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Chemistry-Transuranic Elements

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The Emission Spectrum of Curium

John G. Conway, Milton F. Moore, and W. W. T. Crane

July 22, 1950

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THE EMISSION SPECTRUM OF CURIUM

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July 22, 1950

ABSTRACT

The wave lengths of the most prominent lines in the arc and spark spectra of curium have been measured. The region covered extended from 2516-5000 A. The wave lengths of the lines are given, together with a discussion of methods of spectrographic analysis of curium samples.

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THE EMISSION SPECTRUM OF CURIUM

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INTRODUCTION

In August of 1947 L. B. Werner[1] isolated a sufficient amount of curium that

(1) L. B. Werner, U. S. Atomic Energy Commission Declassified Document AECD-2729

a spectrochemical analysis could be performed. At that time the wave lengths of 54 lines were measured and these assigned to curium.[2] More recently W. W. Crane

(2) J. G. Conway and M. F. Moore, University of California Radiation Laboratory Report UCRL-78 (April, 1948).

isolated addition quantities of curium and a portion was made available for the further wave length measurements.

The handling of active elements such as curium requires many special protective techniques and equipment. To meet these requirements, a controlled atmosphere chamber and filter system was developed and constructed (see Figs. 1, 2, 3, and 4). Before sparking, the controlled atmosphere chamber is made air tight, so that during sparking, no activity can escape into the Berkeley glove box. To remove the activity created by the discharge during the sparking period, air is continuously flushed through the chamber and filter then exhausted onto the roof. The filter system is a six-foot train of loosely packed glass wool fibers connected to the chamber's air outlet. The Berkeley glove boxes are maintained with a separate filter system under negative pressure at all times.

Fig. 1. General view of Berkeley glove boxes and spectrograph.

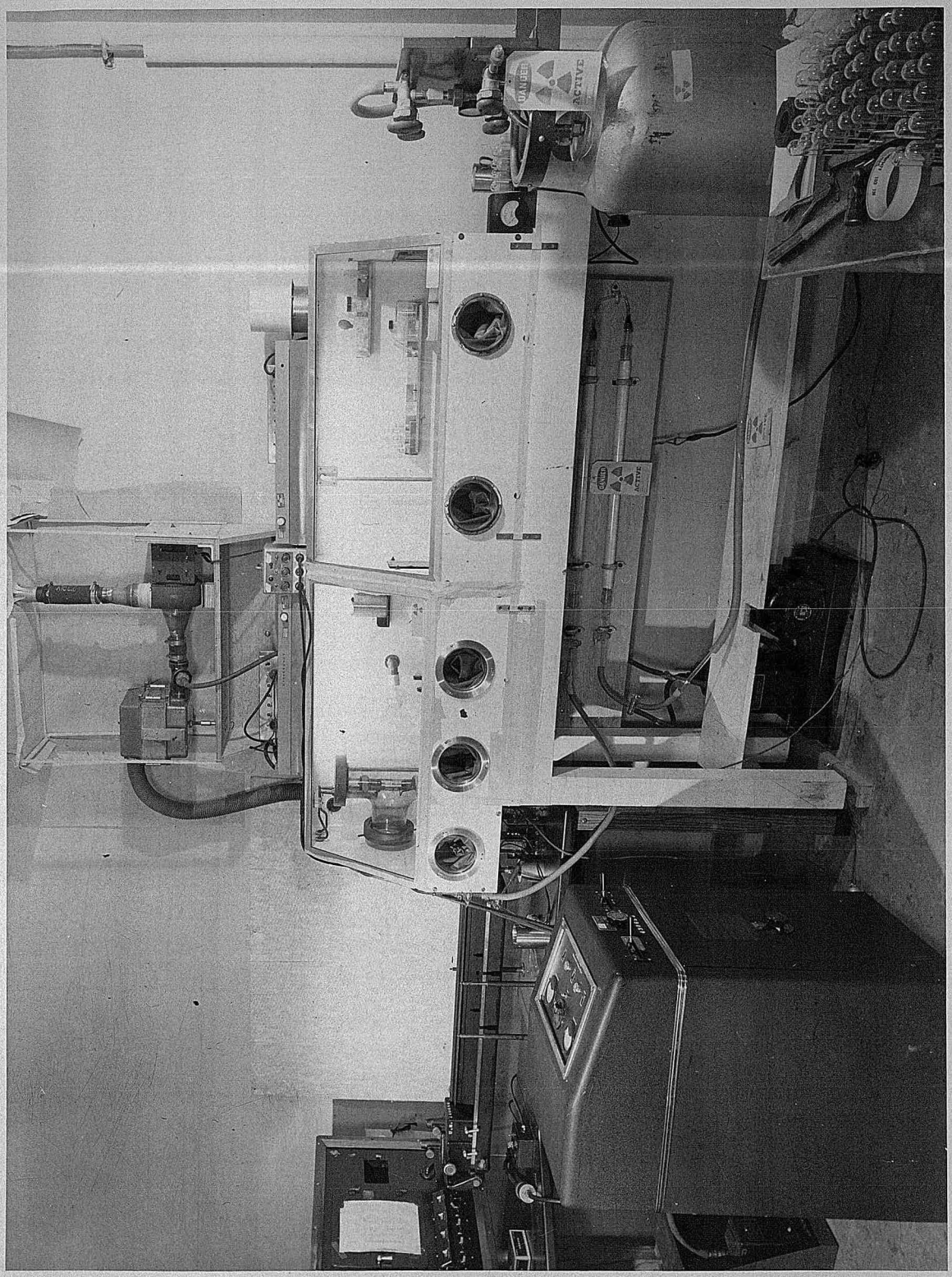

FIG. 1

KODAK—SAFETY FILM
OZ 940

Fig. 2. Controlled atmosphere chamber in open position for changing electrodes.

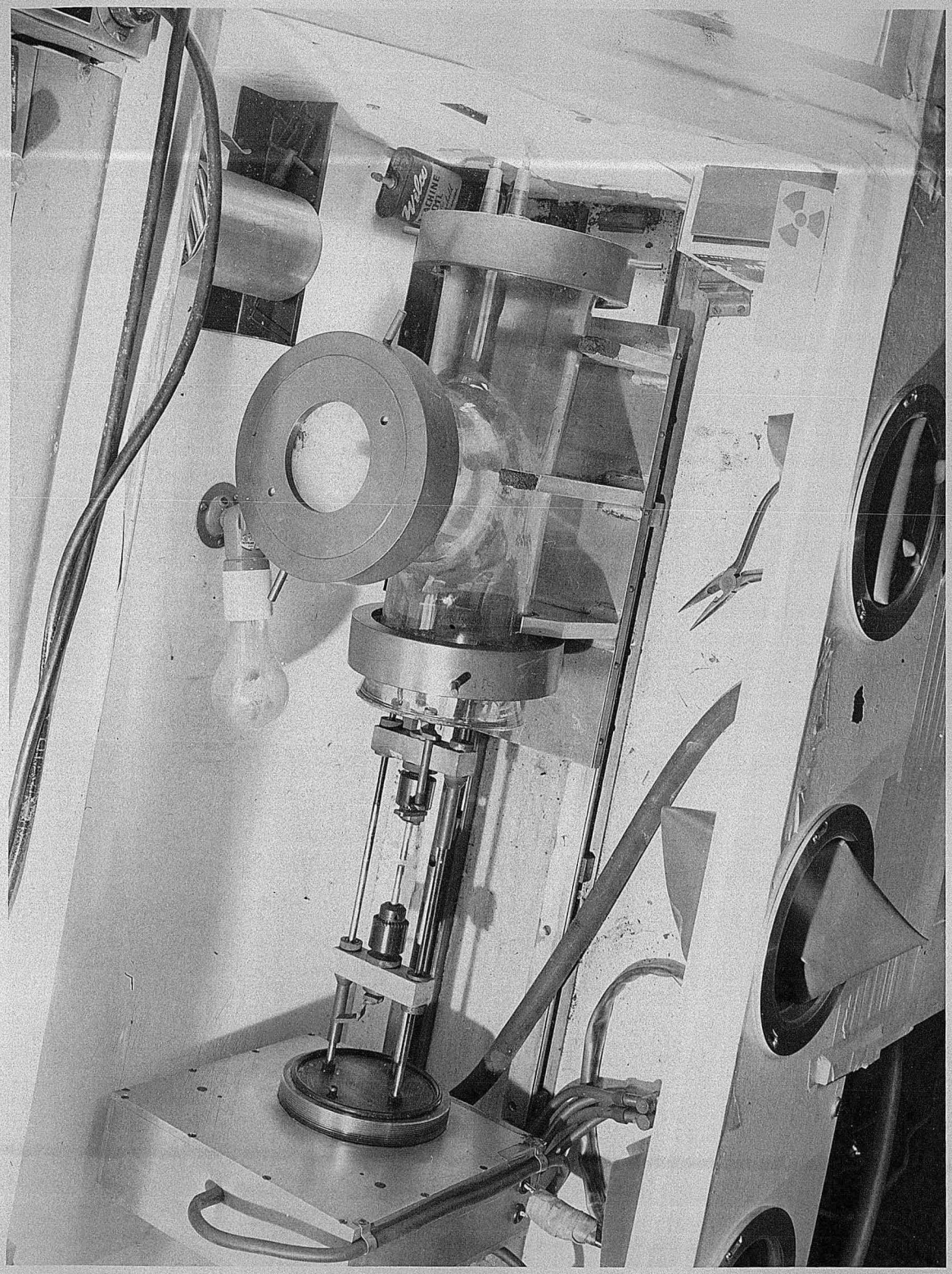

FIG. 2

OZ 941

Fig. 3. Controlled atmosphere chamber in sparking position mounted in Berkeley glove box.

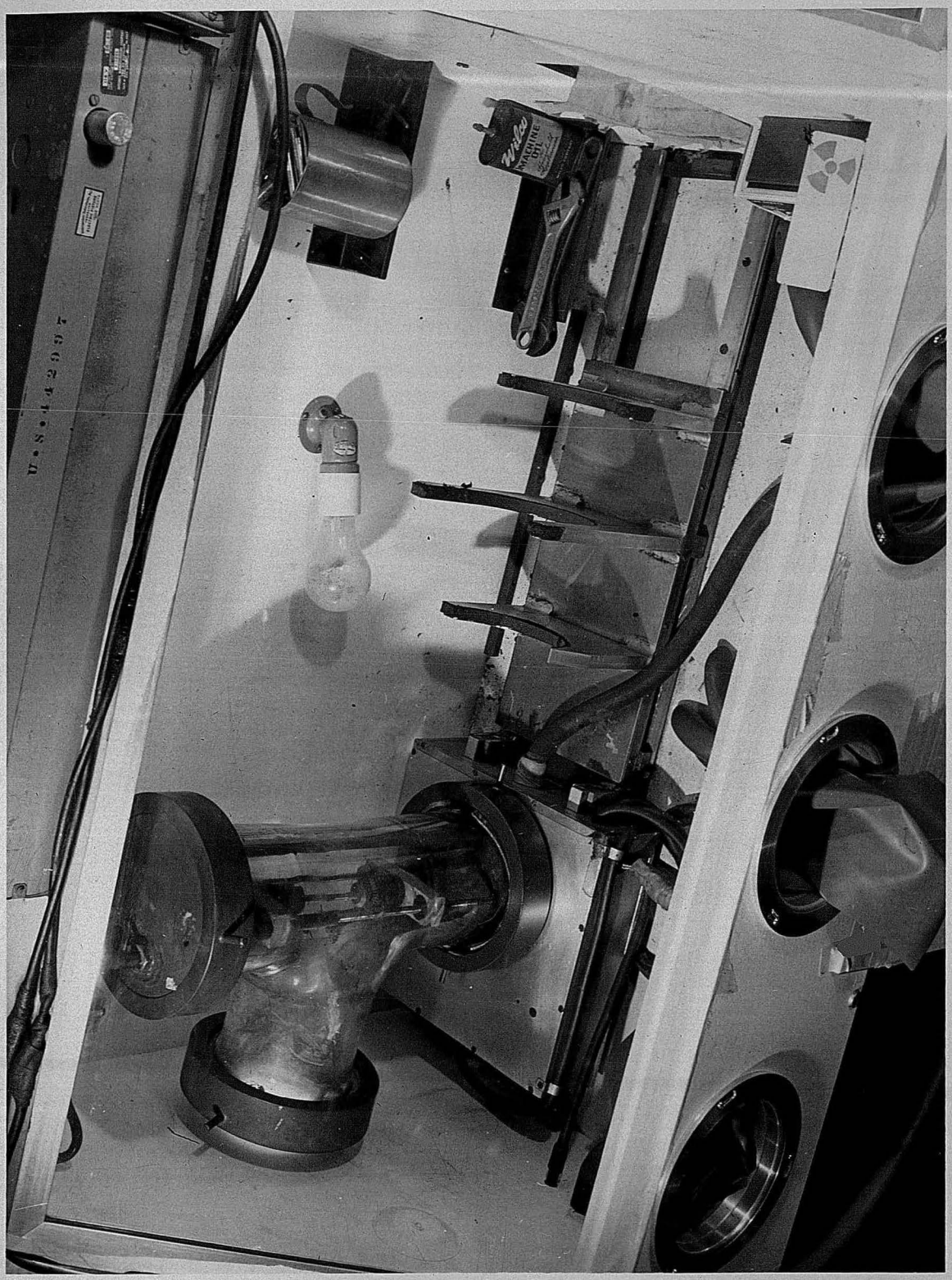

FIG. 3

Fig. 4. A. Cu electrodes held by jacobs chucks.

B. Pyrex glass pipe 4" diameter.

C. Motors to adjust electrode separation (27 VDC).

D. Quartz window 5 1/8" diameter, 1/4" thick.

E. Air inlet.

F. Air outlet.

G. "O" ring gaskets.

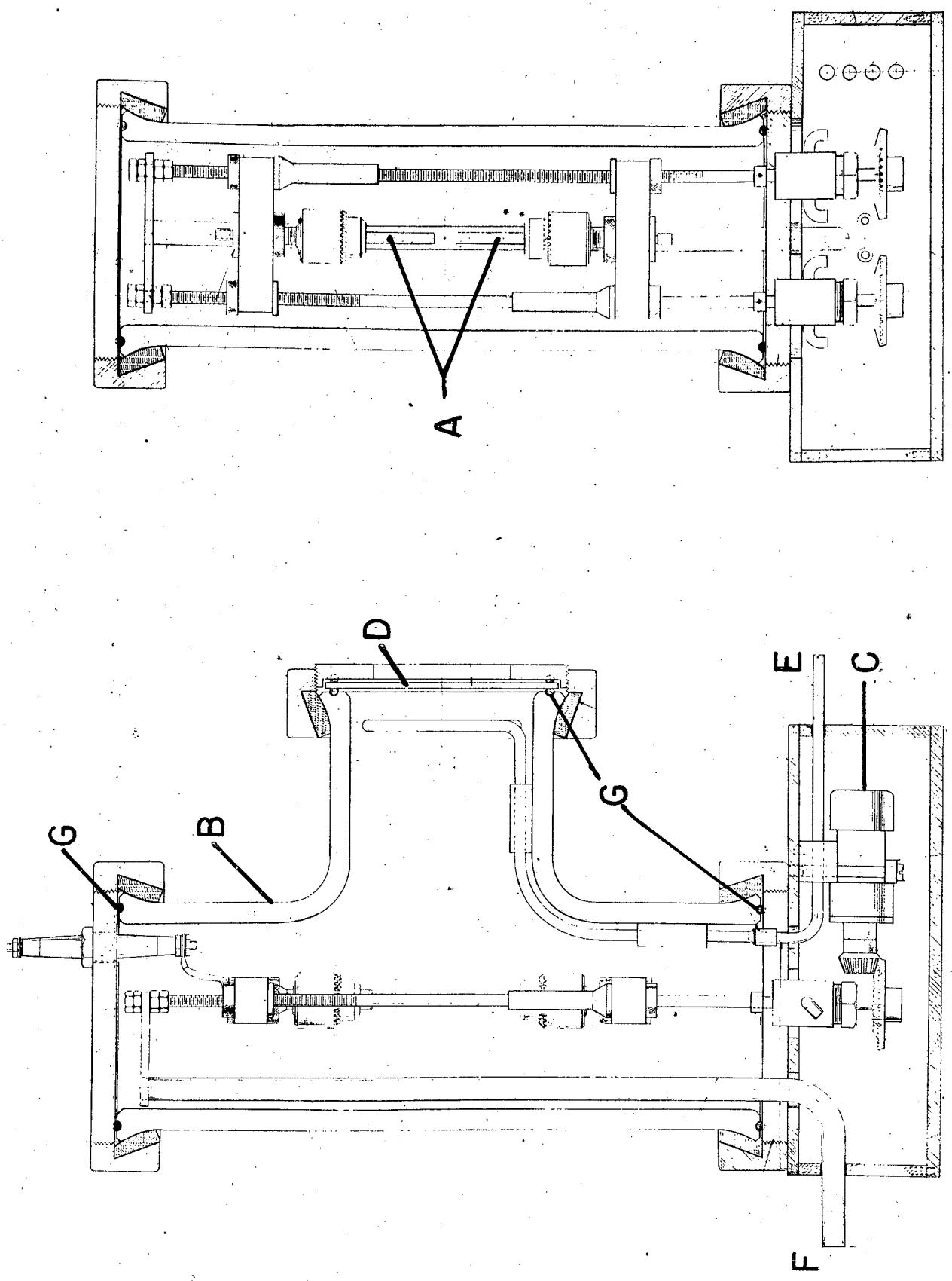

FIG. 4

The curium was supplied in 0.1N HCl solution. One microgram aliquots were evaporated on 1/4" copper electrodes[3,4] and sparked for 15 seconds using an

(3) M. Fred, N. H. Nachtrieb, and F. S. Tomkins, J. Optical Soc. Am., 37, 279 (1947).
(4) M. C. Bachelder, J. G. Conway, N. H. Nachtrieb, and B. S. Wildi, U. S. Atomic Energy Commission Declassified Document MDDC-511 (Dec., 1946).

Applied Research Laboratory unit with 0.021 mfd and 0.36 mh at 100 volts. (See Fig. 5 - sample preparation box.) For arcing one microgram, aliquots were evaporated on 1/8" special spectroscopic graphite and burned at 7 amperes D.C. for 15 seconds. The Cynangen Bands were greatly reduced by the circulation of oxygen through the chamber during the arcing period.

The spectra were photographed in the first order on a Baird modified eagle mount spectrograph using a 25 micron slit. Eastman 103-O and 103-F plates were used. The lines were measured with a Baush and Lomb spectrum measuring magnifier. Copper lines were used as wave length standards in the spark and iron lines in the arc.

RESULTS

See Table I. The wavelengths are good to 0.2 A. Background and band structure limit the number of lines that can be observed in the arc spectra.

Fig. 5. Sample preparation box.

FIG. 5

Table I

Wave Lengths of Curium

Wave Length	Intensity Spark	Wave Length	Intensity Spark	Wave Length	Intensity Spark
2516.0	2	2968.9	4	3473.5*	7
2562.3	1	2984.5	3	3492.9	2
2585.8	2	2996.2	3	3498.9*	5
2616.8	2	2998.3	3	3503.7	3
2617.2	3	2998.8	2	3510.3	3
2625.4	2	3000.8	2	3518.5	2
2628.2	2	3004.1	2	3546.1*	5
2636.2	3	3037.4	2	3550.3	3
2651.1	4	3044.7	6	3567.4*	5
2653.7	4	3046.6	5	3570.4*	2
2677.0	1	3047.5	2	3573.0*	5
2693.8	1	3050.8	2	3581.3*	3
2704.8	1	3059.0	2	3585.6*	3
2707.1	1	3081.6	4	3591.9*	2
2710.1	1	3092.8	4	3619.9	2
2725.6	2	3096.4	1	3639.9	1
2727.7	3	3101.5	1	3643.5	1
2736.8	3	3104.9	1	3670.4*	2
2748.0	1	3118.3	3	3673.2	3
2773.5	2	3143.9	1	3691.7	3
2792.0	1	3161.8	3	3692.5*	3
2796.2	1	3186.4	1	3696.4	3
2796.4	1	3190.3	1	3697.3	2
2811.5	5	3195.6	1	3708.8	1
2817.4	4	3197.0	3	3709.6	1
2821.5	4	3197.5	2	3723.3	3
2832.2	6	3198.0	3	3732.3	3
2833.7	4	3210.0	4	3738.2*	3
2862.2	2	3220.7	6	3739.3*	4
2862.8	2	3230.3	4	3750.5	3
2872.0	3	3238.6	2	3763.6	4
2882.3	1	3252.6*	2	3767.3	3
2888.5	2	3279.4*	2	3778.2*	4
2888.1	1	3296.7*	6	3788.0	1
2909.1	2	3304.9*	2	3799.5	3
2913.1	4	3367.9*	3	3842.1	3
2920.7	5	3374.3*	3	3846.9*	2
2929.0	2	3382.7	2	3903.9	7
2933.2	3	3392.0	3	3908.2	6
2934.9	3	3417.1*	6	3936.6*	5
2935.4	3	3424.2	1	3941.5	1
2944.5	2	3425.9*	6	3942.1	1
2953.0	3	3436.5	1	3947.9	3
2955.6	2	3439.9	3	3948.8	2
2957.5	4	3446.6	2	3953.3	1
2961.8	2	3458.3	1	3957.5	1
2963.0	2	3461.7	7	3960.8*	2

Wave Length	Intensity Spark	Wave Length	Intensity Spark	Wave Length	Intensity Arc
3962.2	2	4239.8	3	2832.2	9
3962.8	2	4283.0	1	3019.6	9
3965.0	2	4289.2	1	3943.7	9
3970.2	2	4293.0	1		
3974.9*	6	4299.1	1		
3984.6	2	4301.5	5		
3990.9	1	4309.7	1		
4003.3*	8	4313.1	4		
4016.2	1	4318.7	3		
4017.0	1	4323.4	5		
4017.9	2	4324.8	4		
4018.4	2	4357.2	2		
4024.5*	3	4433.7	3		
4028.0*	2	4434.2	2		
4031.6*	1	4435.3	2		
4036.4	2	4442.0	3		
4052.4	1	4446.5	1		
4061.6	1	4455.2	2		
4078.9*	4	4546.9	1		
4089.8	4	4570.1	2		
4106.9	3	4608.3	2		
4118.1	2	4632.1	1		
4128.5	2	4665.4	2		
4130.4	2	4670.4	2		
4141.3*	3	4681.8	2		
4148.2	1	4722.8	4		
4156.5	1	4761.6	1		
4156.0	4	4873.8	3		
4164.3	1	4880.5	3		
4188.4	2	4905.6	4		
4194.3	2	4906.3	1		
4202.4	1	4925.5	3		
4208.0	6	4989.9	1		
4218.6	3				

*Lines also found in 1947 experiment.

This work was performed under the auspices of the U. S. Atomic Energy Commission.