Laboratory and Shop Note

Additional Stabilization for the Beam Current in the RCA Type B Electron Microscope

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A CIRCUIT which gives additional stabilization of the electron beam in the RCA Type B electron microscope has been used by the writer for some time, and it has been found to improve the operation for the following reason: Except immediately after having been cleaned, the aperture diaphragms are coated with a non-conducting wax produced by the action of the electron beam upon the pump oil vapor.[1] Electrons from the beam which land on the wax give it a static charge, which is rarely symmetrical, and whose first-order effect is, therefore, to shift the image slightly. Since the amount of static charge is dependent upon the beam current, fluctuations in the latter may often produce fuzziness in the photograph. While it will be agreed that the ideal situation is always to have clean apertures and accurate alignment, any improvement which will make the beam current more nearly constant will be a time saver in that it will reduce the frequency with which cleaning and aligning become necessary.

The electron beam current in the RCA electron microscope is controlled by means of the filament temperature. The filament heating power is radiofrequency, furnished by a vacuum tube oscillator, whose plate supply is regulated electronically. In spite of the fact that the regulation of the input voltage to the oscillator is very good, the filament emission, and consequently the beam current, shows some fluctuation in response to the normal fluctuation in line voltage. This is caused by the fact that the filament necessarily is operated under an emission-limited condition, and the rate of change of emission with temperature is very great. Many electron microscope users have placed a voltage regulator in the main power line, which is a good solution when the heavy equipment required is available. In view of the fact that the filament emission current is affected much more strongly both by line voltage changes and by internal changes than is anything else in the system, we have tried applying direct electronic regulation to that alone. In our case, at least, this has cleared up practically all of the photographic fuzziness which is associated with line voltage fluctuation.

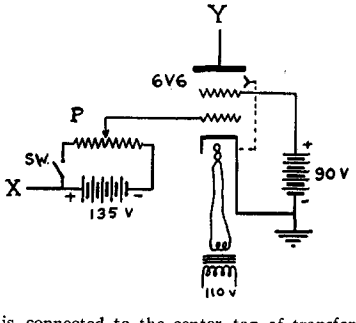

FIG. 1. *X* is connected to the center tap of transformer T19F93; *Y* is connected to either end of resistor R-157. The numbers refer to RCA manual MI-1950-D. Potentiometer *P* is a 500,000 ohm carbon volume control.

The fluctuations in filament emission are reduced by a factor of at least ten, by means of the one-tube circuit shown in Fig. 1. The potential used to control the grid of the 6V6 is obtained at the center tap of transformer T19F93.[2] This is in the return circuit for the electron microscope filament emission current, and there is about 245,000 ohms resistance between this point and ground. Thus, for an emission current of 400 microamperes, this point has a potential of 98 volts, and it changes linearly with the emission current. The plate of the 6V6 draws current in parallel with that of the oscillator which furnishes the filament power. In operation, a slight rise in emission current makes the grid of the 6V6 less negative (.245 volts per microampere change), causing the 6V6 plate current to rise, which increases the drop across R-182 and R-158, and reduces the power generated by the oscillator.

To adjust the regulator the microscope is first turned on with the potentiometer *P* set at the negative end. The regulator then has no effect upon the microscope. If a filament emission of, say, 400 microamperes is desired, the emission is set enough higher than 400 to include the maximum fluctuation—425 or 450; then *P* is turned toward the positive end until the emission is brought down to 400. After the initial setting, *P* can be left fixed, and when the microscope is turned on, the beam control knob can be turned up until the meter "bumps" against the 400 mark. The emission may be reduced for the purpose of taking a photograph by simply turning *P* until the emission is pulled down to the required value, in which case considerable current flows through the 6V6 and the regulation becomes still better.

[1] This fact was emphasized by J. Hillier and R. F. Baker in their paper at the Chicago meeting of the Electron Microscope Society of America, Nov. 16–18, 1944.
[2] See RCA manual MI-12950.

Contributed Points of View

I do not agree with a word that you say, but I will defend to the death your right to say it.
—Voltaire, Letter to Helvetius

To the Editor:

In connection with the current discussion on the adequacy of the existing physics societies, we wish to advocate that a program of reorganization be initiated along the lines indicated in the editorial by G.P.H.[1] and further developed in a recent letter to the editor from W. A. Wildhack.[2]

Briefly, this program would provide for two principal objectives. (1) A new and greatly expanded American Institute of Physics which would have two classes of members: (a) the physics societies now in existence together with any new ones dealing with special interests within or on the borderlines of physics which may arise;

(b) the individual members of all these societies together with any other individuals possessing an interest in physics. Control of the Institute would be vested in delegates who represent the member societies and are chosen by the membership of these societies, and delegates chosen directly by the entire group of individual members.
2. The transfer by the member societies to the new Institute of the major responsibility for the determination of general matters of policy, the formulation of a comprehensive publication and library program including the establishment of a new journal of general interest, and the arrangement of meetings dealing with all aspects of physics.

In view of the anticipated growth of the physics profession after the war, we believe that this is an appropriate time to institute changes which are fundamental to constructive postwar planning in all activities related to physics. We sincerely hope, therefore, that such a program will be carefully considered by the Governing Board of the American Institute of Physics.

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[1] G. P. Harnwell, Rev. Sci. Inst. **15**, 19 (1944).
[2] W. A. Wildhack. Rev. Sci. Inst. **15**, 271 (1944).

New Instruments

W. A. Wildhack: Associate Editor
in Charge of this Section
National Bureau of Standards, Washington, D. C.

These descriptions are based on information supplied by the manufacturer and in some cases from independent sources. THE REVIEW *assumes no responsibility for their correctness.*

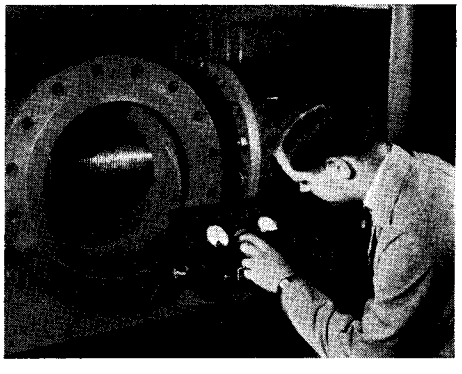
Thermocouple Vacuum Gauge and Control Unit

The Vacuum Engineering Division of National Research Corporation has developed and is now manufacturing a new all-metal thermocouple vacuum gauge, Type E-1, together with its associated control unit.

The gauge features extreme ruggedness of construction and is assembled in a metal envelope. Connection to the vacuum system is made through a standard $\frac{1}{8}$-inch IPS hexagonal shank pipe nipple.

The control unit for the gauge operates directly from 110-v a.c. and indicates pressures in the range of 1 to 1000 microns accurately and continuously. The gauge output meter is calibrated directly in microns.

The gauge and associated control unit provide a good method for locating leaks in vacuum systems. For the purpose, parts suspected of containing leaks are sprayed with acetone or ether. If a leak is present, a sudden increase in the apparent pressure reading will occur. NATIONAL RESEARCH CORPORATION, *Boston, 15, Massachusetts.*



Transmission Photometer

The new Transmission Photometer, for accurately measuring light transmitted through small areas of spectrographic plates, is said to be desirable for use wherever spectrographic analysis is employed, also for microcolorimetric and microchemical analyses and for measuring transmittance through solutions. Requiring a constant a.c. or d.c. power supply of 6 volts, with approximate capacity of 30 amp., the photometer comprises a light source, an optical system, a galvanometer, a photo-cell, and a mechanical stage for accommodating the plate. Stage has a three-point ball-bearing suspension, is movable in three directions. Control knobs on front of instrument facilitate focal adjustment and control of optical-system diaphragms and filters. Instrument is said to be exceptionally easy to operate because all adjustments can be made and seen readily from a single position. SPECIAL PRODUCTS DIVISION, GENERAL ELECTRIC COMPANY, *Schenectady, New York.*