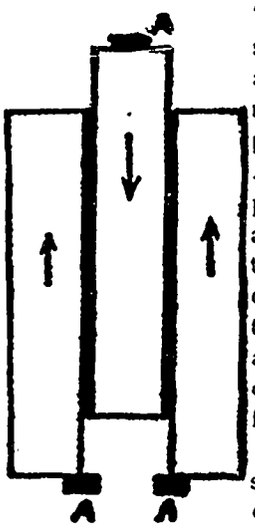
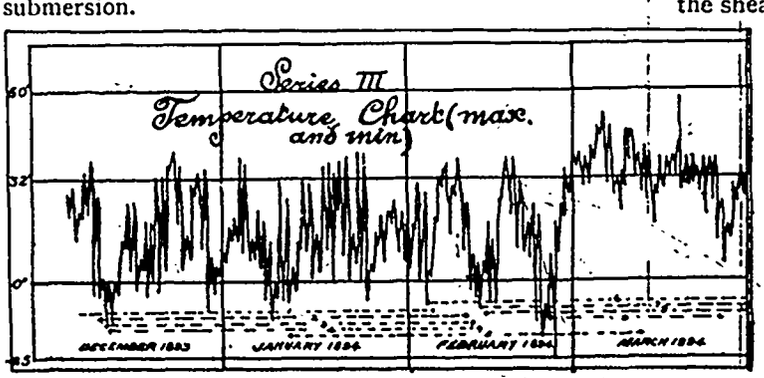
strength of mortar. The method adopted was as follows:—



Three bricks placed, as shown in sketch, were cemented together, and tested at the end of one month. It was found that by placing pieces of soft wood at *A.A.A.*, an action as nearly as possible a shear was obtained, and gave very satisfactory results, the pressure being practically concentrated along the two mortar joints. No side pressure was applied, because the desire was to obtain minimum results where friction was not assisting.

The combined effect of adhesions and friction can easily be computed if the adhesion and super-imposed load are known.

The results are divided into lime mortar, natural cement mortar and Portland cement mortar, also into ¼" and ½" joints, also into flat, common, unkeyed bricks and pressed Laprairie brickkeyed on one side. (1) The lime mortar was mixed 1 lime to 3 of standard quartz sand, by weight; (2) natural cement mortar was mixed, 1 of No. 2 natural cement to 1½ standard sand; (3) Portland cement mortar was mixed, 1 of No. 5 Portland cement to 3 standard sand. (See exhibits of bricks with mortar attached.) The test pieces were chiefly allowed to stand in the laboratory at a temperature of 55° to 65°F., but one set of natural cement mortar and two of Portland cement mortar were duplicated by immersing in water for 29 days, after setting in air 24 hours before submersion.



These results point out many interesting facts: (*a*) the first fact noticeable is that the results are independent of the *thickness* of joint; this is true of lime and cement waters. (*b*) The next one is not evidenced to any extent in the table, but was quite apparent in the testing, viz., that the adhesion of the mortar to the brick was greatest when the mortar was put on very soft, and least when the mortar was dry. This will largely uphold the use of soft mortars by masons, albeit their reason is a purely selfish one, the mortar being easy to handle. The tensile tests of cements made *very* soft are lower than when the mixture has the minimum amount of water for standard consistency. But for adhesive tests the case is evidently the reverse. It may be here mentioned that in these tests all bricks were thoroughly soaked with water before the joints were laid. (*c*) Coming now to the tests on lime mortar, the shears were through the mortar, except in the 4th experiment, and therefore they are quite independent of the key of the pressed brick on the surface of adhesion. This would point out the fact that keyed brick are superfluous in lime mortar joints, and the shearing strength per square inch averages about 10½ lbs. per sq. inch. The tensile strength of the same mixture at the same age was 30 lbs. per sq. in. and the compressive strength 102 lbs. per sq. in. (*d*) The natural cement mortar showed distinctly that its adhesive strength was not as great as its shearing strength, which is the reverse of the lime mortar tests. It also showed that the keyed brick aided in some unknown way, for the results on them are 3 times as great as with the common flat brick. Of course this may have been, and probably was partly due to the different surface of adhesion. In 5 tests out of 21 made on the natural cement mortar, the mortar sheared through, and the average of these 5 was 97 lbs. per sq. inch, which gives the shearing strength proper, while the average adhesive strength of the 13 tests in air which came loose from the bricks was 26 lbs. per sq. inch in common brick, and 48 lbs. per sq. inch on Laprairie pressed brick, and 38 lbs. per sq. inch on Laprairie pressed brick for three tests submerged in water for the whole period.

This would show that the adhesive strength is nearly twice as great on pressed brick as common brick, and that submersion in water had a rather harmful effect than otherwise, on the adhesive strength, and was certainly of no benefit.

The tensile strength of the same mortar at the same age was 132 lbs. per sq. inch; the compressive strength was not obtained, but would have been about 1,000 lbs. per sq. inch. The hints to be taken from these tests are that pressed brick keyed on both sides will give much higher results than flat common bricks, and would probably place the shearing strength of such joints at 100 lbs. per sq. inch, and make it largely independent of the consistency of the mortar. Also that the shearing strength is very much higher in proportion to the tensile strength than was the lime mortar shearing strength to its tensile strength, but about the same proportion to its compressive strength, *i.e.*, 10 to 1.

It becoming evident that the thickness of joint had no appreciable effect, the Portland cement mortar tests were made all ¼ inch thick. The results are surprisingly low. The adhesion on the common brick is about the same for air drying or submersion in water, and is slightly less than half that of natural cement mortar tests, of 1½ to 1. This is a significant fact, for while a neat tensile test of No. 2 natural cement four weeks old is 268 lbs., the No. 5 Portland is 459 lbs. for the same age, and a 3 to 1 No. 5 Portland is 82 lbs. for same age. Thus while any test of this cement would show that a 3 to 1 mixture of the latter would be nearly equal to a 1½ to 1 test on the former, yet in their adhesive properties to common brick the heavily dosed sand mixture was only half as strong as the natural cement mortar with a smaller dose of sand; we might easily have expected this, but the main point is: is it taken account of in considering the comparative values of these mixtures, that the adhesive strength of a Portland cement mortar heavily dosed with sand is low as compared with a weaker, but richer, mixture of natural cement mortar? The shearing of Portland mortar shows that the adhesion to pressed brick is greater than to common brick, but not in such proportion as in natural cements, being 1½ or 2 to 1 in place of 3 to 1 in the latter. But here again comes out the advantage given to Portland cements by testing them under water, the submerged