The points in the cross-section at which this deformation occurred have been plotted in Fig. 6 and the concrete below the same was considered as effective cross-section in computing the moment of inertia and section moduli of the section. The upper inclined line in the figure marks the upper limit of this effective cross-section and the lower inclined line is drawn through the points obtained for the neutral axis for the three sets of readings mentioned above.

The effective section of concrete was divided into five rectangles, a, b, c, d and e. Figs. 6A, 6B, 6C, 6D and 6E show these rectangles with the positions of their respective neutral axes as obtained from Fig. 6.

The steel has been considered as replaced by its equivalent area of concrete assuming the moduli of elasticity of steel and concrete in tension to be 30,000,000 and 2,800,000 respectively. The moment of inertia of each rectangle and its proportionate area of steel was obtained and the results added to obtain the total moment of inertia for the section; using the average position of the neutral axis as 9¼ ins. from the top of slab the section moduli were then determined.

The results are as follows:—

$$I = 14{,}906$$
$$Q_c = 3{,}140$$
$$Q_t = 1{,}612$$

According to Chicago Code,

$$Mr = \frac{WL}{30} = \frac{125{,}000 \times 22.43 \times 12}{30} = 1{,}120{,}000 \text{ inch-pounds.}$$

$$\therefore \quad c = \frac{Mr}{Q_c} = -\frac{1{,}120{,}000}{3{,}140} = -357 \text{ pounds per sq. in.}$$

$$\text{and } c_t = \frac{Mr}{Q_t} = \frac{1{,}120{,}000}{1{,}012} = 695 \text{ pounds per sq. in.}$$

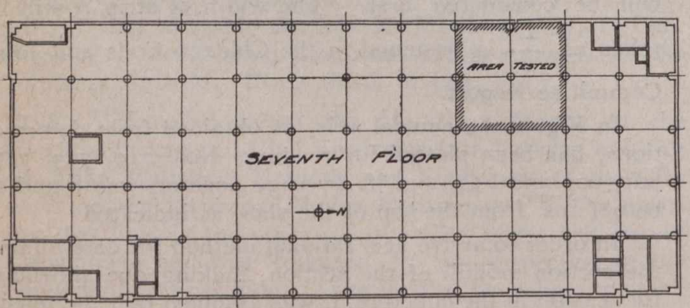

Fig. 1—Key Plan

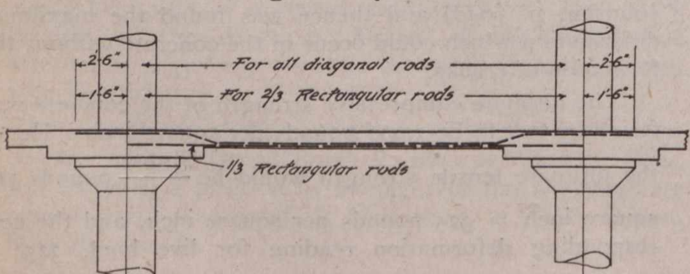

Fig. 2

The average of readings 601, 607 and 614 is —257 for live load only, which corresponds to a stress of —257 ×

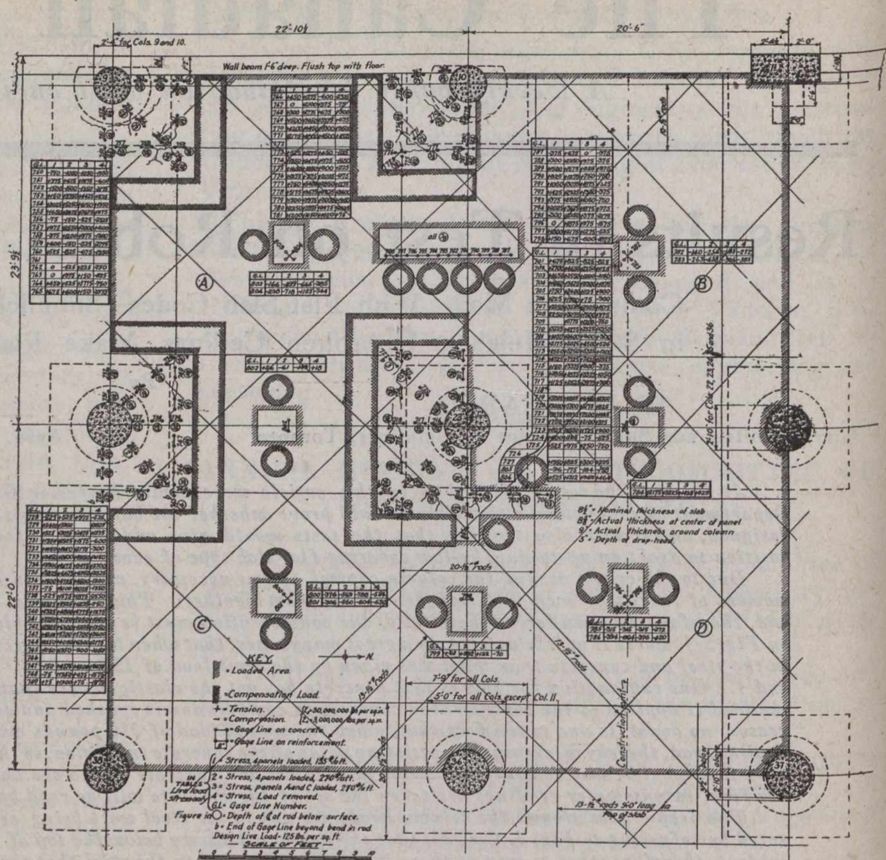

Fig. 3—Plan of Seventh Floor

$\frac{248}{135}$ = —476 pounds per sq. in. for live and dead load combined. This is somewhat greater than the value for c computed above.

Using the extreme fibre stress c_t = 695 pounds per square inch in the concrete as found above, the computed stress in the steel is found to be 5,020 pounds per sq. in.

The average of readings 710, 713 and 717 is 2,300 for live load only, which corresponds to a stress of 2,300 × $\frac{248}{135}$ = 4,230 for live and dead load combined, which agrees very well with that computed.

The Philadelphia Code gives the bending moment as $\frac{WL}{28.4}$ ($\frac{WL}{47}$ for the steel in the straight band, and $\frac{WL}{72}$ for the steel in the diagonal band).

The Joint Committee Report gives the moment as $\frac{WL}{25}$.

The stresses computed by these moments for the readings mentioned above are given in Table 3. It will be noted that the distribution of steel at the column capital in the straight and diagonal bands differs considerably from that required by the Philadelphia Code, so that the table shows a high stress for the steel in the straight band and a comparatively low stress for the steel in the diagonal band at this point in the computation by the Philadelphia Code.

To find the moment coefficient which corresponds to the stresses computed from deformations given by test we may equate the bending moment to the resisting moment thus: $\frac{WL}{x} = Q_t c_t$ and $\frac{WL}{x'} = Q_c c$ where x and x' are the coefficients to be determined.

The average unit stress in the steel for total load as found above from readings 710, 713 and 717 was 4,230 pounds per square inch.