

about N. 60° E. It will now be seen that the planes of oscillation of the first three clocks made wide angles with the direction of motion of the first maximum, while the plane of the fourth clock was almost exactly parallel with that direction and perpendicular to the direction of motion of the second maximum. The fourth clock, then, may easily have escaped arrest

9h 51m 51m 10s 51m 20s 51m 30s 51m 40s 51m 50s 52m

until the second maximum while the other three would have little chance of escaping the first maximum, even if they did not stop during the lighter preliminary tremors. That the second and third clocks stopped during the first maximum is rendered probable by the way in which their pendulums were caught. It would require a considerable acceleration in a direction perpendicular to their planes of oscillation and at times when the pendulums were near the extremities of their arcs of vibration in order to throw their bobs far enough backward to catch in the manner they did. These two clocks are relied upon as giving the time of the first maximum. The chances are, however, that the pendulums were not caught in this particular way during the first three or four oscillations, but went staggering along for a very few beats until finally caught. An interval of three or four seconds was probably occupied in the rapid swelling of the quake from the preliminary milder phase into the full power of the maximum. If we assume for the beginning of the first maximum an instant of time about three or four seconds earlier than that indicated by the two railroad clocks, i. e. 9:51:12, our actual error, it is believed will not exceed four seconds. The clock of James Allan & Co. probably stopped at a slightly earlier phase. If it may be assumed to have been six or eight seconds slow, its stopping would have been easily possible at that phase; for many less sensitive clocks throughout the country were arrested by tremors no more forcible than those in Charleston at the particular phase thus indicated. We shall reach the same result, 9:51:12, if we throw out the fourth clock as relating to the second maximum and (giving the weight 2 to both the second and third clocks and the weight 1 to the first) take the mean readings of the three. The whole tenor of the evidence from other clocks in Charleston points strongly to a time a few seconds later than 9:51 for the first maximum.

It is plainly necessary to select some phase of the earthquake in Charleston or at the centrum as the beginning, with which the beginning in all other places must be compared. It must