

## TECHNICAL NOTES

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### A SYSTEM FOR REDUCTION OF 120-CYCLE MODULATION FROM A-C OPERATED EXCITER LAMPS\*

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The following is a method, applicable particularly to low-priced sound equipment and portable apparatus, for allowing the use of a-c operated exciter lamps with practical elimination of 120-cycle modulation effects on the reproduced sound.

The system depends upon the fact that the current in a gas-filled phototube is a function both of the light incident upon the cathode and the potential applied to the anode—the latter effect being due to increase in ionization of the gas atoms as the voltage is increased. It therefore becomes possible to compensate for periodic

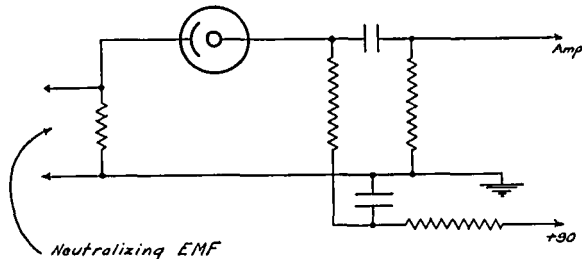


FIG. 1. Compensation for light variations by introduced a-c emf.

variations in the exciting light by inserting, in series with the PEC anode potential, an alternating emf having the proper phase, amplitude, and wave-form. (Fig. 1). Furthermore, as the effect of this a-c introduction on the PEC space-current depends entirely upon the number of primary electrons emitted from the cathode by illumination, the adjustment holds very closely for all degrees of average illumination (as determined by a sound-track, *etc.*, interposed between exciting light and phototube) down to zero.

\* Received July 25, 1940.

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In other words, it is necessary to make only one adjustment of the balancing voltage—say, with no film in the sound head—corresponding to the percentage variation in illumination of the particular type of exciter lamp being used, and the cancellation remains substantially constant for all degrees of illumination as determined by the sound-track.

There are various ways in which a suitable neutralizing voltage may be obtained. The unfiltered or partially filtered sections of the amplifier power-supply

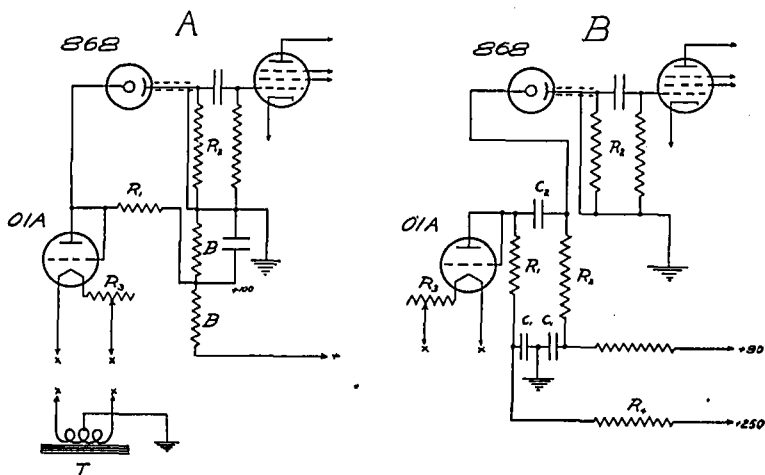


FIG. 2. Circuit employing the principle of Fig. 1.

$R_1$	5,000 ohms	$\frac{1}{2}$ watt	$C_1$	1 or more	mfd
$R_2$	500,000 ohms	$\frac{1}{2}$ watt	$C_2$	0.1	mfd
$R_3$	20 ohms	rheostat	$B$	Bleeder	
$R_4$	50,000 ohms	1 watt			
$T$	6.3-volt amplifier heater supply				
$E_f$ (01A)	$\cong 3$ v. rms: $I_p \cong 2$ ma.				
Exciter lamps	10-v, 7.5a; 10-v, 5a; 9-v, 4a; etc.				

contain a 120-cycle component that may be adapted, by suitable networks, for the purpose.

Fig. 2 illustrates a simple circuit giving excellent results experimentally. Here a 120-cycle voltage of nearly perfect wave-form for the purpose is obtained by utilizing the space-current variations in a filament-type tube operated below temperature saturation.

A shows a simple, direct-coupled circuit, which however has the disadvantage that a fair-sized bleeder is required to insure substantial independence of the d-c PEC potential from variations in the 01A circuit. This disadvantage is removed in B, in which the d-c circuits are isolated. In both cases adjustment is made by regulating the 01A filament current (as the tube operates saturated it is unnecessary that the filament be balanced with respect to ground).

This arrangement, in either case, gives a cancellation of the order of 30 db, when used with any of the commonly used types of exciter lamp, but has the disadvantage of being rather sensitive to power-line variations.