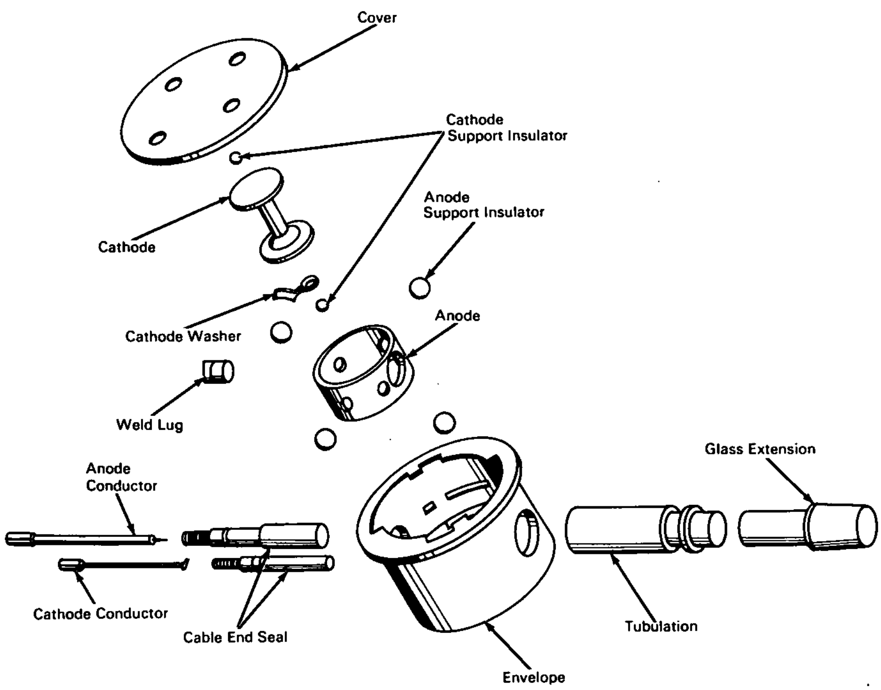
NASA TECH BRIEF

Cold Cathode Ionization Gauge Has Rigid Metal Housing



The problem: To design an ionization pressure gauge to accurately measure pressures to 10^{-14} torr. Hot filament gauges suffer from contamination by chemically active gases that change cathode emissive properties and hence gauge sensitivity. Cold cathode gauges of the glass envelope type suffer helium permeation of the envelope walls that reduces gauge sensitivity and requires frequent bakeout, thus losing its usefulness for long-period monitoring.

The solution: A cold cathode ionization gauge contained in a stainless-steel housing. The Penning effect is used, employing a high-voltage discharge in the presence of a magnetic field to produce an ion current proportional to gas pressure in the gauge.

How it's done: The gauge is contained in a stainless-steel housing consisting of an envelope, a cover, and a tube for attachment to the measured enclosure. Ceramic-to-metal cable end seals provide vacuumtight connections to anode and cathode. The anode is compressively held in the envelope by four support insulators that ride in the channel machined in the envelope side wall. A weld lug provides the electrical connection between anode and anode conductor. The cathode is held in place by two support insulators under compression between the bottom of the envelope and the

(continued overleaf)

cover, which has four projecting lugs on its underside to mechanically lock it to the envelope. A cathode washer press-fitted into the bottom of the cathode provides an electrical connection between cathode and cathode conductor. A glass extension of the tubulation is provided for convenience in connecting the gauge to a glass test system. A permanent cast magnet (not shown) attached pole pieces of low carbon steel surrounds the gauge tube and provides an axial magnetic field of about 1,100 oersted along the tube.

In operation, the gauge envelope is grounded, and a high voltage of the order of 3 to 6 kv is impressed on the anode. The cathode conductor is connected to a milliameter that responds to current changes on the surface of the cathode. These current changes are directly proportional to the density (particle population) of the gas being measured and, therefore, the pressure of the gas.

Notes:

1. The use of a stainless-steel, rather than glass, envelope avoids the problem of electrically charged surfaces that distort the electric field within the gauge and produce inaccurate readings.
2. This type gauge should be useful in industrial applications in the fields of metals, chemicals, food processing, cryogenics, thin-film devices, and in the operation of high-energy particle accelerators.

Patent status: Title to this invention has been waived under the provisions of the National Aeronautics and Space Act (42 U.S.C. 2457 (f)), to GCA Technology, Inc., Bedford, Massachusetts.

Source: W. S. Kreisman and R. Herzog of GCA Technology, Inc., under contract to Goddard Space Flight Center (GSFC-445)