This is the indirect pressure gauge and it necessitates calibrating the ammeter reading with respect to a direct pressure gauge. The pressures covered by these gauges are in the range $1 - 10^{-6}$ Torr. Gives the calibration pressure versus microammeter reading for various vapour and gases. Certain contaminants such as oil vapour from pumps may crack and leave various deposits on the filament and tube walls. To eliminate these deposites it is necessary to clean the gauge tube usually with chemicals & then dry it.

4. Penning Gauge :- The basic geometry of the Penning gauge with a tabular anode has been widely applied to the design of UHV pressure measurements. The manner in which the gauge operates can be seen from fig 1. -

1. The anode A is b/w the two cathodes CC and a magnetic field is produced by a horseshoe magnet. The magnetic field is perpendicular to the planes of the cathodes and the anode. It might appear at first glance that the electrical & magnetic field in a penning gauge are parallel and not crossed.

2. However the potential on the axis of an operating penning discharge is depressed to near cathode potential by the electronic space charge.

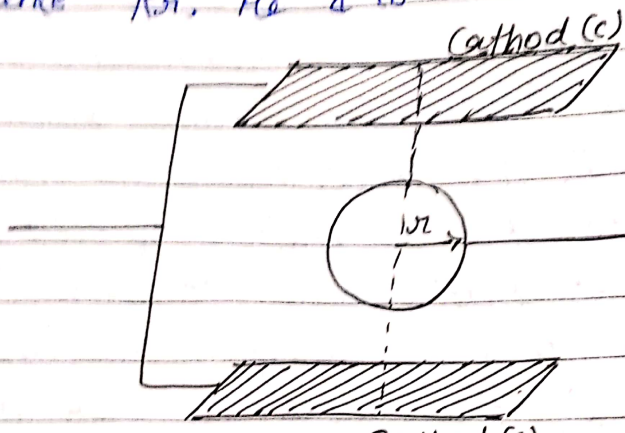
3. Fig 1(b) & 1(c) explain the potential & field configuration inside the Penning gauge tube. A high voltage usually b/w 2000 and 4000V is applied b/w A & C with A +ive & C -ive. The e⁻s leaving the cathod will head for the anode, but the magnetic field has the property of forcing these e⁻ to move in circles. Consequently, the e⁻s will move in spiral paths b/w the cathods before finally working their way over to the anode ring, where these are finally collected. Many e⁻s will not reach the anode b because of inelastic collisions with gas molecules. The +ive ions will not collected by the cathodes while the e⁻ formed in the ionization process will behave like e⁻ that leaves cathodes. The long path of the e⁻ results in many more ions being formed than if they were able to go directly from the cathodes to anode. This gives larger current & simplifies whole problems of measuring electric currents. As a matter of fact, with this type of gauge an amplifier is not essential. Sometimes a small filament is placed behind an off axis hole in one of the cathode plates. The filament is heated to provide e⁻ to starts the discharge & turn off once the discharge is running. This is often used to trigger discharge while measuring very low pressure.

The general form of the calibration curve for a cold cathode discharge is shown in figure 2. The ion – current pressure relation is nonlinear and is given by :—

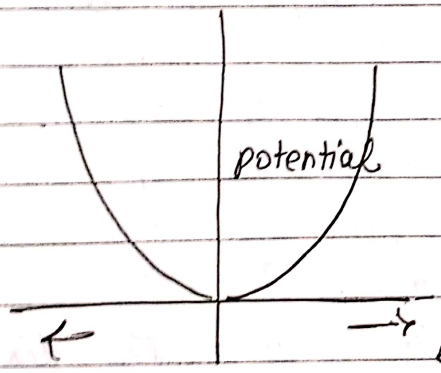
$I^+ = kp^n$ —(1)

where $n \approx 1.2$

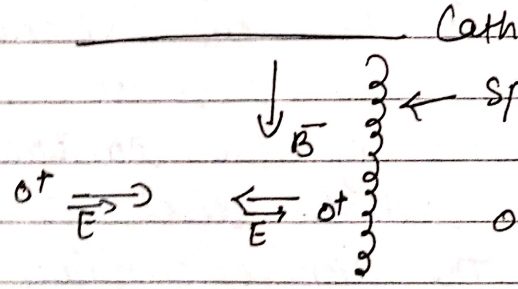
The sensitivity (S) is approximately 1 A/Torr at a pressure of 10^{-4} Torr rising to 6.3 A/Torr at 10^{-7} Torr. The sensitivity is found to decreases with increase in pressure at the calibration could be represented by a series of linear segments separated by sudden jumps for different gases like Kr, He & Co.



(a) Penning gauge & ele
& magnetic field
configuration within g



(b) variation of elec
potential along
radius of ano
ring.



ctn'c field
in the
e ring.

Cathod

Fig 1.