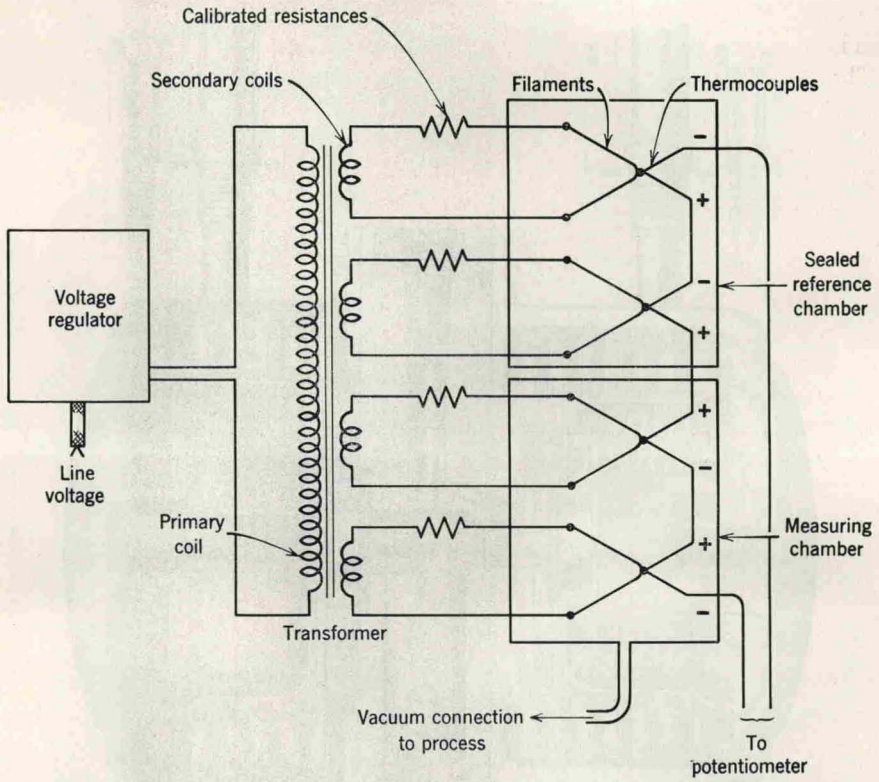

Fig. 11. Circuit of thermocouple-type thermal gage.

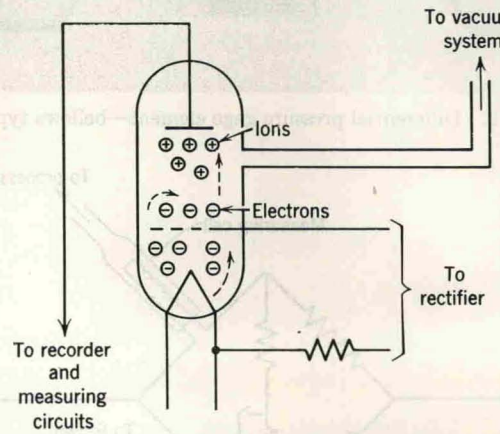

Fig. 12. Ionization gage.

regulator and transformer. There are two sections, a sealed one under high vacuum and a second one connected to the process pressure. A small sensitive thermocouple is located on each of the filaments and each pair of couples are connected in series to increase the generated emf. The two thermocouples in the reference chamber are connected in opposition to the two in the measuring chamber. Thus, their generated emf's oppose each other. This difference in emf is a measure of the difference in pres-

sure between the reference chamber and the measuring chamber. This type of sensor is used in the high and medium vacuum ranges.

The *ionization* sensor is illustrated in Figure 12. The operation is based on the ability of electrons emitted from a hot filament to bombard the molecules of the residual gas in an evacuated system, forming an electric current flow from the resulting ions. The magnitude of the current flow is directly proportional to the number of ions formed. This is an indication of the amount of gas present, which is a measure of the vacuum pressure. The sensor is essentially a triode tube and the electron emission from the cathode is held constant by a precision bridge circuit. The electrons are attracted to the grid, which is at a high positive potential with respect to the cathode, and the momentum of the electrons carries them past the grid to the plate. The plate is held at a negative potential with respect to the grid and repels the electrons, driving them among the molecules of the gas. This bombardment of the gas causes ions to form and, with an existing potential difference, the ions are attracted to the plate, and the current flow is proportional to the number of ions formed. The current flow is proportional to the amount of gas present, actually the number of molecules present, and the magnitude of the current flow is a measure of the vacuum. Ionization sensors are used in ultra high and very high vacuums and must be protected against too high pressures, which would burn out their filaments.

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NOTE: In addition, all of the major instrument manufacturers have available descriptive and instructive data on their pressure gages and transducers.

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