THE STABILITY OF WALLS.

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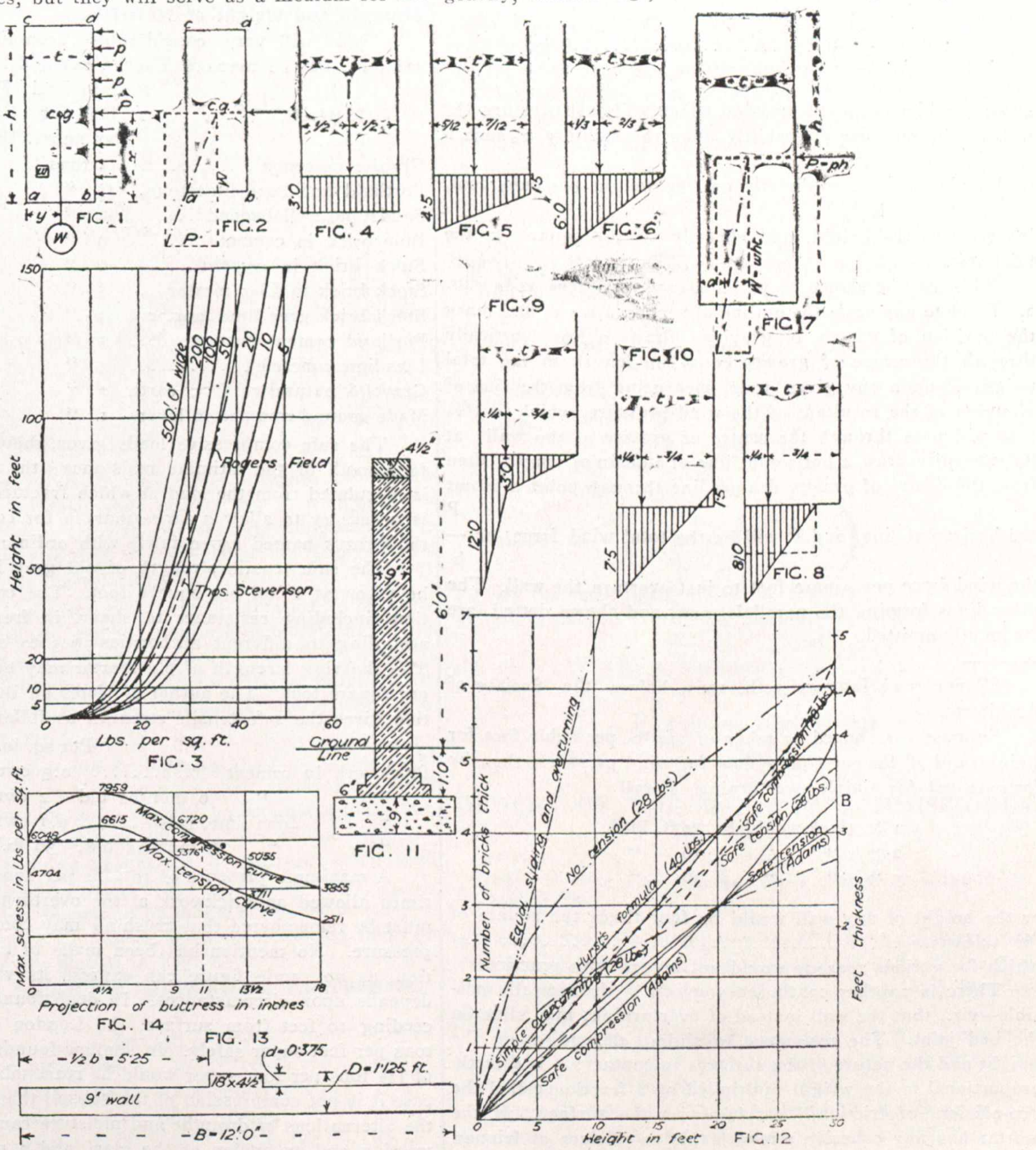
In order to bring the subject of stability of walls within the limits of time permissible in a single evening it is proposed to deal only with one class of walls—viz., those known as boundary, enclosure, or fence walls, which have no load but their own weight to support, and no thrust but that produced by the wind to resist. They are not of great importance in themselves, but they will serve as a medium for the introduction of the general principles of determining stability and save our time when we consider more important cases on a future occasion.

By making one or two assumptions the main principle can be shown very easily, but in the application of this principle to practice there are various points open to discussion, and the actual stability is by no means so certain as might generally be supposed. To make the subject perfectly clear, we will commence with a simple wall of uniform rectangular section, assuming that the wind is blowing horizontally and uniformly over one face, that there is no tensile strength in the mortar and that the wall would ultimately fail by overturning on the outer edge at the ground line without crushing the edge.

Let a b c d Fig. 1 be the section of wall, and as the reasoning that applies to one foot of its length applies to every foot, it will be convenient to consider a length of 1 ft. run. Then the total force of the wind will be the pressure per square foot × number of square feet (i.e., the height, because we are only considering 1 ft. of the length), and the centre of action will clearly be at half the height, the leverage to overturn the wall on point a will thus be x. It is not the distance measured from the point of P diagonally down to point a, because the leverage of any force must be measured from the fulcrum perpendicularly to the direction of the force. The wall being of uniform substance and rectangular in section, the centre of figure will be the position of the centre of gravity, marked c.g., where the whole weight may be considered as acting. This weight W is the weight per cubic foot × number of cubic feet (i.e., the height by the thickness, the length being 1 ft.), and its leverage, resisting the overturning on a, will be y. It is assumed that there is no tensile strength at point b to hold the inner edge down, as when the wall is new the cohesion of the mortar cannot be relied upon.



Figs. 1 to 14.—Stability of Walls.

Let p = wind pressure per square foot in pounds.
w = weight per cubic foot of wall in pounds.
h = height of wall in feet.
t = thickness of wall in feet.
P = total wind pressure in pounds.
W = total weight or resistance in pounds.
x = leverage of wind in feet.
y = leverage of resistance in feet.