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Technical Memorandum

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EVALUATION OF THE MC-439 FLUID-INTEGRATING ACCELEROMETER

A. K. Rue - 1472
D. T. Weems - 1472

ABSTRACT

This report describes the MC-439 integrating accelerometer which is an adaption kit component used in the XW-12/TALOS-W warhead installation. The development program is discussed and an evaluation including a summary of test results is presented.

Work performed under AEC Contract AT-(29-1)-789.

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EVALUATION OF THE MC-439 FLUID-INTRGRATING ACCELEROMETER

FOREWORD

The MC-439 fluid-integrating accelerometer is a velocity measuring device which provides a nuclear safe-arm signal to the XW-12/TALOS-W warhead installation when the missile has attained a preselected minimum velocity.

The MC-439 development was requested by the weapon systems group since the existing MC-234 fluid integrating accelerometer was not satisfactory for the XW-12/TALOS-W application. The MC-234 required a lengthy preconditioning period for heating and stabilizing the fluid temperature, and in addition, it would not perform at the required low values of acceleration.

The MC-439, contrasted with the MC-234, is temperature-compensated, operates at lower values of acceleration, has greater vibration resistance, and has features more suitable for acceptance testing.

At the present time the XW-12/TALOS-W is the only application for the MC-439.

SUMMARY

The MC-439 design and development by Sandia Corporation was initiated in November 1953, with feasibility studies. DPA's were authorized in August 1954, to obtain units for evaluation. First development units were completed in October 1954, and first units representative of final design were received in January 1955. The MC-439 was design-released in April 1955.

Design and development testing was performed in accordance with the weapon requirements and applicable tests as specified in "Tests for Universal Components", SCS-7. Functional and environmental tests performed during the latter part of the development program indicated the basic design was sound with respect to all factors except for vibration environment. Because of inadequate SA-275 vibration isolators, the MC-439 was released as having a reduced SCS-7 vibration capability. Design improvements were incorporated after design release which provided vibration resistance sufficient to pass SCS-7.

All design changes incorporated by Product Change Orders after design release were checked for correctness, manufacturability, environmental resistance, and functional capability by fabricating and assembling into the MC-439 the parts effected by the PCO's. These design changes are not specifically covered in this report.

[redacted]

Sixty-one MC-439 units were involved in the component evaluation program. Test results are summarized in Fig. 1.

CONCLUSIONS

Performance

The performance of the MC-439, when subject to any and all operating and nonoperating environments, is well within the allowable velocity limits.

Environmental Effects on Operation

The effects of the operating and nonoperating environments were determined by subjecting twenty-seven MC-439's to tests representing the environmental conditions. In general, these tests correspond to the tests specified in Environmental Requirements and Tests for Universal Components, SCS-7. Specific weapon requirements allowed the temperature extremes for operating environment to be less than those specified in SCS-7. The results of these tests are summarized in Fig. 1.

Special Requirements

The MC-439 orientation in the missile must be controlled such that the sensitive axis is parallel with the missile axis. The mounting hole configuration is nonsymetrical to prevent improper orientation during installation. The MC-439, being an acceleration sensitive instrument, is affected by the acceleration of gravity. To minimize the effect of this error, the component is initially calibrated at the factory for a launch angle which is the mid-range of operating launch angles.

Adequacy of the Component for Production

With the exception of the vibration isolator system and temperature compensator, the MC-439 is similar to the MC-234 integrating accelerometer. As demonstrated during MC-234 procurement, this type of component can be produced in production quantities. Satisfactory vibration and temperature compensation characteristics were obtained during the MC-439 development program by exercising reasonable care in the fabrication of the associated parts and assemblies. Similar performance should be obtainable on a production basis.

DESCRIPTION

MC-439 Integrating Accelerometer

The MC-439 is a fluid-type integrating accelerometer which senses acceleration over a range of 12 to 25 g's, integrates this acceleration

SUMMARY OF TEST RESULTS
MC-439 INTEGRATING ACCELEROMETER

[illegible] ated
[illegible]

DESCRIPTION:

The MC-439 is a velocity measuring device which senses acceleration over the range of [illegible] g's, integrates this acceleration as a function of time, and closes an electrical switch to indicate when a [illegible] velocity of [illegible] fps has been attained. The governing product specification is [illegible].

The MC-439 was originally designed and tested to [illegible], and all satisfactorily meet all the requirements of this specification except vibration.

STATUS:

The MC-439 was design-released in April 19[illegible], for use in the [illegible] system. The information given below outlines the tests which have been performed in regard to environment and additional tests which are recommended.

The future test program may include tool-made samples, evaluation samples, production tests, and quality engineering tests.

KEY:

1. Test conditions
2. Duration
3. Number of samples
4. Special test features
5. Specifications
6. Conclusions and/or results

[illegible] Processing and Performance (testing during production)	
[illegible] Production Planned Tests	Quality Engineering Recommended Tests (see Note [illegible])
Functional and electrical [illegible] of production [illegible] tolerance [illegible]	1. Functional and electrical tests at [illegible] 2. Time to stabilize component temperature 3. See Note E 4. [illegible]
[illegible] component temperature [illegible]	1. [illegible] 2. [illegible] 3. See Note E 4. See Note [illegible] 5. [illegible]
[illegible] component temperature [illegible]	1. [illegible] 2. [illegible] 3. See Note [illegible] 4. See Note [illegible] 5. [illegible]
[illegible]	1. [illegible] 2. [illegible] 3. [illegible] 4. See Note E 5. [illegible]
[illegible]	1. [illegible] 2. [illegible] 3. [illegible] 4. See Note E 5. [illegible]
[illegible]	Not applicable

Test to Establish Integrity in Choice of Materials and Structural Design (once established and tested, these tests are controlled by drawings and specifications and normally do not require retesting in production)		
Type of Test	Prototype	Quality Engineering Recommended Tests (see Note E)
Fungus	1. Standard test 2. 28-day 3. [illegible] units 5. [illegible] 6. No evidence of fungus growth; all functional tests within tolerance (see Note F)	1. Tests will be conducted when and on those materials or assemblies wherein reasonable doubt exists as to their ability to withstand fungus growth. 3. See Note E 5. [illegible]
Salt Spray	1. Standard test 2. [illegible]-hour 3. [illegible] units 5. [illegible] 6. All functional tests within tolerance	1. Standard test 2. [illegible]-hour 3. See Note E 5. [illegible]
Temperature Cycle	1. Standard test 2. [illegible] 3. [illegible] units 5. [illegible] 6. All functional tests within tolerance	1. Standard test 2. [illegible]-hour 3. See Note E 5. [illegible]
Low Pressure	1. Functional test at [illegible] 2. Time to complete test 3. [illegible] units 5. [illegible], modified 6. All functional tests within tolerance	1. Functional test at [illegible] 2. Time to complete test 3. See Note E 5. [illegible]
Pressure Fluctuation	1. Standard test 2. Time to complete test 3. [illegible] units 5. [illegible] 6. All functional tests within tolerance	Not applicable
Humidity	1. Standard test 2. [illegible]-day 3. [illegible] units 5. [illegible] 6. All functional tests within tolerance	1. Standard test 2. [illegible]-day 3. See Note E 5. [illegible]
Explosive Atmosphere	Not applicable	Not applicable
Sand and Dust	1. Standard test 2. [illegible]-hour 3. [illegible] units 5. [illegible] 6. All functional tests within tolerance	1. Standard test 2. [illegible] 3. See Note E 5. [illegible]
Rain	1. Standard test 2. [illegible]-hour 3. [illegible] units 5. [illegible] 6. All functional tests within tolerance	1. Standard test 2. [illegible] 3. See Note E 5. [illegible]
Linear Acceleration	1. [illegible] linear acceleration 2. Not less than [illegible] minute 3. [illegible] units 5. [illegible] 6. All functional tests within tolerance 1. Constant acceleration input values from [illegible] to [illegible] g's 2. Time to actuate component 3. [illegible] units 5. [illegible] per cent 6. All units functioned satisfactorily	1. [illegible] linear acceleration 2. Not less than [illegible] minute 3. See Note E 5. [illegible]

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SUMMARY OF TEST RESULTS
MC-439 INTEGRATING ACCELEROMETER

NOTES:

A. All units calibrated at 75°±5°F for 1500 fps using [illegible] gram static weight.

B. Component operating temperature environment is from -65°F to +125°F. All units were tested within this temperature range before and/or after high- and low-storage temperatures of +160°F and -65°F, respectively.

C. The one bellows failure experienced during vibration was found to be damaged, prior to the test, at the point of failure. The reset washer on the MC-439 broke loose on a [illegible]; this was attributed to a poor solder connection rather than a design deficiency.

D. Quality Engineering Tests are designed to give a periodic check of the quality of the unit.

E. During periodic quality engineering evaluation of components or adaption kit assemblies, it is recommended that the MC-439 be tested for as many environmental conditions as practicable.

F. Components inoculated internally; no evidence of fungus growth observed.

DESCRIPTION:

The MC-439 is a velocity measuring device which senses acceleration over the range of [illegible] to 25 g's, integrates this acceleration as a function of time, and closes an electrical switch to indicate when a maximum velocity of 1500 fps has been attained. The governing product specification is PS-[illegible].

The MC-439 was generally designed and tested to [illegible], and will satisfactorily meet all the requirements of this specification except vibration.

STATUS:

The MC-439 was design-released in April [illegible], for use in the [illegible] system. The information given below outlines the tests which have been performed in regard to environment and additional tests which are recommended.

The future test program may include lead-made samples, evaluation samples, production tests, and quality engineering tests.

Type of Test	Test to Establish Proper Workmanship, Processing and Performance (generally requires continuous checking during production) — Prototype	Manufacturer's Production Planned Tests	Quality Engineering Recommended Tests (see Note D)
Room Temperature	1. Calibration, functional and electrical at 75°±5°F 2. Time to stabilize component temperature 3. All units 4. TP-[illegible] (manufacturer's tolerance) 5. All functional tests within tolerance (see Note A)	1. Calibration, functional and electrical at 75°±5°F 2. 100 per cent of production 3. TP-[illegible] (manufacturer's tolerance)	1. Functional and electrical tests at 75°±5°F 2. Time to stabilize component temperature 3. See Note E 4. TP-[illegible]
High Temperature	1. Functional test at 125°±5°F 2. Time to stabilize component temperature 3. All units 4. TP-[illegible] (manufacturer's tolerance) 5. All functional tests within tolerance (see Note B) 1. Storage at 160°F 2. [illegible] 3. [illegible] units 4. [illegible] alternate test 5. All functional tests within tolerance (see Note [illegible])	1. Functional test at 125°±5°F 2. Time to stabilize component temperature 3. 100 per cent of production 4. TP-[illegible] (manufacturer's tolerance)	1. Storage at 160°F 2. [illegible] 3. See Note E 4. See Note F 5. [illegible]
Low Temperature	1. Functional test at -65°±5°F 2. Time to stabilize component temperature 3. All units 4. TP-[illegible] (manufacturer's tolerance) 5. All functional tests within tolerance (see Note B) 1. Storage at -65°±5°F 2. [illegible] 3. [illegible] units 4. [illegible] 5. All functional tests within tolerance (see Note B)	1. Functional test at -65°±5°F 2. Time to stabilize component temperature 3. 100 per cent of production 4. TP-[illegible] (manufacturer's tolerance)	1. Storage at -65°F 2. [illegible] 3. See Note E 4. See Note F 5. [illegible]
Vibration	1. [illegible] cps at [illegible] input; [illegible] cps at [illegible] input 2. [illegible]; [illegible] resonance in each plane 3. [illegible] units 4. [illegible] 5. All functional tests within tolerance except for one bellows failure (see Note C)	1. [illegible] at [illegible] input; [illegible] at [illegible] input 2. [illegible] 3. Sampling plan 4. TP-[illegible]	1. [illegible] at [illegible] input; [illegible] at [illegible] input 2. [illegible] 3. See Note E 4. [illegible]
[illegible] Shock	1. Three [illegible] shocks of [illegible] g's for [illegible] [illegible] applied along the three mutually perpendicular axes [illegible] 2. [illegible] 3. [illegible] 4. All functional tests within tolerance	Three [illegible] shocks of [illegible] g's for [illegible] [illegible] applied along the three mutually perpendicular axes [illegible] 1. [illegible] 2. [illegible]	Three [illegible] shocks of [illegible] g's for [illegible] [illegible] applied along the three mutually perpendicular axes [illegible] 1. See Note E 2. [illegible]
[illegible] Tests	1. Flight tests 2. [illegible] flights 3. [illegible] units functioned satisfactorily	Not applicable	Not applicable

Type of Test	Test to Establish Integrity to [illegible] are controlled by [illegible]
Fungus	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. [illegible] All [illegible] tolerance
Salt Spray	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. All [illegible]
Temperature Shock	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. All [illegible]
Low Pressure	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. [illegible]
Pressure Fluctuation	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. All [illegible]
Humidity	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. All [illegible]
Explosive Atmosphere	[illegible]
Sand and Dust	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. All [illegible]
Rain	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. [illegible]
Linear Acceleration	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. All [illegible]
[illegible]	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. [illegible] 6. All [illegible]

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as a function of time, and indicates when a predetermined velocity has been attained by actuating a double-pole, double-throw switch, the MC-606 (see Figs. 2 and 3 for value of velocity). To afford proper performance, environmental durability, and suitability for acceptance testing, the basic integrating element is temperature-compensated, internally vibration isolated, and contained in a rectangular package with an external reset button and access holes for static testing.

The MC-439 (with the cover plate removed) is shown in Figs. 4 and 5. Figure 6 is a schematic showing the dual bellows system and the method of operation. These figures should be used for reference when reading the following description of operation.

The integration of acceleration with respect to time is accomplished by utilizing the inertial force (F = ma) on an acceleration-sensing mass. This force causes silicone oil (DC-200-10), contained in a double bellows assembly, to flow from the outer bellows chamber to the inner bellows chamber through a precise metering orifice. The rate of flow is a function of the magnitude of the acceleration. When a predetermined volume of oil has been transferred through the orifice, a double-pole, double-throw switch (MC-606) is actuated, indicating that the carrying vehicle has reached the required velocity. The displacement of the inner bellows due to the transfer of fluid through the orifice is transmitted through an actuating rod and temperature-compensating element to the MC-606 switch. The amount of actuator rod displacement required to trip the MC-606 determines the MC-439 actuating velocity. Since the fluid viscosity, and consequently the flow rate, varies with temperature, the inner bellows actuator rod displacement, representing a given velocity, changes with temperature. The required total actuator rod displacement must be varied with temperature such that the MC-439 actuating velocity remains approximately constant over the operating temperature range. This is accomplished by the bimetallic temperature-compensating element.

In order to increase the life of the outer bellows when subjected to vibration, SA-275 vibration isolators were incorporated as internal and integral parts of the MC-439 design.

The MC-439 is made up of individual parts assembled by the use of machine screws, except for the bellows assembly which is soldered to provide a fluid seal. The parts, in general, are fabricated from aluminum with an anodize finish. The exceptions are the 80-20 brass bellows, 303 stainless-steel SA-275 vibration isolators, free-machining brass parts soldered to the bellows, Chase 6650 or Wilco morflex bimetal temperature-compensating element, and the Plaskon plastic-cased MC-606 switch.

The MC-439 is approximately 6 x 7 x 3 inches in size and weighs approximately 6 pounds. A Type AN-3102-A-20-16P connector is used for electrical connections. Provisions for static testing include test access holes and an external reset button. Access is provided to the switch-adjusting mechanism for factory calibration. Figures 2 and 3 show typical MC-439 functional characteristics.

Typical Curve
of
Velocity Indication with Various
Constant Values of Acceleration Input
for
MC-[illegible]

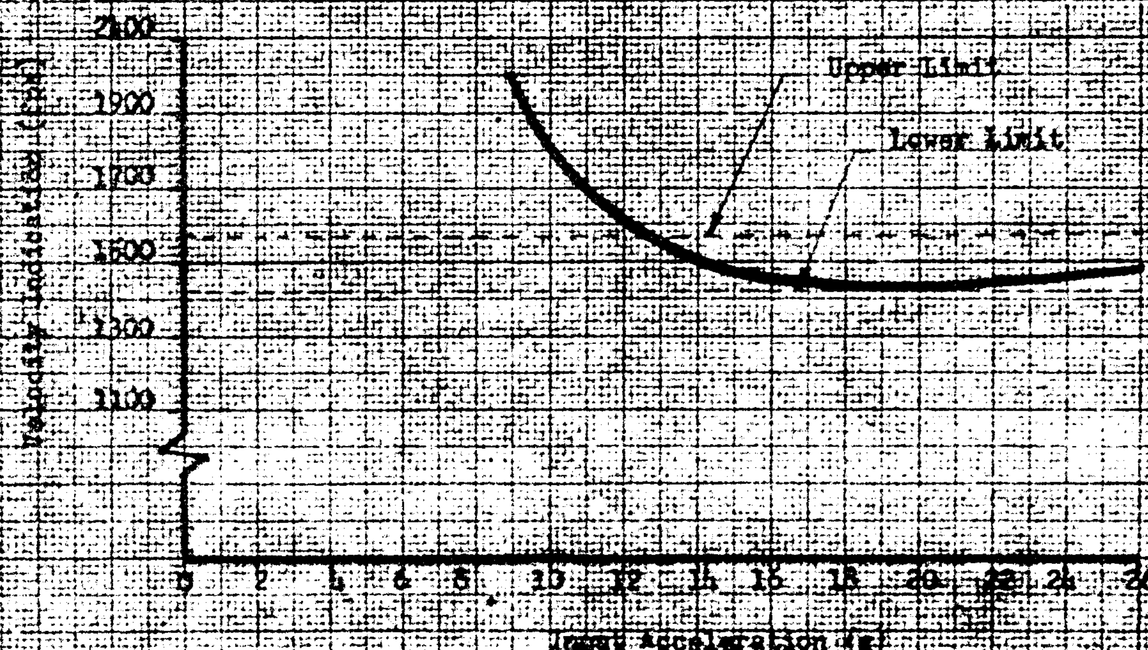

Fig. 2

Typical Curve
of
Velocity vs Temperature
for
MC-439

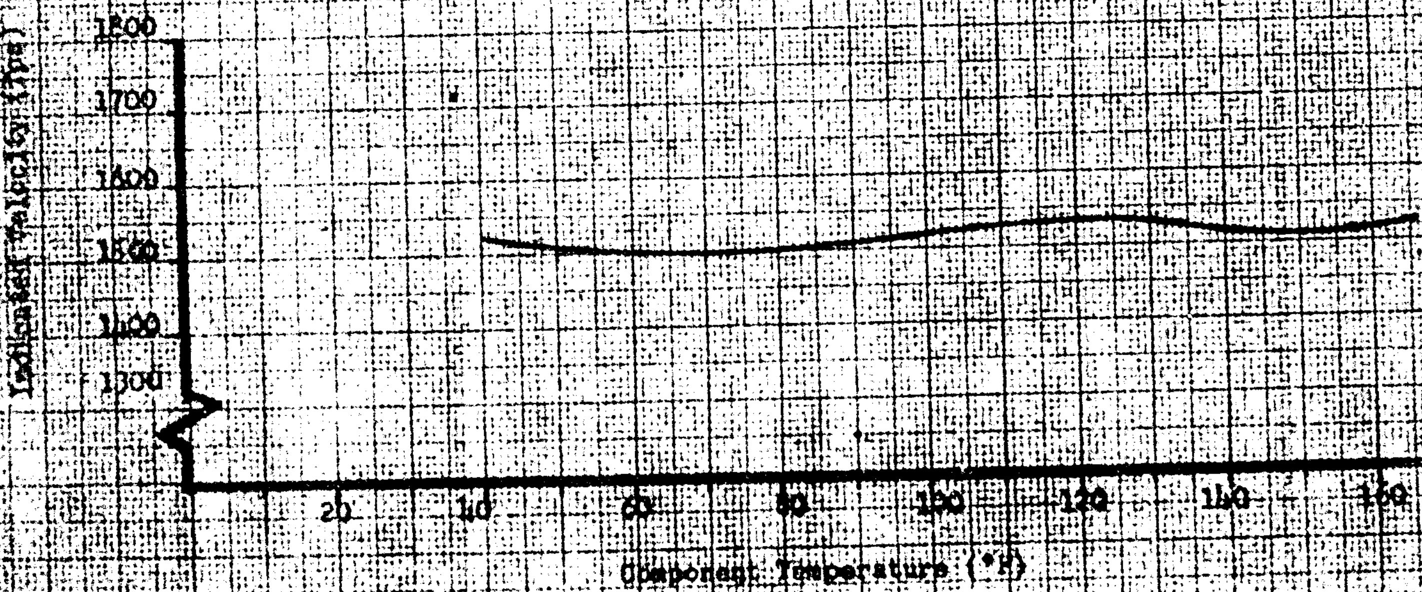

Fig. 3

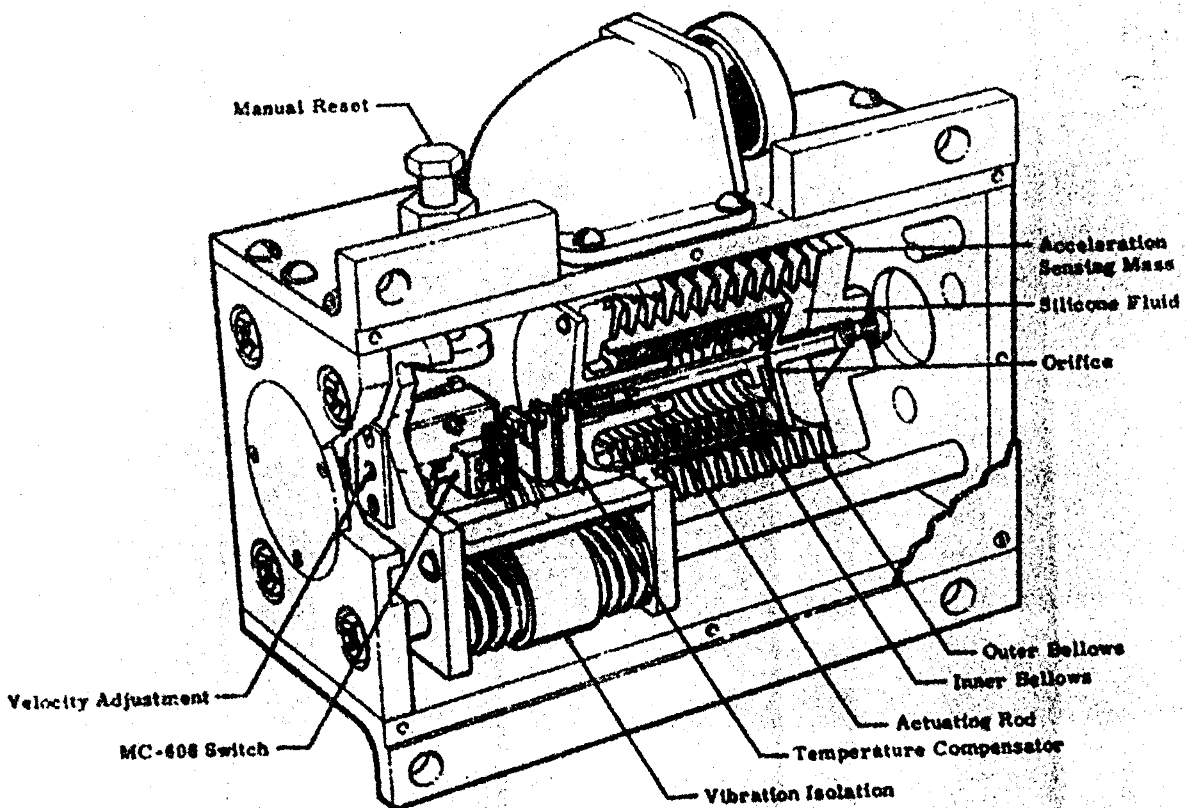

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Fig. 4 -- Cutaway view of the MC-439

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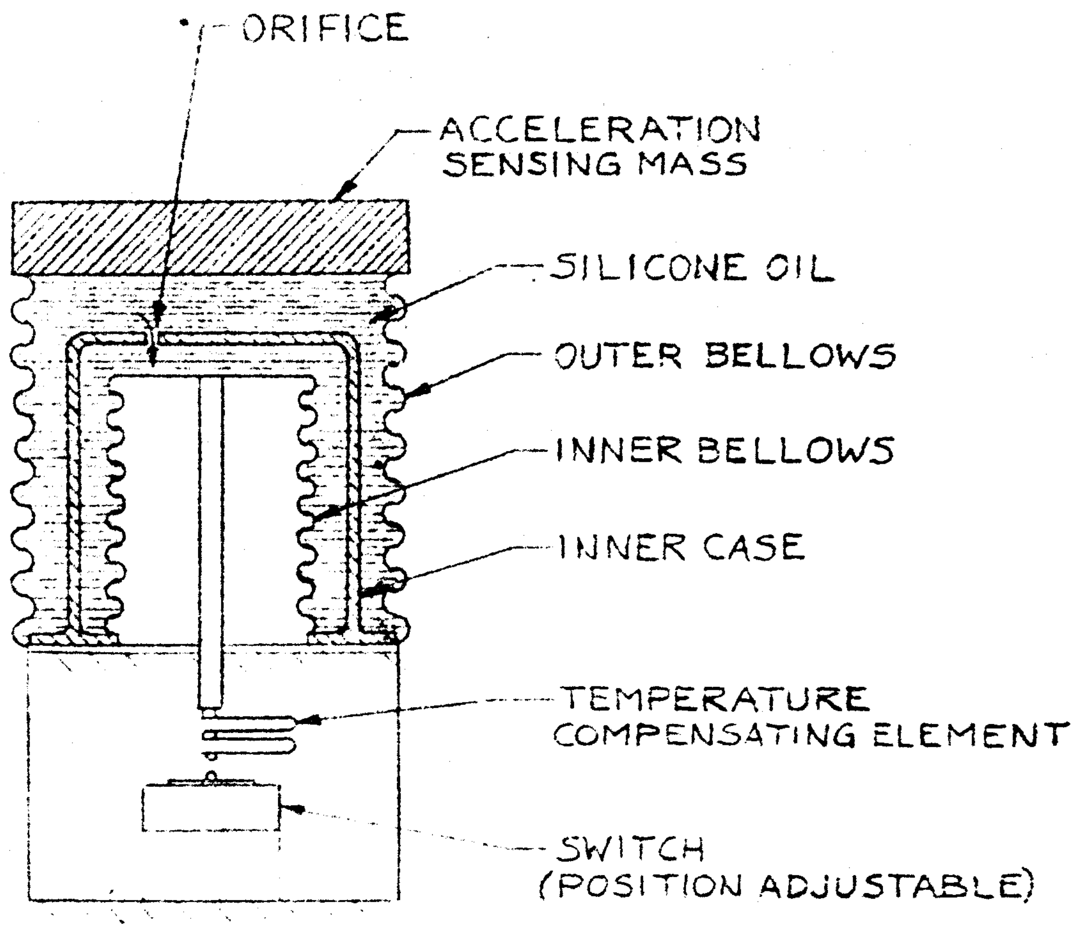

FIG. 6

SIMPLIFIED SCHEMATIC FOR MC-439

MC-606 Switch

The MC-606 switch is a miniature double-pole, double-throw switch which is actuated by deflecting a projected trigger. It is provided with a pull-wire for resetting. The switch is so designed that it will remain either in the reset or actuated position without external means for restraining or positioning.

SA-275 Vibration Isolators

The SA-275 vibration isolator is composed of a mounting spindle with two Met-L-Flex damping pads, each of which is contained inside of a helical compression spring. In the composite system, the spring forces and inertial forces predominate at all frequencies of SCS-7 except in the area of resonance and during shock, at which time the Met-L-Flex damper pads serve to keep the excursion within the physical limits of the system. The SA-275 is so designed that vibration isolation is afforded in the three mutually perpendicular axes, with particular emphasis placed on the longitudinal, or sensitive axes.

No production tester has been designated for use with the SA-275; however, Fig. 7 illustrates a "quick change" fixture used during development testing.

Temperature Compensator

The temperature compensator is a temperature-sensitive bimetallic unit with tandem elements. This device is attached to and varies the effective length of the actuating rod to compensate for variations in fluid viscosity caused by temperature changes. The change in fluid viscosity per degree of temperature is greater at low temperature. Consequently, the compensator loops are so arranged that at temperatures below +75°F both loops are active and at temperatures above +75°F one loop is physically restrained, leaving only one loop active.

To correct for transverse motion inherent with the U-shaped bimetal during expansion or contraction, a curved tip attached to the compensator is of a geometric configuration which provides a horizontal surface in proper alignment to actuage the MC-606 switch.

APPLICATION

The MC-439 was designed and developed for use as a safing component. As used in the TALOS XW-12 system, the MC-439 must actuate to permit charging of the X-unit and operating of the IFI. This then prevents a nuclear explosion should the TALOS-W fail to reach a predetermined minimum velocity.

Two MC-439's are used in parallel to reduce the probability of dud operation.

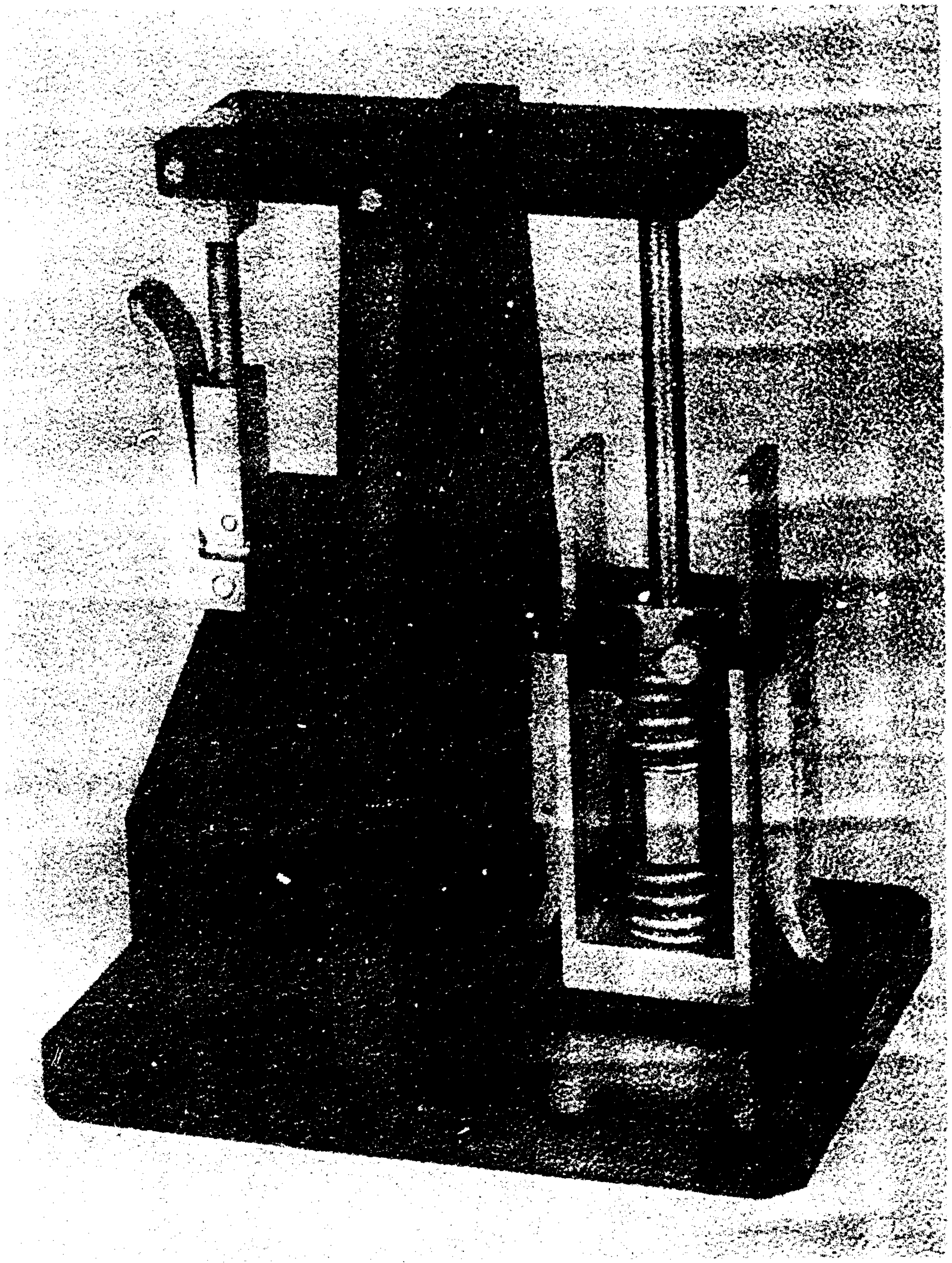

Fig. 7 -- Test fixture used during development to dynamic test the SA-275 Vibration Isolator

[redacted]

TEST AND RESULTS

The MC-439 development testing was performed in accordance with the conditions specified in memoranda from the weapon system group outlining the desired component characteristics. Copies of these memoranda are included in the Appendix.

Environmental Tests

Since SCS-7 was specified as the desired environmental criteria, the component development testing conformed to the applicable SCS-7 tests. During testing it was found that the MC-439 would not satisfactorily pass the vibration test. Inflight vibration proved to be less than originally anticipated; therefore, with the agreement of the weapon system group, the component was subjected to and passed a less severe test. This test was the same as that specified in SCS-7 except that the time duration was reduced by one half. Design improvements after design release resulted in an SA-275 which provided sufficient vibration resistance for the MC-439 to pass SCS-7. The MC-439 drawings were subsequently revised to reflect this improvement.

Results of the environmental program are summarized in Fig. 1.

Special Tests

The MC-439 was dynamically tested on a centrifuge by subjecting it to constant accelerations ranging from 9 to 25 g's. The time between the application of the acceleration and actuation of the MC-606 switch was measured. The actuation velocity for the various accelerations was then determined by the product of acceleration and the resulting actuation time. The test results are summarized on Fig. 1. A typical "acceleration vs velocity" characteristic is shown in Fig. 2.

Tests were also performed to determine the temperature characteristics of the MC-439. This was done by testing the MC-439 at various temperatures from +40°F to +165°F with a static weight representing an acceleration of approximately 18 g's. Results of this test showed that the temperature compensation characteristics were sufficiently repeatable that the MC-439 could be production-tested at two points, +40°F and +125°F, after calibration at +75°F. Results of the three-point temperature tests are summarized in Fig. 1. Figure 3 shows a typical curve of "velocity vs temperature".

Effects of Storage

Storage periods of at least 5 years should have no detrimental effects on the MC-439. The tests performed to evaluate its resistance to natural environments are noted in Fig. 1. The MC-439 specifications require exercising of the bellows assembly and heat-treatment of the temperature

[redacted]

[redacted]

compensating element to minimize drift in characteristics during storage. The testing tolerances in the specifications are adequate to provide for normal component drift and still insure satisfactory performance.

Weapon Tests

The MC-439 was flight tested in four TALOS-W flight tests. The results of these tests are summarized in Fig. 1.

Recommended Tests

The recommended tests are indicated and described on Fig. 1.

PRODUCTION

The MC-439 is controlled in production by the product specification PS-121070, NX-121070, and all drawings listed thereon. Greenleaf Manufacturing Company, St. Louis, Missouri, produced 48 prototype units that were used in the component development program. The cost of these units was approximately $475 each. On a production basis, the unit cost should be approximately $350. At the present time no production is scheduled. Figure 5 is a photograph of the manufactured product.

TEST EQUIPMENT

The functional testing during development was performed using a static weight of 8000 grams to simulate a constant acceleration of approximately 18 g's. At the present time, no production or procuring-agency test equipment has been designed for use with the MC-439, but the test requirements specify the same test methods that were used during the component development. If adequate care is exercised during the testing operation and the test equipment is of the accuracy specified, the testing operation error should be less than ± 1 per cent.

The field tester specified for use with the MC-439 is the T-231. It uses a spring force to simulate acceleration; consequently, leveling is not necessary and the desired shipboard field testing is possible.

A. K. RUE - 1472

D. T. WEEMC - 1472

Case No. 435.02
April 10, 1957

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APPENDIX

October 19, 1953
Ref. Sym: 1331(45)

MR. A. J. CLARK - 5432

Re: Revised Talos-W Requirement for an Integrating Accelerometer

This letter is intended to supersede our letter of June 10, 1953, (Ref. Sym: 1331(30), inasmuch as certain requirements have changed.

Our present requirements are as follows:

1. Reliability should be such that dud probability is 1/100.

2. Overall accuracy including calibration, setting and operational should not exceed ± 10%, over an adjustable velocity range of 1200 to 1800 feet per second.

3. Environmental conditions. SCS-7 should be used as a guide, with the exception that the operational temperature range should be + 40°F to + 165°F. The accuracy of (2) should be possible over this temperature range without the use of heaters.

4. Circuit use. This device will be used to arm the X-unit charge lines and the insertion line. Contacts will be used to control relay circuits, which will in turn handle the heavy current. A DPDT latch type switch is preferred. Electrical connector similar to MC-234.

5. Acceleration vs. time. This curve is the same as that attached to Ref. Sym: 1331(30).

6. Angle of launch. 30° - 55° from the horizontal.

7. Weight and size. Should be similar in size and weight to the MC-234.

8. Test equipment. Should be capable of being calibrated aboard ship as well as on land.

9. Time scales. Flight test number one will occur in December, 1953, with one flight test per month scheduled thereafter. Inasmuch as this is an accelerated program, we are shooting for a system CDR for August 1954, giving us only a total of eight flights before proposed CDR. This is why it is important that we fly our proposed

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components in as many of these tests as possible before August, 1954. We propose to use modified MC-234's for the first two flight tests. If the compensated model will not be ready for the February test, for example, we would like to know enough in advance so that we could procure and modify more MC-234's.

10. MC number. It would be of great value to us to have a new MC number assigned to the MC-234-B, so that we may refer to it on our parts lists and drawings.

Original signed by:

E.A.AAS - 1331-1

EAA:el:hn

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December 17, 1953

MR. A. J. CLARK - 5342

Re: Tolerance on the XMC-439

This letter confirms the verbal agreement concerning the ± 15% tolerance on the XMC-439. The ± 15% figure is acceptable to us, with the nominal center velocity to be 1,500 feet per second. We feel we can justify this seemingly large tolerance to the Navy on the basis of the item being a safing rather than a fuzing device.

There is some question as to where the tolerance on the tester fits in. 5431 indicates this tolerance to be on the order of 2 1/2%. Will this add to the ± 15% tolerance? The 15% figure will give a range of velocity of 1275 - 1725 feet per second.

We are looking at the upper temperature limit of 165°F, and feel there is some possibility that this may be lowered. A definite answer on this will be forthcoming soon.

Original signed by:

L. GUTIERREZ - 1331

EAA:1331-1:el:hn

Copy to:
W. E. Treibel, 1335
L. Gutierrez, 1331

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[redacted]

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April 9, 1954

Ref. Sym: 1331(65)

MR. A. J. CLARK - 5352

Re: XMC-439 Operational Requirements

In a letter to you dated December 17, 1953, tolerances for the XMC-439 were discussed. At that time the tolerances specified appeared attainable. However, the figure of 1500 ft/sec ± 15% over the temperature range of + 40° to + 130°F apparently is not compatible with the present capabilities of the XMC-439 design. Therefore, we have come to the conclusion that we should not specify tolerances, as such, but should rather state the requirements and permit you to set the tolerances to accomplish them.

As you know, the XMC-439 is to be used as a safety device and, therefore, should be safe from prematures and give reasonable assurance that the booster rocket has operated correctly. It is apparent that the later the device operates in the boost phase, the greater the chance of detecting bad rounds. It is also apparent that the later the device works, the tighter the tolerances become. Another reason for holding fairly close tolerances was the desire to assure good quality in the device. Based on these considerations we suggest that you work with the following requirements:

a. Total Impulse 55.8 to 70.4 g-seconds
b. Temperature + 40°F to + 130°F
c. Other environmental criteria - SCS-7
d. Operation 1000 - 1775 ft/sec

A curve of the Talos-W acceleration is attached. Note that the lower total impulse figure occurs under the low temperature condition. If these requirements are incompatible with XMC-439 design, we would appreciate early reports to that effect so that further consideration may be given to the problem.

It is requested that work be continued on design improvements to meet the original specification, but without delaying the accomplishment of a device to meet the above stated requirements. It is further requested that an informal report summarizing past work and future plans for temperature compensation for the XMC-439 be submitted to Division 1331.

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It is proposed that a meeting of representatives from 5352, 5431, and 1331 be held on Monday April 12, 1954, at 10:00 AM in Room 128, Building 880-II, to discuss these new requirements and their effect on various phases of the Talos-W program.

Original signed by:
L. GUTIERREZ - 1331

EAA:1331-1:el:hn

DISTRIBUTION:
1/5A - A. J. Clark, 5352
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