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DETERIORATION OF ELECTRICAL INSULATION OF MAIN MAGNET COILS FROM MAGNET G-1

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Brookhaven National Laboratory

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AGS DIVISION TECHNICAL NOTE

No. 70

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During a routine inspection of the coils on magnet G-1, some burning was noticed on the micarta insulating spacers at the up-stream bracket. The coils were removed. The burned spots were at areas at the edges of the micarta spacers under end brackets and one side bracket, (third from the up-stream end about the middle of the coil side).

The coils on magnet G-1 are of the original National Coil Company production, mica tape with polyester impregnant. This magnet was in a low radition area until 1962. Since then, it has been exposed to the radiation from the two targets at F-20.

A sketch of the coil assembly on the magnet is shown in Fig. 1. Photographs of the burned areas are shown in Figs. 2, 3, 4, 5, 6 and 7. (The coil numbers are shown on Fig. 1.)

The mica coil insulation at the burned areas was not punctured. Coil 372 at the burned area (using a 1-3/4 in.diameter electrode) withstood 6 kV ac for 15 seconds. Coil 349 at the burned area had too great a leakage current at 6 kV but withstood 3 kV for 30 seconds.

The micarta insulation had the appearance of being eroded. Coil 349 was positive to ground and coils 372 and 396 were negative to ground.

New coils and micarta insulation had been put on the magnet before the tests reported herein were made. Changes were being made on magnet G-11 which is also in a high radiation area. It was decided, after discussions between Messrs. Czaja, Gefers, Grisoli, Plotkin and Rutan to use two mica plates with a film of Kapton (polyimide) between. The mica selected was NEMA Grade 9 rigid plate with inorganic bond. This provides the high resistance of mica to radiation and ionization (corona). The Kapton film has high radiation resistance and has a high fire resistance. This is a trial installation.

This new combination will be inspected during shutdowns over the next few years.

A number of tests for surface and volume insulation resistance were made on the coils. Tests were also made at high voltage both with dc and ac potentials. These are summarized in a supplementary report for record purposes.

When testing at high voltage, a 1-3/4 in. diameter cylindrical electrode with rounded edges was used. In areas where the surface resistance was lower, a sparking developed which seemed to be under the outer impregnated glass tape of the magnet coils. These sparks would burn an irregular path from the electrode. With the dc tester, due to its limited ampere rating, usually only one path was burned at a time. If it stopped some distance out, a new one would start. These are shown on Figs. 8 and 9. With the ac tester, several paths would burn at the same time. With both sets, the voltage had to be kept below the value which caused trip-out currents to flow.

An attempt will be made to explain the creepage actions in a supplementary report which will also include the test data.

(Note - Color photographs Figs. 2 to 9 are included only with the original copy available at the Accelerator Department office.)

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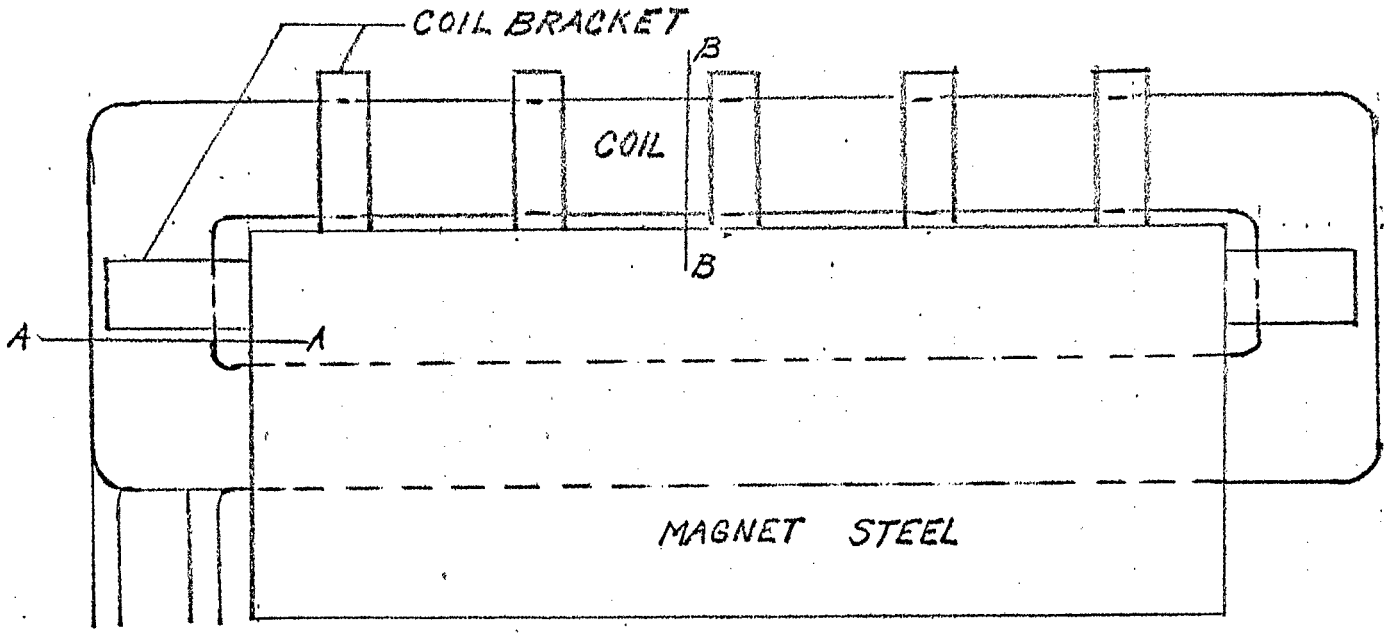
Admin. Group

FIG-1

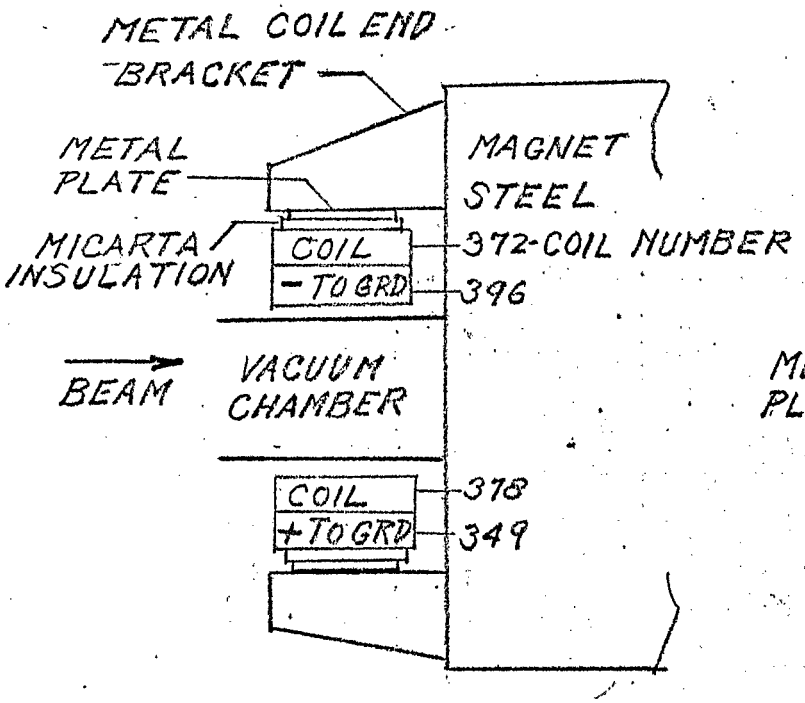
BROOKHAVEN NATIONAL LABORATORY

BY EJO DATE 10/69 SUBJECT SCHEMATIC COIL MOUNTING - MAIN MAGNET - MICARTA INSULATION SPACERS SHEET NO. ____ OF ____

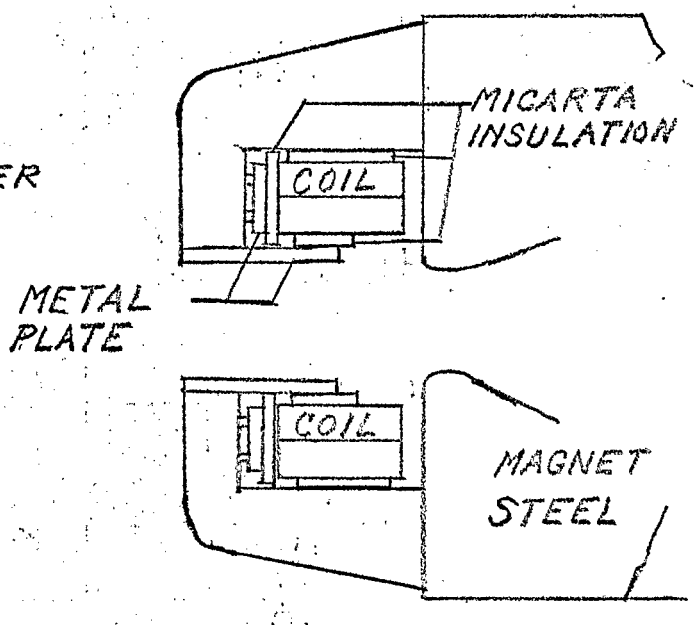
CHKD. BY ____ DATE ____ DEPT. OR PROJECT ____ JOB NO. ____



MAGNET G-1 PLAN

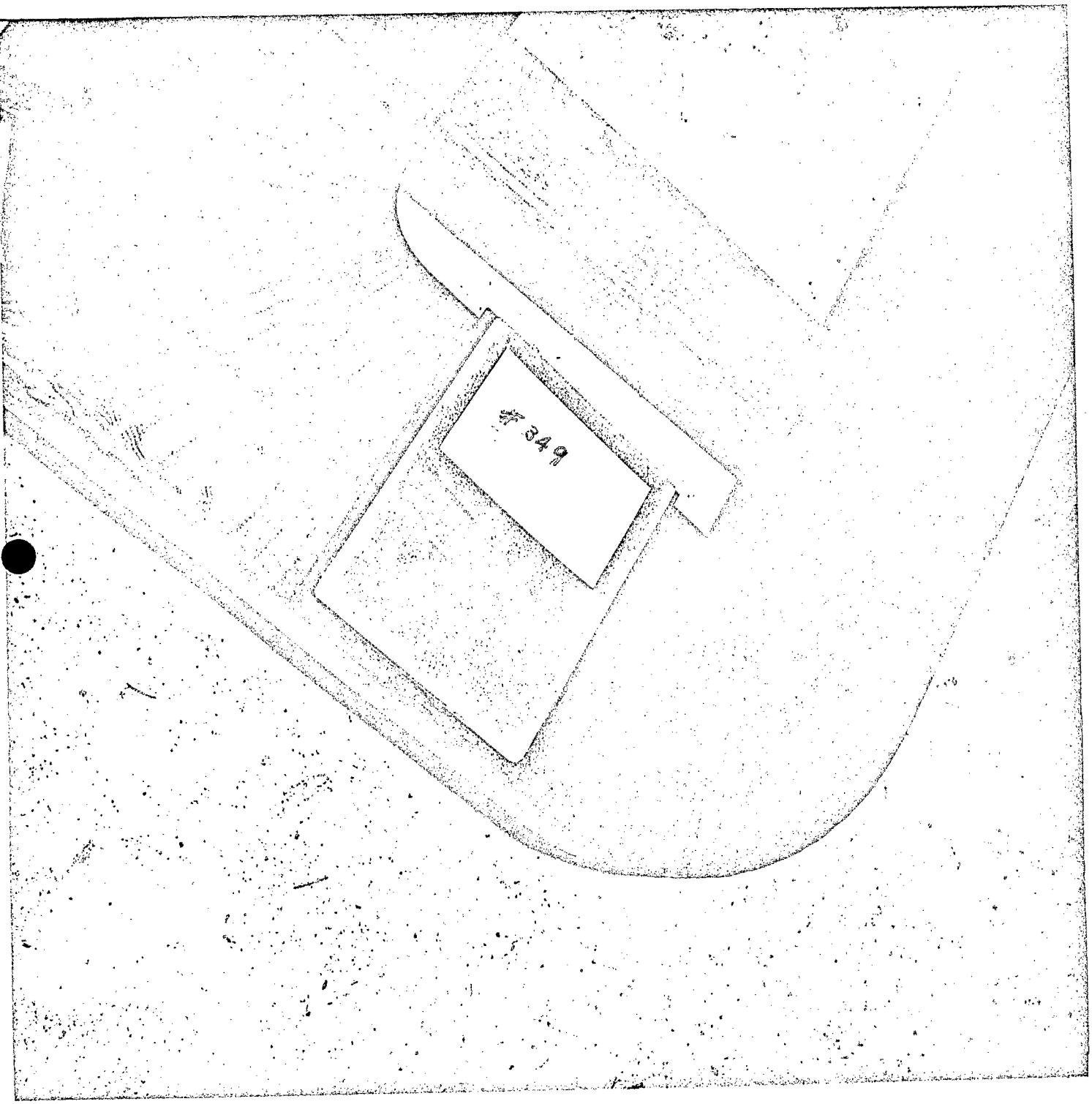


ELEVATION AT A-A



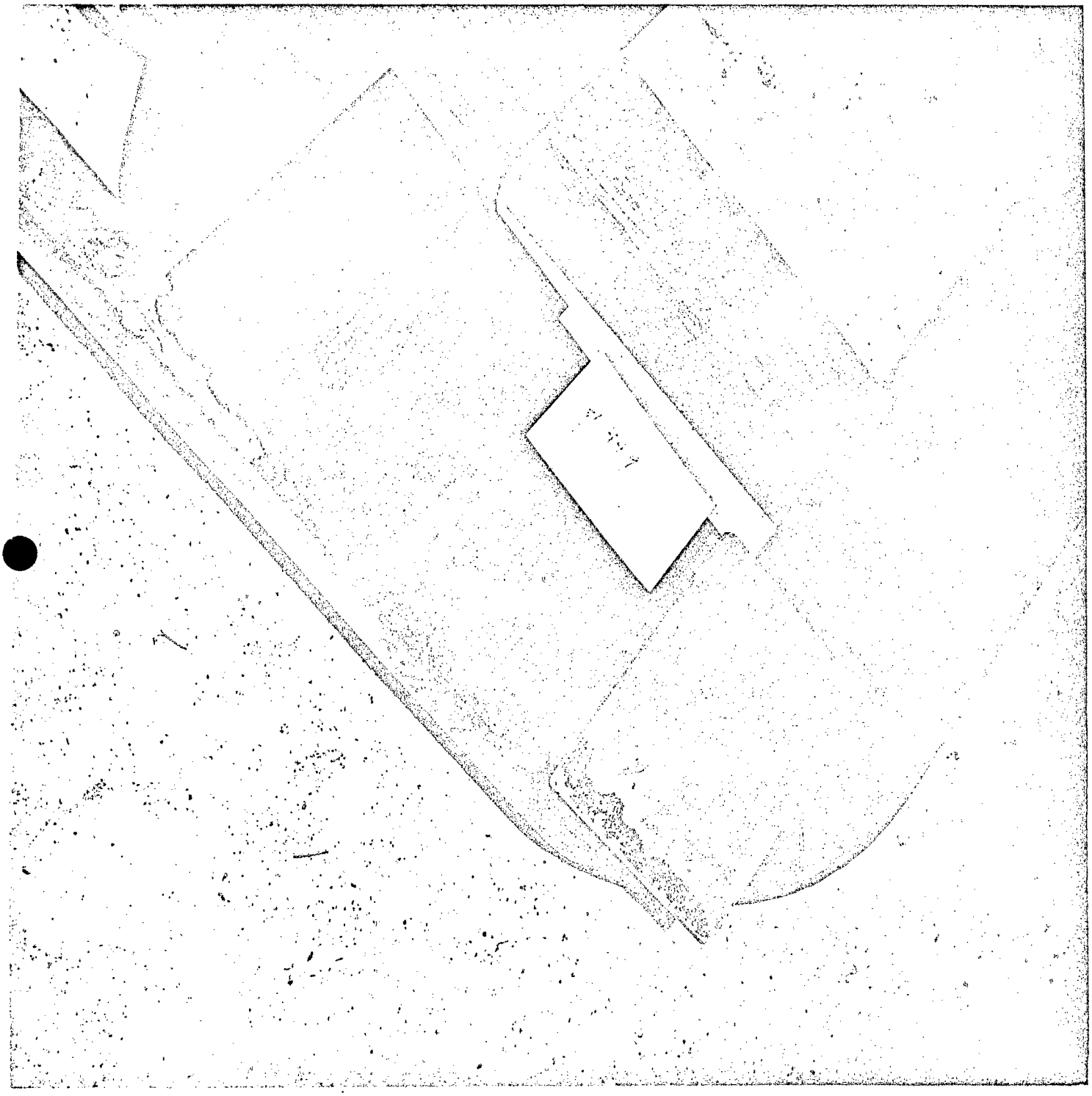
ELEVATION AT B-B

FIG 2



ASSEMBLED

FIG 3

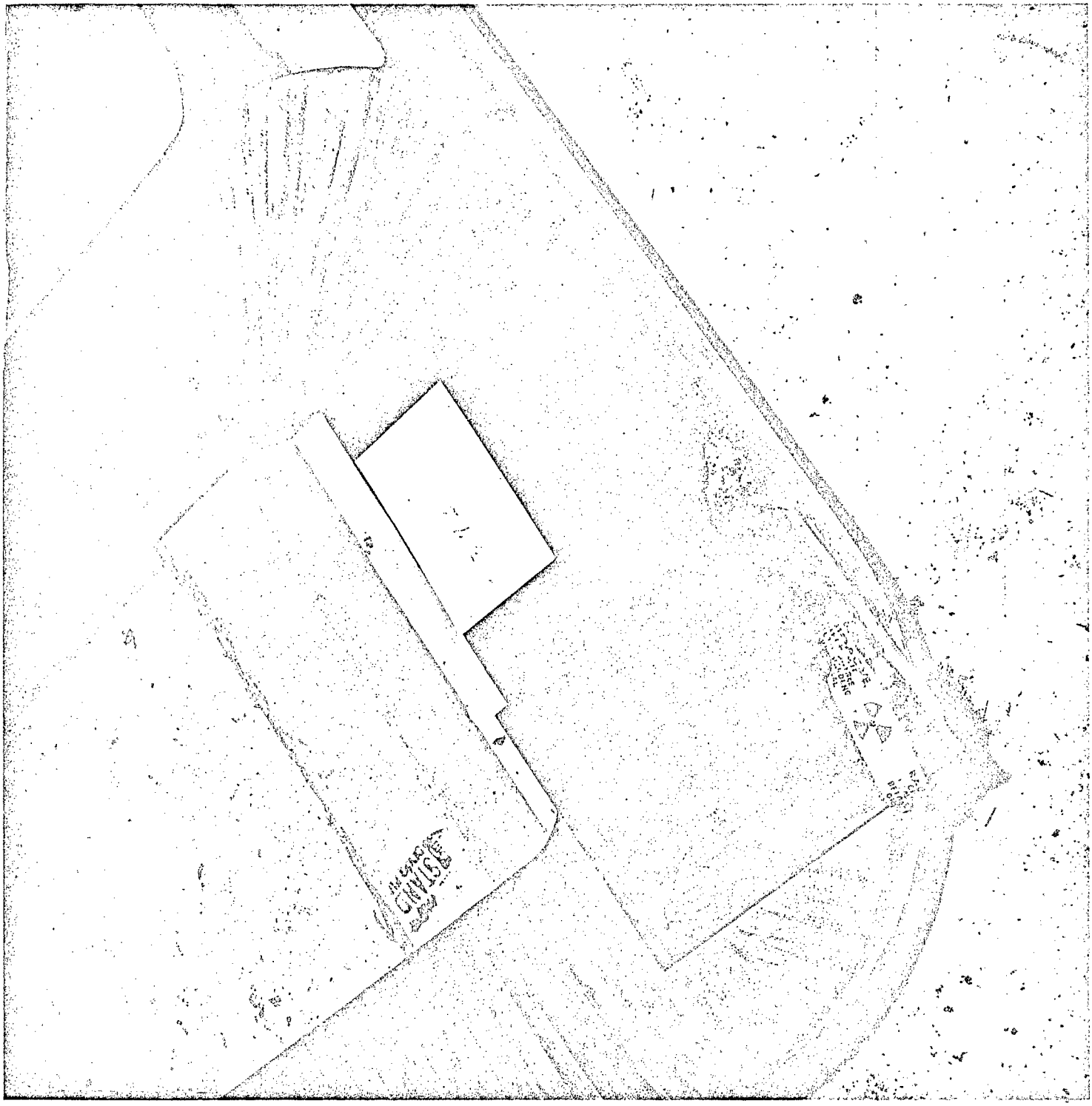


DISASSEMBLED

FIG 4

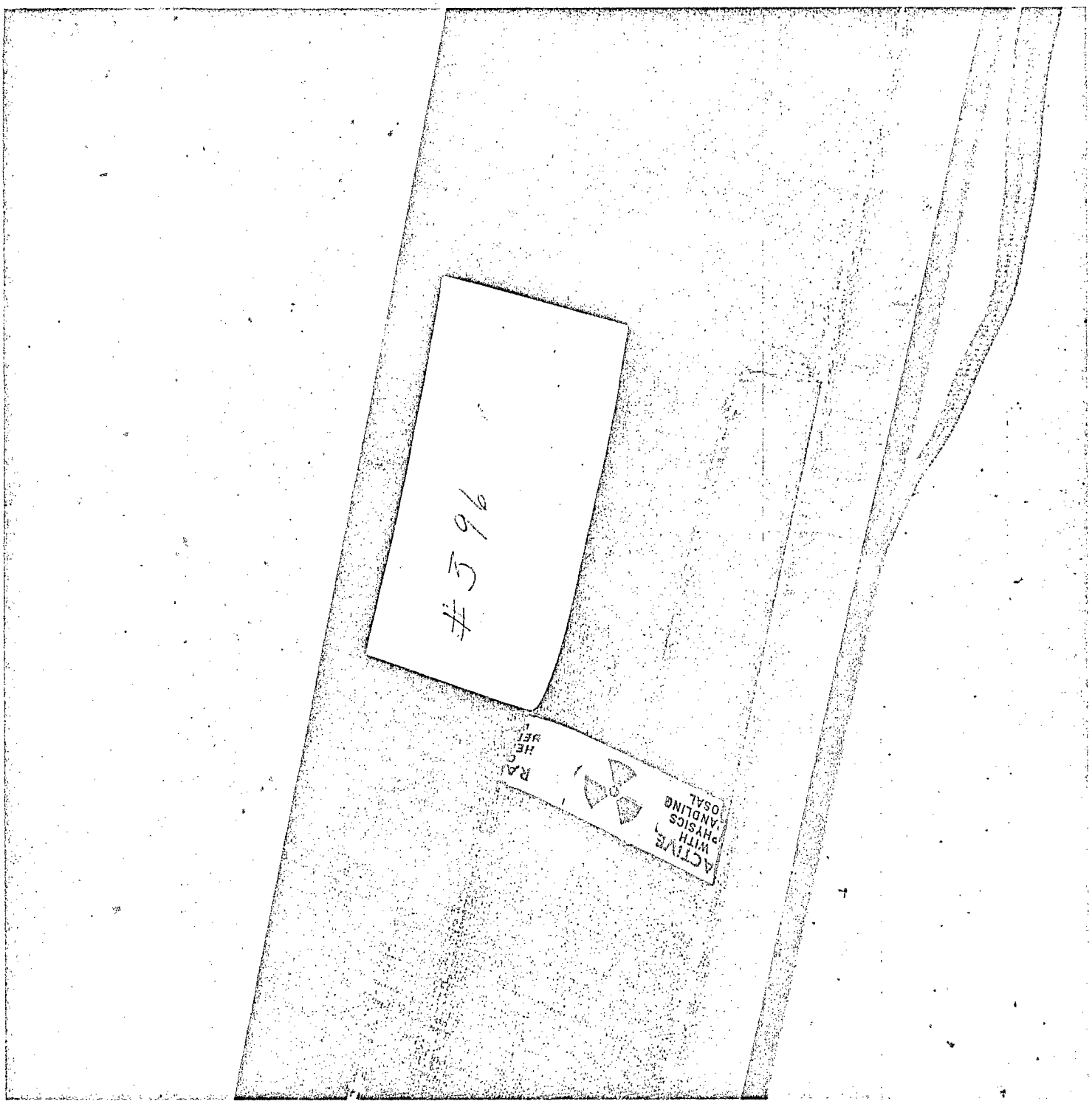
ASSEMBLED WITHOUT METAL PLATE (SEE FIG 2)

FIG 5



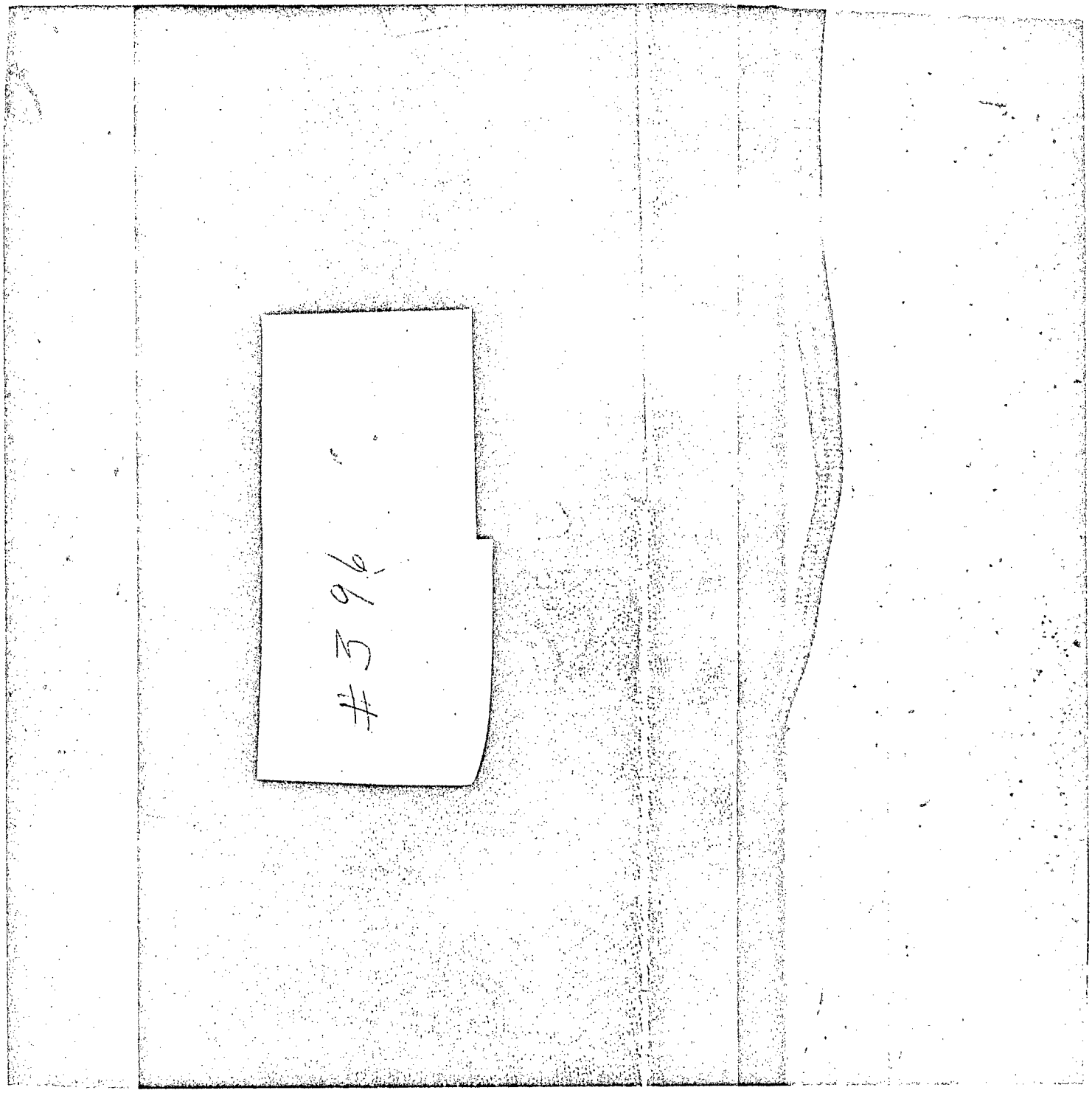
DISASSEMBLED

FIG 6



ASSEMBLED

FIG 7



DISASSEMBLED

COIL-349

COIL-349