TIME OF FLIGHT

INSTRUCTION MANUAL

18mm MCP MICROCHANNEL PLATE DETECTOR

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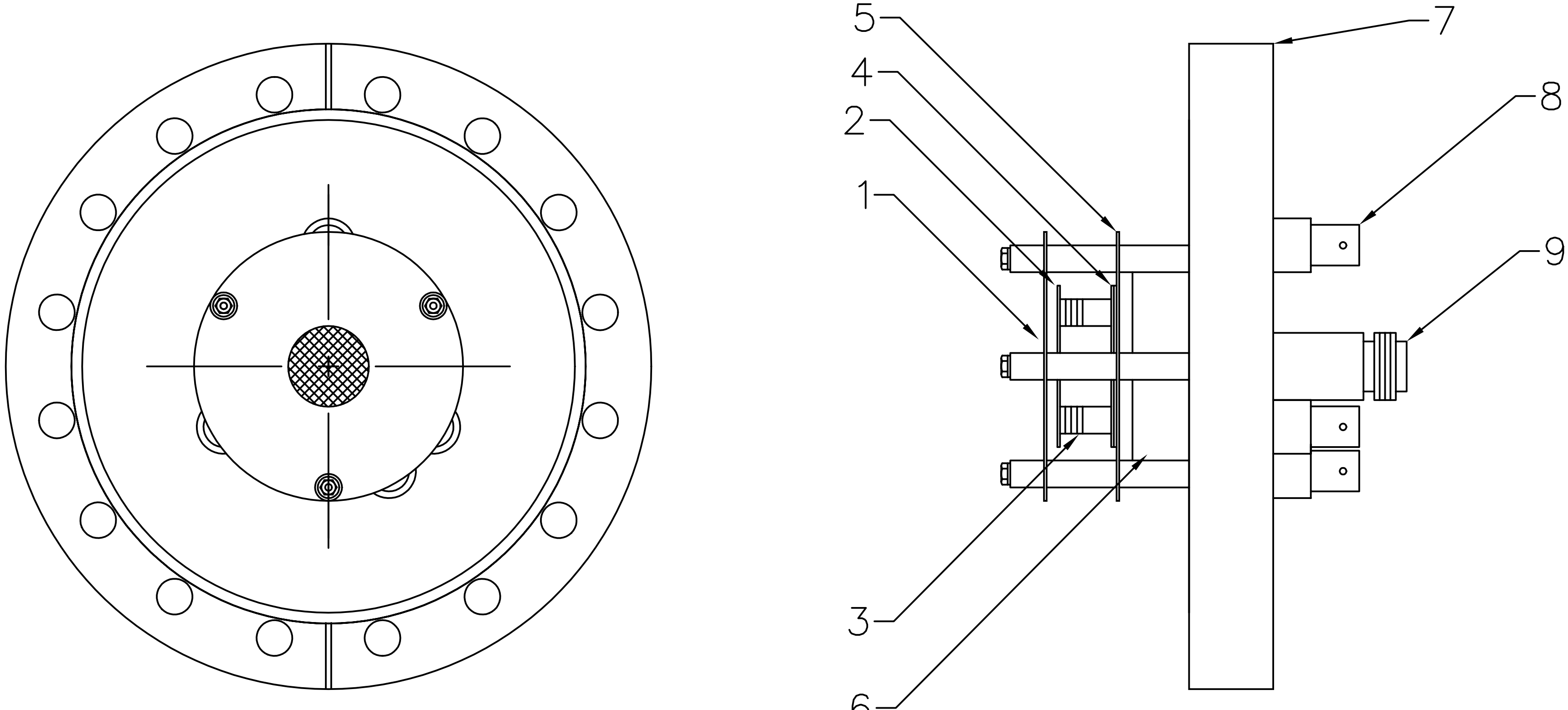

1 – INPUT GRID
2 – SPRING CAP
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8 – SHV FEEDTHROUGH
9 – 50 OHM FEEDTHROUGH

C–0701

18mm MICROCHANNEL PLATE
DETECTOR A

1.0 SPECIFICATIONS

1.1 MECHANICAL SPECIFICATIONS

Ground Plane grid diameter (input aperture) .750 inches
Grid transmission, 90%
Active surface area diameter, .750 inches
Distance from Input Grid to face of vacuum flange, 1.3 inches
Maximum protrusion from flange face into vacuum system, 1.75 inches
Minimum tube I.D. for vacuum housing, 2.75 inches
Maximum bakeout temperature, 300°C

1.2 MATERIAL SPECIFICATIONS

Structural plates, connectors, fasteners and grids, 304 stainless.
Channel plate spacer and contact pads, nickel.
Insulator spacers, alumina.
Anode face pad, 304 stainless.
Anode and Anode Shield, 6061 Aluminum.
Microchannel Plates, Galileo MCP-18B or equivalent. Diameter, .972-.978. Thickness, .016-.018 in. Channel diameter, 10 micron. Channel spacing 12.5 microns max.

1.3 ELECTRICAL SPECIFICATIONS

Maximum voltage across each plate, 1000 v.
Gain, 1000 minimum per plate at 1000 v. Gain is down approximately one decade at 700 v. per plate.

2.0 GENERAL DESCRIPTION

This detector is designed to handle the fast ion pulses provided by the Time of Flight Mass Spectrometer. It has 50 ohm output and provides high gain with sub-nanosecond rise time.

It is fitted with an input grid wired to an external SHV Feedthrough. This can be grounded using ground cap provided or "Teed" to liner. This presents a flat, field free plane to the incoming ions.

Shipped mounted on a 42, 6 inch or larger CONFLAT flange. Baked and pinched off in its own vacuum housing.

3.0 INSTALLATION

3.1 VACUUM

Do not open the vacuum housing until ready to install the detector in the vacuum system. Repeated brief exposure to air will not damage the plates. Extended exposure will allow the plates to absorb sufficient amounts of water to distort and crack.

Allow the detector to pump to below $1x10^{-6}$ torr and remain there for 12-16 hours before applying voltage.

3.2 ELECTRICAL

If the detector is to be used with the R.M. JORDAN power supply, connect power supply output VD to the input of the divider box. Connect divider box outputs, VD1, VD2, and VD3 to detector feedthroughs. Connect shorting plug on feedthrough marked G to operate input grid at ground potential.

If another power supply is to be used, wire a divider circuit according to Fig. 1. It is highly recommended that you purchase a resistor kit from R. M. Jordan company, Inc. If this is not possible be sure to use Caddock or equivalent high voltage resistors. Carbon film and carbon composition resistors are not adequate for high voltage applications. When building this circuit it is important that 2.5 meg. equalizing resistors be placed in parallel with the plates. If these are omitted, the unequal resistance of the plates will cause one plate to take a disproportionate share of the load which will exceed its breakdown voltage. We recommend using a 5000 volt power supply with a 7 megohm series resistor. When using a 3000 volt or higher power supply use the formula on page 8 to calculate the value of the series resistor.

A 50 ohm signal cable is included with the detector. Additional cables can be purchased separately.

4.0 **INITIAL CHECK OUT**

Connect the signal cable to the vertical input of an oscilloscope with 1 MΩ impedance and sensitivity in the 10 millivolt range.

Slowly increase the voltage while watching for arcing and excess noise spikes. When the plates have a large amount of gas on the surface, pulse frequency can become high enough to actually cause a DC offset at the anode.

If the noise is more than a few pulses per second, turn up the voltage until they just appear and wait. The noise should decrease with time. Repeat this until the desired voltage level is reached. This is usually about 500-700 volts per plate for a fresh detector. (1000-1400 volts at VD1)

If arcing occurs for any reason such as a gas burst, turn down the voltage to avoid sustained arcing. Arcing is usually the result of dust or rough spots on the plates or electrical contact surfaces. It can usually be corrected by disassembling, blowing the plates with dry gas and reassembly with the top plate reversed. If this doesn't work, repeat the procedure, reversing the bottom plate.

4.1 OPERATION

If the channel plate detector is satisfactory after the initial steps above, it is ready to be

used for ion detection. Be sure to terminate signal into a 50Ω load.
It is best to keep the plates under vacuum. If it is necessary to go to atmospheric pressure it should be done with dry nitrogen or air if possible.

There are 2 primary mechanisms for deterioration of gain. One is coating of the front face from ion bombardment. This will be in proportion to sample pressure and ion beam intensity. The second occurs within the channels near the output side of the plates where high electron currents can bombard the surfaces and cause depletion of the oxides and polymerization of surface species.

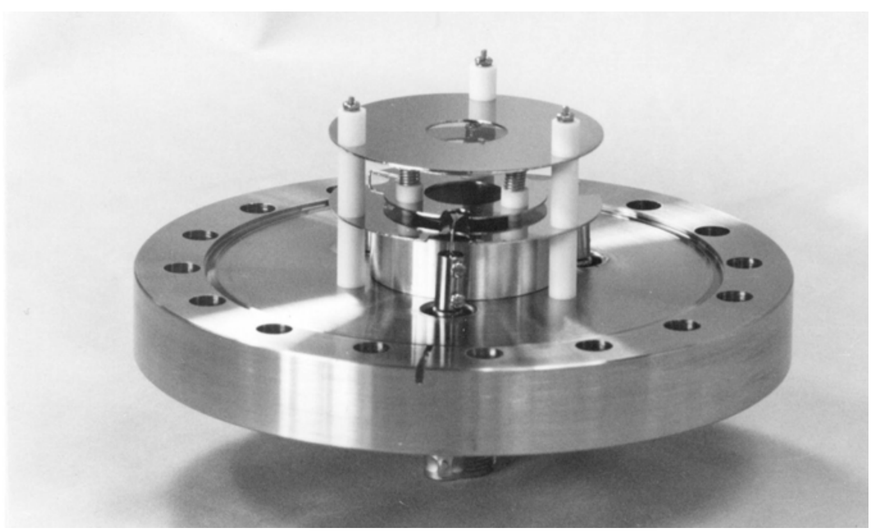
The best way to avoid both of these is to not generate more signal than you need. Reduce the gain and sample pressure whenever possible to extend the life of the detector.

5.0 **<u>MAINTENANCE</u>**

It is strongly recommended that the assembly be returned to the manufacturer for any cleaning of metal or ceramic parts.

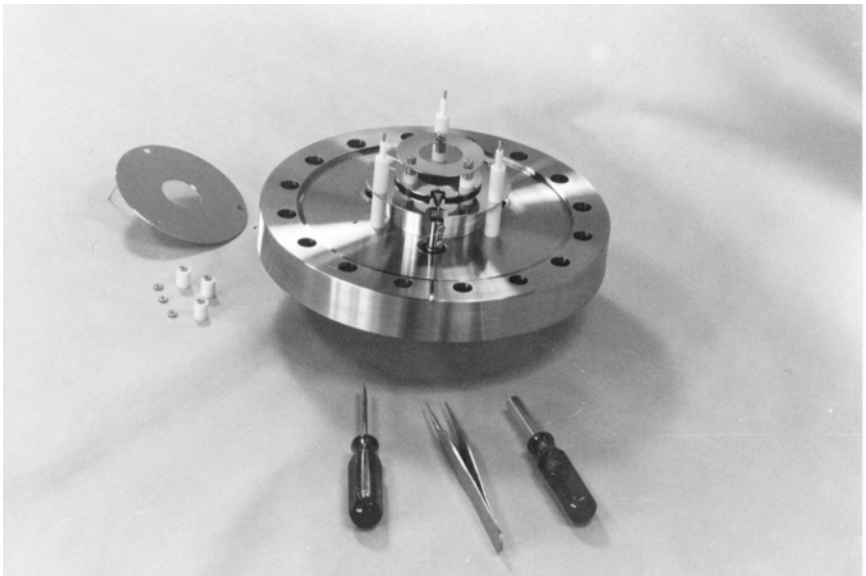
Where this is not possible, an overhaul kit can be ordered which contains new replacements for all parts which normally need cleaning.

Eventually it will be necessary to replace depleted channel plates.
This is done as follows: (refer to dwg. C-0701 for nomenclature).
All the following operations must be done in a dust free area with the usual precautions against fingerprints, etc.

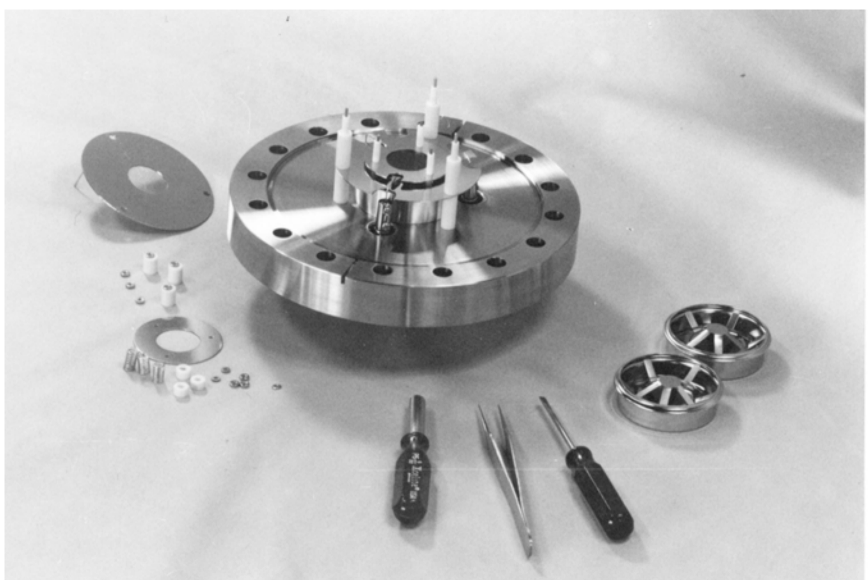


C-0701, 18mm MCP Detector Assembly

1. Remove nuts, washers and ceramic spacers. Disconnect lead from barrel connector and lift off Input Grid being careful not to damage mesh.

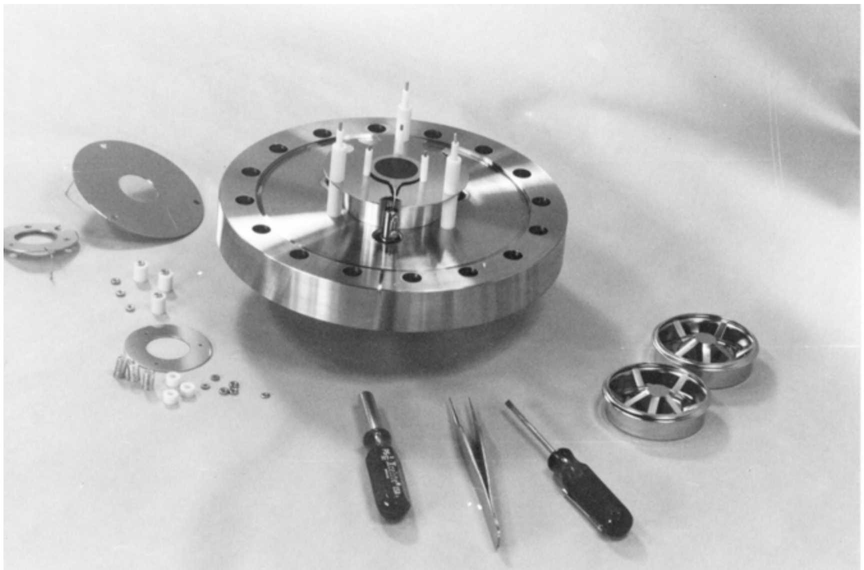


2. Remove nuts and lift off Spring Cap, springs and ceramic spacers.

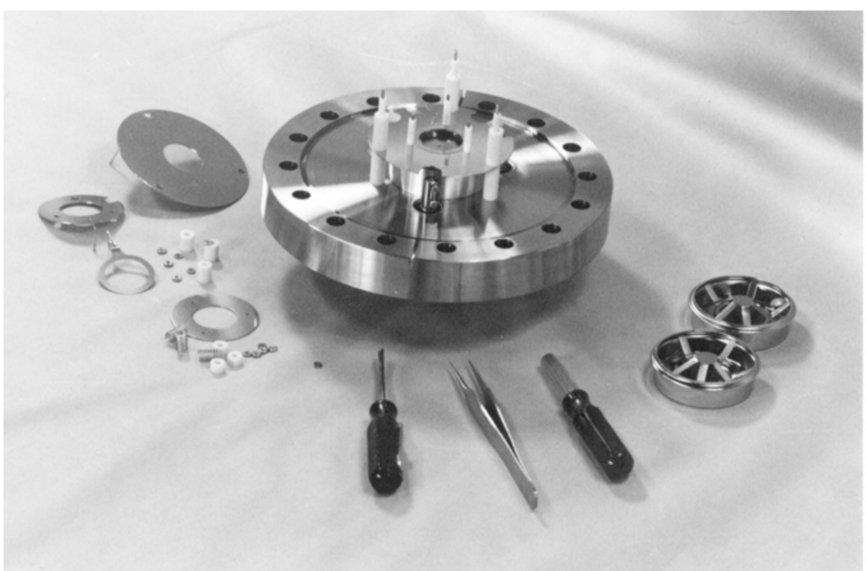


3. Disconnect lead from barrel connector and lift off top (hold down) plate from Channel Plate Stack assy.

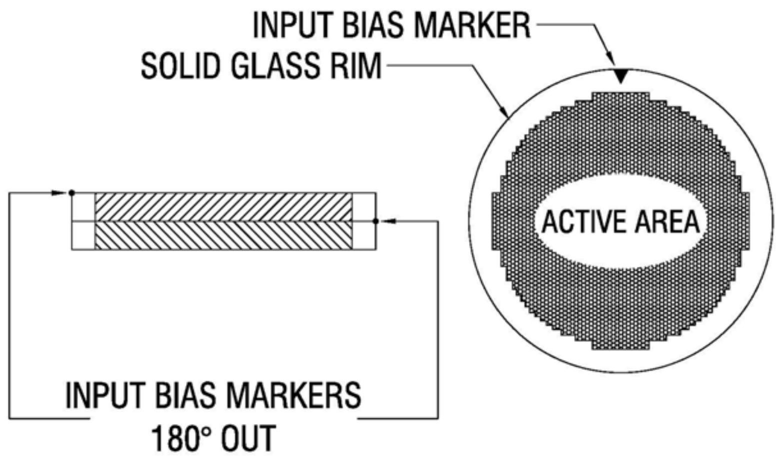
4. Remove top channel plate.



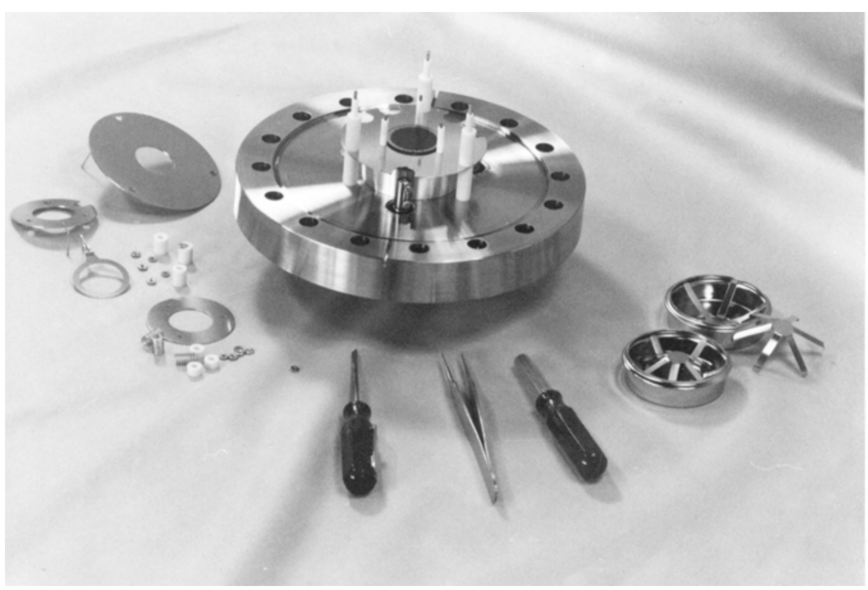
5. Disconnect Spacer lead from its barrel connector, lift Spacer and remove bottom channel plate.



6. Take a new channel plate from its shipping container being careful to handle it by the outer rim. Blow off any dust with dry nitrogen or clean, dry compressed air. Do not use canned freon. Do not allow anything to contact active area on microchannel plate as this will cause plate to be noisy. Note which direction Input Bias marker is pointed. Microchannel plates should be installed such that Input Bias markers point in opposite directions. This places plates in a "chevron orientation" providing maximum electron output.

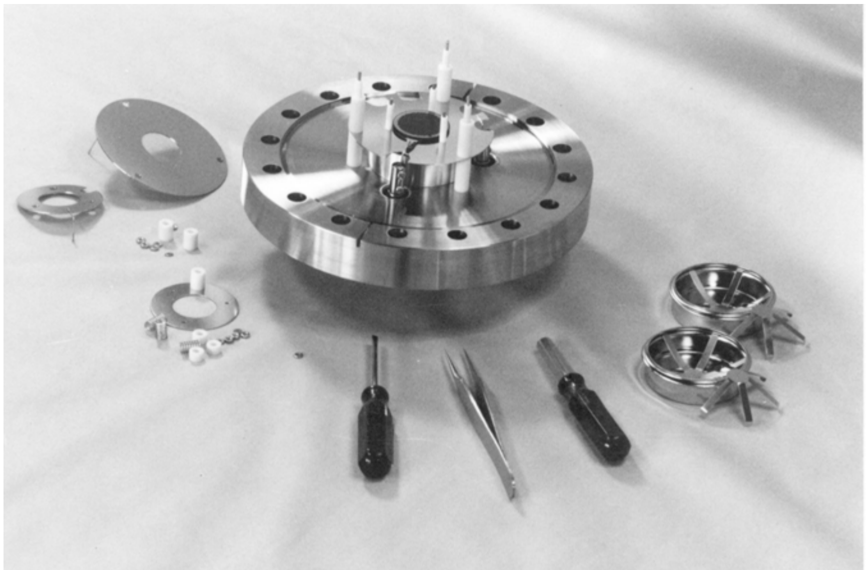


7. Put this plate on the Base and center it.

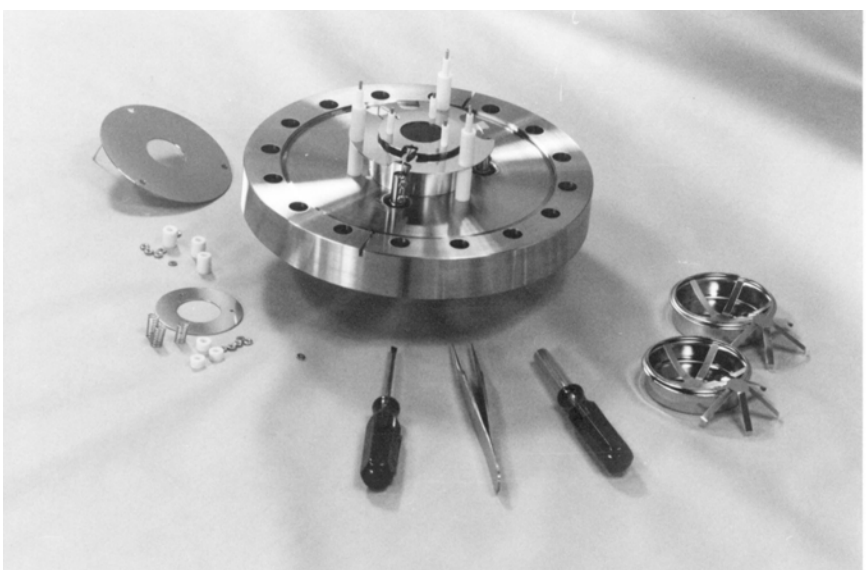


8. Place the Spacer on the channel plate and insert its lead into D2 barrel connector. It is the one in line with the leak check groove in the flange as in the photo. Do not tighten the connector screw.

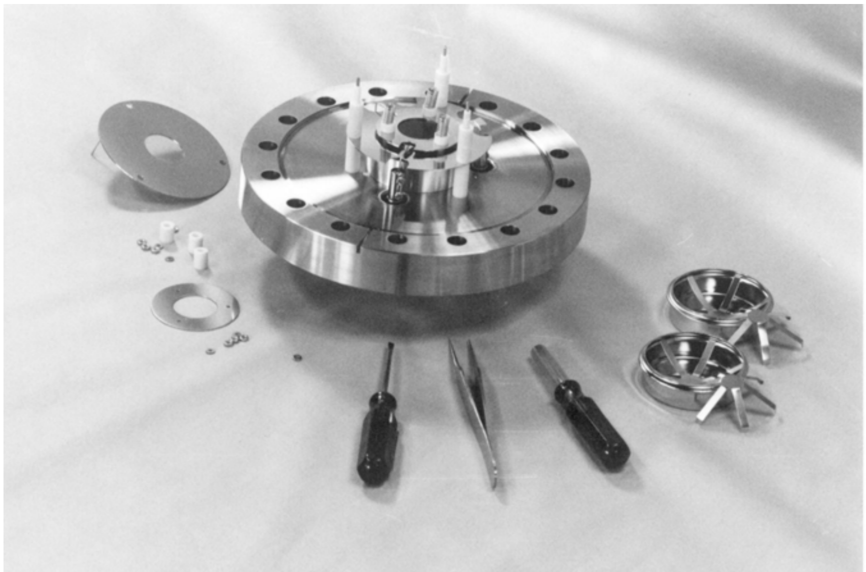
9. Repeat steps 6 and 7 for the top channel plate.



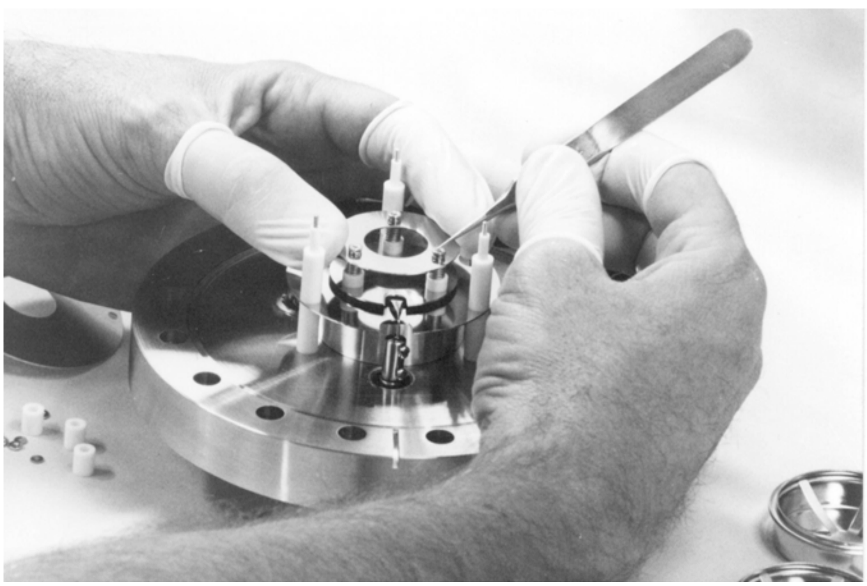
10. Replace top (hold down) plate and insert its lead into D1 barrel connector. Do not tighten the connector screw.



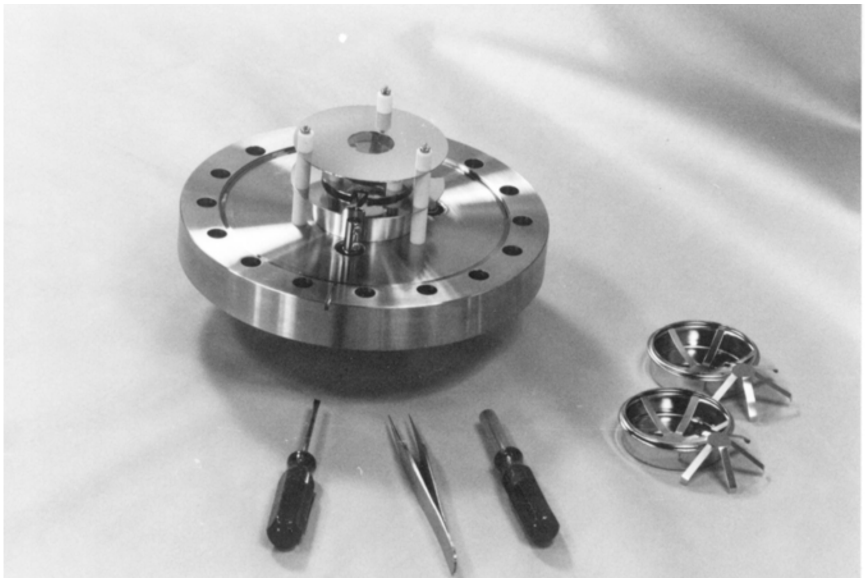
11. Replace spacers and Springs.



12. Place Spring Cap over studs and hold it down evenly with fingers while replacing washers and nuts. Alternately tighten nuts one turn at a time in a circular pattern until all are snug.



13. Replace Input Grid and tighten screws in the four barrel connectors.



Our TOF Power Supply generates voltages D1, D2, and D3 from a zero to -5KV power supply with this voltage divider circuit.

The same circuit can be used with a lab power supply. For a zero to -3KV power supply, R would then be:

$$R = \frac{V\text{-}2200V}{400uA} = \frac{3000V\text{-}2200V}{4 \times 10^{-4}} = 200 \times 10^{4} = 2.0 \text{ MEGOHMS}$$

To assure that maximum voltage never exceeds 1000V across either plate, resister values may be increased sufficiently to compensate for resister tolerance variations.