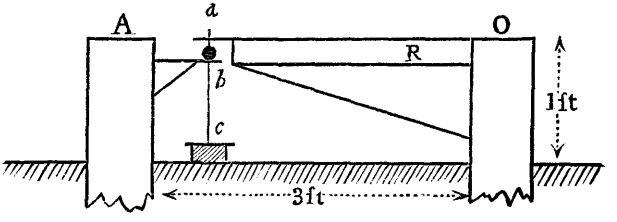
RELATIVE MOTION OF NEIGHBOURING POINTS OF GROUND.

By John Milne.

[Read January 26th, 1887.]

The following notes describe a series of experiments which were made to determine how far two or more points situated within three or four feet of each other synchronized in their movements when disturbed by an earthquake. The importance of such an investigation will be recognized when we reflect upon the relative effects which would be produced upon a rigidly constructed building under the two following circumstances, first when the ground to which the building was attached moved as a whole, and second when a portion of the ground upon which the building stood was moving in one direction while another portion moved in another direction. In one case the building would simply suffer in consequence of the inertia of its various parts, while in the other these effects might be supplemented by a racking action at its foundation,—one portion receiving impulses in one direction while another portion received impulses in another. Again, if it was found that two points of ground situated within two or three feet of each other did not synchronize in their movement,

it would necessitate our placing two portions of any seismograph designed to record the motion of a point, upon the same pedstal or post. The manner in which the investigations were made will be understood from the accompanying sketch illustrating the apparatus which was employed.



A heavy post about 9 in. in diameter was driven to a depth of about 2 ft. in the ground, 1 ft. projecting above the surface. On the South, North-west, and North-east sides of this, three similar posts, *A*, *B*, and, *C* were also driven in the ground. In the sketch only one of these is shown. Radiating from *O* in the direction of *A B* and *C* were three light arms, one of which *Oa* is shown in the sketch. These were made of light deal, and to give them rigidity they were stiffened by a broad horizontal rib marked *R*, so that the arm had a + section. At *a* there was a conical hole in a brass plate which was immediately above a similar hole in a light brass bracket firmly fixed to the post *A*. If the motion of the post *O* coincided with that of the post *A*, then these holes it was assumed would remain above each other. To test whether this was the case a light multiplying lever *a b c* was passed through these holes, terminating with a sliding needle pointer at *c* which rested on a smoked glass plate. Any relative motion of *a* and *b* would be shown by a multiplied representation (6 times) of such movement on the plate. At *B* and *C* there were similar arrangements. The only source of error would be a switching movement of the arm *Oa*. This, however, I do not think likely. The results of the observations which show that in all earth-

quakes there was a motion of *O* relative to *A*, *B* and *C* are given in the following notes and table:—

RELATIVE MOTION.

November 21st, 1884.

Plate S. .....4 mm. S.W.
Plate N.W. .....2·2 mm. in several directions.
Plate N.E. .....No visible mark, probably rubbed off.

November 24th, 1884.

Plate S. .....1 to 0·8 mm. mostly S. to W.
Plate N.W. .....2 mm. or 0·5 mm.—2 mm. is probably not the earthquake motion.
Plate N.E. .....mere dot.

November 27th, 1884.

Plate S. .....1·3 mm. in several directions.
Plate N.W. .....1·4 mm. mostly N.W. marked "Partly made when taking out."
Plate N.E. .....No mark.

November 29th, 1884.

Plate S. .....0·9 mm. ?, apparently 0·5 mm.
Plate N.W. .....0·5 mm.
Plate N.E. .....0·4 mm.

December 1st, 1884.

Plate S. .....Motion of 5 to 6 mm. in S.W. This might have been produced by the pointer swinging or creeping out, as seen from the diagram.
Plate N.W. .....2.2 mm. W.N.W.
Plate N.E. .....Mere dot.

December 6th, 1884.

Plate S. .....1 mm.
Plate N.W. .....1 or 2 mm.
Plate N.E. .....——?

December 7th.

N.W. 1 or 2..... S. a dot..... N.E. dot.

December 9th.

N.W. 1 or 2. ..... S. a dot. ..... N.E. dot.

December 14th.

N.W. 1 or 2. ..... S. irregular 5 mm. ? ..... N.E. dot.

December 16th.

N.W. 2. ..... S. a dot. ..... N.E. dot.

January 24th.

N.W. 1 mm. ..... S. 3 or 4 mm. ..... N.E. 5 mm.

February 1st.

N.W. 1 mm. ..... S. a dot. ... N.E. irregular motion.

February 4th.

N.W. 1 or 2 mm. ..... S. a dot. ..... N.E. 4 mm.

February 6th.

N.W. a dot..... S. a dot. ..... N.E. a dot.

MOTION OF THREE POINTS RELATIVELY TO A FOURTH.

No.	DATE.	INTENSITY.	SOUTH.	NORTH-WEST.	NORTH-EAST.
	1884				
—	Nov. 21	—	4.	2.2	—
—	Nov. 24	—	1.	2.	—
—	Nov. 27	—	1.3	1.4	—
—	Nov. 29	—	.9	.5	.4
—	Dec. 1	—	566?	2.2	—
—	Dec. 6	—	1.	1.5	—
—	Dec. 7	—	—	1.5	—
—	Dec. 9	—	—	1.5	—
—	Dec. 14	—	.5	1.5	—
—	Dec. 16	—	—	2.	—
	1885				
—	Jan. 24	—	3.5	1.	5.
—	Feb. 1	—	—	1.	—
—	Feb. 4	—	—	1.5	4.
—	Feb. 6	—	—	—	—