

While this paper is a valuable contribution on the subject of Grain Pressures, the question is treated from a theoretical point only. Mr. Airy appears to have been lacking in the necessary practical experience to enable him to take into consideration all the conditions which apply in actual practice.

Mr. Airy first made tests with a view to obtaining the co-efficient of friction between grain and grain (or the angle of repose) and the different materials of which bins are usually constructed. From this data and the weight of the grain, he produced a formula for calculating the pressures in a bin of any given depth or breadth. This formula gives the maximum load on the bin bottom when the depth of grain in the bin is equal to 3-5 times the breadth. As, however, a further depth of grain is added to the quantity already in the bin, the load on the bottom decreases until the grain ultimately reaches a depth when the only remaining weight on the bin bottom would be that of a pyramid or cone of grain whose sides were at the greatest angle of repose and the base equal to the horizontal area of the bin and all the balance of the weight of the column would be carried by the bin walls, thus entirely neglecting the important fact that the weight on the bottom having once obtained the maximum, cannot be decreased by any increase of lateral pressure, unless by slightly lowering the bottom.

Airy's formula therefore shows the paradox of the greater the weight and depth of grain in the bin, the less the load on the bin bottom. Considering the bin to be filled with grain, and taking the total horizontal pressure against the bin sides multiplied by the co-efficient of friction, this would be theoretically correct, but this calculation totally ignores the fact that this total side pressure is not produced until the bin is filled. Practically this decrease of pressure or load on the bottom could be produced by slightly lowering the bin bottom away from the bin sides after the bin was filled, since by this time sufficient side pressure would have been produced to support the full contents of the bin. It would, however, be quite safe to use Airy's formula since in designing a bin the bin bottom would require to be of sufficient strength to carry the maximum load for the lower depth of grain, and the walls for the maximum horizontal pressure and the vertical load.

In 1897 the failure of a Coal Bin in Patterson, N.J., started a discussion in "Engineering News" on the pressures produced by coal and other granular materials stored in shallow bins. This discussion was started by the Editor of "Engineering News," and a number of engineers throughout the country contributed more or less valuable letters on the subject, but no records of actual tests were given, and since the discussion was confined almost entirely to