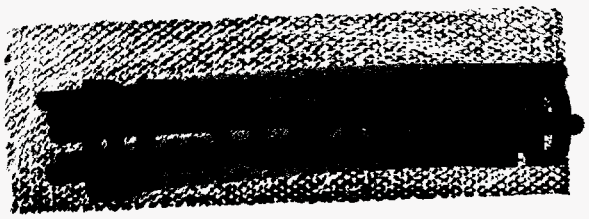

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Contract Number AT-33-1-GEN-53

MOUND LABORATORY

Operated By

MONSANTO CHEMICAL COMPANY

MIAMISBURG, OHIO

M. M. Haring
Laboratory Director

LABORATORY INSTRUMENT DESIGN PROGRESS REPORT

Date: January 1 to April 30, 1949

Prepared by: R. G. Olt

Distributed:

JUN 1 7 1949

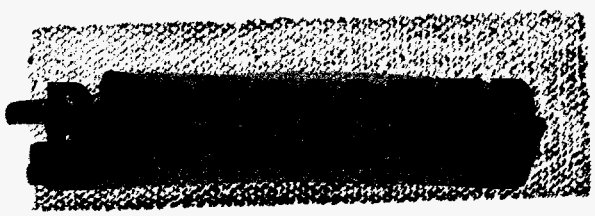

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TABLE OF CONTENTS

I. PERSONNEL

A. Group 7

R. L. Chaplin, Jr.*, D. L. Haas, L. A. Jewett, C. H. Mellor, R. G. Olt, S. R. Orr, E. J. Rosbac**, and E. W. Stautzenbach

* Transferred to Group 5, April 1, 1949.

** Vacation April 23, 1949.

II. ABSTRACT

A. Group 7

Starting with this report, research activities previously reported under:

1a. Quartz-Fiber Microbalance Research

1b. Quartz-Fiber Microbalance Design

1c. Quartz-Fiber Microbalance Construction and Maintenance will be reported under the following specific problem titles:

1. Quartz Fibers

   a. A Mechanism for Drawing Quartz Fibers

   b. Measurements of the Properties of Quartz Fibers

2. Quartz-Fiber Structures

   a. The Standard Torsion Equal-Arm Balance

1a. A Mechanism for Drawing Quartz Fibers

The development of improved means for drawing and handling long lengths of predetermined diameter quartz fibers is to be covered by this title.

Due to the problems associated with moving, there is no progress to report for this period.

[redacted]

1b. Measurements of the Properties of Quartz Fibers

The determination of strength, elastic constants, form, and structure of fibers as drawn and under various conditions of use will be covered by this title.

Due to the problems associated with moving, there is no progress to report for this period.

2a. The Standard Torsion Equal-Arm Balance

Analysis of the design and operating characteristics of the Kirk-Kraig type quartz-fiber microbalance and vacuum housing will be covered by this title.

Due to the problems associated with moving, there is no progress to report for this period.

3. Design and Construction of a Mass Spectrograph - D. L. Haas, C. L. Lesher, and C. H. Mellor

A mass spectrograph previously used at Hanford Engineer Works was received at this site on March 8, 1949. Considerable restoration and replacement of portions of both the analyzer tube and electrical systems will be required in order to place the instrument in usable condition.

4. Design and Construction of a Cloud Chamber - R. L. Chaplin, Jr.

A review of the principles and application of the cloud chamber and a proposal of a design for construction and use here has been reported in MIM-283.[1]

Work on the design and construction of a cloud chamber has been set aside until its useful application can be more clearly defined.

5. Refilling B-wall Tubes - C. H. Mellor

An experimental procedure has been formulated for investigating the possibility of refilling B-wall tubes. The equipment for evacuating and refilling has been set up and the initial experiments have been started.

III. DETAILED REPORT

A. Group 7

3. Design and Construction of a Mass Spectrograph - D. L. Haas, C. L. Lesher, and C. H. Mellor

[redacted]

A survey of mass spectrographs available within the Atomic Energy Commission indicated that an instrument located at the Hanford Engineer Works was capable of being adapted for use in research involving a wide range of masses.

Accordingly, transfer was arranged and the available portions of the instrument were received at this site on March 8, 1949 where the property number U.S.A.E.C. 14993 was assigned.

This spectrograph was originally constructed according to the style of Mattauch by Shaw and Rall[2] at the University of Chicago in 1939. After transfer to Hanford, modifications were made to the analyzer tube on the ion source side of the magnet changing the instrument from combined electric and magnetic (double) focusing to straight magnetic (single) focusing style.

On removal from the shipping crates, the instrument was examined for general condition and completeness. Obvious needs included complete replacement of the evacuation system and major reconstruction of the analyzer tube. The general state of the electrical portions indicated need for thorough testing and calibration in order to determine exact condition and suitableness for use. Repair of electrical breakdowns in the magnet coils and power supply units was necessary before calibrations could be made.

Since ions of different masses are separated in a mass spectrograph according to the radius of curvature they form while passing through a magnetic field, values used for control and analysis are determined from the radius of curvature according to the formula:

$$\rho = \frac{1}{B}\sqrt{\frac{2Vm}{ne}}$$

where:

m = mass of the particle.

V = the accelerating potential in abvolts.

n = the specific charge on the ion.

B = the magnetic flux density in gauss.

e = the electron charge in electromagnetic units.

ρ = the resulting radius of curvature in centimeters.

[redacted]

The radius of curvature is shown to be proportional to the square roots of the accelerating potential (V), the mass (m), and the inverse of the ion charge (n); and inversely proportional to the magnetic field strength (B).

In order to make accurate mass determinations and isotopic separations, it is imperative that the two variables V and B in the above formula remain very constant over a long period of time. Both of these terms (V and B) can be regulated by electronic controls.

It has been determined that the electrical regulation of the magnetic field, as the instrument was received, is one part in 20,000 which is adequate for stable resolution. However, the accelerating potential applied to the ionizing source was not stabilized.

For operation as a magnetic-focusing mass spectrograph, the accelerating potential should be regulated to one part in 10,000 over the approximate range of 900 to 3000 volts for complete coverage of masses from number one to number 400. Present plans anticipate provision of a suitably regulated potential source.

The portions of the ion source received with the spectrograph were designed for analysis of solid samples only. Work is underway on a design of an ion source which will be capable of accommodating both solid and gaseous samples.

IV. TIME DISTRIBUTION SUMMARY

	MAN-MONTHS					TOTAL
Classification	S-202	S-205-P	S-206-P	S-413	S-524	
Problem 1a						
1b						
2a						
3		2 1/2	2 1/2	2 1/2		7 1/2
4			3			3
5		1/2				1/2
Non-Research Activities and Services	4	1	5 1/2	1 1/2	12	24
Total						[redacted]

V. REFERENCES

1. Chaplin, R. L., Jr., Information Report, MLM-283, Mound Laboratory, Miamisburg, Ohio (February 21, 1949).

2. Shaw, A. E. and Rall, W., Rev. Sci. Inst., 278-288 (1947).

RGO/mrr

[redacted]