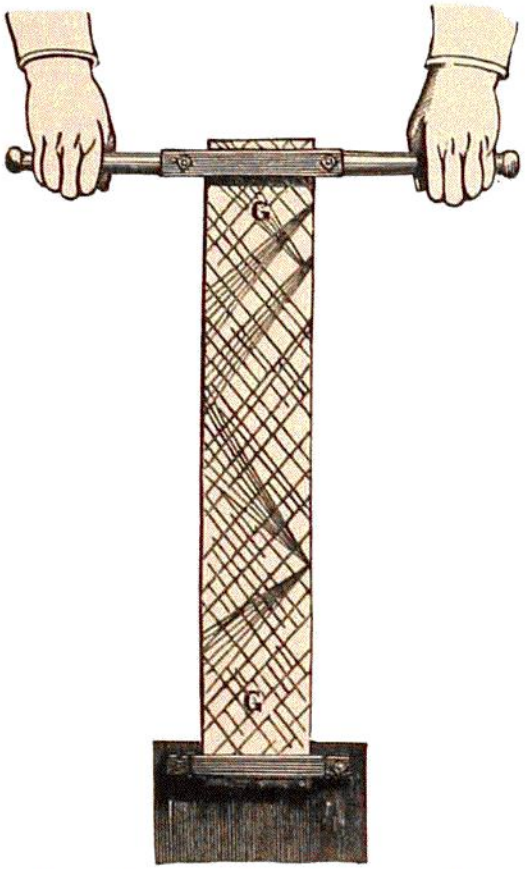
the reflections from the surfaces of fracture give a false appearance of ridges along the fractures.) Daubrée draws attention to (1) the approximate parallelism of the lines, and yet their slight divergence; (2) the crossing of one set of lines by another nearly at right angles, *anti-parallels*, as he calls them; (3) the fact that the lines are in groups; (4) the fact that joints may be an instantaneous effect; (5) the very important fact that the force producing the joints did not act at right angles to either set, but at the extremity of a bisectrix to the angle of intersection of the two sets; and (6) the fact that the slower the action of the force and the larger the plates, the nearer the approach to parallelism between the lines in each set. Fractures made by torsion might be left open when those from direct pressure would remain closed. Other instructive figures are given in his work on Experimental Geology. Joints may also be due to the vibrations of earthquakes (Crosby), and to changes of temperature (pages 260, 264).

345.



Lines of fracture produced in a plate of ice (GG) by slight torsion. (× ½.)

346.

Portion of a plate of ice showing its fractures (×½). From a photograph.

2. Earthquakes.

An earthquake is a series of vibrations begun in some region of local disturbance in the earth's crust, and propagated upward and outward from this place as a center. Slight tremors may be produced by falls of large rock-masses, where undermining has been carried on. But true earthquakes come, for the most part at least, from one or the other of the following sources of disturbance: —

(1) Vapors suddenly produced, causing ruptures and friction; or, commonly, (2) sudden movements or slips along old or new fractures.

Earthquakes due to the former of these methods are common about volcanoes. At the Hawaiian Islands, shakings that are destructive over the island of Hawaii at the moment of some of the more violent eruptions do