Now, it is obvious that in a rectangular truss, as represented in Fig. 52, the end posts, and one panel-length of the upper chord at each end, as well as one counter-brace, are entirely useless, as it regards sustaining weight of structure and load. It will readily be seen, moreover, that no counter-braces except those of the two middle panels, in the 8 panel truss, Fig. 52, have any sustaining action, unless the variable exceed 4 times the permanent load of the truss.

It is furthermore manifest that there is a large amount of surplus material in the portions of lower chord toward the ends; the tension of that chord being in the several panels, proceeding from the end (in the case of Fig. 52), as $3\frac{1}{2}, 6, 7\frac{3}{4}$ and 8. Hence, over one-fifth of the material in a chord of uniform section, is in excess.

But the greatest sacrifice of economy in the Howe Bridge as usually constructed, results from the steep pitch of the braces. For, while, as was seen [lxvi], braces act with about the same economy at an inclination giving a horizontal reach equal to the vertical, as when the former equals only one-half of the latter, that is, with $h = v$ and $h = \frac{1}{2}v$, it was shown in the succeeding section, that the action upon verticals was nearly twice as great in the latter, as in the former case. For instance, suppose Fig. 18 to represent a 16 panel truss, with thrust braces and tension verticals. Estimating successively the action upon verticals with diagonals crossing two panels, as in Fig. 18, and the same with diagonals crossing but one panel, we find the action over 85 per cent more in the latter than in the former case.

With regard to chords, the horizontal effect is essentially the same in both cases, while the vertical thrust