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NRL Report No. 4446

PROGRESS REPORT

For The Period

August and September 1954

Work Performed

on

NRL Problem No. 74H03-01

Supported Jointly by

Los Alamos Scientific Laboratory

and

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NAVAL RESEARCH LABORATORY
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NRL Problem No. 74H03-01 - "Weapons Instrumentation"

(Work done by R. V. Talbot, J. D. Shipman, C. B. Dobbie, M. R. McCraven and J. H. Miller)

Photomultiplier Development

Investigation of the causes of regeneration in the high-current photomultiplier at high output levels is continuing.[1] The visible light observed around the collector wires has been analyzed with a spectrograph and the spectrum has been identified as that of the arc discharge of hydrogen. The hydrogen is probably introduced during the cleaning process, when the metal parts are hydrogen fired, and apparently is not all baked out before the tube is sealed. Attempts will be made to eliminate more hydrogen in subsequent tubes.

The average photocathode sensitivity of 3 NRL high-current photomultipliers has been compared with the average of 12 type 5819's and the high current photomultiplier photocathode has been found to be approximately one-half as sensitive as that of the 5819.

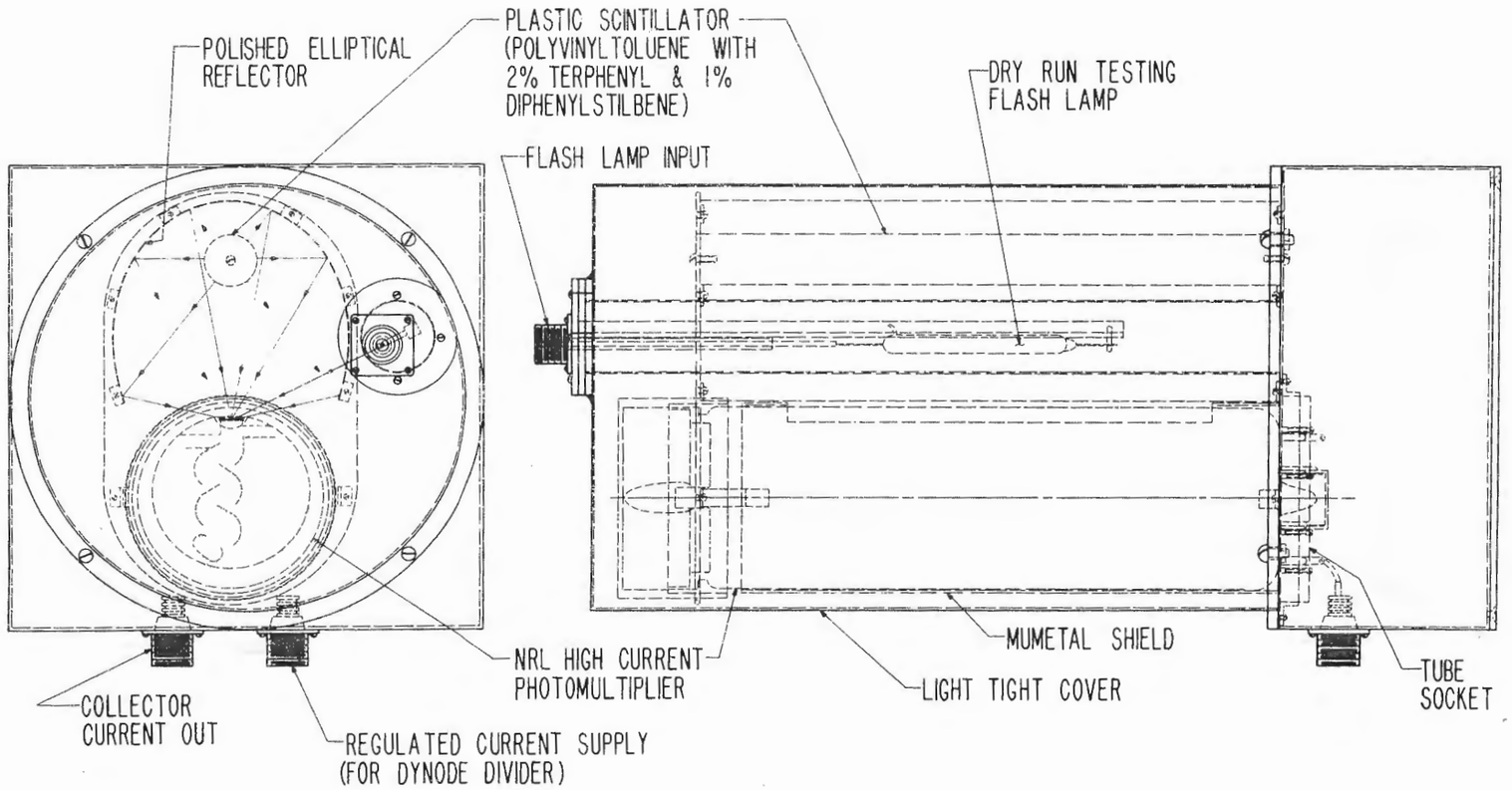
A complete detector using the NRL high-current photomultiplier and a plastic scintillator has been built as shown in Figure 1. This detector has been calibrated and found to have a sensitivity of about 2×10^{-12} amperes/gamma/cm^2sec, approximately 1000 times better than that of the photodiode detectors previously used.

In this detector the tube is operated such that the peak linear output current is approximately 2 amperes. As mentioned previously some of the tubes are unstable at this peak output level when operated at the voltages which give this detector sensitivity. It is expected that lowering the hydrogen content of the tube and installing better light baffling to keep the light generated in the collector region from getting back to the cathode will reduce this regeneration.

Cathode-Ray Tubes

Of the three tubes delivered by Rauland Corporation, the first and third have been returned as unsatisfactory although much useful information was obtained from both tubes. It was expected that the third tube would provide improved

[1] Progress Report for February and March 1954, NRL 4360



NOTE !
RESISTORS AND CONDENSERS FOR THE DYNODE DIVIDER ARE NOT DRAWN IN. CONDENSER SIZES WILL BE DETERMINED BY THE LOW FREQUENCY RESPONSE DESIRED.

FIG. 1 PROPOSED OVER-ALL DETECTOR USING NRL HIGH-CURRENT PHOTOMULTIPLIER

performance. However it appeared to have a defective cathode which led to very poor writing speed. The second tube is now being used in connection with the wide-band amplifier work. Considerable progress has been made toward the design of a matched 125 ohm connector to be used on the deflection structure. It is expected that the next tube to be built will have such connectors.

Wide-Band Amplifiers

A fast time-base sweep has been built for use with an indicator incorporating a TW-11 cathode-ray tube, to be used with the proposed 300 mc bandwidth amplifier. The indicator is now capable of sweeping the beam across the face of the TW-11 tube in approximately 15 ns. Measurements are now being made with this indicator on the prototype amplifier push-pull output stages using 4X150A tubes.

A small number of the improved Ivy type amplifiers are now being built. Problems of assembly and alignment in order to obtain uniform performance will be worked out in this process.

Pulse Inverters

Additional work has been done on the 50 ohm pulse inverter using ferrite material. As a result of changes in the input and output transitions the relative response has been improved considerably over that reported previously.[2] Figure 2 shows the relative response of the modified inverter. Measurements of the characteristic impedance of the inverter as a function of frequency are now being made.

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[2] Progress Report for June and July 1954, NRL 4427

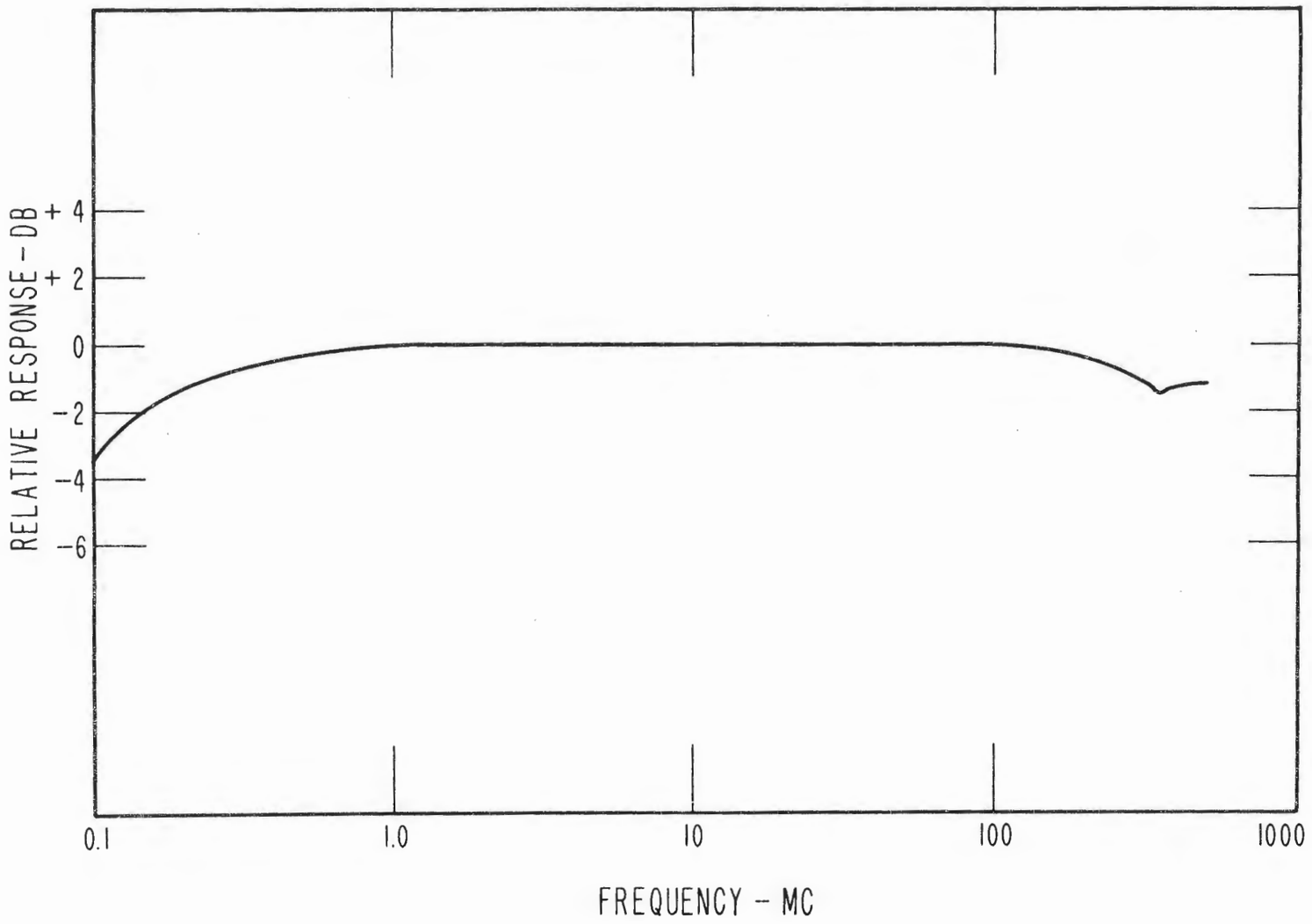

FIG. 2 RELATIVE FREQUENCY RESPONSE OF PULSE INVERTER