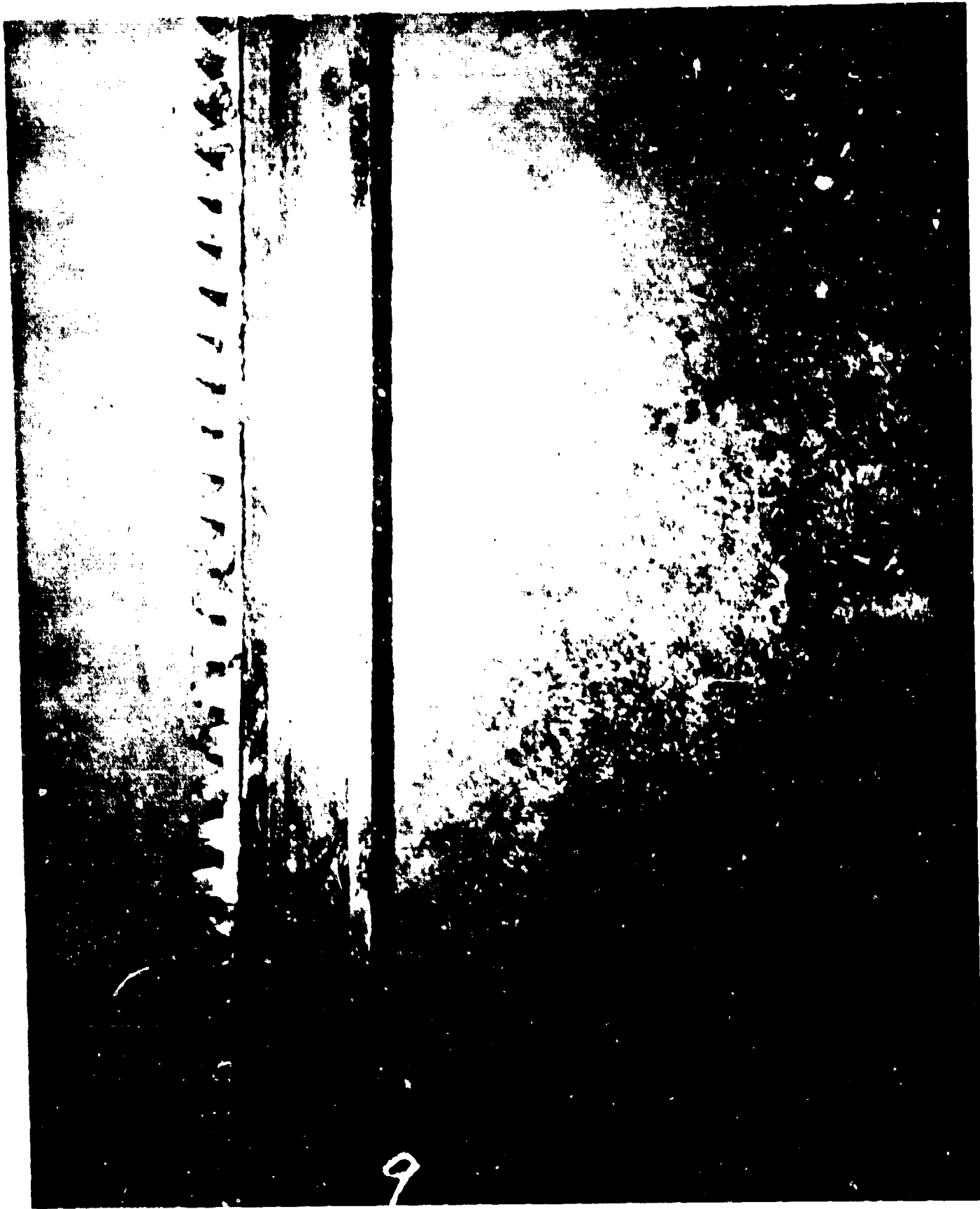
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AA-CR-90-2202-2. View of forward elevator showing displacement of flange coupling on equalizing shaft.

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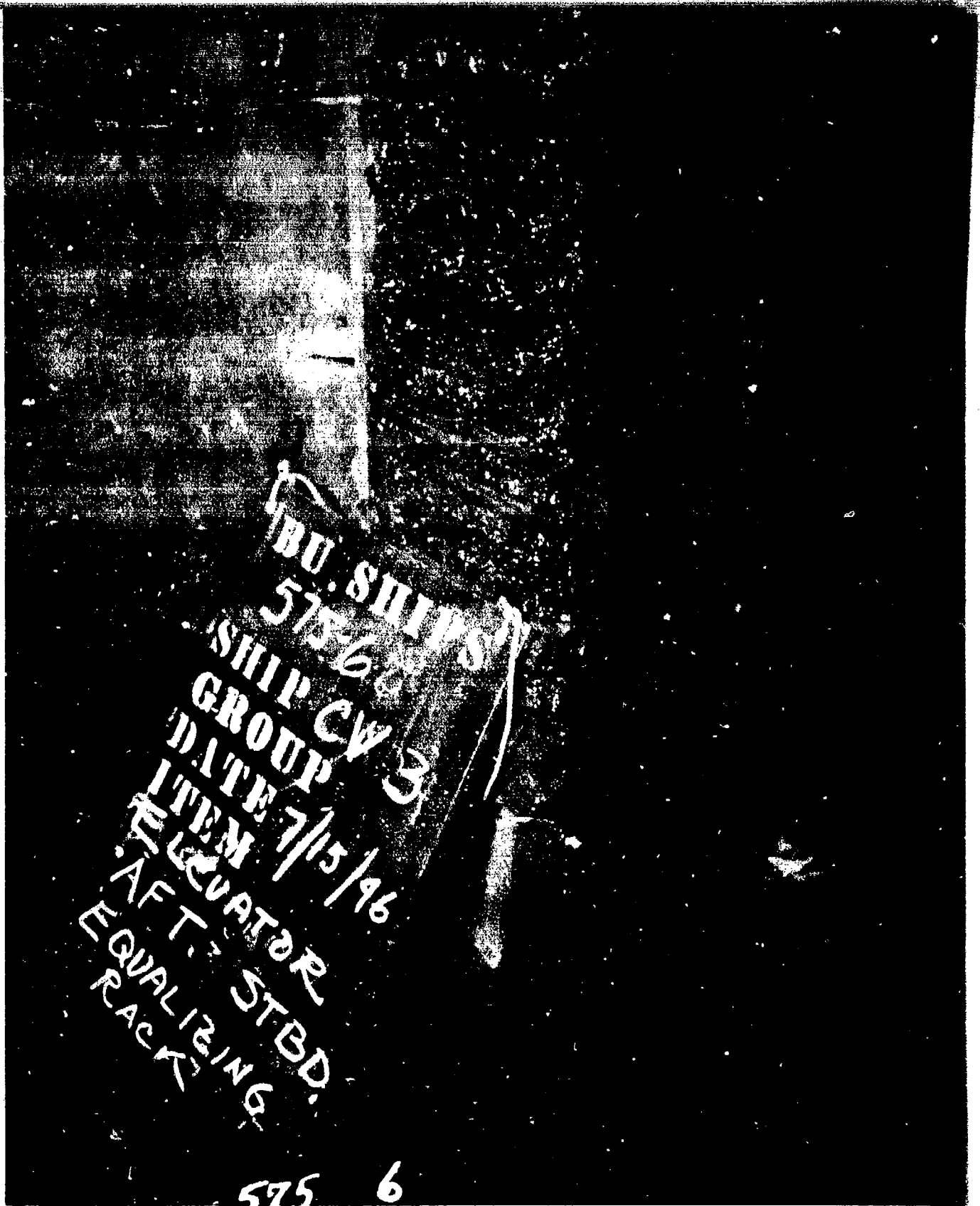


AA-CR-100-2199-9. Damage to auxiliary rack which resulted from misalignment of equalizing shafting.

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AA-CR-90-575-6. View of forward elevator well, after starboard equalizing rack. Showing effect of uneven wear of pinion on rack by misalignment of equalizing system.

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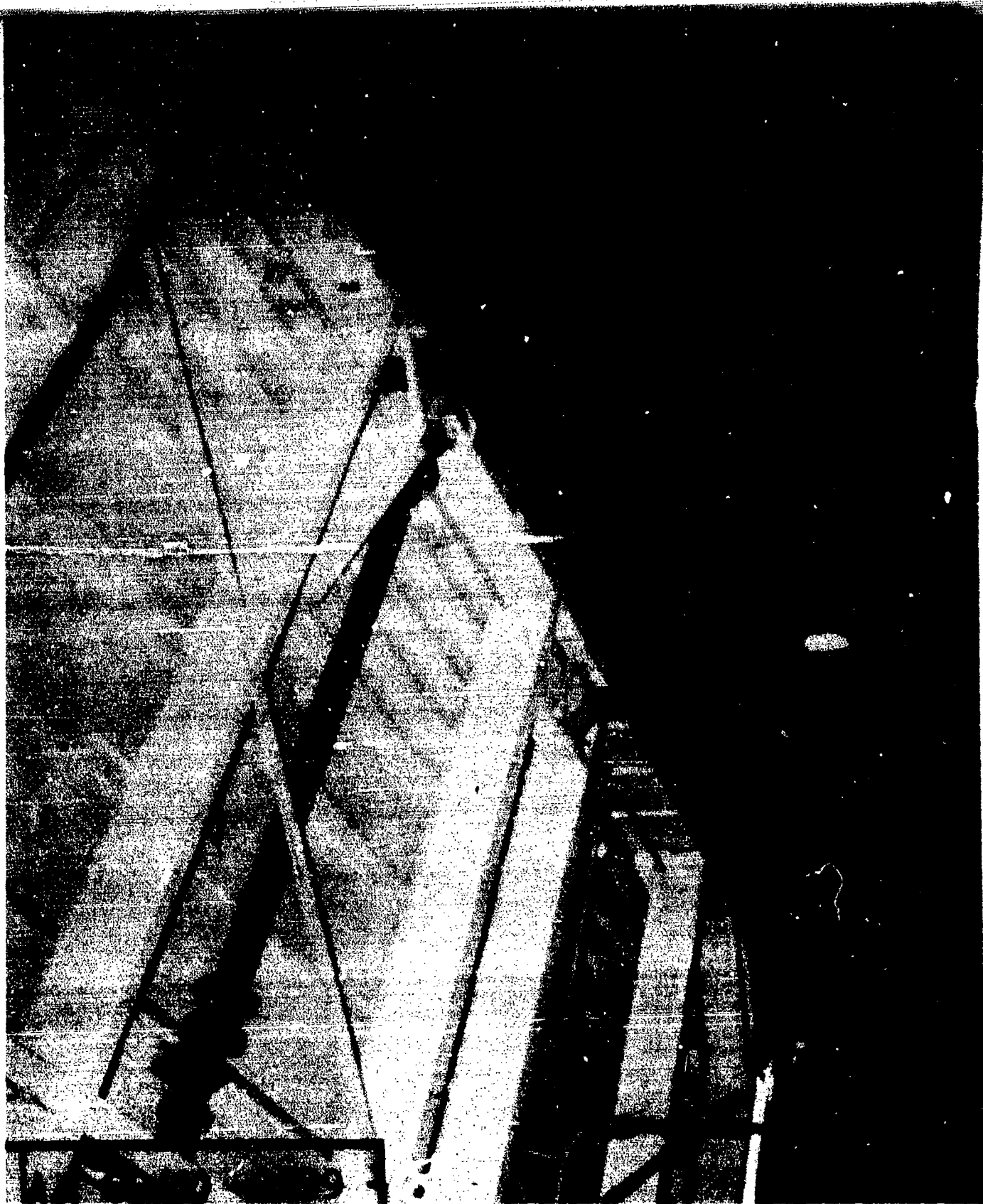
AA-CR-100-2199-7. Looking forward and to port at lower side of elevator platform. Showing features of structure and equalizing system.

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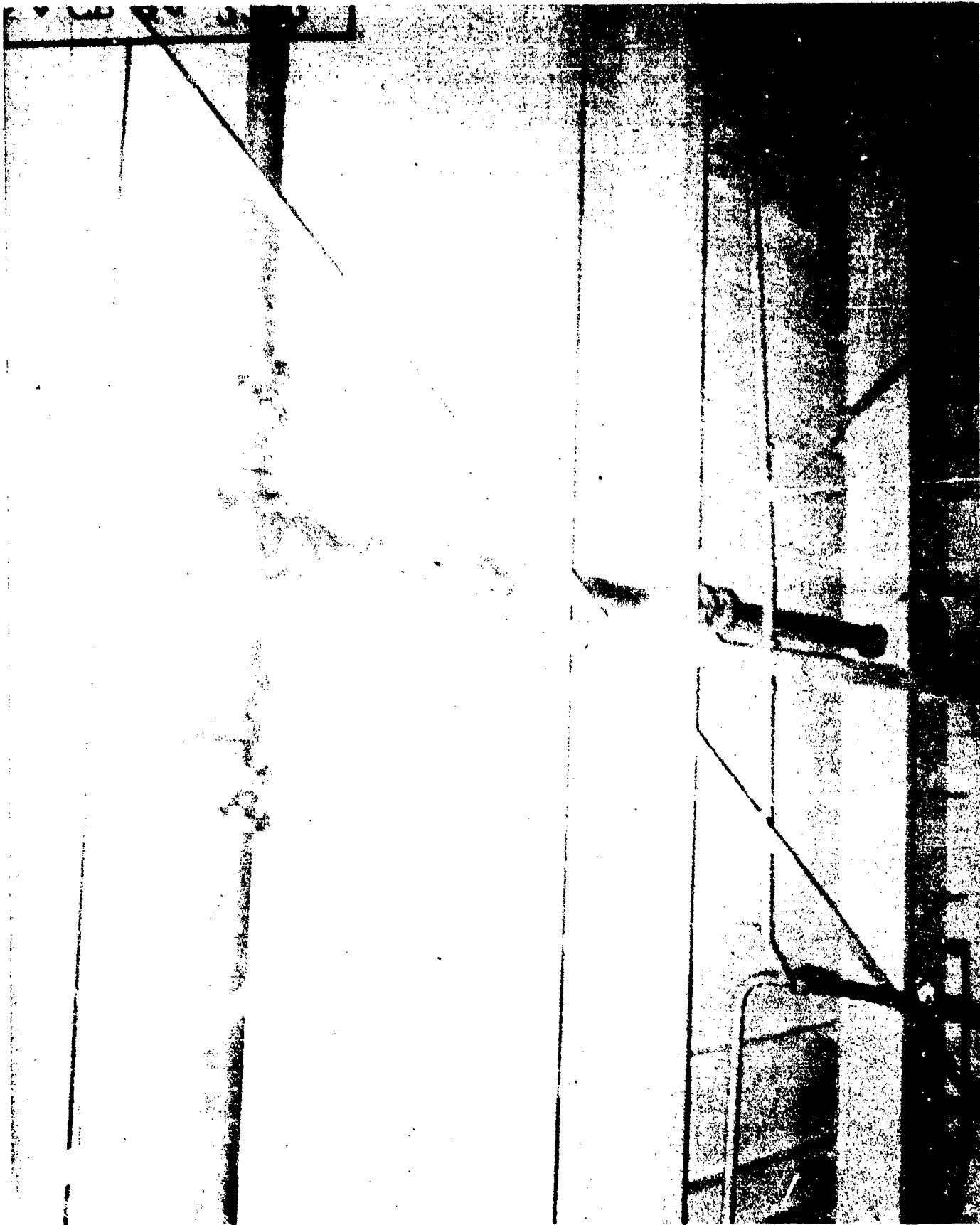
AA-CR-100-2199-8. Looking forward and to starboard at lower side of elevator platform. Showing features of structure and equalizing system.

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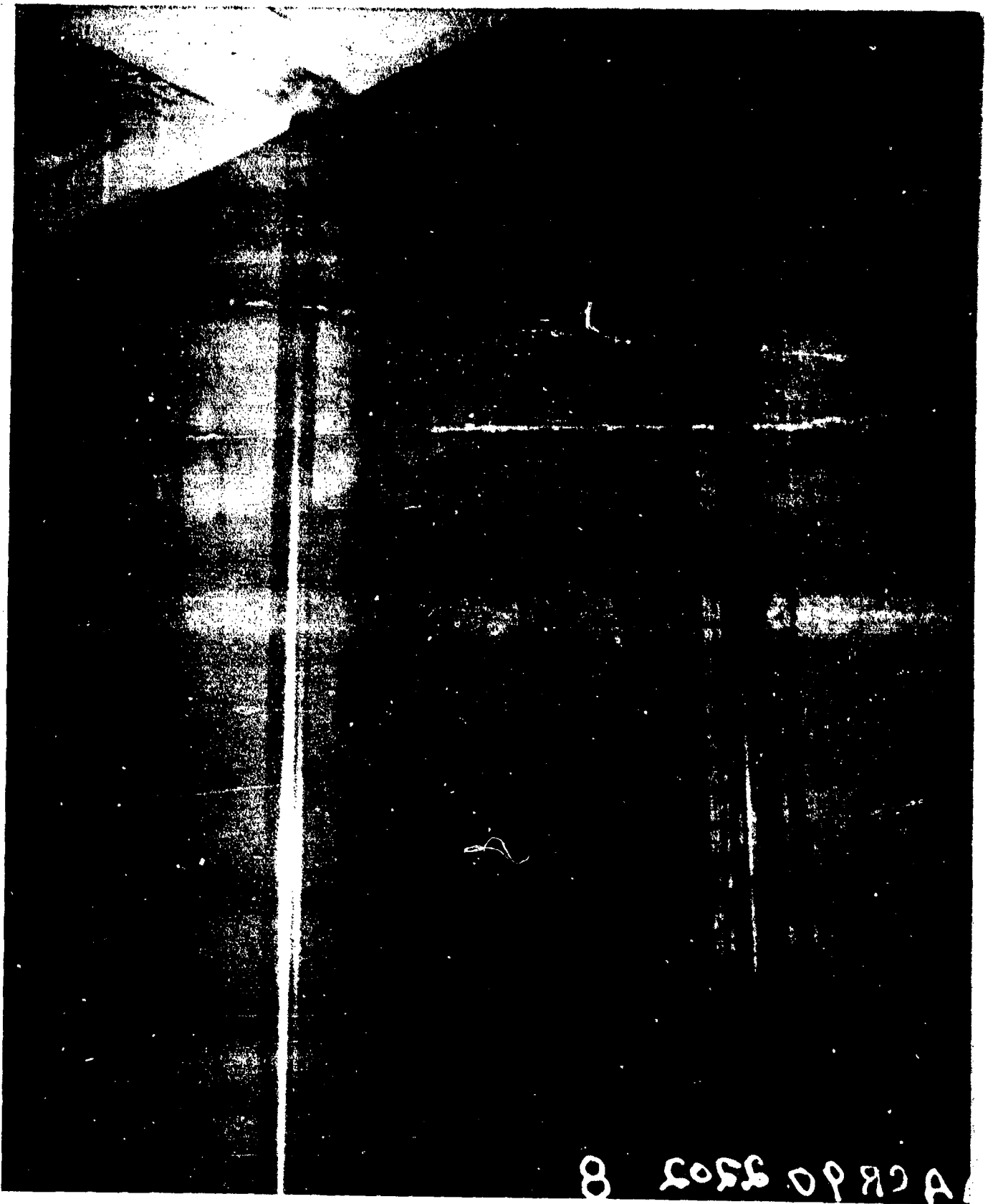
AA-CR-90-2202-7. Lower side of elevator platform showing equalizing gearing and structural support.

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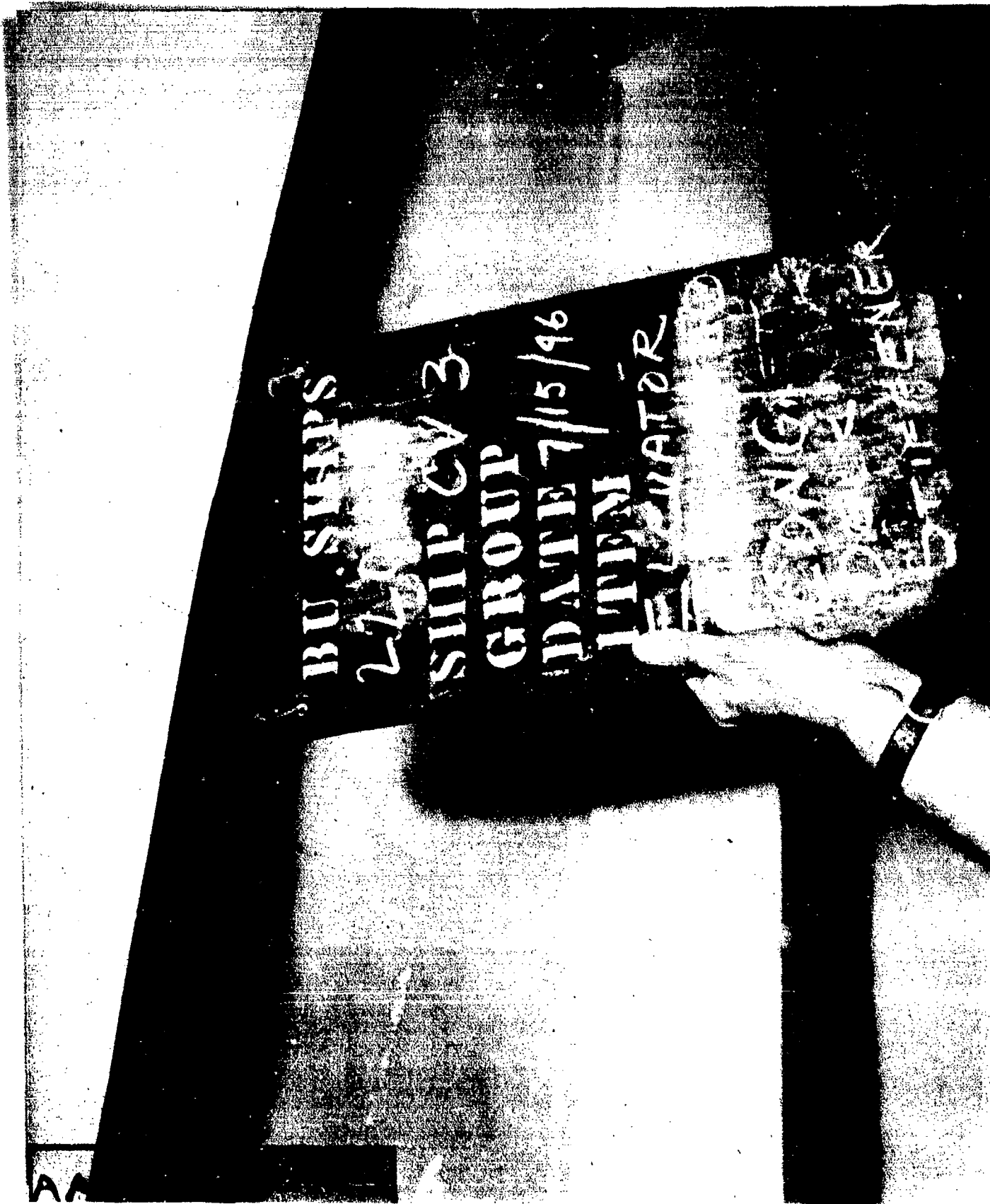
AA-CR-90-2202-8. View of forward elevator well showing port equalizing rack and part of equalizing system under elevator platform.

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AA-CR-90-2202-6. View of forward elevator showing distorted longitudinal stiffener.

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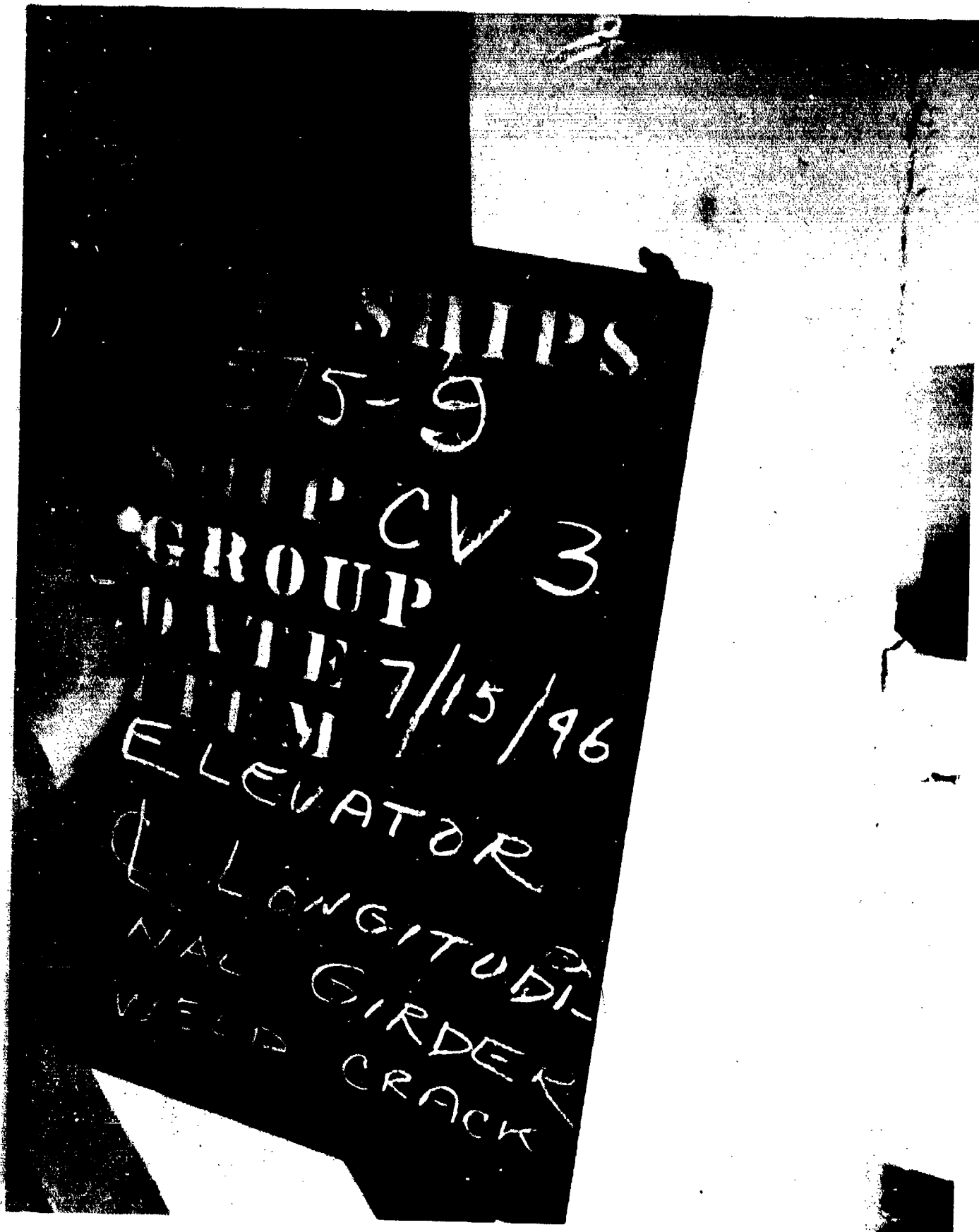
AA-CR-90-2202-5. View of forward elevator showing distorted bracket over transverse girder.

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AA-CR-90-575-9. Centerline longitudinal girder of forward elevator showing cracked weld.

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AA-CR-90-575-12. View of forward transverse girder of forward elevator showing deflection of bottom and top flanges.

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AA-CR-90-575-10. View of centerline longitudinal girder of forward elevator showing cracked weld in stiffeners.

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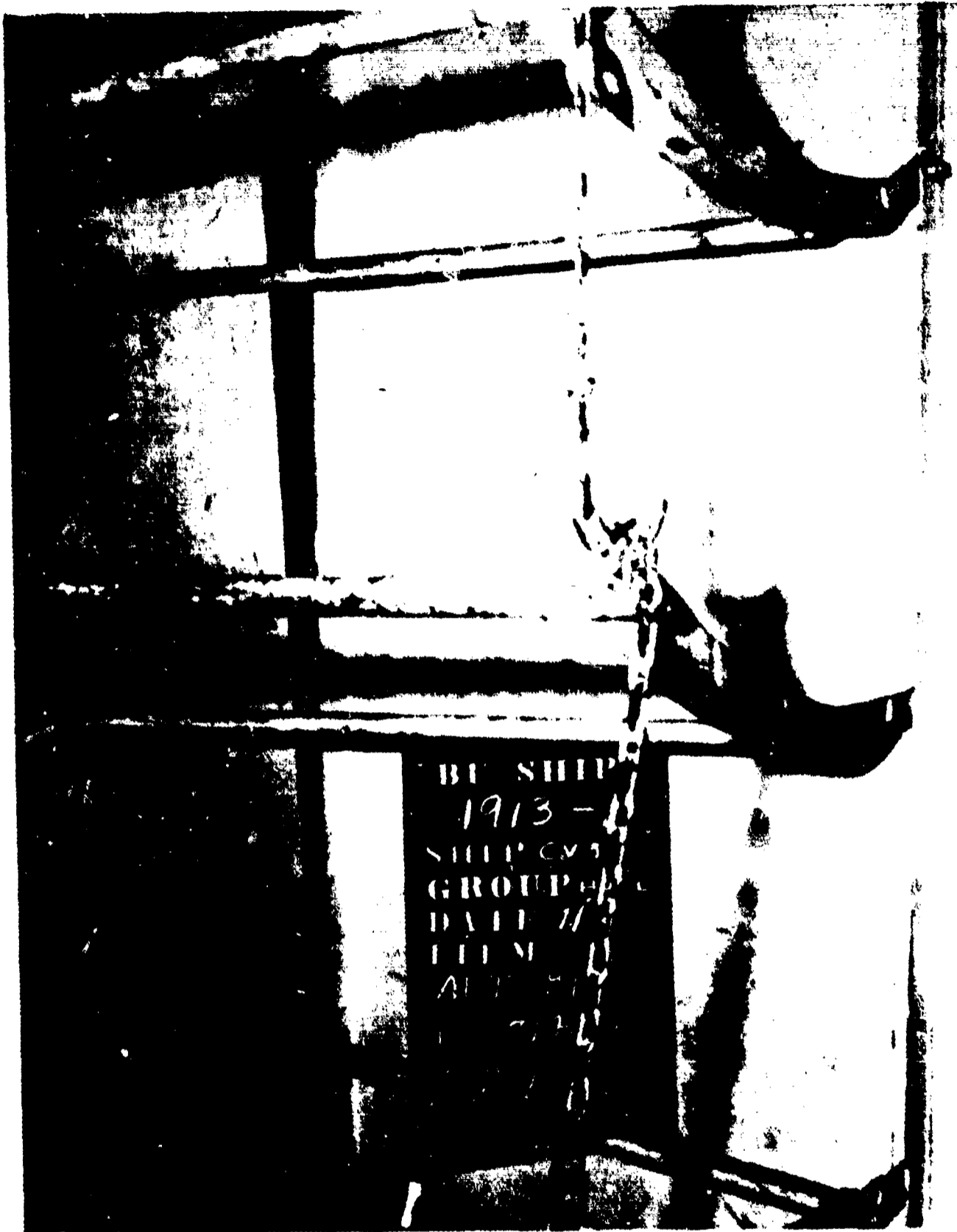
AA-CR-90-575-11. View of centerline longitudinal girder of forward elevator showing deflection of flange.

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AA-CR-82-1913-1. View in crews quarters 02 level, bulkhead 214, port, showing ruptured weld in light metal bulkhead.

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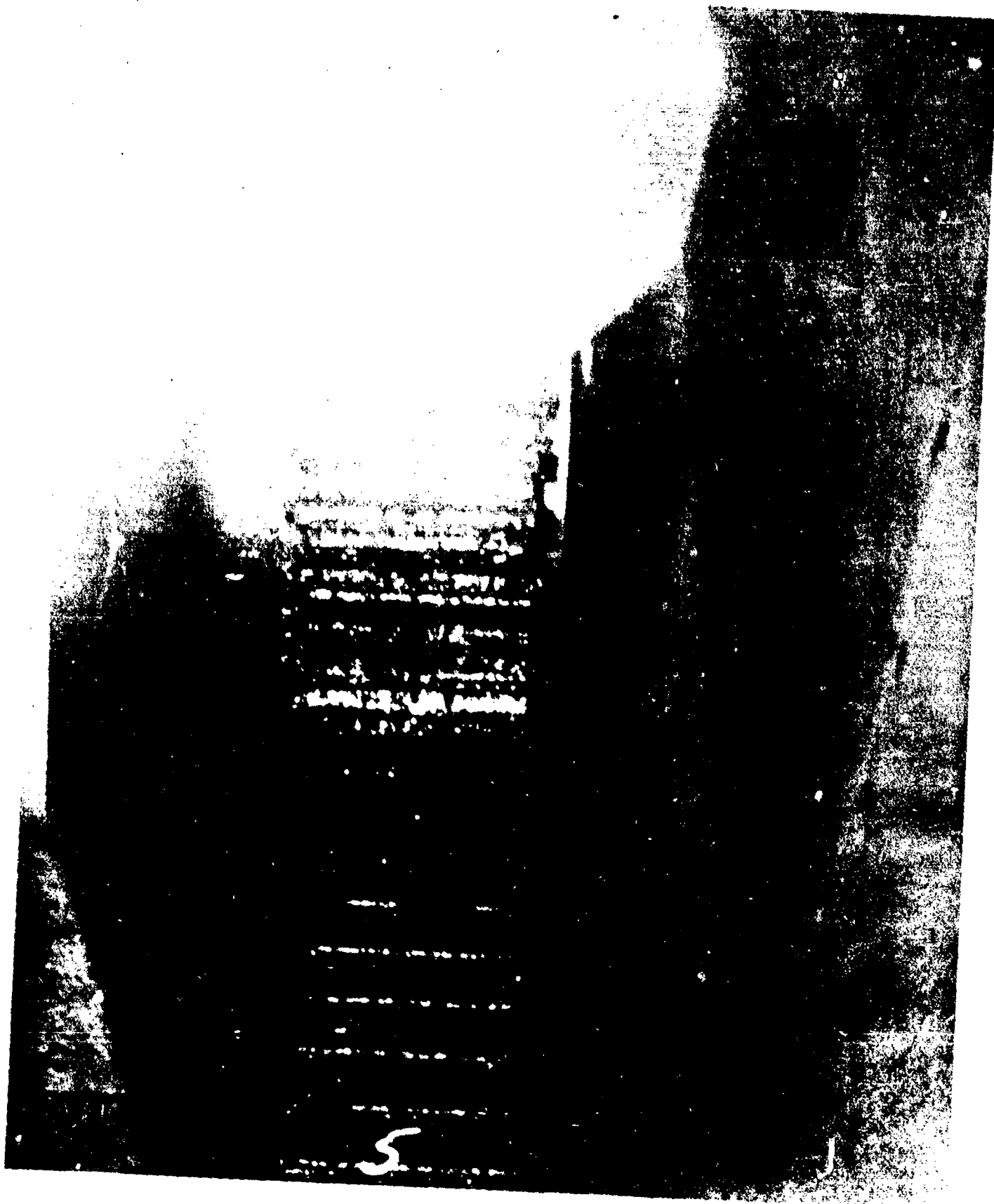
AA-CR-100-2199-4. Starboard equalizing rack, and pinion.

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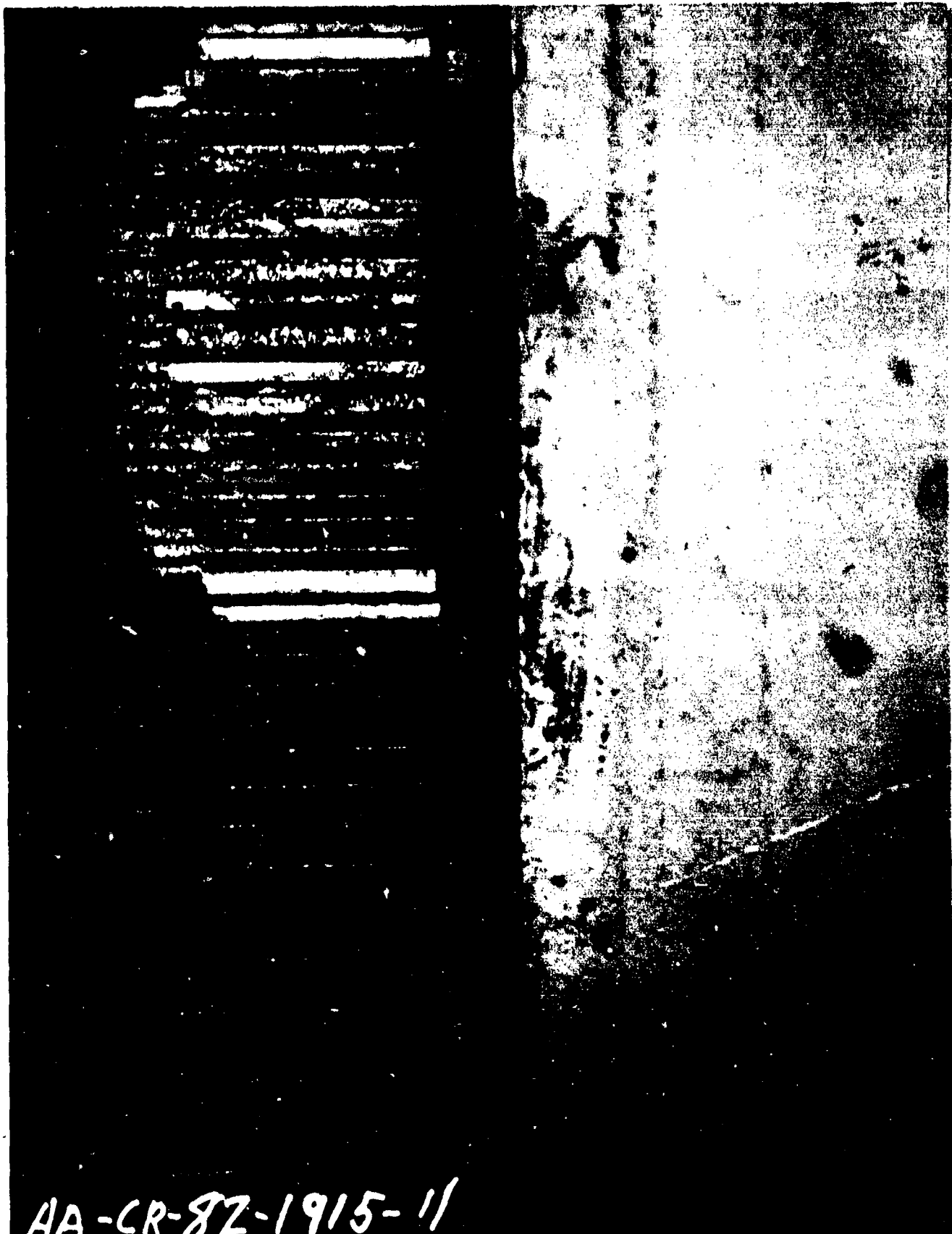


AA-CR-100-2199-5. Port equalizing rack and pinion.

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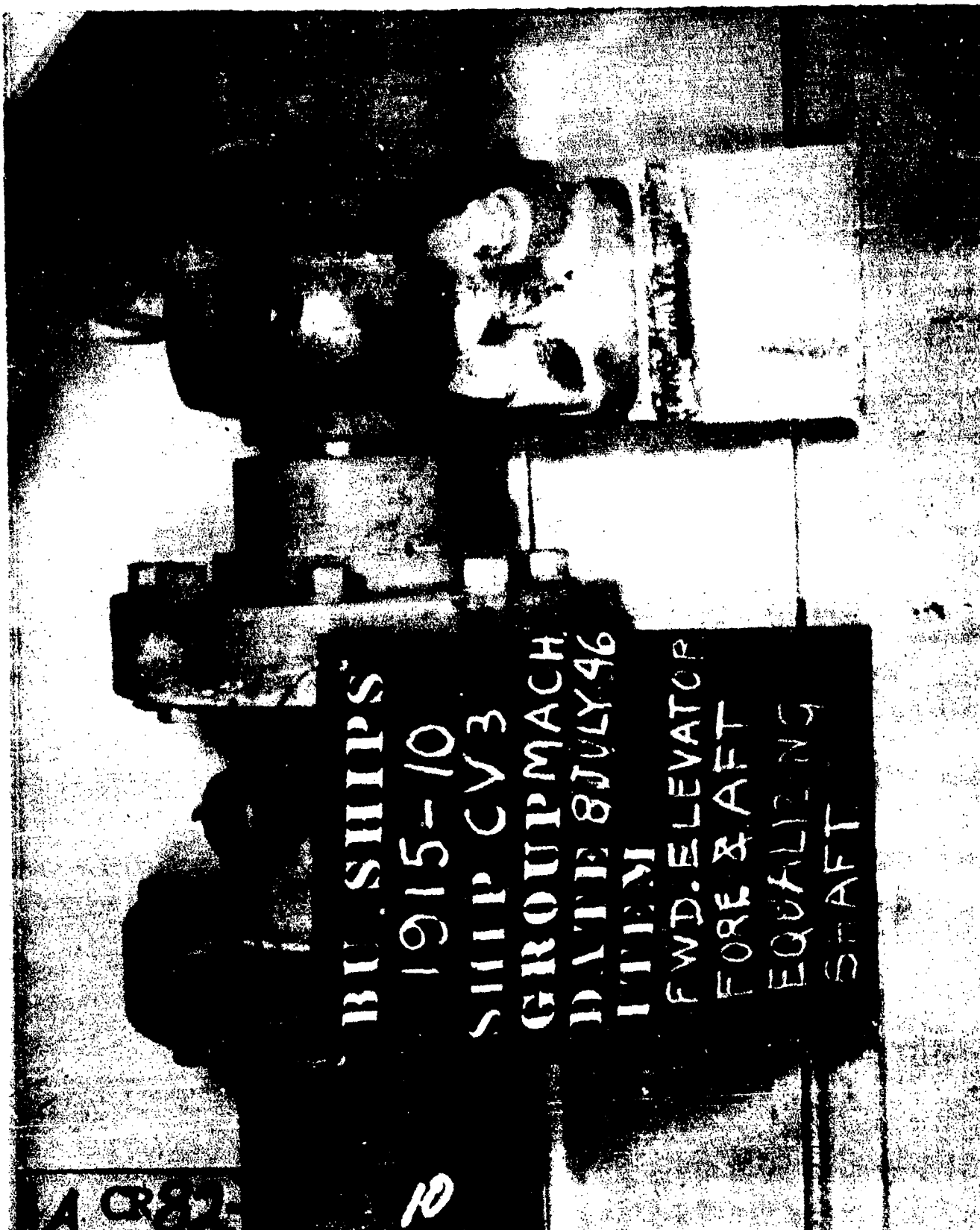
AA-CR-82-1915-11. Forward elevator; forward equalizing shaft,
pinion and rack.

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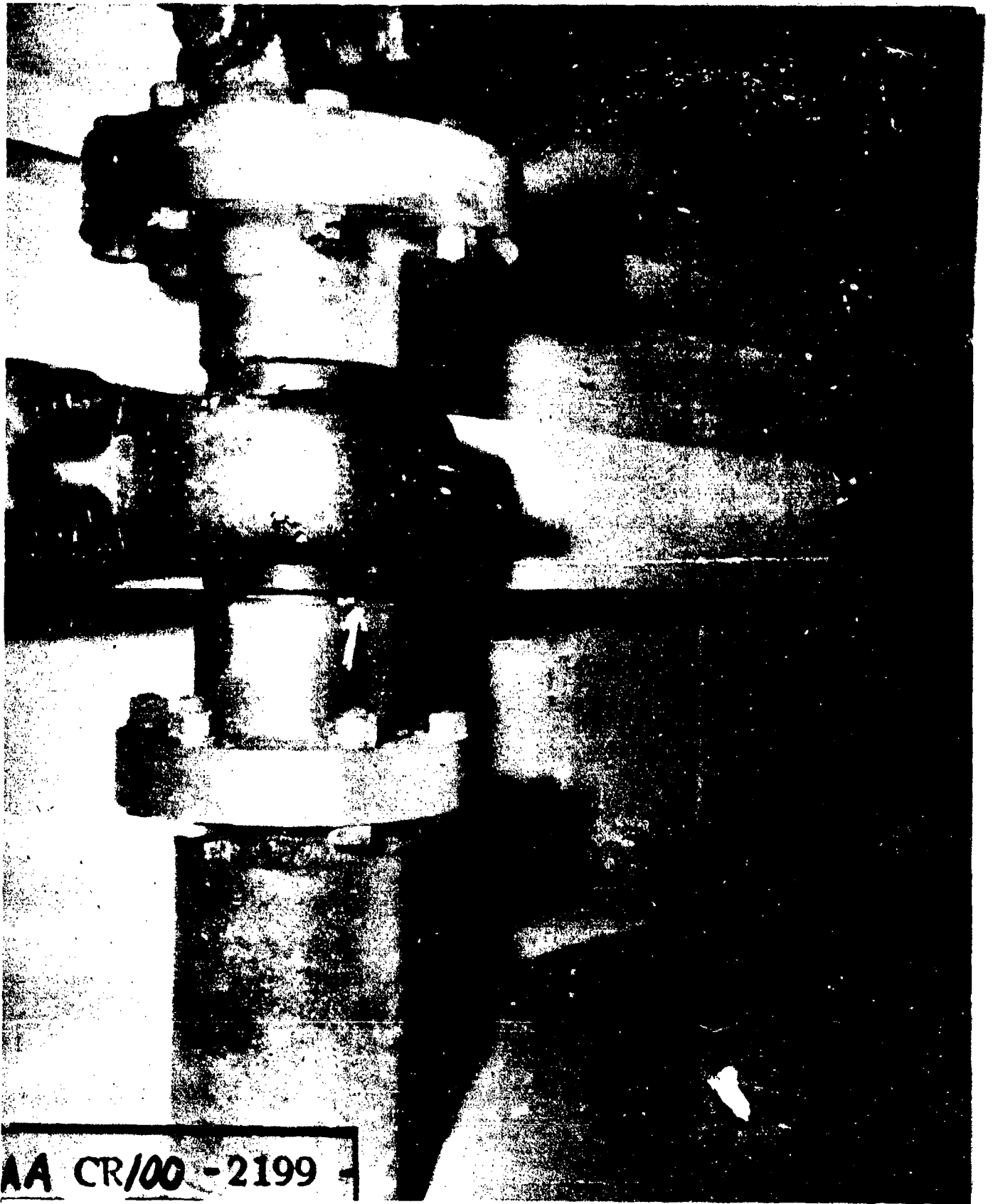
AA-CR-82-1915-10. Forward elevator, forward and aft equalizing shaft, universal and bearing.

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AA-CR-100-2199-6. Athwartship equalizing shaft.

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APPENDIX

SHIP MEASUREMENT DIAGRAM

TEST ABLE

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APPENDIX A

SHIP MEASUREMENT DATA

A. Deck Survey.

The intact condition after test A of the flight and hangar decks did not warrant resurvey of the decks.

B. Deck Deflection Scratch Gages.

Eleven scratch gages were installed between the flight and hangar decks to record the relative movement between these decks. Although several of the gages indicated that elastic deflection in the neighborhood of one inch had occurred, none indicated any permanent set. A tabulation of readings is on page 81 .

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U.S.S. SARATOGA (CV8)

DECK DEFLECTION GAGES

TEST A

SHIP CV 3

FR. NO.	LOCATION		MAXIMUM COMP.	MAXIMUM EXP.	PERMANENT DISTANCE		SET EXP. / COMP.	REMARKS
	DECK	DIST. OFF ϕ			DISTANCE	DISTANCE		
33	MAIN	ϕ	3/4"	3/16"	0	0	0	
59	MAIN	ϕ	0	0	0	0	0	
91	MAIN	ϕ	3/16"	0	0	0	0	
127	MAIN	ϕ	3/16"	0	0	0	0	
144	MAIN	ϕ	0	0	0	0	0	
164	MAIN	ϕ	0	0	0	0	0	
168	MAIN	PORT	5/16"	1/8"	0	0	0	
168	MAIN	ϕ	5/16"	0	0	0	0	
168	MAIN	STB'D	1/2"	0	0	0	0	
173	MAIN	ϕ	9/16"	3/16"	0	0	0	
186	MAIN	ϕ	0	0	0	0	0	

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APPENDIX

COMMANDING OFFICERS REPORT

TEST ABLE

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COMMANDING OFFICER'S REPORT

PART A - GENERAL SUMMARY

I. Target Condition After Test.

(a) Stability.

There was no change.

(b) Structural Damage.

Structural damage was very slight. Slight distortion of the elevator platform caused a forward movement of the fore-and-aft pinion and starboard movement of the athwartship's pinion, causing the pinion to gouge large pieces of metal from the auxiliary racks when lowering of the elevator was attempted. Relative vertical movement between the flight and main decks caused buckling in athwartship bulkheads around an unsupported doorway at frame 104 main deck starboard and around an unsupported window at frame 108 main deck starboard. Pressure of blast dished two lightly constructed non-watertight exterior bulkheads amidship's at frame 214 main deck six inches and three inches respectively, and the flag bags on the signal bridge three inches.

(c) Operability.

All machinery, electrical, ship control and electronic equipment was operable except the airplane elevator which was inoperable due to mechanical misalignment.

Fire control damage was as follows:

(1) Sight transmission of 5"/38 mount #7 (Fr. 128) out of commission.

(2) 40mm Mk. 51 directors #3 and #5 show large errors in boresight alignments.

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(3) 20mm Mk. 14 sights #12 and #14 have bubbled ray filters.

Gunnery damage was as follows:

(1) 5"/38 mount #7 elevation motor out. Can be elevated Manually but not depressed. Overload in sight deflection transmission mechanism. Sight deflection crank slips when trained in a clockwise direction.

(2) #1 40mm quad. #4 water pump motor out of commission.

(3) #3 40mm quad. #1 and #3 firing motors out of commission.

(4) #7 40mm quad. #1 water pump motor out of commission.

(5) #6 40mm quad. Local and automatic train, and train amplifier out of commission. Selector switch seems to be source of trouble.

(6) #8 40mm quad. Train amplifier out of commission.

(d) Heat Effects.

The heat wave approached from astern blistering paint work on unshielded vertical surfaces facing aft and started a fire in the Army Quartermaster equipment on the flight deck. Exposed skin of personnel facing the direction of the heat wave would have received 75% first degree burns 25% second degree burns.

II. Forces Evidenced and Effects Noted.

(a) Heat.

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The heat wave approached from directly astern blistering paint on unshielded vertical surfaces aft with maximum amount at the stern from main deck level to 12 feet from water's edge and on surfaces near the after portion of the stack from the 04 to the 07 level. It diminished in intensity until barely discernible at the bow. Maximum blisters were 2 1/2 inches in diameter with first paint layer scorched and ruptured, second paint layer blistered but unscorched, and third paint layer intact. Elasticity of doped surfaces of flight deck aircraft was reduced. There was no scorching on fore-and-aft surfaces and no penetration effect.

(b) Fires and Explosions.

One fire developed on the flight deck in the Army Quartermaster equipment on the flight deck between frame 103 and 114 and from port waterway inboard 32 feet, destroying the Army equipment and badly burning the flight deck in that area. The fire was extinguished by salvage boat and did not spread. The fire apparently started from the action of heat wave on one of the combustible materials amongst the equipment. There were no explosions aboard this vessel.

(c) & (d) Shock and Pressure.

The pressure wave approached from directly astern, caused a relative movement between the flight and main deck a maximum of 1", exerted force on the airplane elevator, tore plexiglass from aircraft green houses and navigation bridge windshields, tore flight deck aircraft battens from the control surfaces, caused slight buckling of some flight deck aircraft wing and tail assemblies, and dished the following unshielded vertical surfaces facing aft:

- (1) Two 1/8 non-watertight spot welded bulkheads main deck frame 215 dished 6" and 3" respectively.
- (2) Gear locker main deck frame 215 dished 1".
- (3) Flag bags on signal bridge dished 3".

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(4) Gear locker on flag bridge dished 1".

The elevation stowing pin of the SM radar antenna was sheared and the antenna jammed at -30 degrees elevation. Four-ampere fuzes were jarred out of holding clips in fuze box on main deck, frame 60.

(e) Effects Peculiar to Atom Bomb.

The only evidence of appreciable radioactivity was on the main and flight deck exteriors on the port quarter where .2 of one Roentgen unit was recorded by Geiger Counter at 1200, 2 July. Since the sea on the port quarter had been declared radiologically "hot" on 1 July, the water pumped onto the flight deck by the salvage vessel in extinguishing the flight deck fire may have been the cause.

III. Results of Test on Target.

(a) Effect on Propulsion and Ship Control.

Propulsion and ship control were unaffected.

(b) Effect on Gunnery and Fire Control.

Except for the damage to mount #7 (5"/38) there was little damage to the gunnery installation aboard this vessel. Mount #7 is out of commission as far as effective shooting and operation is concerned. Although some of the 40mm suffered damage to water pumps and firing motors, the majority of the guns are able to function with normal efficiency. The 20mm guns were undamaged.

(c) Effect on Watertight Integrity and Stability.

Watertight integrity and stability were unaffected.

(d) Effect on Personnel and Habitability.

Unshielded personnel topside would have received flash burns and injuries. Habitability was unaffected.

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(e) Total Effect on Fighting Efficiency.

Loss of one 5"/38 twin mount would curtail the gunpower of the ship by about 10%. Air operations would be limited by the damage to the flight deck aircraft and by the inoperability of the elevator for about three hours by which time normal operation could be restored by ship's company.

IV. General Summary.

The effect on a ship of this type by the atom bomb exploded at the distance of this vessel is minor.

V. Recommendations.

(a) Provide protection against flash and pressure for topside personnel and equipment.

(b) Redesign topside structures to withstand pressure.

(c) Provide additional support for the airplane elevator platform either by additional plungers or locking bars extending the width of the platform, and install thrust surfaces to prevent horizontal movement of the equalizing shafts.

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USS SARATOGA (CV3)

CONFIDENTIAL

Classification (~~Canceled~~) (Changed to _____)

By Authority of Joint Chiefs of Staff (Action 15 Apr 49)

John Beggs Capt
AFSWP

[REDACTED]

CONFIDENTIAL



Defense Special Weapons Agency
6801 Telegraph Road
Alexandria, Virginia 22310-3398

TRC

4 April 1997

MEMORANDUM TO DEFENSE TECHNICAL INFORMATION CENTER
ATTN: OMI/Mr Bill Bush

SUBJECT: Declassification of Documents

The following is a list of documents that have been declassified and the distribution statement changed to Statement A, Approved for Public Release.

XRD-41, AD-366731-
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XRD-39, AD-366729-
XRD-38, AD-366728-
XRD-34, AD-366720-
XRD-13, AD-366725-
XRD-8, AD-366699-
XRD-5, AD-366697-
XRD-6, AD-366698-
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XRD-22, AD-366709-
XRD-26, AD-366713-
XRD-28, AD-366715-
XRD-29, AD-366727-
XRD-36, AD-366722-

If you have any questions, please call me at 703-325-1034.

Arndith Jarrett

ARDITH JARRETT
Chief, Technical Resource Center