

waves must be surface waves. The average speed of these waves is 3.4 km. or 2.1 miles per second. For instance in the San Francisco catastrophe those waves took nearly 17 minutes to reach us here, an arcual distance of  $35^{\circ} 25'$  or 3930 kilometres, velocity 3.8 km., hence to complete the circuit of the earth would take a little more than ten times as long, or over two and a half hours.

When, however, we make comparison of the two phases of the preliminary tremors, we note two important facts, the first is, that the time interval is not proportional to the arcual distance, as it is for the above surface waves; now, the natural inference would be that the wave travels along the chord between the hypocentre and the place, and, of course, the chords are not proportional to the arcs which they subtend. On closer examination of the records there will still be a small outstanding difference after making due allowance for the ratio of the chords, that is, the farther place shows the greater velocity, or which comes to the same thing, the time interval for the farther place is relatively shorter than for the nearer place, allowing for difference of distance along the chords. Strictly speaking these chord distances are only applicable in an isotropic medium, in an ælotropic medium we would find the path concave to the surface of the earth, which is really the condition which obtains. This further speed we find attributable to the greater depth, and hence greater density and elasticity of matter through which the waves reaching the farther stations travel. From the relationship which we have shown to exist between velocity, elasticity and density, and from the observed fact that the velocity increases with the depth, to within certain limits, it follows that the elasticity must increase faster with the depth than does the density. This, then, is the first fact that we note with reference to the first preliminary tremors as interpreted from different seismograms. The second is that the interval between the first and second preliminary tremors is not only not constant, but increases with the distance from the hypocentre. This fact immediately differentiates the nature of the waves. It is evident and obvious that one kind of pulsation is gaining on the other, otherwise the two recorded