VI. SPECIAL REPORT FROM THE TUBE LABORATORY

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Tube Laboratory Facilities The facilities of the Tube Laboratory include

Complete glass-blowing shop

Hydrogen furnace brazing of silver, copper, and other metals

Hydrogen and air induction brazing

Vacuum pumping, baking, bombarding of tubes

Stock of special metals nickel, tungsten, kovar, molybdenum, nichrome, etc

Special machining and fabrication of small parts

Mounting, assembly, spot welding, etc , for vacuum tube work

Chemical facilities plating polishing, chemical cleaning, metallurgy

In addition to these facilities for tube making, the laboratory is equipped to design and construct special devices of many kinds

Molecular Beam Pirani Gauge Two detectors have been constructed for the Molecular Beams Project These are of the Stern-Pirani type, and both involve the use of pyrex optical glass flats having grooves cut in the optical surfaces as chambers for the sensitive elements Four nickel ribbons are used, each having the dimensions 0 0001" thick, 0 005" wide

In the first of these detectors, Fig 1, the elements a b, c, d, are about four inches long and are held under tension in four grooves 0 015" wide, 0 001" deep and running the entire length of the glass block (4 inches) A second ungrooved glass flat is placed face down on the grooved block as a cover, and tightly clamped to expel the air The nickel ribbons are free to expand in the grooves, enough tension being applied at one end of each to keep them taut

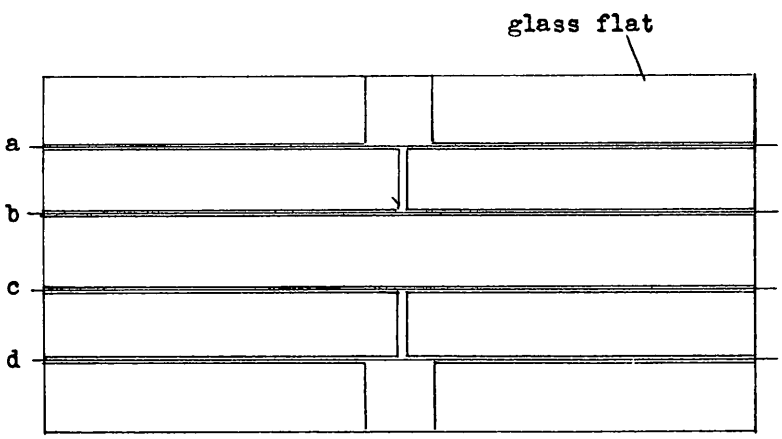

Figure 1 First type of Pirani detector Approximate actual size, dimensions of grooves are given in the text

In the second apparatus Fig 2, two grooves 1 1/4" long run across the block, which is two inches wide These grooves are 0 060" wide and 0 010" deep and there are two nickel ribbons in each, a, b, c d, held under tension, and not in electrical contact A second block with matching, similar grooves is placed face down upon the first but is separated from it by several pieces of gold foil 0 0005" thick, so as to form chambers and slits and to block off the two chambers The whole is clamped together with uniform pressure

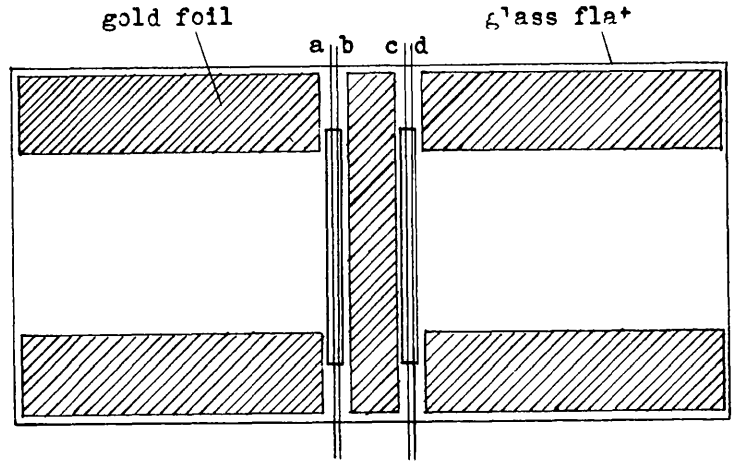

Figure 2 Second type of Pirani detector Approximate actual size, dimensions of grooves are given in the text

In each case the detectors are enclosed in shield boxes and mounted on closure plates of the molecular beam apparatus The second instrument is equipped with a mechanism for adjusting the slit angle and height.

Pickup Tube for Electronic Potential Mapping In connection with the potential mapping project, a pickup tube was constructed which consisted of an electron beam source, an anode, two pickup grids close to the anode, and a focusing shield

A second tube has been completed in which there are sixteen grids arranged in mosaic, with two grid-anode spacings and two intergrid spacings

Other Projects Among the other projects in which the Tube Laboratory has given material assistance are

5-mm Oxford type tube

High-power 10-cm magnetron

Transmission of energy from radiation on silicon crystals, also investigations on other semi-conductors

Microwave spectroscopy

Low temperature research superconductivity of lead

Microwave linear accelerator

Travelling-wave tube

Impeller tube (Laboratory for Nuclear Science and Engineering)

Electron collector (LNSE)

Square-law diode (electronic differential analyzer)

Electrostatic storage tubes (Servomechanisms Laboratory)

Projects Planned. Construction of a 60-kva vertical hydrogen brazing oven using Globar heating elements and a gas-tight retort or chamber of moly-chrome-nickel steel This furnace will have approximate dimensions as follows I D 14 inches, length inside 20 inches Maximum temperature will be about 1200°C This furnace will be used for all types of eutectic and pure metal brazing up to the melting point of copper

Construction of small x-ray diffraction apparatus for metallographic analysis

Investigation of intermediate melting-point solders and brazing alloys

Expansion of facilities for induction brazing, with and without hydrogen atmosphere, and in vacuo.

Resumé of Recent Work in Chemical Section (1) Caesium A quartz resonant cavity is being developed to hold hot caesium vapor in connection with the work on microwave spectroscopy Pure caesium is produced by reducing the chloride with calcium and distilling the product in vacuo The caesium prepared in this manner can be heated in an evacuated quartz tube to 450°C without evidence of reaction with the quartz, above 520°C there is appreciable reaction with the walls.

The quartz cavities are machined to size with a diamond wheel.

(2) High Temperature Furnace A small electron bombardment furnace is under construction for work on the properties of semi-conductors, and for sintering refractory catnode materials such as thorium oxide This furnace will cover the temperature range 2500° to 3000°C It consists of a small crucible support surrounded by a heater which is mounted inside two tantalum radiation shields The assembly is enclosed in a pyrex tube with a ground joint to facilitate removal of the sample

(3) Thorium Oxide Cathodes Work is now in progress on the production of pure ThO_2 cathodes for high-power magnetrons The requirements for a suitable thorium oxide cylindrical cathode are (a) that it must have high density, and (b) that it must have good resistance to thermal shock The effect of impurities and addition agents on the electron emission is being investigated

(4) Trideutero-ammonia Equipment has been set up to produce trideutero-ammonia for microwave gas work. The method consists of passing deuterium oxide vapor over freshly prepared magnesium nitride

(5) Square Pyrex Tubing In connection with work on some special types of Dewar flasks a method of drawing pyrex tubing with square cross section has been developed With suitably shaped mandrels, a large variety of cross sections may be produced

Facilities of Chemical Section The Chemical Section maintains facilities for electroplating and electropolishing of metals, and is also completely equipped for the chemical cleaning of special metals used in vacuum tube work The Laboratory is equipped to do metallographic work Facilities are also available for special work in ceramics, such as steatites and pure oxide refractories