lapping occurs with sera of the latter group to the California virus antigen, but not in the reverse direction. With DeBoer and Cox[7] benzene extracted antigens, and our recent modification of their method,[8] much less overlapping occurs and when our antigen is employed in its optimal dilution (the highest antigen dilution which gives the highest serum titer in a combined antigen-serum titration), there is absolutely no overlapping detectable between any heterologous serum and antigen in original serum dilutions as low as 1:4.

Summary. Herein is described a simple, economical and quick method for preparing highly specific, high titer guinea pig immune sera for use as positive controls, and for standardizing antigens in the complement fixation test. This method has been used for producing sera for Western and Eastern equine, St. Louis, Japanese B, West Nile, Russian Spring-summer and the Hammon-Reeves California virus.

[7] DeBoer, C. J., and Cox, H. E., *J. Immunol.*, 1947, **55**, 193.

[8] Espana, C., and Hammon, W. McD., PROC. SOC. EXP. BIOL. AND MED., 1947, **66**, 101.

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A Suitable Current Stabilizer for the Tiselius Apparatus.*

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It has become evident that present methods of current control for the electrophoretic apparatus of Tiselius can be improved. It is common practice to use a voltage-stabilized power supply to furnish the current. While this power supply gives a constant voltage across the whole cell, it does not furnish a constant current because of fluctuations of resistance within the cell. Most of these fluctuations probably arise within the electrode vessels. Inasmuch as the resistance of the central part of the cell is not a constant fraction of the total resistance of the cell, the voltage drop across this part and the field strength within it do not remain constant. Because of this it is customary[1] to measure the current and to calculate the field strength by means of the equation: $X = I/qk_s$.

X = field strength in volts per cm.

I = current in amperes.

q = cross-sectional area of the central part of the cell.

k_s = specific conductance of sample in reciprocal ohms.

In order to apply this equation to apparatus employing a voltage-stabilized power supply it is necessary for the operator to make frequent observations of the current and to compensate for fluctuations by altering the applied voltage. This frequent adjustment is tedious as well as time-consuming.

It is preferable that current-stabilization rather than voltage-stabilization be used. The simple circuit which has been found suitable for the Tiselius apparatus is herein given. It is based on the principle that the plate current of a pentode vacuum tube remains constant despite changes in plate voltage. Further stabilization is obtained by the degenerative effect of the resistance in the cathode circuit.

In operation the switch S_2 is connected to the dummy load R_3 and then the switch S_1 is closed. This dummy load serves two purposes: first, the tubes are brought to normal operating temperatures in order to avoid subsequent fluctuations due to thermal changes; and secondly, the dummy load has approxi-

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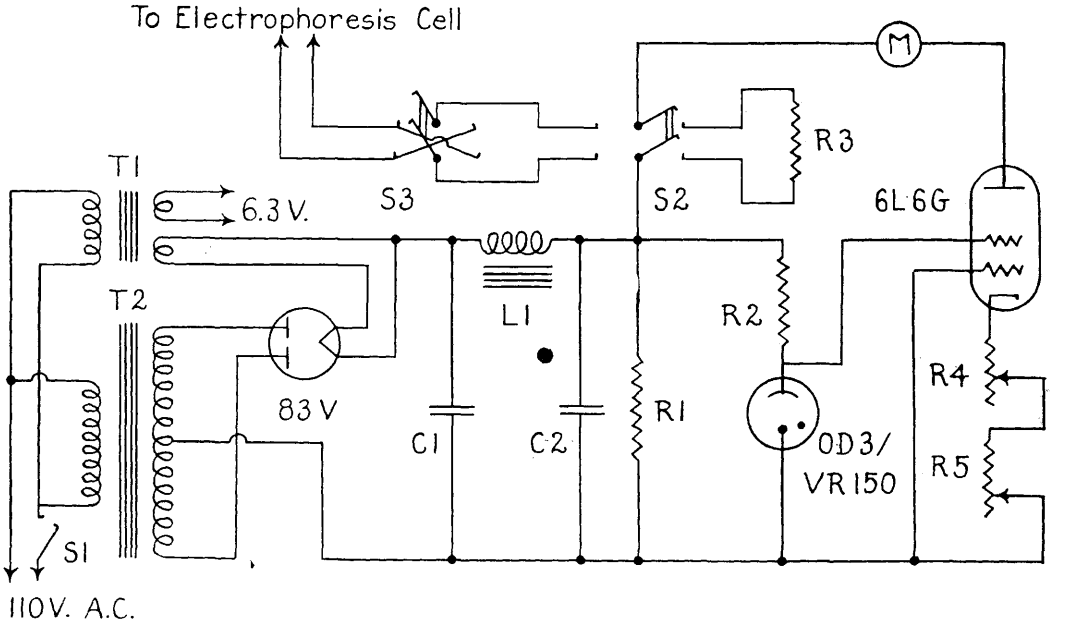
[1] Abramson, H. A., Moyer, L. S., and Gorin, M. H., *Electrophoresis of Proteins*, p. 61, Reinhold Publishing Co., New York, 1942.



PARTS LIST

T1—Filament transformer with 5 V and 6.3 V windings.
T2—Power transformer—450 V each side of center tap.
L1—Filter choke—10 h.
C1, C2—Filter condensors—8 mfd, 600 V.
R1—50,000 ohms, 10 watts.
R2, R3—20,000 ohms, 50 watts.
R4—Potentiometer rheostat, 2000 ohms, 5 watts.
R5—Potentiometer rheostat, 200 ohms, 5 watts.
S1—S. P. S. T. switch.
S2, S3—D. P. D. T. switches.
M—0-30 milliameter, accurate to 0.5%.

mately the same resistance as the electrophoretic cell and so the 2,000 ohm rheostat R_4 may be set so that the current is approximately that required in the cell. Then S_2 is changed so that the current will flow through the cell and the final adjustment made with the 50 ohm rheostat R_5. S_3 is a reversing switch employed for alternation of the polarity of the electrodes on successive runs. The switches and controls are mounted so that the power switch S_1 is never closed when the cathode resistance is very small or when the plate circuit of the 6L6 G is open. This avoids damage to the tube.

It is found that the current variations with this source are undetectable on the milliammeter (½% accuracy) used to measure the current. The effect of fluctuations of line voltage and of cell resistance is negligible. Thus the current through the Tiselius cell is maintained at a constant value. The measurement of current by means of a standard resistance and potentiometer seems unnecessary and unjustified. A precise milliammeter is much more convenient and inexpensive and offers sufficient precision for all electrophoretic studies.

The cost of this circuit, exclusive of the milliammeter, was less than 20 dollars. For size, cost and performance it has been satisfactory for currents of 15-30 ma. It is possible that some of the simple constant-current circuits studied by Hill[3] could easily be adapted for use with electrophoretic cells.

2 Swingle, S. M., *Rev. Sci. Inst.*, 1947, **18**, 128.

3 Hill, W. R., *Proc. of the I. R. E.*, November, 1945, p. 785.