

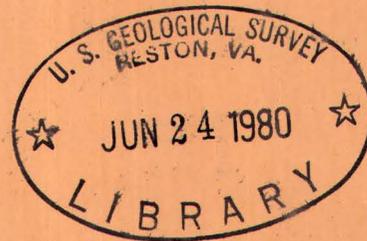
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# The Design of the Model V Transmission Fluorimeter

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THE DESIGN OF THE MODEL V TRANSMISSION FLUORIMETER

by

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Trace Elements Investigations Report 133



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## ABSTRACT

A transmission fluorimeter for the measurement of the fluorescence of uranium in fluoride melts is described. The instrument incorporates several improved features which have not been published previously. Unlike the earliest models, the design of the new fluorimeter, with its close machining of parts, reduces the possibility of light leakage and also increases considerably the ease with which the various components of the instrument may be assembled and adjusted. The Model V fluorimeter is a very rugged instrument with a compact arrangement of parts. It possesses great flexibility so that various phototubes, measuring devices, light sources, and filter combinations may be used interchangeably.

Detailed shop drawings are given for the construction of the fluorimeter.

## INTRODUCTION

The use of transmission fluorimeters for the measurement of the fluorescence of uranium in fluoride melts has been discussed in other papers.<sup>1,2,3,4/</sup> The Model II fluorimeter was described <sup>1,2/</sup> without detailed drawings inasmuch as it was an experimental model.

Newer models have been built, and the Model V instrument described in this paper incorporates the various improved features of these instruments. No further marked changes in design are contemplated, and therefore we are presenting detailed drawings of the instrument.

Like earlier models, the Model V was designed to be a rugged, light-tight instrument, with compact arrangement of parts and great flexibility. Various phototubes, measuring devices, light sources, and filter combinations may be used interchangeably. The chief difference between the two "fluorimeters" is that the Model II is rectangular whereas the Model V is cylindrical.

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<sup>1/</sup> Fletcher, Mary H., U. S. Geol. Survey, Trace Elements Investigations Rept. 130 (in preparation).

<sup>2/</sup> Fletcher, Mary H., May, Irving, and Slavin, Morris, A transmission fluorimeter for use in the fluorimetric method of analysis for uranium: U. S. Geol. Survey, Trace Elements Investigations Rept. 104, August 1949.

<sup>3/</sup> May, Irving, and Fletcher, Mary H., A preliminary report on a transmission fluorimeter: U. S. Geol. Survey, Report TWC-184, 1948.

<sup>4/</sup> May, Irving, and Fletcher, Mary H., A battery-powered fluorimeter for the determination of uranium: U. S. Geol. Survey, Trace Elements Investigations Rept. 135 (in preparation).

For clarity the word "fluorimeter," in quotation marks, as used in this paper refers to that part of the complete fluorimeter which houses the filters, sample slide, and shutter.

The Model V "fluorimeter" is machined from solid brass. The "fluorimeter" head includes the sample slide, shutter, and a holder for the primary filters. The sample slide is provided with adaptors so that several sizes of fluoride melts may be accommodated. The secondary filters are in the bottom plate which screws into the "fluorimeter" head. The bottom plates are of two types--A and B. Type A is used with an RCA-1P21 photomultiplier tube or with the Photovolt Electronic Photometer (Model 512). It is threaded to fit the Photovolt search unit. Housings for the 1P21 photomultiplier tubes were built to have the same thread as the Photovolt search unit so that either phototube can be used with the type-A plate. The type-A plate is constructed so that phototube housings can be removed or installed while the fluorimeter is in position on the supporting stand. The type-B bottom plate is used with the RCA 5819 photomultiplier tube. The Cinch No. 3M14 socket with mounting ring 3R14 is used with this tube.

The filter holders are made for two-inch-square filters. An adaptor ring for each filter holder permits the use of filters of different thicknesses.

The instrument is shown in detail in figures 1 - 7. In figure 1, one-half of drawing A is a section showing the fluorimeter assembly with type-A bottom plate and Photovolt search unit in place; figure 1,

drawing B shows the arrangement with type-B bottom plate and RCA 5819 photomultiplier tube. The stand, lamp support, and shield are the same for both arrangements. Figure 2 is a cut-away drawing showing additional details of the "fluorimeter." The remaining figures are detailed shop drawings for the construction of parts shown in figures 1 and 2. All parts of the "fluorimeter" shown in figures 3 and 4 must be machined to a class-4 fit or better; those shown in figure 5 need be only a class-3 fit.

A thin glass disc (not shown in the figures) is required in the sample slide under the adaptor ring. The purpose of this disc is to prevent flakes of the sample from falling into the fluorimeter. This glass must be nonfluorescent. We have found that discs cut from photographic plates used in spectrum analysis are satisfactory.

The lamp shown in figure 1 is a General Electric EH-4 or CH-4 lamp. This lamp requires a porcelain socket with an admedium base. It is operated with a Sola No. 30, 852 Constant Voltage Transformer designed especially for H-4 lamps. The lamp temperature is controlled by ventilation with a "Bon-Air" Darkroom Ventilator.

The primary filters are two-inch-square Corning No. 5874 ultra-violet filters, polished thickness. Two of these filters are generally used. The secondary filters may be either a combination of Corning filters No. 3486 and 9780, moulded or polished thickness, or an interference filter peaked for maximum transmission at 5550A.

Various combinations of phototubes, and current amplifying and

measuring devices which may be used with this "fluorimeter" have been described elsewhere.<sup>5,6/</sup>

#### ACKNOWLEDGMENTS

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We are especially indebted to Alexander E. Herold, Jr., who did all of the machine work and made many valuable contributions to the final design.

Special thanks are also due to Joseph Ramish who assisted in the original design, and to John V. Waitowitz, Melvin E. Hanes, and Karl M. Kozee who prepared the drawings appearing in this paper.

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<sup>5/</sup> Fletcher, Mary H., May, Irving, and Slavin, Morris, A transmission fluorimeter for use in the fluorimetric method of analysis for uranium: U. S. Geol Survey, Trace Elements Investigations Rept. 104, August 1949.

<sup>6/</sup> May, Irving, and Fletcher, Mary H., A battery-powered fluorimeter for the determination of uranium: U. S. Geol. Survey, Trace Elements Investigations Rept. 135 (in preparation).

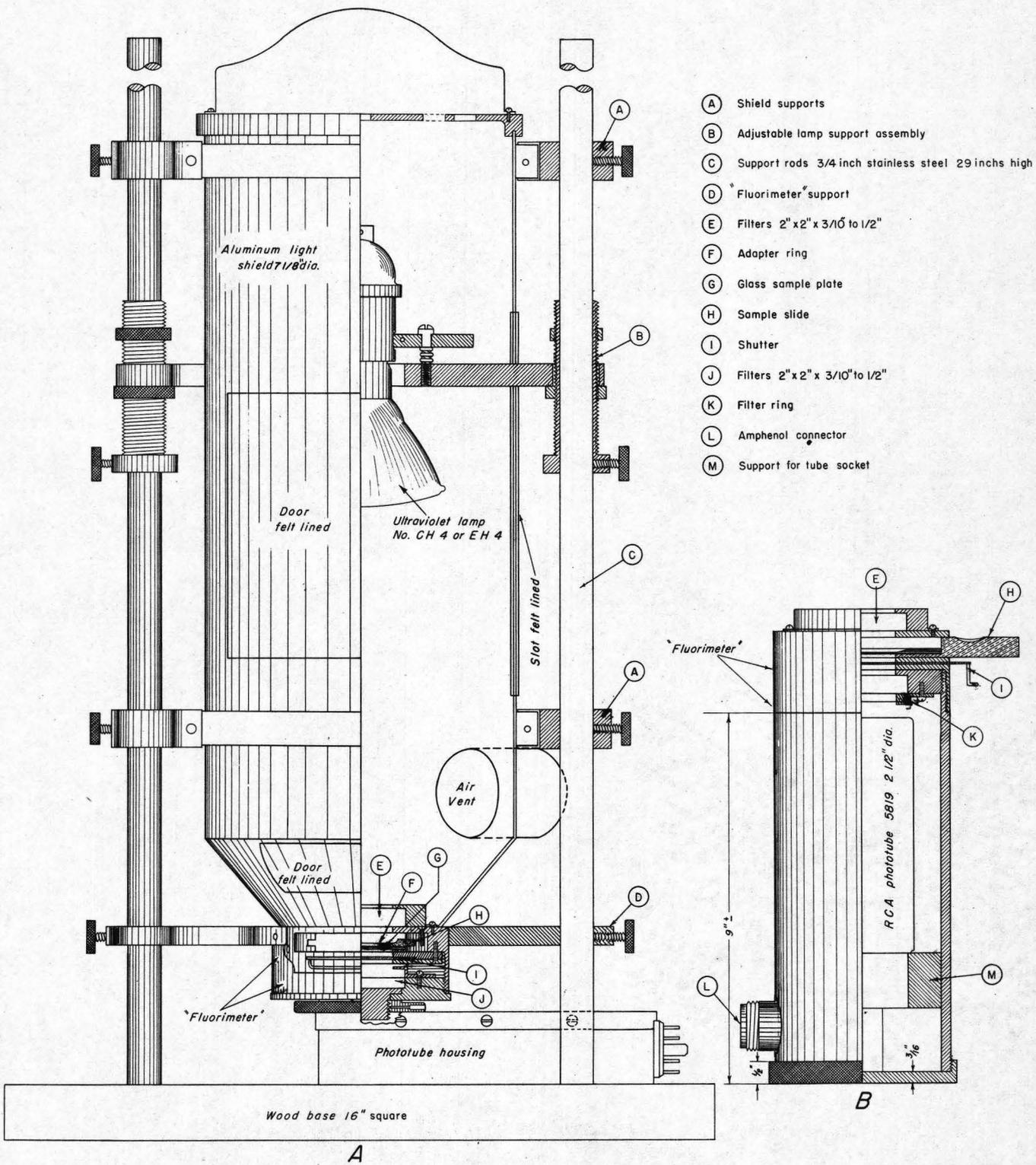
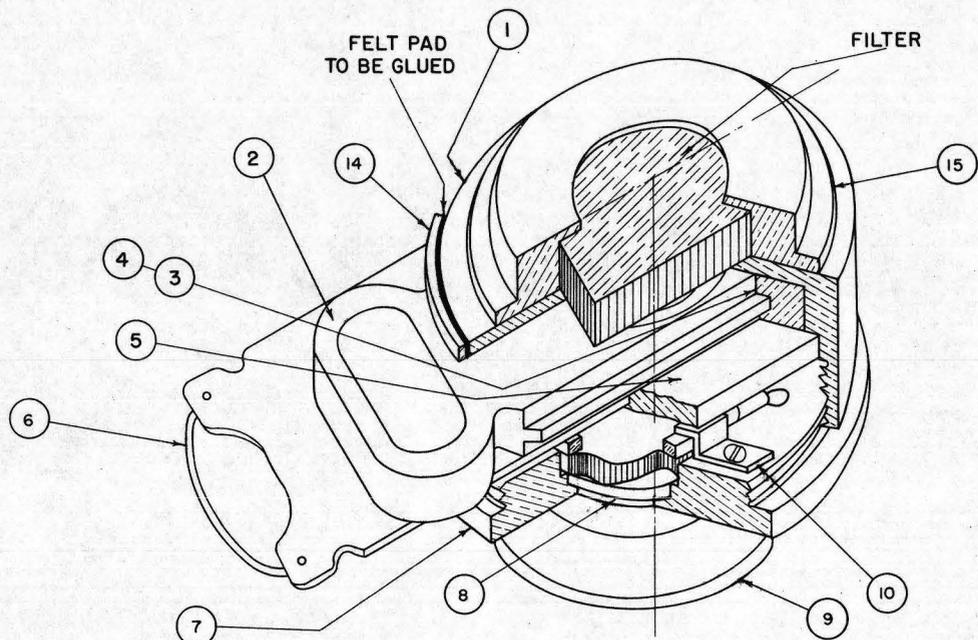
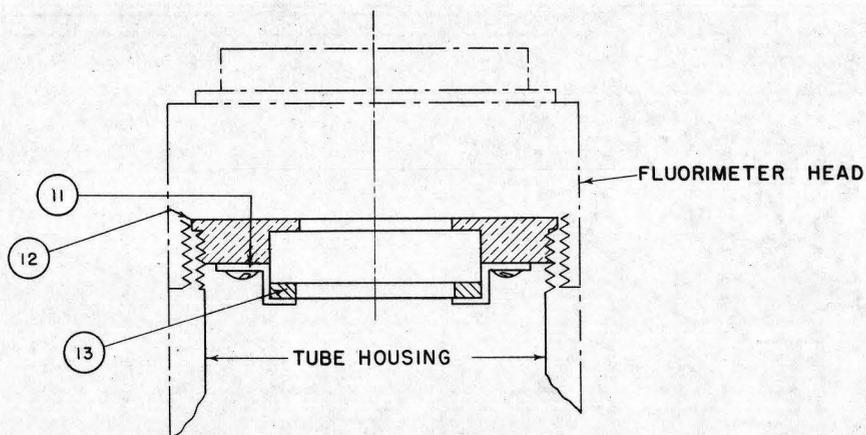


Figure 1- Fluorimeter assembly



"FLUORIMETER" ASSEMBLY WITH BOTTOM FILTER PLATE TYPE "A"  
CUT AWAY SECTION EXPOSING CONSTRUCTION, SHUTTER OPEN



CROSS - SECTION OF BOTTOM FILTER PLATE "B"  
AT ASSEMBLY IN TUBE

Figure 2 - "Fluorimeter" - cut-away and and cross-section

	SLIDE ADAPTER RING		4	BRASS	SHEET
	FLAT HEAD SCREW	No. 6-32 x 7/16	4	"	
	FLAT HEAD SCREW	No. 8-32 x 5/8	4	"	
	BOLT	2-56 x 1/8	1	"	
	HDLS. SET SCREW	No. 4-40 x 7/8	1	"	
	BUTTON HD. SCREW	No. 4-40 x 1/4	12	"	
	BUTTON HD. SCREW	No. 8-32 x 1/4	2	"	
15	TOP PLATE		1	"	FIG. 4
14	BLACK OUT PLATE		1	"	" 4
13	FILTER RING		2	"	" 4
12	FILTER PLATE		1	"	" 4
11	FILTER CLIP		4	"	" 3
10	FILTER CLIP		4	"	" 3
9	SPANNER NUT		1	"	" 4
8	PLATE FLANGE		1	"	" 4
7	BOTTOM FILTER PLATE		1	"	" 4
6	SHUTTER		1	"	" 3
5	SHUTTER SLIDE		1	"	" 3
4	SLIDE GUIDE L.H.		1	"	" 3
3	SLIDE GUIDE R.H.		1	"	" 3
2	SAMPLE SLIDE		1	"	" 3
1	FLUORIMETER HOUSING		1	BRASS	FIG. 3

ALL FITTINGS TO BE LIGHT TIGHT



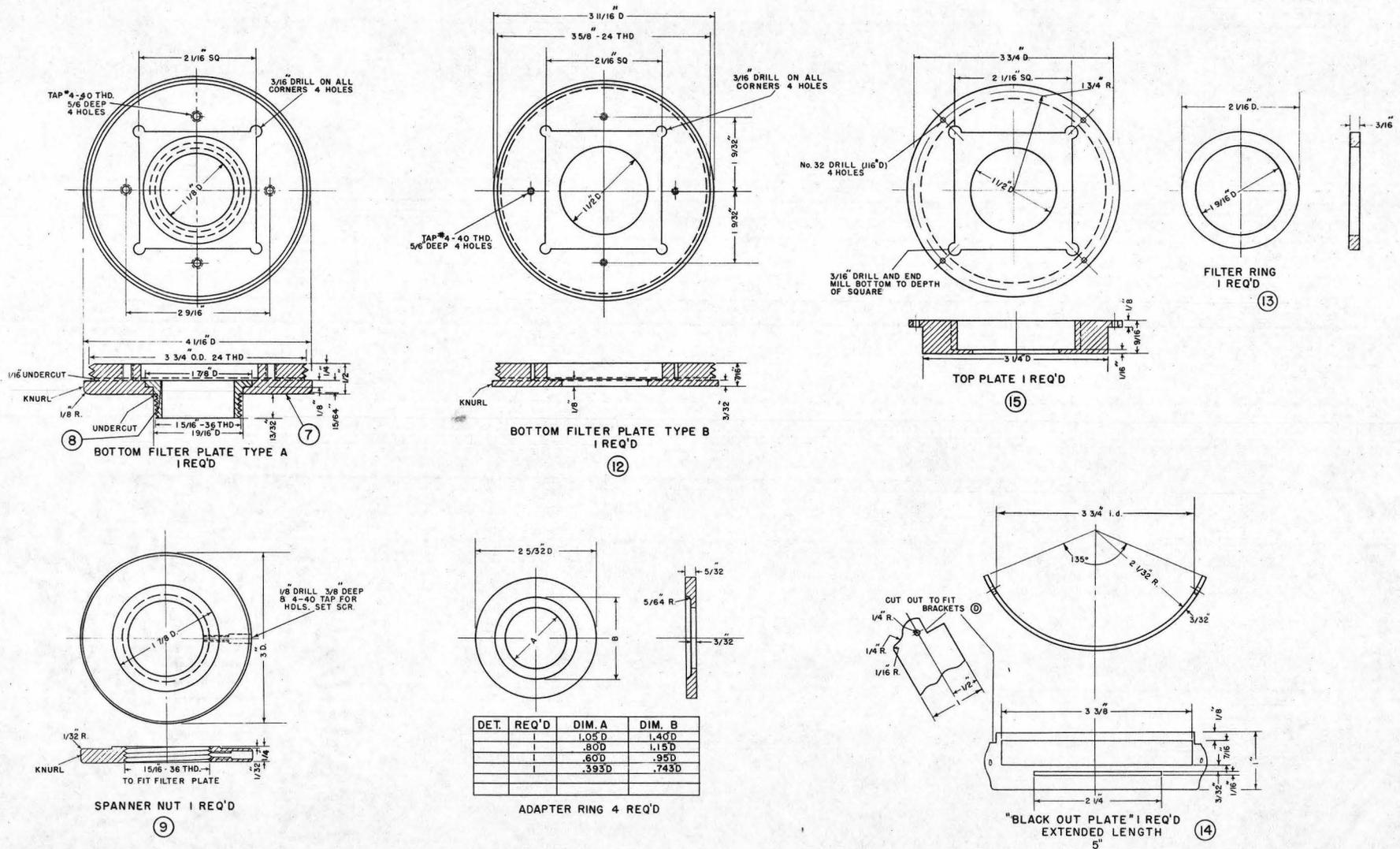


Figure 4 - Details of parts shown in Figure 2





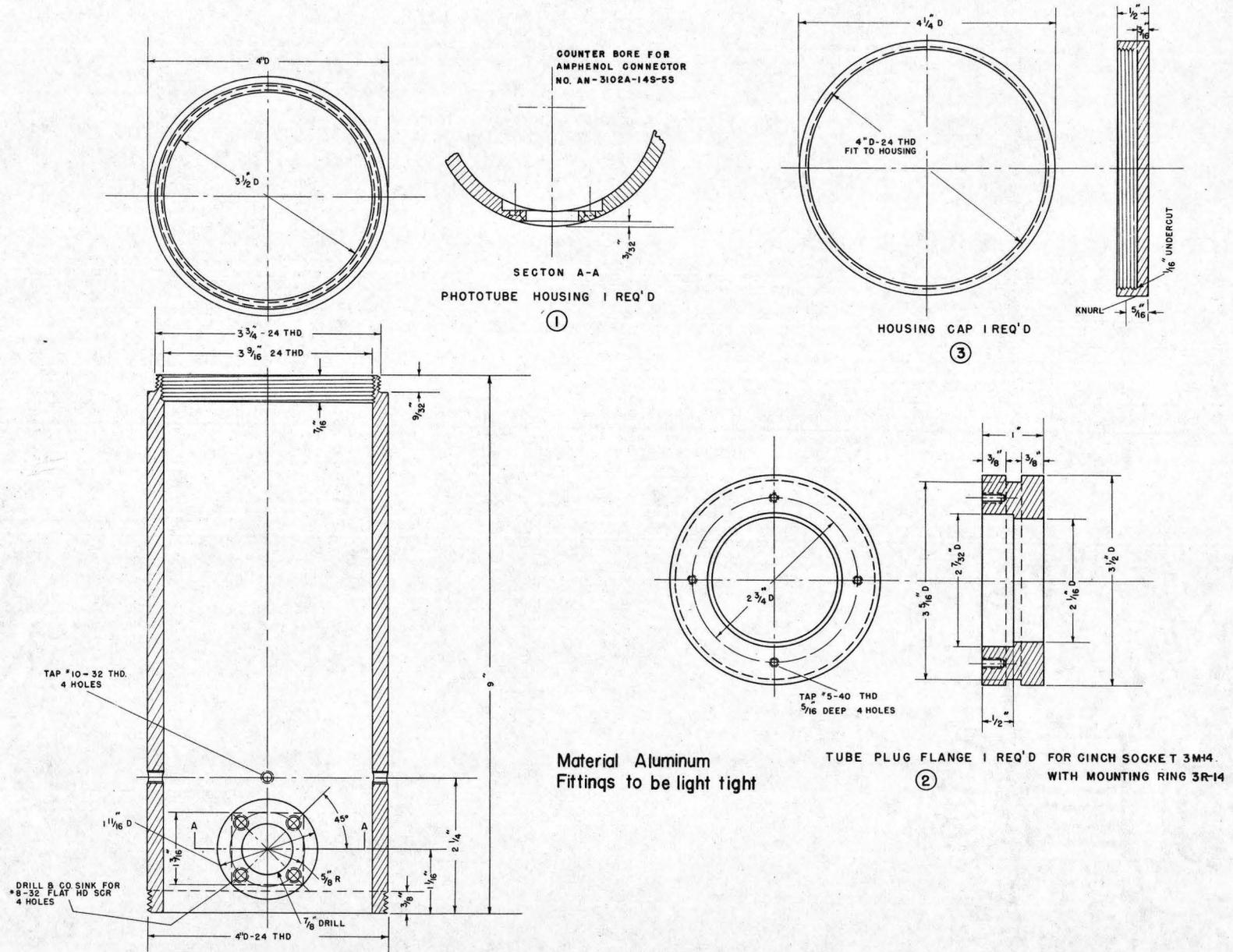


Figure 7 - Details of construction of Phototube housing Type B