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QUARTERLY PROGRESS REPORT NO. 4

ON

DETONATIVE COMBUSTION

(PERIOD 15 MAY 1952 TO 15 AUGUST 1952)

BY

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INTRODUCTION

This work represents a continuation of that previously reported in Progress Reports 1, 2, and 3 and UMM - 97 (now being printed) on the subject of detonative combustion. Active work on this phase was not begun until the latter part of June.

This extension will be devoted largely to a photographic study of detonation waves traversing a section of varying geometry and also of waves passing over models. In addition, tests will be made to investigate detonation limits and the effect of pressure on detonation.

The shock tubes available from previous tests will be utilized for this study, along with a larger one which is currently in the design and fabrication stage.

SHOCK TUBE

In order to effect the photographic study described, it was deemed necessary to use a larger shock tube. Accordingly, an inexpensive shock tube is being made which will have inside dimensions of 2-1/4 inches by 3-1/4 inches. As before, there will be a reservoir section and a test chamber which will be joined by flanges.

The reservoir section is to be formed of welded structural angle iron having a 5/8 inch wall thickness. The test section is being made of cold-rolled steel. Provision is made for sides of high optical quality plate glass. The glass will be 1 inch thick and will allow a visible testing area of 3-1/4 inches by 8 inches. The test section is shown in Fig. 1.



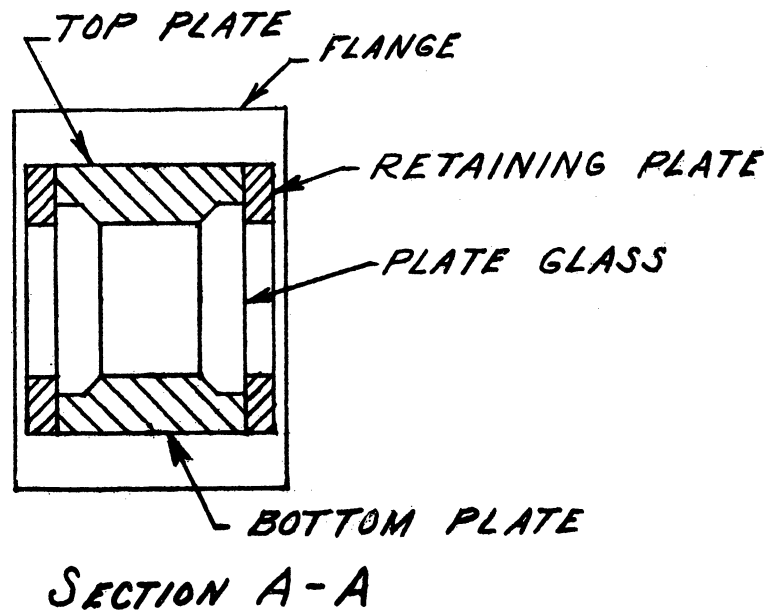
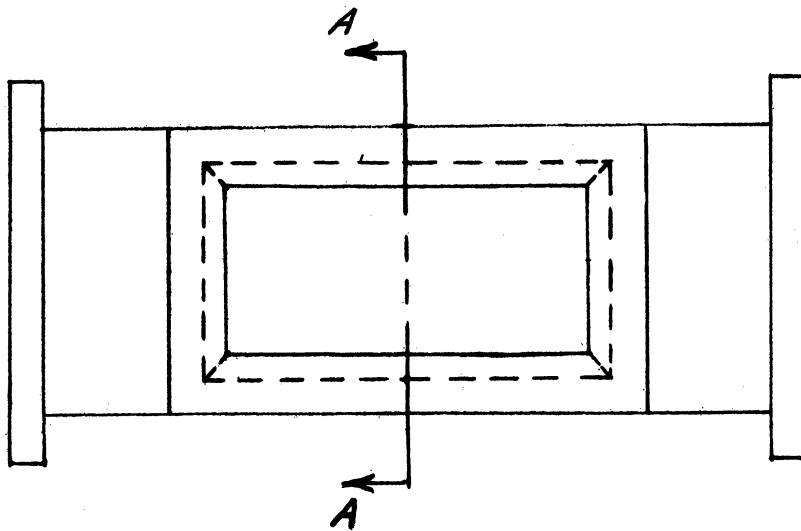


FIG. 1 - SHOCK TUBE TEST SECTION



The top and bottom plates of the test section will enable inserts to be attached providing changes in cross-sectional area. Models may also be attached in the same fashion.

For the present, the detonation waves will be initiated by a spark plug in this large tube. However, allowance is made for the introduction of a diaphragm assembly if later tests require shock-induced detonation. The smaller shock tubes previously used are of course, readily available for the shock-induced detonations.

#### OPTICAL ARRANGEMENT

A larger schlieren system is being assembled which will utilize two parabolic mirrors. One mirror is 6 inches in diameter, while the other has a diameter of 7 inches. Different-sized mirrors were selected only because they were already on hand.

A greater portion of the flow field may be photographed with this arrangement than has been possible in the past. This should be particularly advantageous in the case of reflected shocks from sudden restrictions in cross section or from models.

As in previous tests, an ionization probe will sense the detonation wave and send a pulse through the time delay circuit to the spark gap. The light emitted will be reflected and collimated by the first mirror; then it will be passed through the test section and on to the second mirror. The light is then reflected over a knife edge to the camera. A schematic diagram of the schlieren system is shown in Fig. 2.





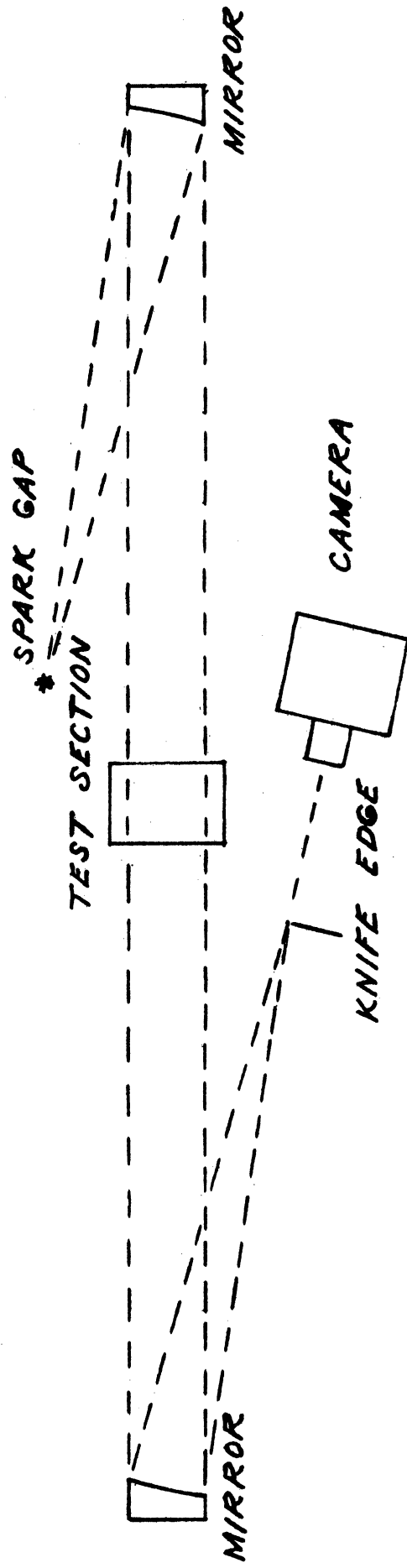


FIG. 2 - SCHLIEREN SYSTEM





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