

Before proceeding further we must now enquire into the slippings which occur in riveted connections under ordinary working loads.

SLIPPINGS IN RIVETED CONNECTIONS.

The researches of Van der Kolk, to which reference has already been made, threw great light on the slipping in riveted connections.* He measured the slippings at the various rivets in a great number of connections, as well as the extensions between consecutive rivets, for loads gradually varying from zero to past the maximum allowable working load. In doing so, he found that from the very commencing of the loading at a joint there is a gradual relative slipping of the plates at each rivet, part of which disappears when the load is removed, and the remainder of which is permanent. The former is called the elastic slipping and the latter the permanent slipping.

The test pieces employed were all butt joints with two cover plates, there being a single line of rivets in the direction of the stress-producing force. In some cases there were two rivets on each side of the splice, and in other cases three. The cover plates for all the specimens but those of one series were each one-half the thickness of the main plates, while for the specimens of that series the plates were all of the same thickness. The thickness of the cover plates for the first group of specimens was 0".493 and of the main plates 0".985, while for the second group the plates were all 0".61 thick. In every case the plates were carefully machined to a width of 2".76. With four rivets in a joint the spacing was 3".15, while for six rivets it was 2".60. The rivets were $\frac{3}{4}$ inch in diameter.

The slippings at each rivet of every joint were embodied in a very complete series of diagrams, from which typical ones have been prepared for Figs. 2, 3 and 4. The upper diagrams in each figure give the elastic slippings for the various applied loads, and the lower ones the permanent slippings for the same loads. The upper part of each diagram refers to the rivets above the splice (the specimen being considered as standing vertically), and the lower part to the rivets below the splice. Distinctive lines are used for the outer, middle and inner rivets. The plotted slippings at any rivet are the averages of the observed slippings on the right and left sides of the test piece.

Fig. 2 gives the load slip diagrams of three typical machine-riveted specimens with cover plates, each one-half the thickness

* See Zeitschrift des Vereines Deutscher Ingenieure, 1897, p. 739.