CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

SECRET
SECURITY INFORMATION

25X1

COUNTRY	USSR (Kalinin Oblast)	REPORT NO.	
SUBJECT	Design of an Acceleration Transmitter for Use with Guided Missiles' Steering Mechanisms	DATE DISTR.	28 May 1953
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THE APPRAISAL OF CONTENT IS TENTATIVE.
(FOR KEY SEE REVERSE)

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SOURCE:

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1. [redacted] further information on the missile, and my assumption that the missile was to be ground-controlled is based only on the design peculiarities of the accelerometer /described in this report/.

2. Two accelerometers installed at right angles to each other in the missile comprised a single unit. A space was left in the mounting case for additional electrical equipment, of what type I do not know.

4. The technical requirements for the acceleration transmitters were primarily the following:

   a. Plus-minus 8 Gs static and low frequency acceleration.

   b. Unit to function in only one acceleration direction.

   c. Maximum unilateral and torsion acceleration error to be less than 0.5 percent.

   d. Power output at the exit poles of the bridge to be 5 ma. at 2,000 ohms.

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STATE	#x	ARMY	#x	NAVY	#x	AIR	#x	FBI		AEC				

(Note: Washington Distribution Indicated By "X"; Field Distribution By "#".)

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e. Highest possible linear reliance on the measuring value of acceleration: permissible deviation plus-minus 5% of the maximum scale value.

f. The absolute error of the measurement value itself was to be less than 1% of the maximum scale value.

g. Temperature range from plus 40° to minus 50 degrees; air pressure from one atmosphere to 0.3 atmospheres.

h. Insulation resistance minimum 50 M Ohm under 100% moisture conditions.

i. Insulating value (dielectric strength) of the coils toward each other: minimum 5[illegible] volts; and against mass , minimum 250 volts.

4. The acceleration transmitter was built in two parts which were virtually identical and had one connection plug for the entire unit. /See sketches on pages 4 and 5./ A spring suspended mass was used for the measuring system of the acceleration transmitter. The deflection of this mass resulting from acceleration of the unit is measured electrically and converted to an acceleration reading. Air damping rather than electrical damping was employed in an effort to maintain design simplicity in the unit. The variation of air pressure and its resulting effect on damping was recognized and accepted by the design engineers. In order to make this system independent of lateral or torsional accelerations, the mass was mounted between two ring clamped membranes /see sketches on pages 4 and 5/. The membranes were turned out on a lathe from 9 mm. thick plates. In reducing the plate thickness, minimum cutting pressure was applied to prevent warping of the membrane. In order to achieve a suitable zero point, the following measures were utilized.

a. Use of a special nickel steel with a minimum hystereisis (exact composition unknown to me).

b. Metal was treated for corrosion prevention (method of treatment unknown). The membranes were clamped together. /See sketch on page 4./ A very small bleed hole in each membrane surface serves to equalize the atmospheric pressure developed by the inner and outer space. The rims of the membranes were mounted between an upper and lower housing half by means of bolts. These housings were made of normal mild steel and are identical in their dimensions. A clearance of 0.2 mm was maintained between the membrane surface and the housings. This air gap provided a very effective damping of the measuring system.

5. A test data transducer (Messwertwandler) is clamped in each half housing. Each transducer contains two complete identical coils which form a wheatstone bridge. Through movement of the measuring system toward one side or the

other, the impedance of one test data transducer is increased and the other is decreased. The potential differences in the measuring section (Messdiagonale) of the bridge are a direct measure of the flexure of both membranes and therefore a measure of the acceleration which effects the mass.

6. Only Soviet parts were used for the acceleration meter and for the junction bridge. Copper oxide rectifiers fabricated on the island were used originally. Later, Soviet selenium-rectifiers were employed despite the Germans' concern over their stability characteristics. The input current for the junction bridge and for the accelerometer was provided by a DC-AC rotary converter regulated by a Bucholdt regulator GDU 90 (500 cycles, 40 volts).

7. The acceleration meter was mounted on a trestle, or wedge mount made of sheet metal, with a circular cut for the cap of the meter. The unit was mounted by three of the six bolts which bound the housing halves and the membranes. The three bolts were correspondingly lengthened for this purpose.

8. The units were tested on a centrifuge with a lever arm of approximately 60 cm. The rpm were determined by counting and the use of a stop watch. Test results were as follows:

a. Flexure or deflection of the membrane was approximately plus-minus 0.1 mm. at plus-minus 8 g (low g limit values unknown).

b. Power output 5.5 ma. at 2,000 Ohms.

c. Natural frequency: F_e of approximately 160 to 200 cycles.

d. Damping coefficient: Theta of approximately 0.33.

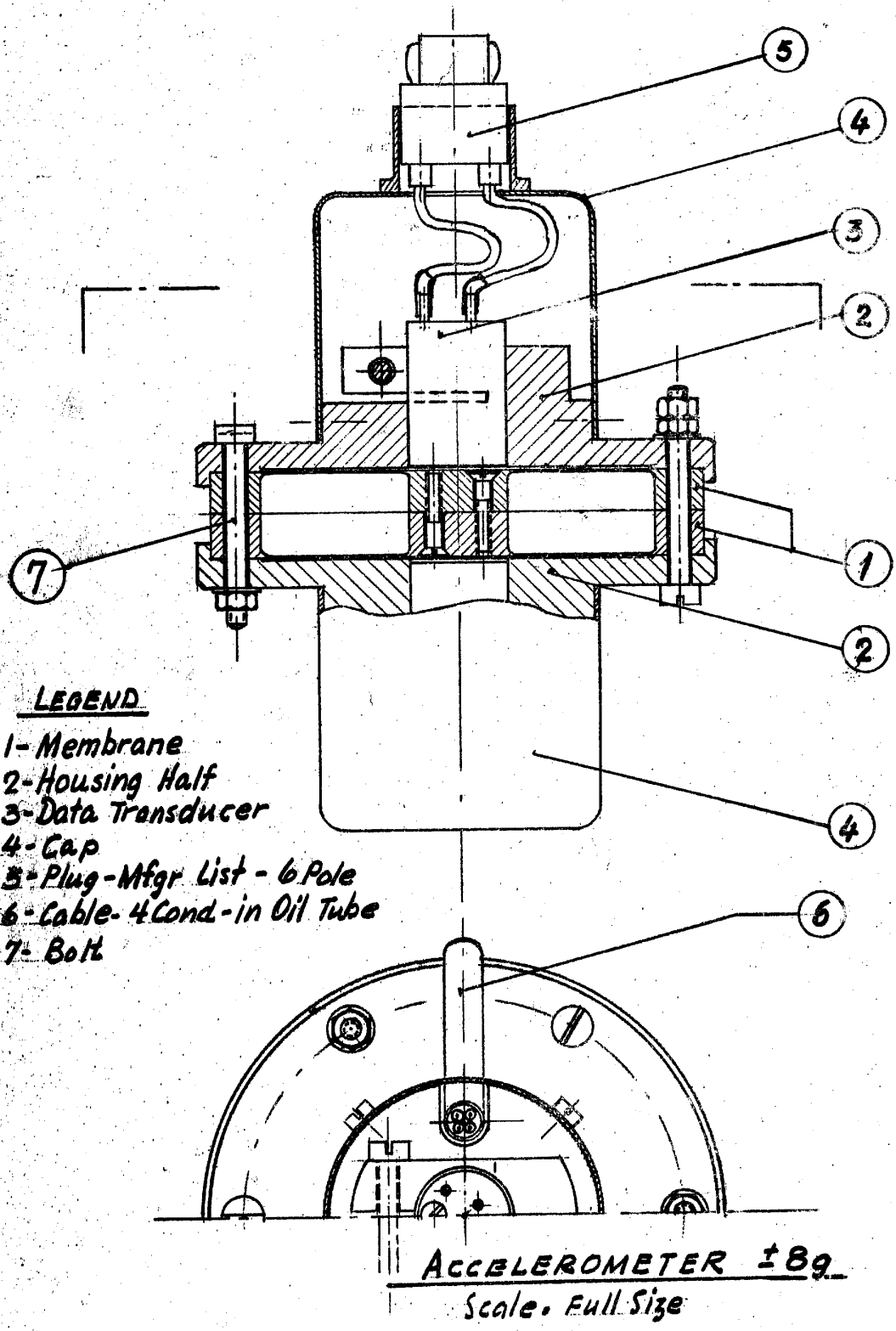
e. Instrument error: maximum 0.8%.

f. Linearity error: maximum plus-minus 3.5%.

g. Effective lateral or torsional acceleration was so small that it could not be measured. 25X1

h. [redacted]

9. Sixteen of these acceleration meters and eight bridge casings were built at Branch No.1 of NII 88. Because of insufficient suitable condensers and potentiometers, only five bridge casings were completely assembled. These instruments, completely assembled and calibrated, were sent to Moscow in December 1951 or February 1952.



LEGEND

1- Membrane
2- Housing Half
3- Data Transducer
4- Cap
5- Plug - Mfgr List - 6 Pole
6- Cable - 4 Cond - in Oil Tube
7- Bolt

ACCELEROMETER ±8g

Scale. Full Size

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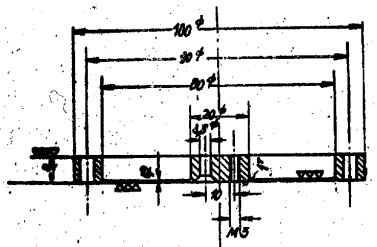
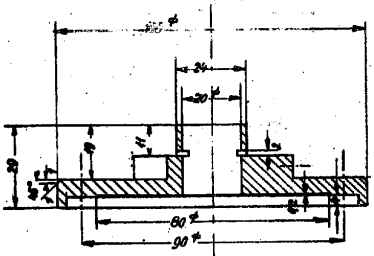
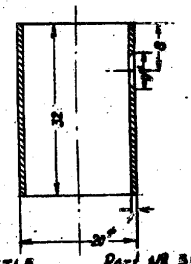
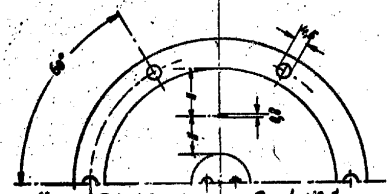
- 5 -



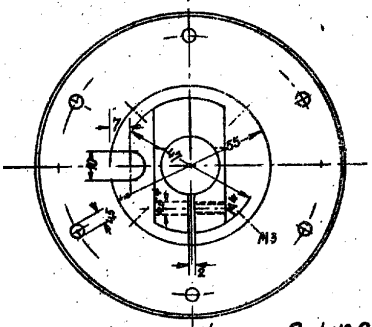




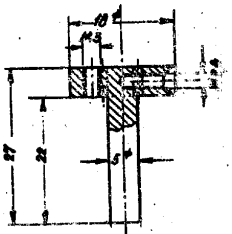
MANTLE Part No 24
Armco Electrical Oxidized

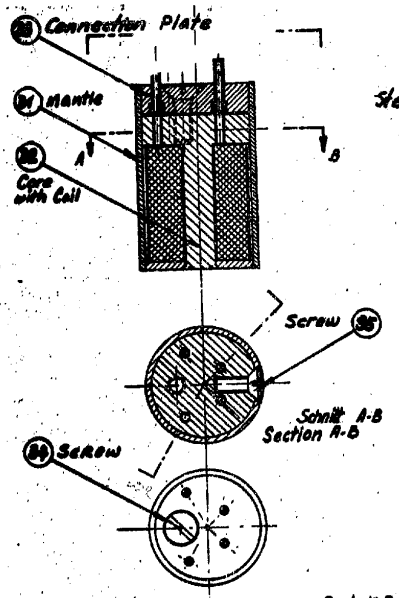


MEMBRANE Part No 1
Nickel Steel - with minimal hysteresis
Electrically Oxidized

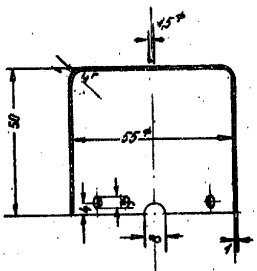


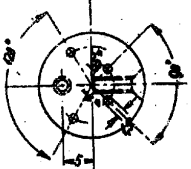
HOUSING HALF Part No 2
Steel - Nickel Plated Gehäuse - Hälfte



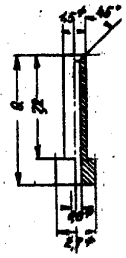


DATA TRANSDUCER Part No 3
Meßwertwandler

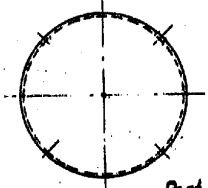




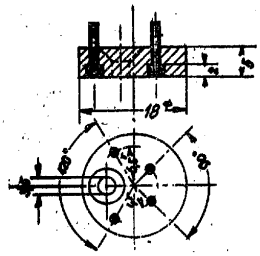
CORE DETAIL
Armco Electrical Oxidized



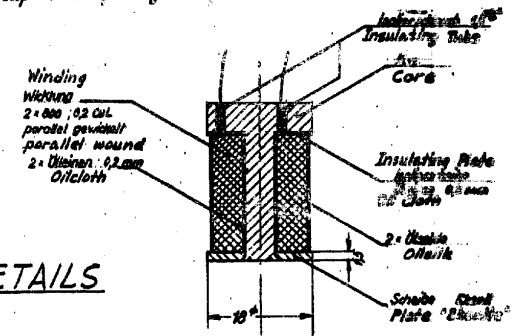
Soldering Lug
Messing – Brass
Lötöse



LOWER Cap Part No 4
Anodized - Upper cap with opening for Plug



CONNECTION PLATE
"Ebonite" Part No 33



CORE with COIL Part No 32

ACCELEROMETER PARTS - DETAILS

Scale 1 Approx. Full Size

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