TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE
37401

TVA
40TH ANNIVERSARY OF PEOPLE IN PARTNERSHIP

July 26, 1974

Mr. Donald F. Knuth, Director
Directorate of Regulatory Operations
United States Atomic Energy Commission
Washington, DC 20545

Dear Mr. Knuth:

BROWNS FERRY NUCLEAR PLANT UNIT 2 - LOSS OF SUCTION TO CORE SPRAY PUMPS DURING PREOPERATIONAL TESTING

Initial report of the subject potential deficiency was made on May 31, 1974. An interim report was submitted in my letter to you dated June 28, 1974.

In compliance with paragraph 50.55(e) of 10 CFR Part 50, this is submitted as the final report of this deficiency.

Very truly yours,

J E Gilleland

J. E. Gilleland
Assistant to the Manager of Power

Enclosure
CC (Enclosure):
Mr. Norman C. Moseley, Director
Directorate of Regulatory Operations
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Region II - Suite 818
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Atlanta, Georgia 30303

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BROWNS FERRY NUCLEAR PLANT UNIT 2

LACK OF SUCTION TO CORE SPRAY PUMPS CAUSED BY

PARTIALLY CLOSED VALVE HCV-75-1

FINAL REPORT

On May 31, 1974, an initial report was made regarding the subject deficiency on Unit 2 at the Browns Ferry site to W. S. Little, AEC-DRO inspector, Region II. This report was made verbally by C. D. Bolinger at the site in compliance with Paragraph 50.55(e) of 10CFR50. An interim report was provided by our letter of June 28, 1974, to D. F. Knuth. This is the final report for the occurrence.

Description of the Occurrence

On December 10, 1973, loss of suction in the common inlet line to core spray pumps 2A and 2C occurred during preoperational test GE-12. The difficulty was maloperation of valve HCV-75-1. This valve was a normally open, manually operated butterfly valve located in one of the two 16-inch lines leading from the suppression pool ring header. In this particular case, the 16-inch line led to core spray pumps 2A and 2C. The defective valve was cut out of the pipeline and replaced with a new valve from Unit 3. At the time the occurrence was considered to be not reportable and was handled as such.

During a rerun of portions of preoperational test GE-12 on the Core Spray System (CSS) on May 25, 1974, core spray pumps 2A and 2C lost suction in the high flow ranges (3125-6250 gpm) while taking suction from the torus. This occurrence required manual shutdown of the pumps. Valve HCV-75-1, which is a normally open, manually operated maintenance valve in the suction line to both of these pumps, appeared to be only partially opened even though the indicator showed it to be fully opened. This valve is the replacement valve installed in Unit 2 following the similar occurrence that took place on December 10, 1973.

Cause of the Deficiency

Inspection of valve HCV-75-1 revealed the problem to be a function of the disc-to-shaft installation. Figure 1 shows the actual condition of the disc-to-shaft installation. After the keeper plate was removed, the disc keyway damage can be seen in Figure 2. Apparently the valve's failure to open and close properly was the result of vibration of the disc on the shaft. The disc keyway as shown in Figure 3 was deformed on one side. In addition, the bull gear shown in Figure 4 was worn approximately 1/16-in. as a result of contact with the adjustable stop screw. As the disc vibrated on the shaft, the vibration was suppressed in one direction by the disc keyway and in the other direction by the gear stop. This condition prevailed until excessive deformation of the disc keyway and failure of the keeper plate and bolts allowed the key to dislodge from the keyway on the shaft.

An inspection revealed that a similar failure occurred on valve HCV-75-29, the respective valve in the suction line to core spray pumps 2B and 2D, but in this case the valve remained in its fully open position. Figure 5 shows the deformed condition of the keyway on the shaft of HCV-75-29 very clearly. However, the pumps associated with HCV-75-29 did not experience a loss of suction.

Safety Implications

The CSS is used along with other Core Standby Cooling Systems [High Pressure Coolant Injection System (HPCIS), Low Pressure Coolant Injection System (LPCIS), and Automatic Depressurization System (ADS)] to provide adequate cooling of the reactor core under abnormal and accident conditions. The HPCIS is used to cool the core in the early stages of cool down to overcome the high pressure in the core. Later, when the pressure in the core has been reduced, various combinations of components in the LPCIS and CSS can be used for further cooling of the core. Two technical specifications for the Browns Ferry Plant specify limits on operations relative to the availability of the CSS. First, Technical Specification 3.5.A.1 requires that the CSS be operable prior to reactor startup, and also, whenever there

is irradiated fuel in the reactor vessel at vessel pressure greater than atmospheric. Technical Specification 3.5.A.2 requires reactor shutdown if one CSS loop remains inoperable after seven days.

Since HCV-75-1 is in one of the two redundant CSS loops and since the valve in the redundant loop (HCV-75-29) was in its normally open position, we concluded that the failure of HCV-75-1 in a partially closed position would not compromise the safety of the plant. An alternate water source for the CSS pumps is provided by connections, through manually operated valves, to the condensate storage tanks.

Description of Corrective Action

The corrective actions taken for valves HCV-75-1 and -29 were as follows:

1. HCV-75-1: This valve was cut out of the system and replaced with a valve that had been rebuilt earlier to the manufacturer's original specifications.
2. HCV-75-29: This valve was cut out of the system and replaced with a new valve from Unit 3.

Means Taken to Prevent a Recurrence

The disc-to-shaft joints for the valves involved in this occurrence were strengthened by:

1. Using a larger key.
2. Machining a deeper and wider keyway in the shaft.
3. Building up the disc thickness at the keyway.
4. Assembling the disc-to-shaft joint using a larger keeper plate over the key-keyway assembly and six 3/8-in. bolts instead of four 1/4-in. bolts to secure the keeper plate.
5. Installing a safety wire through the heads of all six bolts.

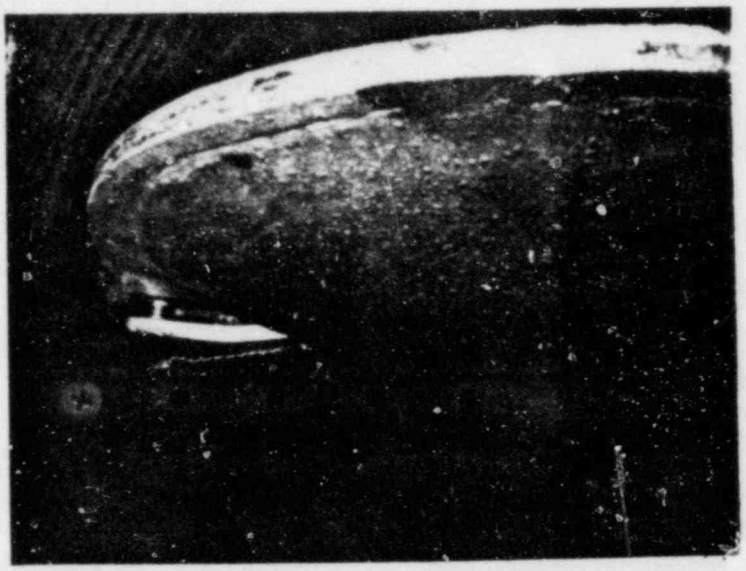


FIG. 1–DISC-TO-SHAFT INSTALLATION

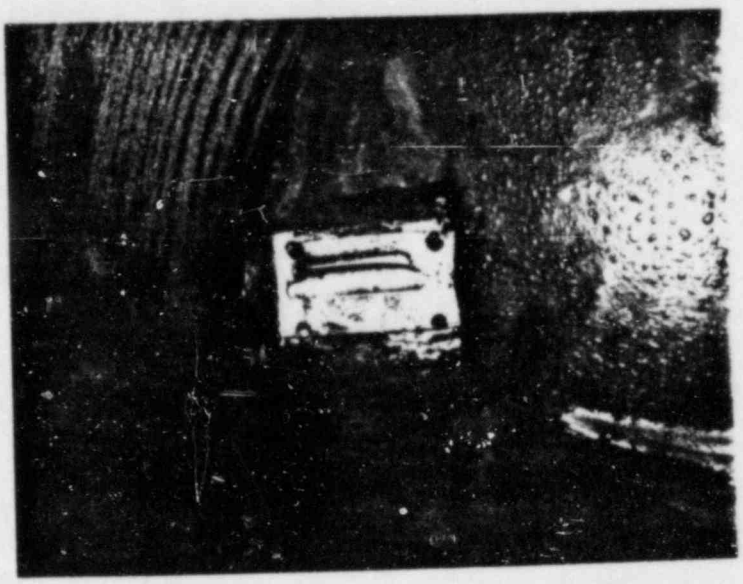
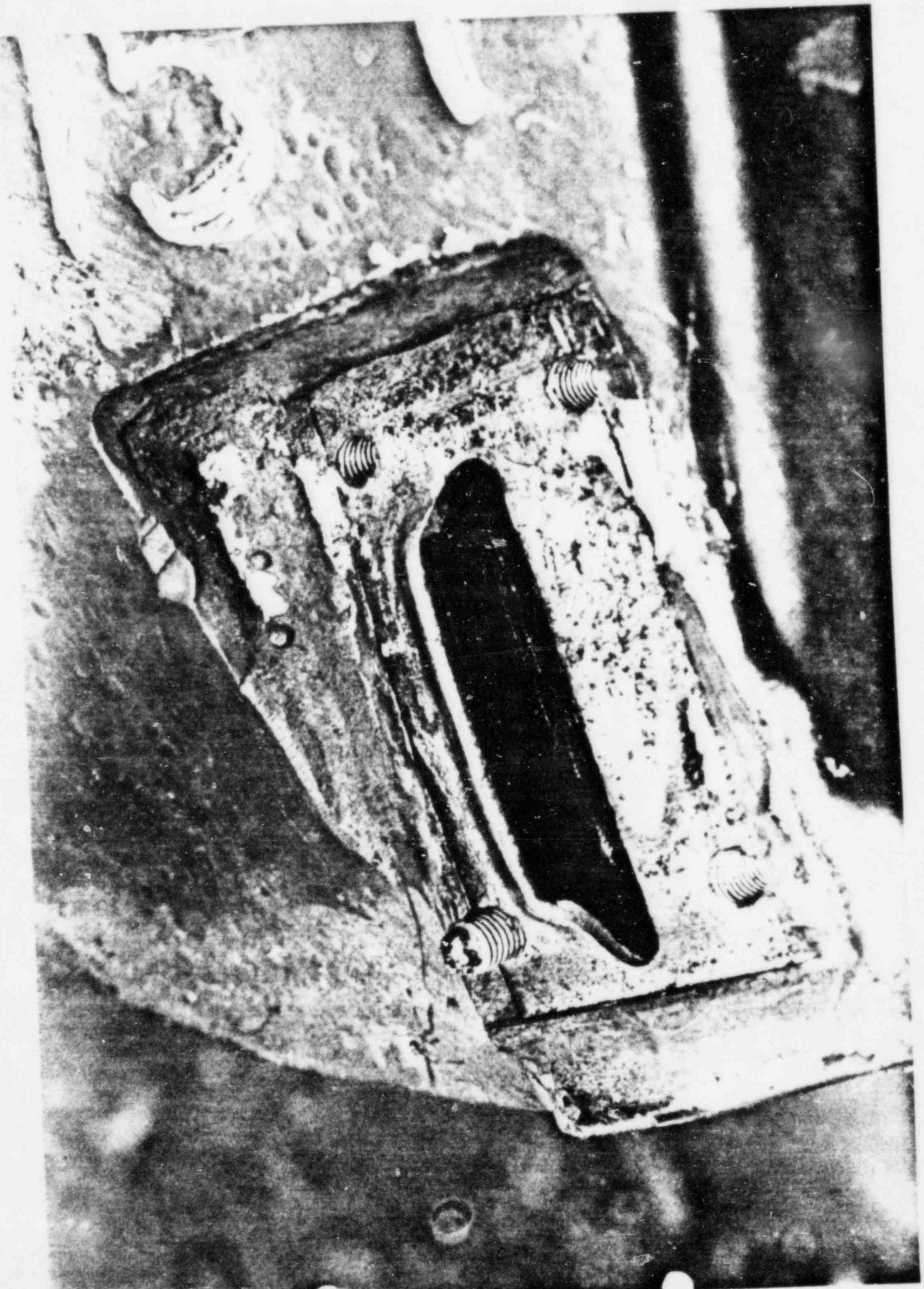


FIG. 2–DISC & SHAFT KEYWAY DAMAGE



DEFORMATION

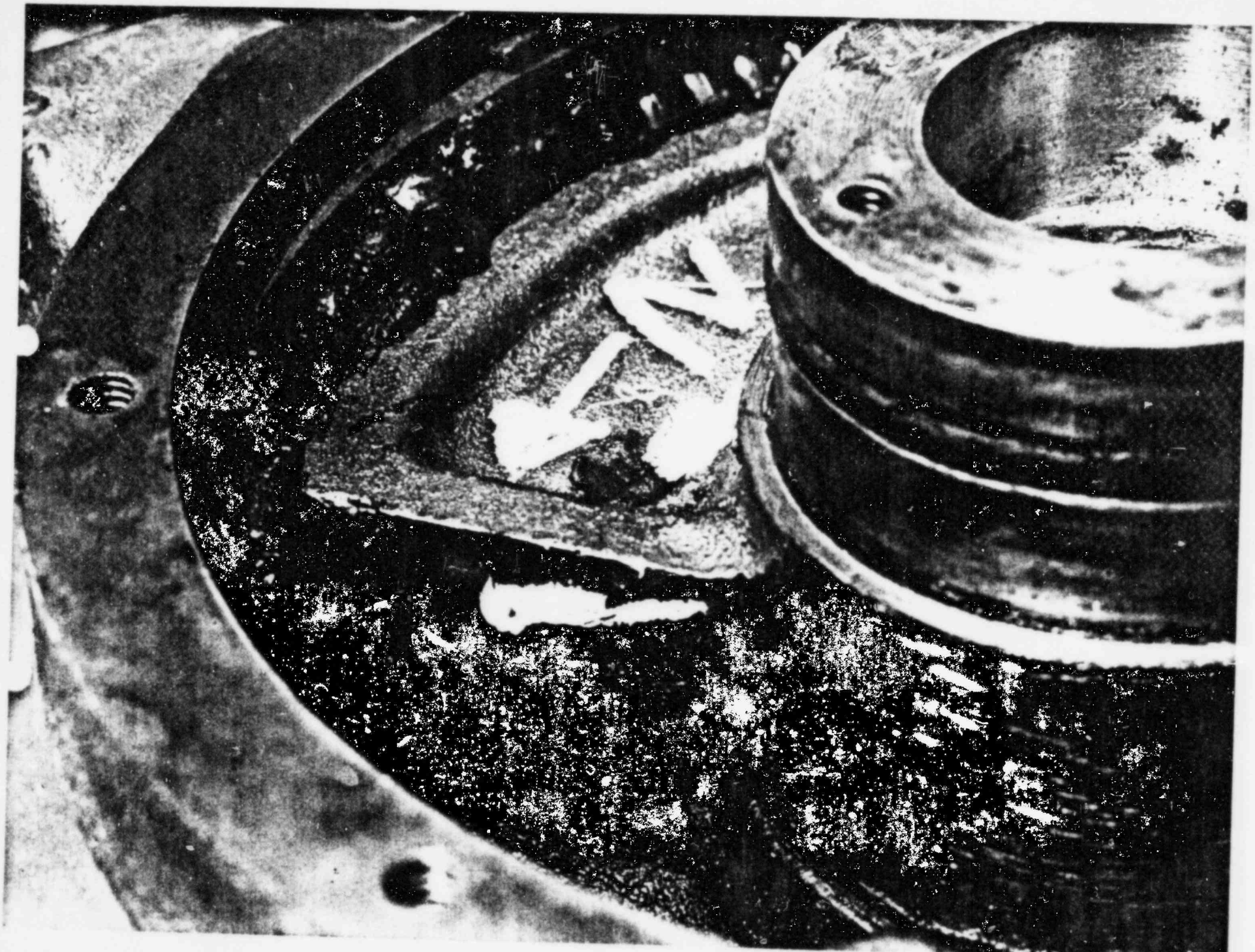


FIG. 4–WEAR ON BULL GEAR TEETH

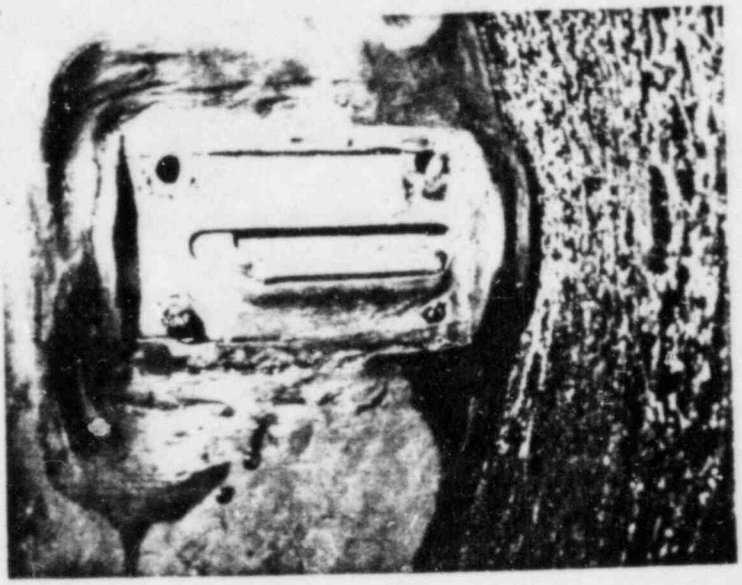


FIG. 5—DISC-TO-SHAFT INSTALLATION