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WRITTEN BY B. W. Admire & F. S. Nayor	**ATOMICS INTERNATIONAL** *A Division of North American Aviation, Inc.*	TDR NO. 2616	
SECTION 793		GO 7508	
GROUP 33	**TECHNICAL DATA RECORD**	LEDGER ACCT. 3621	
UNIT Coolant System Equipment		SUB-ACCT. 4908	
APPROVED BY: (SUPERVISOR) W J Hallett	PROGRAM HNPF	TWR 00263	
OTHER	PROJECT Develop and Test Mechanical Pumps	DATE June 30, 1958	
		PAGE 1 OF 6	

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SUBJECT: A Gas Shaft Seal for the HNPF Sodium Pump

CONTENTS:

I STATEMENT OF PROBLEM:

The problem was to develop and test a gas seal for a 5" diameter rotating shaft. The seal used was a commercial lip type seal using oil as the gas sealing medium. The HNPF requirements for a gas shaft seal are such that no helium leakage is permissible from the housing to the atmosphere at a gas pressure of 5 psig and ambient temperatures for a period of at least one year at shaft speeds of approximately 900 rpm. (Reference 1)

II SUMMARY OF RESULTS AND RECOMMENDATIONS:

Results

1) There was considerable oil leakage between the lip seal and and the rotating shaft. Helium leakage could be readily detected by the numerous bubbles in the escaping oil.

2) Bubbles forming on the surface of the leather indicated that there was helium leakage through the lip itself.

3) The lip seals tested had an average life of 29.8 hours before failure.

4) There was much wear evident on all seals tested.

5) The seals tested showed a marked temperature increase during operation. From ambient at the beginning of each run, the seal temperatures leveled off at about 135°F after 3 hours running time.

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6) One lip seal tested showed a leakage rate varying from less than 2 cm^3/min (minimum sensitivity of flowmeter)to a maximum of 8.4 cm^3/min during a 40 hour test run with a shaft speed of 300 rpm. The helium gas was maintained at 10 psig at ambient temperatures.

7) During the relatively short period of 16 hours the helium gas leakage rate on the next lip seal tested increased from less than 2 cm^3/min to an excessive rate of 25.8 cm^3/min. This run was conducted with a shaft speed of 300 rpm and with the gas at 10 psig and ambient temperatures.

8) During a 50 hour run with a shaft speed of 600 rpm another lip seal showed a helium leakage rate increase from a minimum of less than 2 cm^3/min to a maximum of 2.6 cm^3/min. The helium was maintained at a pressure of 10 psig and at ambient temperatures.

Recommendations

1) In order to meet the HNPF requirements of zero helium leakage to the atmosphere it will probably be necessary to use a double seal arrangement.

2) These lip type, oil labyrinth gas shaft seals are not recommended for use on HNPF sodium pumps with large rotating shafts.

3) It is recommended that a face type seal with oil as the gas sealing medium be built and tested.

III DESCRIPTION OF EQUIPMENT AND METHOD USED:

The oil labyrinth type, leather lip gas shaft seal consists of a spring loaded circular leather lip mounted in a stainless steel ring. This circular leather lip is press fitted around a rotor which in turn is secured to the rotating shaft by set screws. Below the lip seal, enclosed in the housing, is a labyrinth arrangement (fabricated by AI) which is filled with oil. The oil acts as the gas sealing medium while the leather lip provides the seal to contain the oil. The entire seal assembly can be seen in the attached drawing (Figure 1).

Method Used

The leather lip type seals, as received from the National Motor Bearing Company, were inspected and found to be free from any dirt or grit. The test housing was machined from mild steel and its configuration can be seen in the attached photographs. The housing was found to be helium tight.

The leather lip seal was press fitted over the rotor and securely bolted to the housing. During this assembly it was often noted that the leather lip had curled back upon itself. However, due to the housing configuration, it was impractical to assemble the seal in any other way.

The gas used in this test was helium which was supplied to the seal assembly

through the housing.

The test stand shaft was driven by a 3 horsepower variable speed motor. A static test was conducted at both 5 and 10 psig to ascertain the overall tightness of the system.

A dynamic test was conducted on each lip seal at both 300 and 600 rpm shaft speeds. After each failure the seal was replaced by a new seal of the same type. There was a total of 6 of these seals tested. Tests were run at both 5 and 10 psig helium pressure. At the time of the test specific HNPF requirements were unknown and it was assumed that these pressures would provide performance information in excess of any requirements that might be established.

IV REFERENCE:

1. Personal communication; R. W. Atz and H. Holz, April 30, 1958

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PREPARED BY: F.S. NAYOR	ATOMICS INTERNATIONAL A DIVISION OF NORTH AMERICAN AVIATION, INC.	PAGE NO. 4 OF 6
CHECKED BY:		REPORT NO. 2616
DATE: June 30, 1958	OIL LABYRINTH TYPE LEATHER LIP GAS SHAFT SEAL	MODEL NO.

1. Circular Leather Lip (See Inset)
2. Rotor
3. Housing
4. Cover
5. Oil Drain
6. Oil under Sealing Pressure

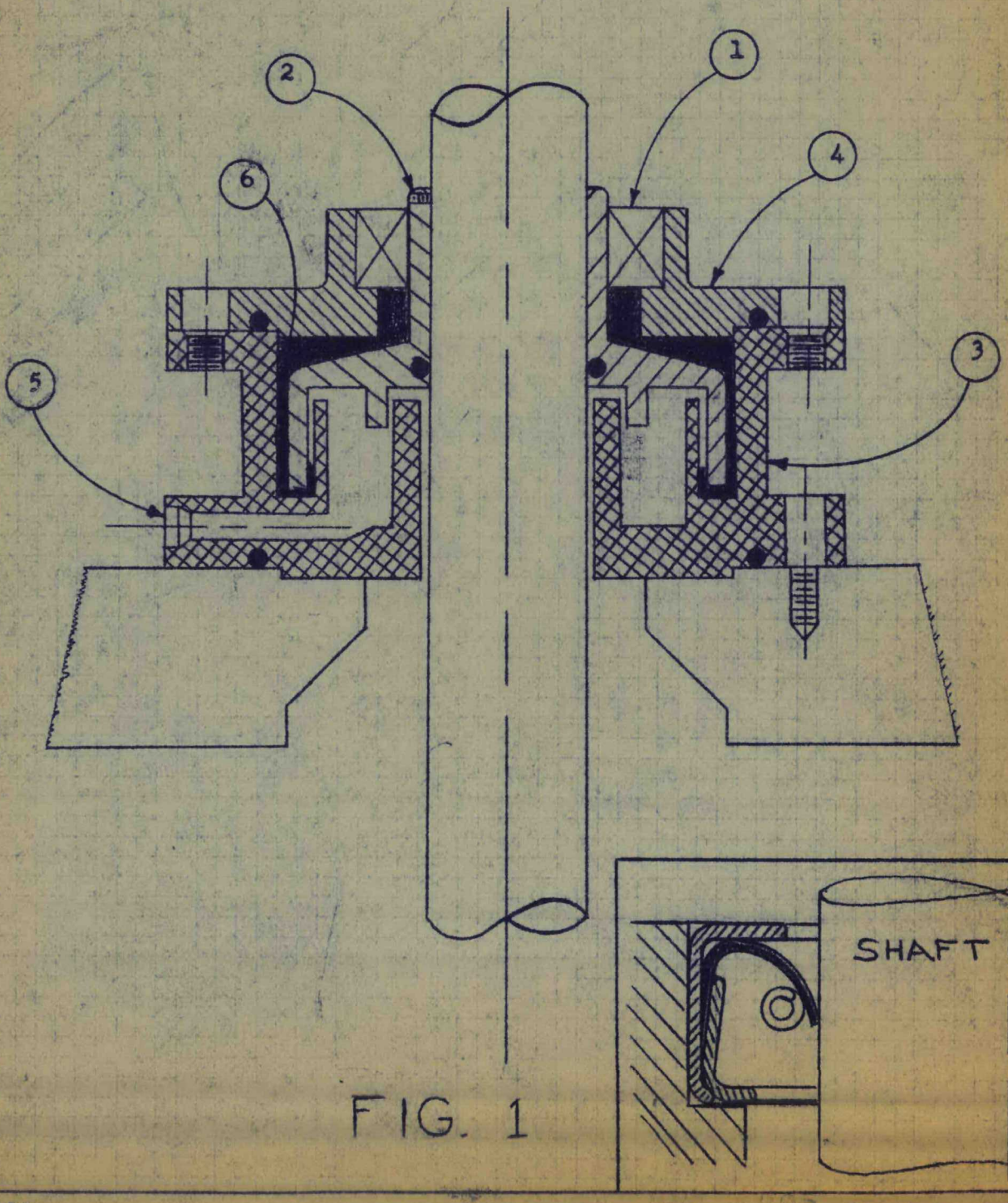
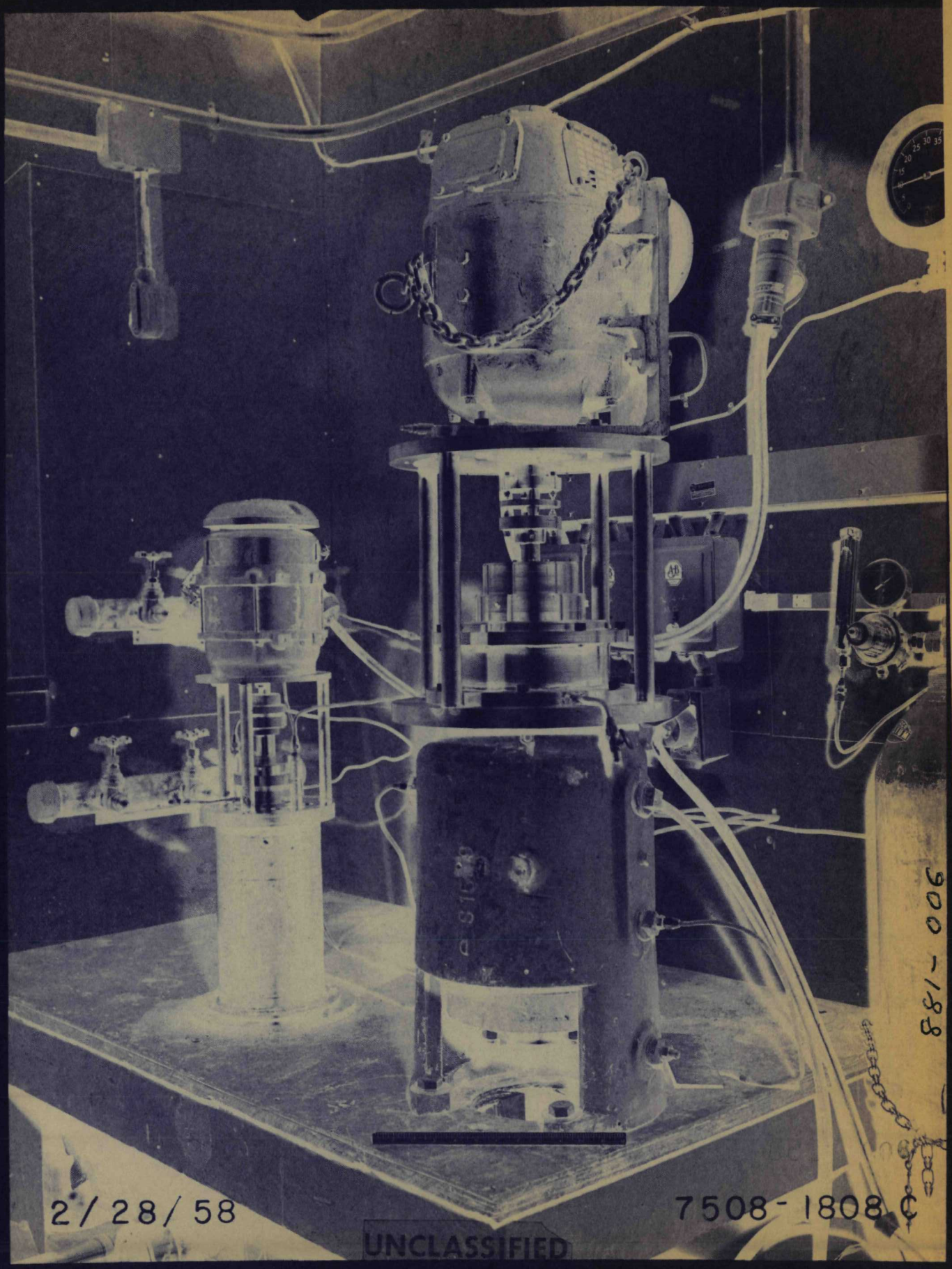


FIG. 1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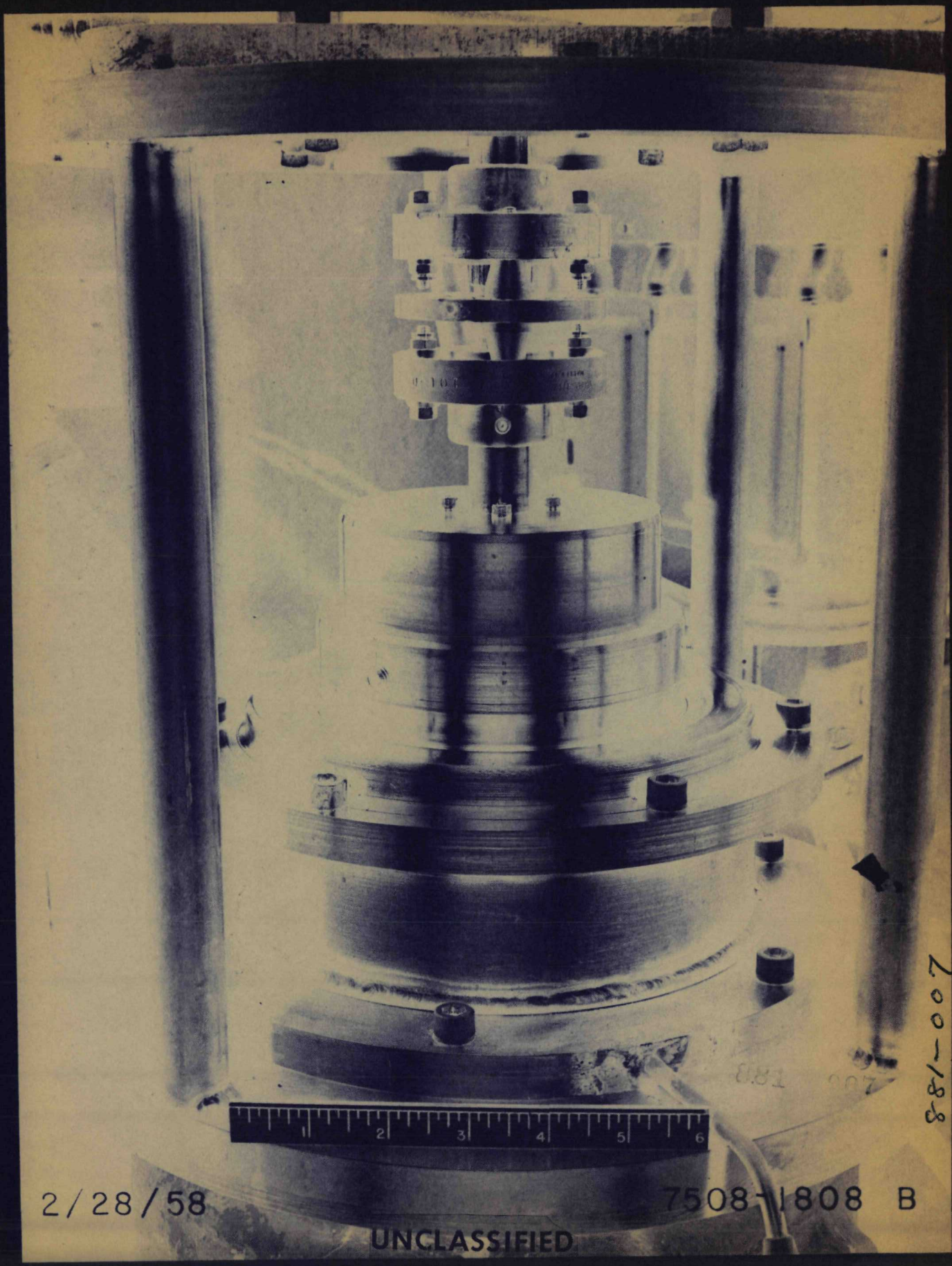
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