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SHEAR TESTS ON DU PONT EXPLOSIVE RIVETS WITH THE COUNTERSUNK HEAD MILLED FLUSH AFTER EXPANSION

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INTRODUCTION

In the investigation described in references 1 to 3, it was found desirable to allow the head of a machine-countersunk rivet to protrude a definite amount above the skin surface before driving and then to remove the protruding portion after driving. In this way, tight and smooth rivets were obtained even though large tolerances in countersunk depth were permitted.

This paper presents the results of a similar investigation in which the heads of Du Pont explosive countersunk rivets were allowed to protrude varying amounts above the skin surface before expansion and the protruding portions were removed after expansion.

SPECIMENS AND TEST PROCEDURE

The specimens for this investigation consisted of two sheets of 24S-T aluminum alloy riveted together in the form of a lap joint with two 1/8-inch countersunk Du Pont explosive rivets, as shown in figure 1. All rivets were expanded within 1.5 to 6 seconds after a Du Pont riveting iron was applied. The protruding portions of the countersunk heads were then removed with a flush-rivet milling tool similar to the one described in reference 4.

The height of the rivet head above or below the skin surface before expansion is designated h_b, positive when the rivet head is above the skin surface and negative when the rivet head is below the skin surface.

The testing procedure was the same as that used in the investigation of reference 1.

RESULTS

It was concluded in reference 1 that a comparison of the quality of machine-countersunk riveted joints on the basis of maximum load alone is not justified; the yield load as a measure of tightness is a better criterion of the strength quality of a flush-riveted joint. The yield load is defined as the shear load per rivet for which the sheets are permanently displaced an amount equal to 4 percent of the rivet diameter. This definition is arbitrary and corresponds, in a measure, to the arbitrary definition of yield point commonly specified for aircraft materials.

The variation of yield load and maximum load with h_b is shown in figure 2 for the two sheet thicknesses used. This figure indicates that tight rivets are obtained if the countersunk heads are allowed to protrude above the skin surface before expansion and the protruding portions are removed after expansion. The increasing tightness when h_b increases may be due to one or more of the following factors:

1. Increase in shoulder height (s)

2. Decrease in countersunk depth (a)

3. Movement of charged portion of rivet shank from outside the sheets to partly within the sheets

On the basis of these few tests, it would appear desirable to investigate the possibility of filling the entire shank with an explosive charge in order to permit greater tolerances in the diameter of the drilled hole and still produce consistently tight rivets. This advantage might outweigh the disadvantage of the reduced maximum load that would result from the decrease in cross-sectional area of the rivet shank.

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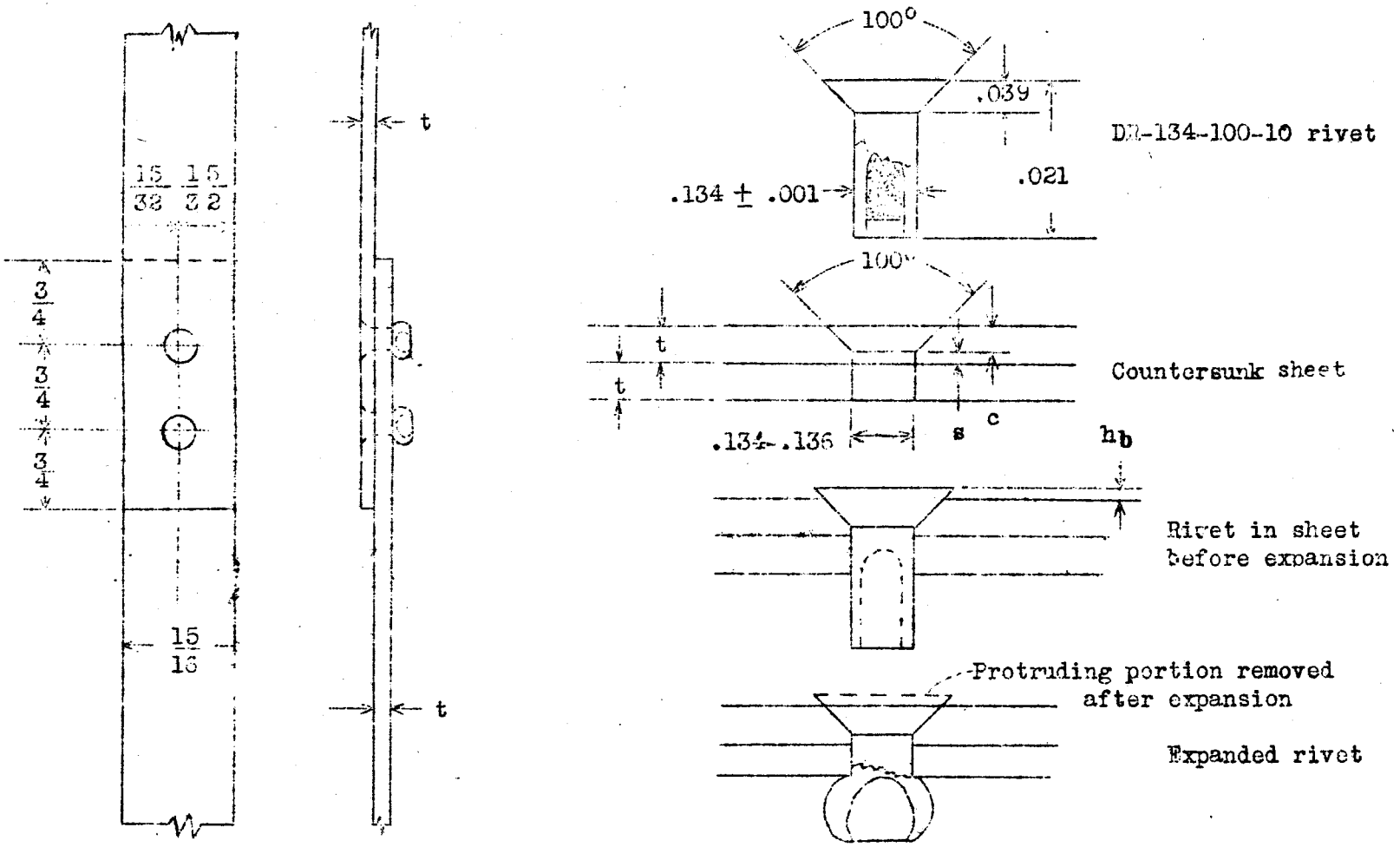

Figure 1.- Dimensions of test specimen and rivet.

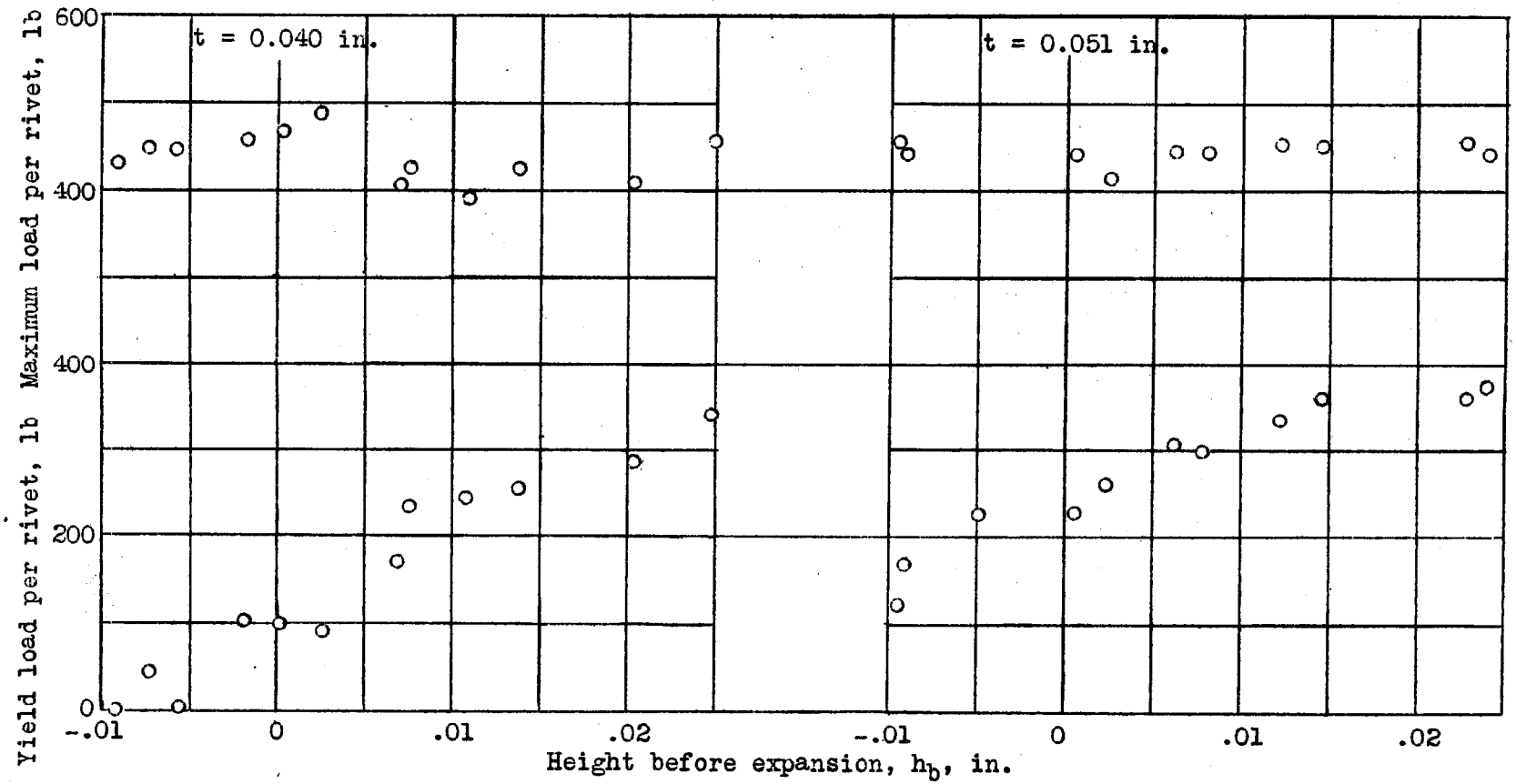

Figure 2.- Variation of yield load and maximum load with h_b for two sheet thicknesses.