AIP | Review of Scientific Instruments

Polystyrol as an Insulator

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Citation: Review of Scientific Instruments **9**, 331 (1938); doi: 10.1063/1.1752360
View online: http://dx.doi.org/10.1063/1.1752360
View Table of Contents: http://scitation.aip.org/content/aip/journal/rsi/9/10?ver=pdfcov
Published by the AIP Publishing

off the valve seat, and hence allowing more air to escape). (2) The increased flow through the compensating inlet into the valve increases the jet pump action in the valve, "sucking" more air out of the chamber K, and thus reducing the pressure in the output. (Experimentally it is possible to reduce the output pressure below atmospheric pressure by flowing enough air through the compensating inlet.)

By adjusting the screw clamp on the inlet I, the relative proportions of air entering the regulator through the two inlets may be varied so as to obtain a substantial balance between the effects of under- and over-compensation. It is in this way that the regulator stabilizes the output pressure over a wide variation of input pressure.

Performance

The regulator has been extensively tested, and has been found satisfactory for output gauge pressures of from 2 to 50 cm Hg, and for output flows of from zero to 4 liters/sec. Doubtless this range could have been considerably extended.

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[1] Chapman, "Carrier Mobility Spectra of Liquids Electrified by Spraying and Bubbling," Phys. Rev. **54**, 520 (1938); **52**, 184 (1937).

Increasing the Sensitivity of a Phototube Relay

The chief cause of insensitivity of a phototube circuit controlling a mechanical relay is the lag of the relay. This lag can be greatly reduced by placing an electronic relay between the phototube circuit and the mechanical relay, or by using an electronic relay to control the load directly.

The circuit illustrated in Fig. 1 has proved to be entirely

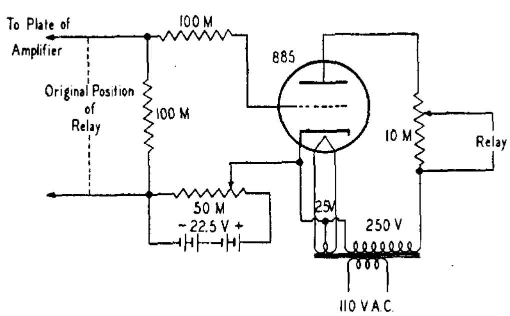

Fig. 1. Modified phototube relay circuit.

satisfactory for this purpose. The over-all sensitivity of the relay was increased by a factor of 25 without any decrease in stability. The mechanical relay in the plate circuit of a commercial phototube relay[1] is replaced by a 1 watt resistor connected in the grid circuit of an RCA 885 thyratron in such a way as to place the drop in the resistor in series with a permanent negative bias supplied by a battery, the amount of the permanent bias being adjusted to obtain maximum sensitivity. The plate supply for the thyratron is a small 250 volt transformer (rated at 10 watts) in series with a 10 watt wire-wound resistor. Part of the drop in the resistor is used to drive the mechanical relay removed from the original circuit. As the output of the amplifier increases, the bias reaches the cut-off value corresponding to the maximum of the a.c. plate voltage and the thyratron becomes nonconducting. When the bias falls below this value, the thyratron again passes current. The relay action can be reversed by placing the drop in the resistor of the grid circuit of the thyratron in opposition to the permanent bias, which must be increased to exceed the cut-off value.

This circuit has been used in connection with a high-sensitivity galvanometer. The image of a 50 c.p. headlight bulb is focused, after reflection from the $\frac{1}{4}$-inch mirror of the galvanometer, on a spherical mirror 2 meters from the galvanometer. The mirror has a straight vertical edge which causes the light intensity on the phototube to vary with the galvanometer deflection. The phototube[2] is placed at the focal point of the mirror. It is found that the filament image which is 18 mm wide, travels about 1 mm between the position corresponding to relay on and that corresponding to relay off. With the galvanometer used the over-all sensitivity is about 0.1 microvolt.

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[1] For example a G-M Laboratories No. 5351-A phototube relay.
[2] G-M Laboratories No. 71-A Visitron.

Polystyrol as an Insulator

Current leakages and small residual potentials are often troublesome, especially in wet weather, across the insulators of electrometers, bridges, and other sensitive electrical instruments. Insulators of polystyrol, a transparent plastic, are very free of such effects. This material is machined more easily than amber, or sulphur, because it is not brittle and has greater mechanical strength. While the monostyrol is being polymerized into polystyrol, it can be pressed into a variety of shapes.

An electrometer bushing of $\frac{3}{4}''$ diameter and $\frac{1}{8}''$ thickness showed only 10^{-15} amp. current leakage with 90 volts across it when the humidity was 75 percent at a temperature of 85°F. When the voltage was removed, the residual e.m.f. amounted to less than 0.1 percent. Race and Leonard[1] have shown that polystyrol has a power factor nearly that of fused quartz, 0.00042 at 1000 kilocycles, and a dielectric constant of 2.4 as compared to that of fused quartz 4.1, and that of sulphur 4.6.

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[1] Race and Leonard, Elec. Eng. **55**, 1347 (1936).