— Column 1 —			— Column 2a. —		
Test 5.	Test 14.	Test 15.	Test 11.	Test 12.	Test 13.
0.020	0.016	0.009	0.029	0.027	0.021
0.009	0.010	0.009	0.024	0.019	0.016
0.008	0.010	0.007	0.023	0.018	0.014
0.008	0.009	0.006	0.010	0.018	0.014
0.007	0.009	0.006	0.008	0.018	0.011

In the early use of Column 1, it failed unexpectedly under a slightly oblique load; the alternate lattice bars buckled in one half of the column; the lattice bar loads were not determined by tests upon them, but compression tests had been made on similar bars and the lattice bar load was estimated from these compression tests and it is given in the bulletin as "Probable Maximum Load on Lattice Bar in Pounds, 2,100." It is this result that Pearse has used to confirm his results.

Column 1 was tested in cross-bending also; the "under" lattice bars that were in compression were found to have a maximum stress in each from 39% to 72% greater than the average stress in the bar, while in the "over" bars that were in compression the maximum stress was from 131% to 450% greater than the average stress.

Tests of large columns by Howard, given in Trans. Am. Soc. C.E. for 1911, show insignificant stresses in the lattice bars observed.

Vol. 16 of the Proceedings of the American Railway Engineering Association gives results of tests upon seventeen lattice bar columns conducted at the Bureau of Standards. One was a large plate and angle column, the others were channel columns. The lattice bar strains were erratic, generally small, and compressive in most cases. While the columns did not show much transverse shear, we may express the results in terms of the transverse shear that would be expected to give the same strains and we may express this transverse shear as a fraction of the column load. With a load increase of 28,000 lbs. per sq. in. on the heavy column, the maximum shear indicated was about 0.8% of the column load. The smaller columns under different load variations from 14,000 to 29,000 lbs. per sq. in. showed different maximum values of shear, the average of which is about 0.9% of the column load and the largest value that appears to be normal was about 1.6% of the column load. The per cent. of shear seems to increase with increase of slenderness ratio, and for columns of the same slenderness ratio it is smaller for heavy columns than for light columns. Column No. 17 showed an abnormal lattice bar strain with a load increase of 14,000 lbs. per sq. in., but this lattice bar showed little strain for subsequent heavier loading.

It is believed that the results of these recent tests do *not* warrant the conclusion that lattice bar loads should be materially decreased in the design of ordinary columns. The most of these columns were made under stricter specifications regarding workmanship than are common. They were carefully adjusted to their bearings by highly intelligent men. They were loaded by means of a testing machine of unusual accuracy and rigidity. They were all tested with flat ends. It is apparent that the strain gauge lines were on the exposed side of the various lattice bars; Talbot and Moore found that the strain on one side only of a lattice bar may differ very widely from the average strain over the section of the bar, and we should naturally expect the strain on the exposed face to be smaller than the average strain. Perhaps these tests may be looked upon as indicating the lower limit of what may be expected in the way of lattice bar loads *that result from column loads.*

It may be admitted that the present method of assigning loads to lattice bars, such as by Pearse's Equation (d), is not logical. We have not learned that it has given unsafe results. The chief difficulty in trying to get up a consistent method for the design of a column is that different people do not agree upon the meaning of column formulas. I do not think the stress that Pearse designates by S_0 should be considered constant for columns of different slenderness ratios or for columns of some different types of cross-section.

Admitting that Pearse may be right in this respect, he has erroneously introduced a factor 2, that makes all of his results twice too large on this score. Then his equation 7, as applied to the actual length of the column, can hardly be admitted for his purpose. Many people have assumed this equation for the column curve and for certain purposes it matters very little; but that is not true in this case. If a column deflects with no part overstressed and at a load less than that given by Euler's formula, it is because its load is not central. Its axis takes the form of a portion of the sinusoid curve; the whole sine curve extends to the greater length that a column of the same section would have in order to be about to fail by buckling under the same load, the Euler length for this stress. For the columns and average stresses given below the lattice bar loads given by Pearse's formula should be multiplied by the factors indicated.

Slenderness ratio L/r	Average stress S_1	Correcting factor
20	13.325	0.01
40	12.825	0.05
60	12.050	0.10
80	10.835	0.16
100	9.200	0.21

The resulting lattice bar loads would be so small that in many cases we might expect the lattice bars to receive larger loads in transportation and erection. I suspect that Talbot and Moore were not far from right when they concluded in Bulletin 44: "It seems futile to attempt to determine the stresses which may be expected in column lacing for central loading by analysis based on theoretical considerations or on data now available."

This futility should not lead us to close our eyes to the possibility of certain loads that can be roughly approximated. A column must be transported and erected; it may be at the bottom of a pile of bridge or building material and should be capable of carrying a good load in addition to its own weight. Some of the lattice bars may be so badly bent that they can carry little load; the adjacent bars should be amply strong.

A channel may not be initially straight; if it is straight before punching holes in its flanges it will not be so thereafter. Riveting tends to bend members more than punching does. It is safe to say that very few channels of latticed columns would remain straight if the lattice bars were sawed in two so that each channel could take its natural form without restraint. In columns, these channels are held to straightness, insofar as they are straight, by the lattice bars, arranged with the channels in triangular truss elements. Some of the lattice bars must carry load due to this service which they perform. If the channels would bend into circular arcs on being released from the lattice bars, we can see that the lattice bars that are near the ends of the column would carry loads due to this bending of the channels, but the intermediate lattice bars would be comparatively free from