change in intensity between the times when the zero and peak height are recorded will cause a small error. The magnitude of the error is proportional to the fractional change in intensity multiplied by the ratio of the zero signal to peak height signal; for example, a change of intensity of 10 percent and a zero reading which is 10 percent of the peak height would cause a 1 percent error in the reading of the difference. If the intensity does not change between the zero and peak readings, there is, of course, no error.

The results of this technique so far indicate a possible precision as low as 0.2 percent using a surface ionization source. Better results than this would be difficult to obtain, since fluctuations in the distributions of intensity in the ion beam will limit the precision in the ratio of ions collected by the grid collector to those collected by the single slit collector. This ratio is dependent on the uniformity of the wires in the grid. If this technique is used on a gas source this factor may not be a limitation, since the distribution in the ion beam is more constant and should not vary between samples.

[1] H. A. Strauss, Phys. Rev. **59**, 430 (1941).
[2] Nier, Ney, and Inghram, Rev. Sci. Instr. **18**, 191 (1947).
[3] C. McKinney, McCrea, Epstein, Allen, and Urey, Rev. Sci. Instr. **21**, 724 (1950).
[4] Gorman, Jones, and Hipple, Anal. Chem. **23**, 438 (1951).
[5] M. G. Inghram and W. A. Chupka, Rev. Sci. Instr. **24**, 518 (1953).
[6] W. E. Glenn, AECD-3337, January 3, 1953.

Cutting Tool for Alkali Metals*

D. B. TRAUGER
K-25 Laboratories, Carbide and Carbon Chemicals Company, Oak Ridge, Tennessee
(Received July 3, 1953)

ALKALI metals are frequently supplied in cylindrical extruded slugs. It is often desirable to cut these into smaller pieces for use in laboratory experiments. Ordinary cutting tools such as a saw or chisel are not satisfactory because of the tendency of the alkali metals to adhere to other metals and to flow under pressure.

A tool has been devised which will cut soft metals quickly with a clean separation of the pieces. In principle it is similar to a cheese or butter cutter in that a fine wire is drawn through the metal. The device is shown in Fig. 1. A No. 20 piano wire can be drawn through a cylinder of alkali metal several inches in diameter in a few seconds by hand turning of the spindle. The unit is small and easily operable in a dry box.

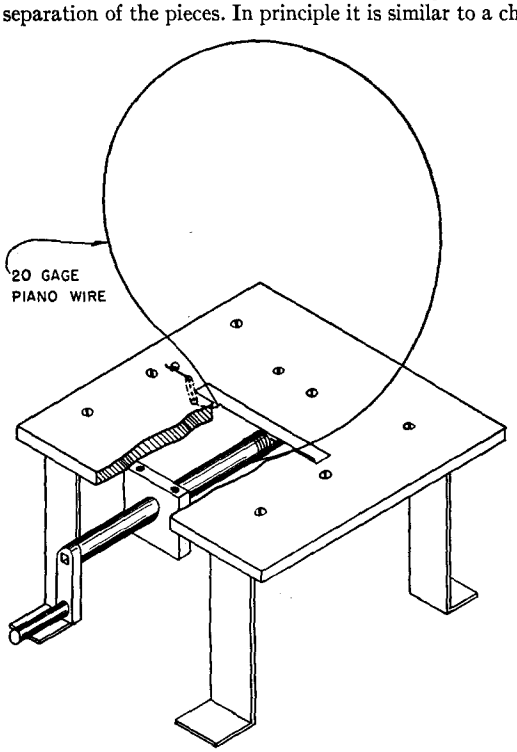

FIG. 1. Alkali metals cutter.

* This document is based on work performed for the Atomic Energy Commission by Union Carbide and Carbon Corporation at Oak Ridge, Tennessee.

Oil Manometer for Ultra-High Vacuum Systems

MANFRED A. BIONDI
Westinghouse Research Laboratories, East Pittsburgh, Pennsylvania
(Received September 1, 1953)

RECENTLY, ultra-high vacuum systems have been developed for handling very pure gas samples.[1] The problem of measuring gas pressures in the mm Hg range without introducing significant contamination to such systems has led to the design of two types of manometers at these laboratories. A null-reading absolute manometer[2] has been developed for use on systems which attain a limiting vacuum of $\sim 10^{-10}$ mm Hg and a rate of rise of contamination pressure of $\sim 10^{-11}$ mm Hg/min. The present note describes a direct-reading oil manometer which achieves certain simplifications over the null-reading manometer without seriously impairing the ultra-high vacuum properties of the system.

The manometer is shown in Fig. 1. It is constructed of Pyrex glass tubing and is filled with Octoil-S.[3] The lower section contains a nichrome wire element for heating the oil during bakeout of the vacuum system. The particular dimensions of the manometer shown in Fig. 1 have been chosen for use with the standard vacuum systems and bakeout ovens employed in our laboratories.[4] The scale of Fig. 1 is calibrated to read pressure directly in mm Hg when the manometer is filled with Octoil-S.

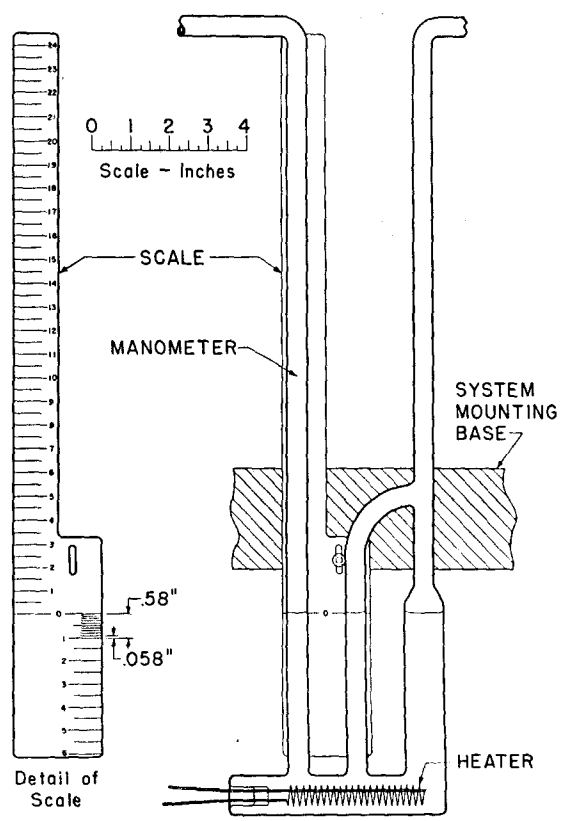

FIG. 1. Oil manometer and scale. The scale calibration for Octoil-S is shown, the smallest division corresponding to 0.1 mm Hg. The heater, which has 10 ohms resistance, consists of a $\frac{1}{16}$-in. diam coil having 28 turns of 16-mil Nichrome V wire.

The connection of the manometer to a gas handling system is shown in Fig. 2. One side of the manometer is connected directly to the pumps to give a constant "zero" pressure reference. When the main valve of the system is closed and gas is admitted to the system, the pressure difference across the valve results in a manometer deflection. The unequal cross-sectional areas of the manometer columns cause the liquid to rise in the left-hand column at roughly four times the rate at which it falls in the right-hand column. In this way it is possible to make full use of the vertical height available in the system. In order to attain maximum reading accuracy, equal cross-sectional area columns are used to produce similar oil meniscus shapes.

Since these manometers are usually used on ultra-high vacuum systems which do not contain refrigerated traps, the effect of the vapor pressure of the Octoil-S must be considered. At 25°C, Octoil-S has a vapor pressure of 3×10^{-8} mm Hg.[3] This pressure is undesirable in the handling of very pure gases. It has been found that a clean copper baffle readily stops oil vapor molecules.[5] In the present apparatus, a cylinder of rolled corrugated copper sheet[5] five inches in length is inserted in the glass manifold between the manometer and the gas handling system (see Fig. 2).

During bakeout of the vacuum system (usually for 12 hours at ~420°C), the oil in the manometer is heated with 15 watts of

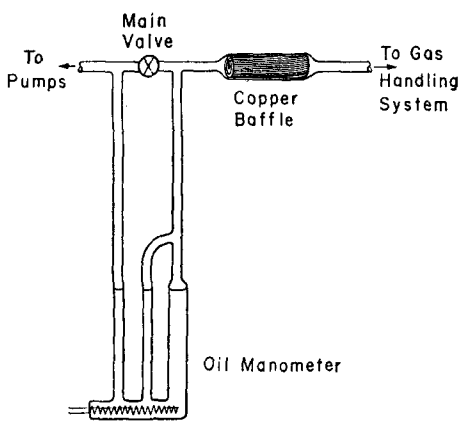

FIG. 2. Connection of oil manometer to the gas handling vacuum system. The copper baffle transmits the pressure of the gas in the system to the manometer, but prevents oil molecules from the manometer from contaminating the system.

power in order to degas the oil thoroughly without distilling a measurable amount of oil from the manometer. Several systems using these oil manometers have consistently attained limiting vacuums of $\sim10^{-9}$ mm Hg and rates of rise of contamination pressure of $\sim10^{-10}$ mm Hg/min following bakeout. One such system, which was left standing for three weeks, showed no increase in the rate of rise of contamination over the value found immediately following bakeout.

The present direct-reading oil manometer thus provides a simple means for measuring pressures in the 0–30-mm Hg range without introducing significant contamination to a vacuum system. If the simple scale of Fig. 1 is replaced by a scale with knife edge slider and vernier, an accuracy of approximately ±0.01-mm Hg is attained in reading the height of the oil columns.

The author wishes to thank the various members of the Physics Department who have contributed helpful suggestions concerning the design of the manometer.

[1] D. Alpert, J. Appl. Phys. **24**, 860–876 (1953).
[2] Alpert, Matland, and McCoubrey, Rev. Sci. Instr. **22**, 370 (1951).
[3] *High Vacuum Equipment Catalog*, Distillation Products, Inc.
[4] See reference 1, Fig. 7.
[5] Presumably the oil molecules are adsorbed by the clean copper surface. Since it is found that the copper baffle remains effective for several weeks, it appears that the surface can hold many monolayers of oil molecules. A detailed investigation of the physical processes involved is being carried out by the Physical Electronics Group of our laboratories; a brief note describing the construction and operation of the copper baffles has been submitted to *The Review of Scientific Instruments* by D. Alpert.

A Linear Gate Circuit for Pulse-Height Analyzers*

PAUL R. CHAGNON
The Johns Hopkins University, Baltimore, Maryland
(Received September 1, 1953)

IN many coincidence experiments it is necessary to measure the distribution in height of only those pulses from a scintillation counter which correspond to a certain coincidence or anticoincidence signal. When a multichannel analyzer is used to measure the pulse-height distributions, this may be accomplished in two ways: the discriminator may be "keyed" or "gated" by the coincidence pulse so that it only operates immediately after the coincidence,[1] or a gate circuit may be used which permits only the pulses corresponding to a coincidence to be amplified and set to the discriminator.[2]

The first of these methods suffers from the disadvantage that the maximum single-counter rate (not the coincidence rate) is limited by the response time of the linear amplifier and analyzer. For example, an amplifier-discriminator system whose operating time is 100 microseconds (not unusually long) would be thoroughly jammed by a single-counter rate of 10^4 per second even though the coincidence rate were only a few counts per minute. The alternative method generally suffers from nonlinearity and instability of the gate circuit.

A balanced gate circuit having good linearity and stability has been developed in this laboratory for use with an improved version of the fast neutron spectrometer.[3] The block diagram of the spectrometer is given in Fig. 1 to illustrate the manner in which the gate is used. In this case, the height of the pulse from counter No. 1 is measured only when counter No. 1 is in coincidence with counter No. 2. The operation of the circuit can be clearly understood from the wave forms shown with the schematic diagram in Fig. 2. The coincindence pulse operates a trigger circuit, the output of which cuts off the clamp tube V_1, thereby permitting the phase splitter V_2 to operate. The signal pulse, slightly delayed (about 0.15μsec with respect to the trigger pulse) is applied to one grid of V_2, resulting in signal pulses of opposite polarities at the two plates. The output of V_2 is fed to the difference amplifier V_3, so that the rectangular "pedestals" are subtracted, while the signal pulses are added. The output signal may be taken from either plate of V_3, giving a choice of polarity. The entire operation takes less than 1 microsecond. Matched components are used, and after the tubes are well aged, the final balancing of the circuit is done with the 2000-ohm potentiometer.

The system is linear within 1 percent, and has a gain of about 2, over an input pulse-height range of about 0.1 to 4 volts. After the initial aging of the tubes, the observed drift in the height of the residual pedestal is less than 2 percent of maximum output over a period of several hours, and perhaps 5 percent, over several weeks. Ungated pulses are completely rejected when a negative input is used; for positive input, pulses up to about 12 volts are rejected.

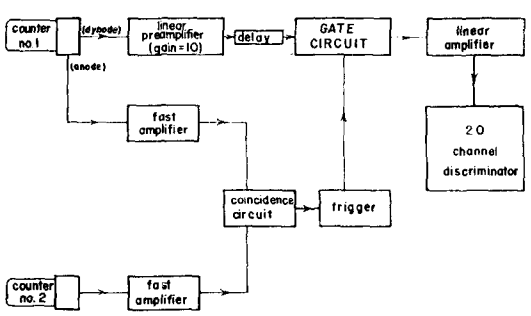

FIG. 1. Block diagram of the neutron spectrometer, illustrating use of the gate curcuit. It should be emphasized that the signal is gated before the main linear amplifier, completely eliminating blocking of the amplifier and discriminator at high single counting rates.