RCA MANUFACTURING COMPANY, INC.

A RADIO CORPORATION OF AMERICA SUBSIDIARY

Harrison, New Jersey

RCA RADIOTRON
D I V I S I O N

APPLICATION NOTE NO.70
February 17, 1937

APPLICATION NOTE
ON
AN EXPOSURE METER FOR CATHODE-RAY OSCILLOGRAPHS

An important feature of the cathode-ray oscillograph is the ease with which a trace can be photographed. Any recurrent trace can be photographed with an ordinary camera, provided the trace remains stationary during a period sufficient for the exposure. Because the intensity of a trace and, hence, its density on the film can be varied over a wide range in most cathode-ray oscillographs, it is desirable to have some means for reproducing with fair accuracy a given intensity. This Note describes the construction of a simple, inexpensive exposure meter, which facilitates the adjustment of intensity to a predetermined value.

Because the light intensity from a tungsten-filament lamp can be reproduced easily, the intensity of a trace on a cathode-ray tube can be set to a predetermined value by matching its brightness with that of the filtered light from a calibrated tungsten lamp. The exposure meter shown in Fig. 1 facilitates this comparison. The light from the lamp passes through a color filter, which passes light of nearly the same color as that of the trace to be photographed. This colored light falls on a white diffusing surface of matte paper, which reflects the colored light to the eye aperture. Thus, the light from the lamp appears to the eye as a colored oval. The light from the trace to be photographed passes directly through the hole in the center of the diffusing surface to the eye aperture. With the proper color filter in place, therefore, the image at the eye aperture consists of colored light from the trace to be photographed surrounded by light of nearly the same color from the lamp. The two components of the image are matched by adjusting the intensity of the trace or the filament current of the lamp until the brightness of the two components is the same.

The exposure meter is calibrated easily. The intensity of a trace is adjusted to a low value. The exposure meter is placed against the screen of the cathode-ray tube and the intensity of the comparison lamp is adjusted until a match is obtained. The filament current of the lamp is then recorded and a photograph of the trace is made. The intensity of the trace is increased slightly and the process is repeated for the same lens speed, magnification, exposure time, and film emulsion. A suf-

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ficient number of trace intensities are calibrated to cover the working range of the tube. To reproduce a desired intensity of any portion of a trace, it is only necessary to set the filament current of the comparison lamp at the proper value and vary the intensity of the trace until a match at the desired portion is obtained. It is usually necessary to insert a neutral filter at aperture B of the exposure meter to facilitate calibration of high trace intensities. The location of this filter is shown in Fig. 1.

Fig. 2 shows a number of trace intensities and pertinent data corresponding to each trace. Two calibration readings are shown for each trace: the first corresponds to the intensity at the peaks of the trace and the second corresponds to the intensity at the center of the trace. The high intensity of the trace at the peaks is due to the low velocity of the spot at these points.

When filament current is used as a measure of the amount of light obtained from the lamp (Fig. 3A) only about one-half the meter scale is useful, because the filament does not begin to glow until the meter reads about half scale. The bridge circuit shown in Fig. 3B is recommended for use when it is desirable to spread the readings over the entire meter scale. The bridge is balanced by adjusting R_3 with just enough of R_1 and R_2 in the circuit to cause the lamp to glow dimly. R_1 and R_2 are then decreased and R_4 is increased until the meter reads full scale with R_1 and R_2 zero. The amount of light from the lamp is then adjusted by varying R_1 and R_2. The calibration of the exposure meter is determined in terms of the bridge current (I_m).

This exposure meter has been in use for over a year in our laboratory. Its simplicity and ruggedness contribute to its practicability; its accuracy is more than adequate for most purposes.

SUGGESTED CONSTRUCTION FOR EXPOSURE METER

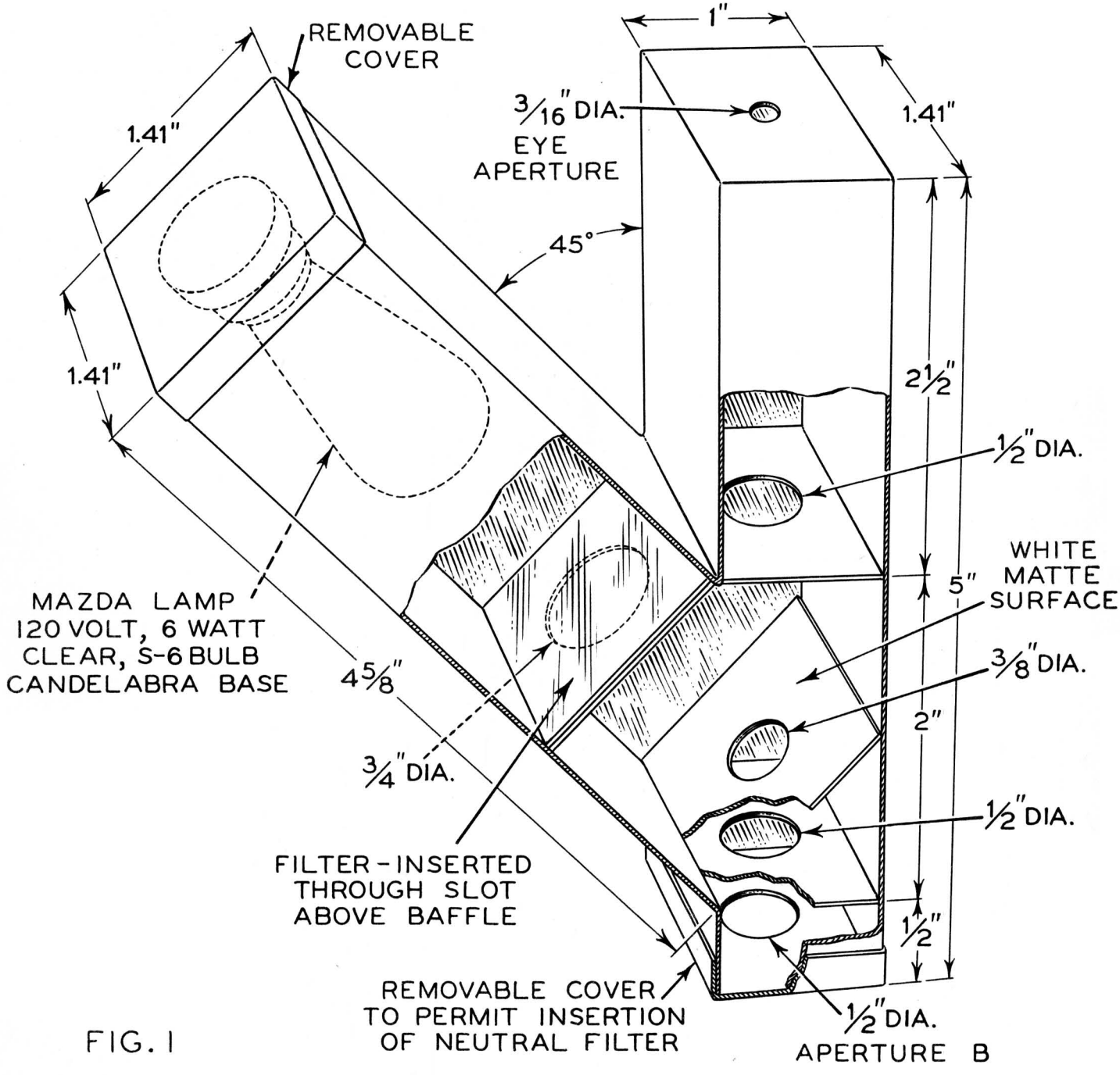
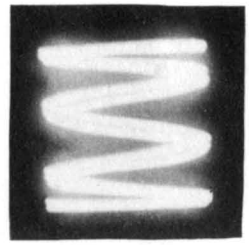


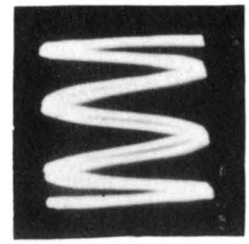
FIG. 1

NOTE: ALL INTERIOR SURFACES PAINTED MATTE BLACK EXCEPT AS INDICATED.

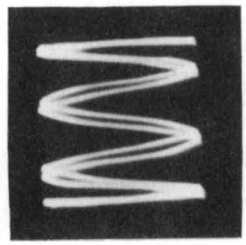
CALIBRATION AND COLOR-FILTER DATA FOR EXPOSURE METER



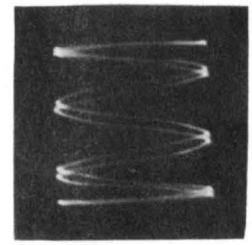
1



2



3



4

CALIBRATION DATA *

Trace No.	**Filament-Current Method** Fig.3A		**Bridge Method** Fig.3B	
	Peak of Trace (Ma.)	Center of Trace (Ma.)	Peak of Trace (Ma.)	Center of Trace (Ma.)
1	49	44	15	12
2	45	41	12.5	10
3	41	38	10	8
4	37	34	7.5	6

* These calibration data were obtained under the following conditions: Camera lens, f 4.5; exposure time, 5 seconds; magnification, 1; film, Verichrome; filter, Eastman Kodak Neutral Gray Filter (10% transmission) at aperture B of Exposure Meter. (Magnification is the ratio of size of image to size of object.)

This set of calibration data is given only as a guide and is not to be considered as a general calibration for this type of exposure meter. Each exposure meter should be calibrated individually, and recalibrated if the lamp is changed.

FILTER DATA

Fluorescent Screen Type	**Nearest Commercial Color Filter**
Phosphor No.1 - Green (Medium Persistence)	Eastman Kodak No.58A
Phosphor No.2 - Blue Green (Long persistence)	Eastman Kodak No.43
Phosphor No.5 - Blue (Short Persistence)	Eastman Kodak No.47A

FIG. 2

FILAMENT-CONTROL CIRCUITS FOR EXPOSURE METER

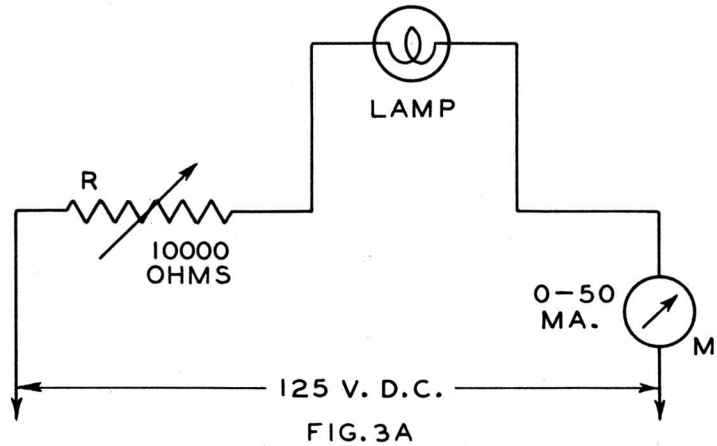


FIG. 3A

SEE FIG. 1 FOR LAMP TYPE

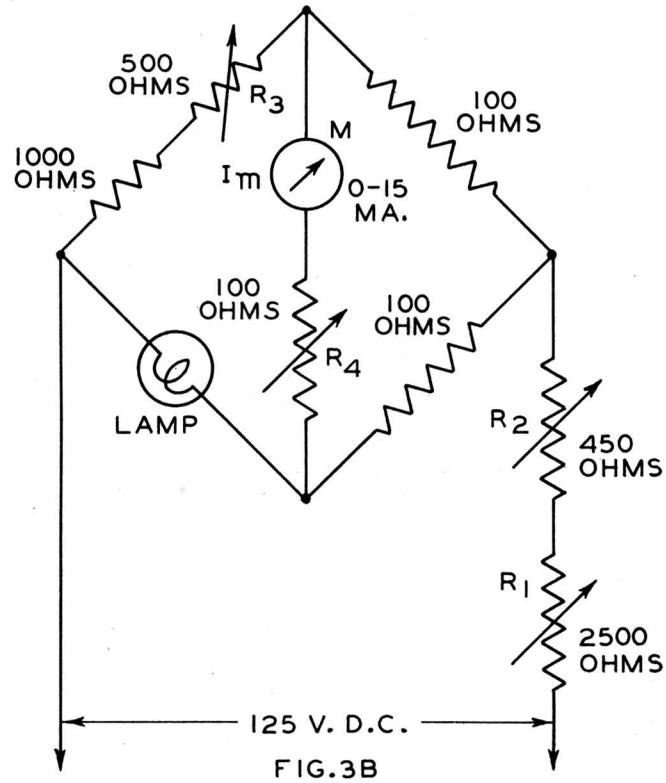


FIG. 3B

SEE FIG. 1 FOR LAMP TYPE