

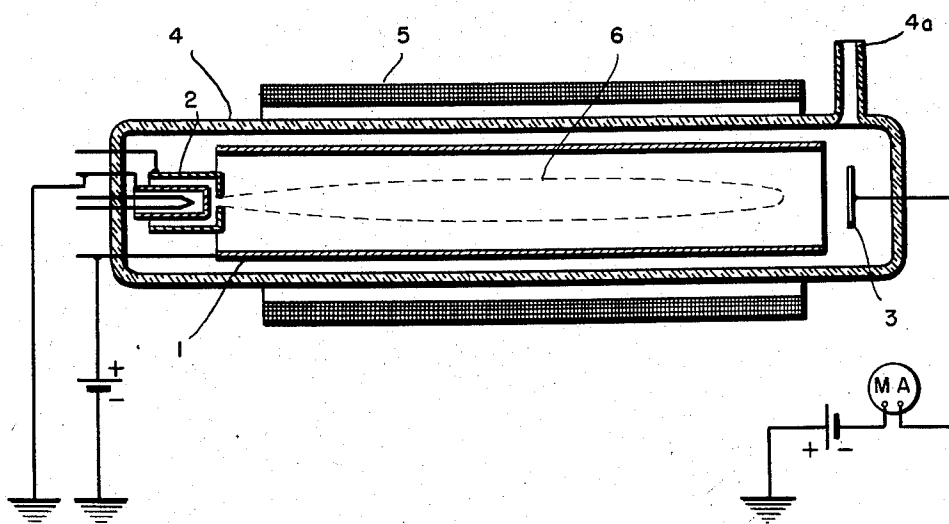
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ION GAUGE

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ION GAUGE

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2 Claims. (Cl. 315—108)

This invention relates to ion gauges and is particularly directed to structures for minimizing undesired electron current in the circuits intended to measure ion current.

The usual ion gauge structurally resembles a simple triode comprised of a fine wire high-pitch grid enclosed in a tubular anode. The grid is operated at a positive potential while the anode is operated at a negative potential with a microammeter connected in the anode circuit. In operation, the electrons are attracted from the cathode toward and through the grid and oscillate about the grid ionizing any gas molecules present. The positively charged ions are then attracted by the negative plate and the current flowing in the plate circuit is a measure of the gas pressure in the envelope. Unfortunately, the electrons striking the grid, or other structures, produce soft X-rays which rays travel in random directions with many impinging upon the anode. These impinging X-rays dislodge photoelectrons from the anode and produce a current in the meter circuit in the same direction as the ion current. The minimum ion current measurable, accordingly, is limited by the photoelectron current. Ordinary gauges are capable of measuring pressures no lower than about 10^{-8} millimeters of mercury. This limit is determined by the relatively large amount of incident X-rays and subsequent photoelectron current in the anode of a standard gauge.

The object of this invention is to produce an improved ion gauge with a view to minimizing electron current in the ion current-measuring circuit.

The objects of this invention are attained by directing a beam of electrons along the axis of a long tubular anode and confining these electrons to paraxial travel by a coaxial magnetic field. An ion collector at the far end of the tubular anode receives the ion current produced by the electron beam without intercepting an appreciable number of the soft X-rays.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawing, wherein:

The single figure of the drawing shows a longitudinal section of one ion gauge embodying this invention.

The ion gauge shown in the figure comprises an elongated tubular anode 1 with an electron gun 2 at one end and an ion collector plate or probe 3 at the other end. Surrounding the envelope 4 and coaxial with the anode is the magnetic coil 5. Tubulation 4a is for connecting to any chamber the internal pressure of which is to be tested. Electrons emitted from the gun move generally along the axis of the anode and are confined to the paraxial direction by the magnetic field of coil 5, forming an electron beam 6. Initial acceleration of the electrons propels the beam through the anode region but is insuffi-

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cient to propel the electrons beyond the far end of the anode. Accordingly, they follow a reflex path returning to the gun and are collected on its electrode structure. The total length of the path is adjusted to provide a sufficient number of ions for good gauge sensitivity. Ions produced by the electron beam in traveling this path are moved toward and collected by the negatively charged collector 3.

While it is true that any electron bombardment of the interior surfaces of the tube structure will produce X-rays, the source of the X-rays is now limited to the end of the gun where the electron beam is collected and the fraction of these X-rays which are able to strike the ion collector is extremely small because of the small solid angle defined by the face of the collector 3 and the point source of electrons at the gun 2. This is to be compared with the large solid angle of the conventional structure where the collector almost completely surrounds the cathode and the grid from which the X-rays are emitted.

Therefore, by means of this invention, photoelectron current produced by X-ray bombardment is minimal in the measured ion current.

Good results have been obtained by an ion gauge having a tubular anode about nine (9) inches long and two (2) inches in diameter with 100 volts applied to the anode and 10 to 100 negative volts applied to the ion collector. The tube in appearance is similar to that of an orthicon tube structure.

While the anode may be a separate tubular structure as shown, the anode could comprise a metallic or carbon coating on the interior of the envelope and need not necessarily be circular in cross-section or uniform in diameter, and could consist of multiple electrode structures.

While the principles of the invention have been described in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of the invention.

What is claimed is:

1. An ion gauge for measuring gas pressure approaching absolute zero comprising an elongated tubular anode, a positive source of potential connected to said anode, a gun at one end of the anode, an ion collector plate across the other end of the anode, a negative source of potential connected to said collector and a magnetizing coil coaxial with and surrounding the anode to confine electrons to paraxial reflex paths within the anode and for confining and focusing positive ions onto said collector.

2. An ion gauge comprising an elongated tubular anode, a positive source of potential connected to said anode, a gun centered at one end of the anode and an ion collector plate across the other end of the tubular anode, a negative source of potential connected to said collector and means for confining and accelerating electrons to a reflex path within the tubular anode without said electrons striking the anode or collector structures and for confining and focusing positive ions onto said collector.

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