The HVEE Model 358 Duoplasmatron ion source is a modified Von Ardenne type ion source. It is actually a gas-fed ion source (typically $H_2$ or He) capable of producing positive or negative ion beams. The working principle is based on two-stage discharge. The first discharge (region A of the figure) is produced by electrons generated by a thermo-ionic emission from a filament. Electrons are guided by means of a confining magnetic field into a second chamber (region B) containing the flowing gas. The ionized gas starts a secondary discharge between the intermediate electrode and the anode. Since all the source is kept at 20kV (depending on positive or negative operation) the ions run towards the extraction plate, kept at ground potential.

A low-pressure arc discharge in the gas to be ionized is electrostatically constricted by a funnel-shaped intermediate electrode placed between the electron-emitting cathode (hot filament) and the anode. A strong axial magnetic field between the intermediate electrode and the anode further constricts the discharge to a narrow plasma beam along the axis of the exit aperture.

Positive operation is required for helium, for which only $He^+$ can be created with a good efficiency inside the source. $He^+$ ions after extraction pass through a so called charge exchange channel, in which vapor of lithium is present. The result is that about 1% of the incoming He beam turns negative and can be thus further accelerated. Obviously, this limits the maximum current available for He ions to few uA.
SNICS ION SOURCE (Source of negative ions by Cesium sputtering) (Model 860).

Cesium sputtering ion sources are now the most widely used negative ion sources in tandem accelerator laboratories.

The atoms we wish to accelerate must be incorporated into the Target Holder or the sputter cathode. For example, for silicon ion beam, solid silicon powder (target) is packed into the holder (which in our case is made of copper). The target holder is cooled through the insertion rod.

The cesium bottle (Cs resorvoir) is heated. The cesium via the pipe reaches the ion chamber and collides with the spherical ionizer, which is kept at positive voltage w.r.t. the cathode, and at a temperature of about 1100 degrees). Certain amount of Cs atoms loose an electron and become positive ions, which are then repelled and focused by the electric field to collide onto the target.

The target being cooled, cesium vapors condense on the surface of the target, producing a thin layer of neutral cesium. As a result of the collision inside the target, few atoms of the target material flow out to surface (*sputtering*). Most of the target atoms that reach the surface have no charge. However, on passing through the Cs layer the atoms of the sputtered material exchange an electron with neutral cesium and become negative.

These negative target ions are then repelled from the cathode potential and accelerate towards the positive ionizer. The ionizer is provided with a central hole of about 8 mm in diameter and the negative beam pass through this hole to be further accelerated to the ground potential (-20 to -30kV) of the extraction electrode.