were constructed so that the rivet holes were perfectly concentric and the rivets all fitted perfectly, and a load were applied to the connection, the rivets would be stressed equally. This could not be the case, however, because of the elastic properties of the material of the connection. Professor William H. Burr, of Columbia University, speaking of the influence of the elastic properties of the plates in riveted connections on the distribution of stress among the rivets, says: * "In the case of lap joints with three or more rows of rivets (frequently found in truss work), or in similar work when two rows of rivets join a small plate to a much larger one, the outside rows, or row, in consequence of the stretching of the material at the joint, must take far more than their portion of stress, if, indeed, they do not carry nearly all. The same condition of things will exist in butt joints if two or more rows are found, under similar circumstances, on the same side of the joint."

A very neat demonstration of this necessary inequality of stress-distribution among the rivets of a perfect connection is given by Professor W. H. Boughton, in the Proceedings of the Ohio Society of Surveyors and Civil Engineers, for 1902, page 17. A connection of the form shown in Fig. 1, composed of one $3'' \times \frac{1}{2}''$ bar and two $3'' \times \frac{1}{4}''$ bars connected together by three rivets, is considered. A pull P is supplied in the direction of the line of the rivets. Let it be assumed, as is done in practice, that the stress is distributed equally among the three rivets. If this be true $\frac{1}{3}P$ is taken out of the main bar by the rivet A into the two side bars, $\frac{1}{3}P$ by the rivet B, and $\frac{1}{3}P$ by the rivet C, leaving a stress in the main bar between A and B of $\frac{2}{3}P$, and between B and C of $\frac{1}{3}P$. At the same time the stress in the *two* side bars between A and B is $\frac{1}{3}P$, and between B and C it is $\frac{2}{3}P$. But the area of the main bar is the same as the area of the two side bars together, hence the extension of the main bar between A and B is twice the extension of the two side bars, and the extension of the main bar between B and C is one-half the extension of the two side bars. Assuming, then, that the rivets fit their holes perfectly, the distance between their centres in the side bars is less than in the main bar for rivets A and B, and greater for the rivets B and C. From this necessarily follows an inequality of distortion of the rivets, which is shown diagrammatically in Fig. 1 (a). Rivets A and C are more distorted than rivet B, and are consequently more highly stressed, although we set out with the assumption that all the rivets were equally stressed. It is manifest that with the plates of the connection of the relative areas assumed, the rivets A and C would be equally stressed and each more highly than B. With these relative

* "Elasticity and Resistance of the Materials of Engineering," p. 700.