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FINAL REPORT
FOR
SSD-52801

(September, 1971 - April, 1972)

Contract No. NAS5-11487

Prepared By

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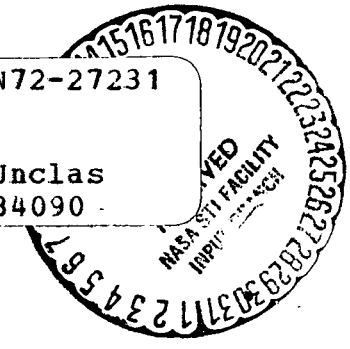

Prepared For

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

FINAL REPORT

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Contract No. NAS5-11487

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ABSTRACT

This report covers the work performed for the construction and delivery of four SSD-52801 RF Mass Spectrometer Tubes (7-5-5) by Sperry Electronic Tube Division. These tubes were delivered to the Goddard Space Flight Center under Contract NAS5-11487 during the period September, 1971 to April, 1972.

SECTION I

INTRODUCTION

This report covers the pertinent aspects and details of the construction and delivery of four (4) SSD-52801 (Sperry D-Spec 89195) Mass Spectrometer Tubes for NASA, Greenbelt, Maryland.

Included in the report is a short, general discussion of mass spectrometer tubes. A description of the SSD-52801 and a discussion of the construction and problems associated with that construction are included to aid in avoiding future pitfalls. Future recommendations are supplied.

SECTION II

MASS SPECTROMETER TUBES - GENERAL

The function of a mass spectrometer tube is that of qualitative and quantitative analysis of the atomic and molecular components of a gaseous mixture. Since this analysis is done with the test piece and testing components in a vacuum, some samples of liquids and even solids at atmospheric pressure can be included with gases in the list of materials susceptible to evaluation.

A mass spectrometer tube accomplishes its separation and evaluation of the sample components by influencing the paths taken by ionized molecules of various masses. One class of instruments such as the magnetic sector, cycloid, omegatron, etc. uses a magnetic field to deflect ionized particles into an amount determined by the mass of the particle. A collector is placed in a way to selectively pick up a particular molecule at a given potential - flux relationship. Other instruments such as the Bendix, Bennett, Monopole, Quadropole, etc., filter out all but a desired molecular mass at a particular instant of time by determining the particle's time of arrival at a grid, collector, or mere point in space to coincide with an aiding pulse or radio

frequency cycle peak. Particles of all other masses are lost by misdirection and deionization. Referring to Figure 1, for instance, ionized particles from the F-G_1-G_2 network are electrostatically pulled into the G_3-G_4 maze wherein only the particles traveling at a particular speed (determined by the mass of the particle) and being aided by the alternating potential applied to alternate grids G_3 and G_4 continue to a collector.

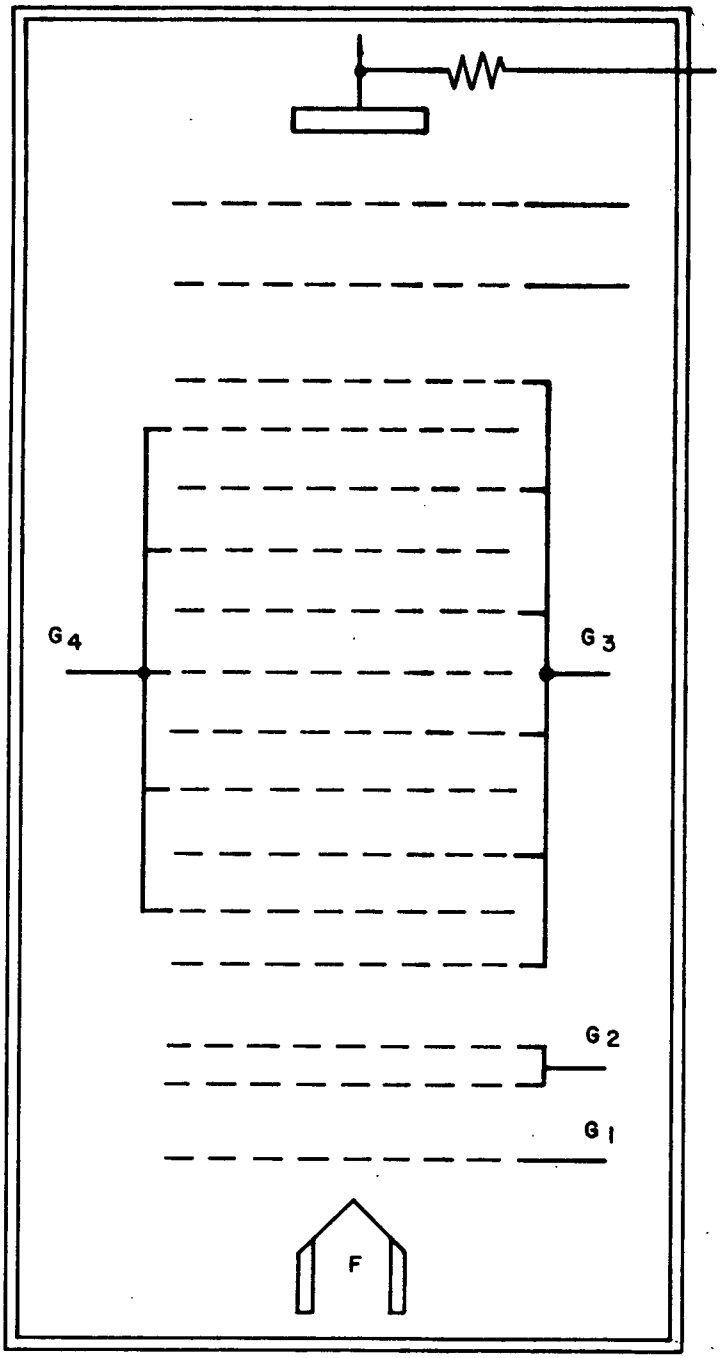


FIG.- I SCHEMATIC DIAGRAM OF THE BENNETT TYPE RF MASS SPECTROMETER L00045

SECTION III

THE SSD-52801

A. Description

The SSD-52801 Mass Spectrometer Tube is of the Bennett Type. It is described in electrical cycles of grid spacing as 7-5-5. The general work procedure and materials content for the SSD-52801 was derived from previous tubes built for NASA (Sperry D-Spec. 89099). Initial work under the auspices of NASA was done by the Sperry Gyroscope Division, Great Neck, New York. Later work was performed at Sperry in Gainesville, Florida.

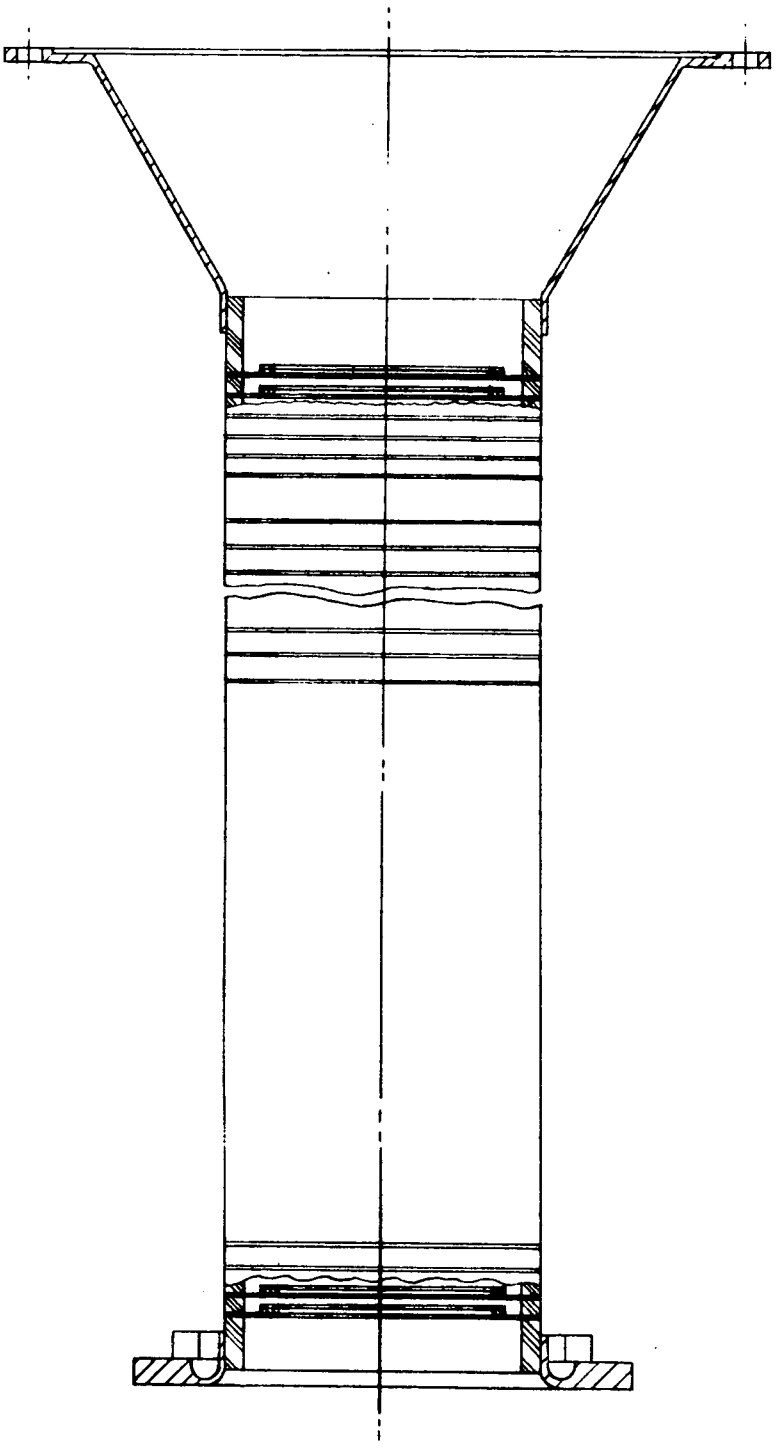
Extreme care in production of parts, sub-assemblies and final assembly is a necessity for these tubes. The mounting grid tabs were individually lapped after nickel plating to maintain close tolerances, as were the metallized ceramic surfaces. This is required to keep grid to grid tolerances in line. The mesh on the grids must be oriented and stretched consistently without over-stretching or allowing ripples to form in the mesh. The grids were carefully inspected by three different persons to assure freedom from loose mesh wire, broken wire, finish and dimensional tolerances. Figure 2 illustrates the position of the grids in the body.

This series of tubes (SSD-52801) differed from the previous Mass Spectrometer tubes built by SETD in two ways. One is the absence of a collector and the other is the absence of gold on the grid mesh. The latter presented a fabrication problem that was solved by plating the internal surfaces before brazing.

B. Problems

Seven (7) tubes were brazed into assemblies of which three (3) were lost. The loss was due to two major problems: (1) grid mesh separation, and (2) body leaks. Grid mesh separation was immediately solved by increasing the number of welds in the grid assembly. However, the body leaks were not easily controlled. All tubes underwent a double brazing cycle to ensure against leaks. A third brazing attempt to seal leaks was not used because of excessive alloying and possible weakening of the joints along the kovar surfaces.

Because of previous experience in building the Bennett type tubes and development work conducted by SETD, this program was completed with few difficulties.



L00046

Figure 2 Cutaway Drawing of SSD-52801

SECTION IV

RECOMMENDATIONS FOR FUTURE CONSTRUCTION OF MASS SPECTROMETER TUBES

1. The clear, hard, electrically resistant coating used on the previous tubes was EC-200 supplied by Emerson and Cuming, Inc. This material worked fine and satisfied the requirements, but it was found to outgas readily. CE-1155 supplied by CONAP, Inc. was used on the last two tubes shipped. Ease of application plus satisfying all requirements are the reasons for recommending CE-1155 as the coating on future tubes.

2. The specification should include more definite information on covering the open end of the completed tube for shipping.

SECTION V

CONCLUSION

The program accomplished its prime purpose, that of delivery of four (4) SSD-52801 Mass Spectrometer tubes to NASA. Previous experience constructing this type of tube led to expenditious delivery with a minimum of problems. The extreme care shown by technical and assembly personnel during the construction of these delicate instruments is acknowledged.