The crest-line oscillates also horizontally. The sand of which each ripple-mark is constituted tends to come to a standstill immediately under the crest, and its profile (see fig. 191) shows that it grows increasingly thinner as it descends. Owing to this the leeward slope acquires a greater degree of steepness than it is able to maintain, and in consequence of the gathering load on the crest, there is a sand-slip in the lower part of the leeward slope. This, it is true, endeavours to restore the angle *a—b*, which however in consequence of the moment of inertia in the movement of the downward sliding sand shoots forward to the position *c—d*. No sooner is this result achieved than the loading up begins again on the upper part of the leeward side of the dune. The horizontally oscillating period is more irregular than that of the vertically oscillating period.

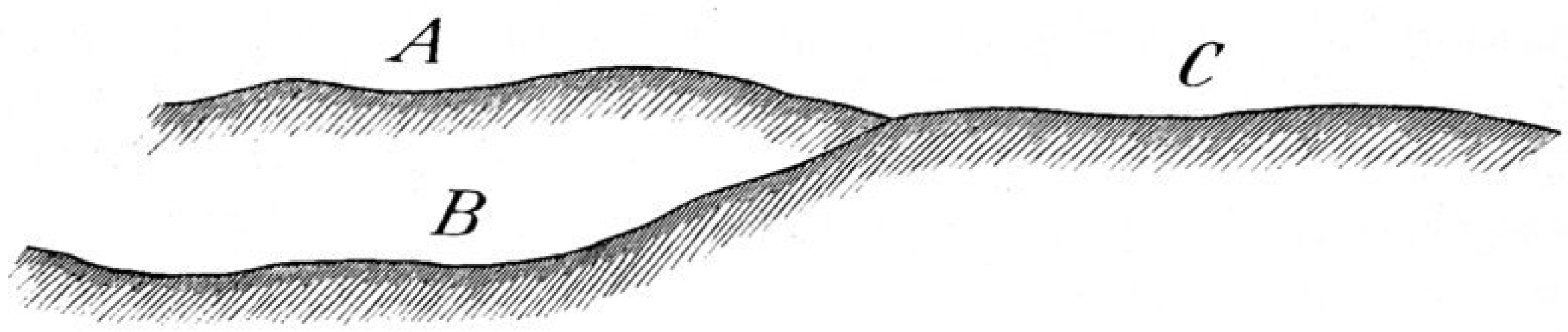


Fig. 192.

Seeing now that, as I have assumed, the ripple-marks augment in size as they advance, it might be expected that they would also advance at an increasingly slower rate in consequence of their augmenting mass, and that this process would be intensified in proportion to their proximity to the summit of the dune, and that consequently they would as a rule be overtaken by the ripple-marks that follow them. As an actual fact this does not happen, for not only is the augmentation of mass relatively insignificant in the short ascending paths which even the very biggest dunes offer, but the higher the ripple-marks climb, the more they become exposed to the wind, with a consequent increase of velocity, so that as a rule their rate of advance remains tolerably uniform all the way up the dune-side. Add to this the local deviation which even a constant and uniform current of air must experience when it impinges upon the irregular surface of dunes, in consequence of which the wind in amongst the dunes is generally gusty and squally. This may easily be observed when you get under the shelter of a dune: the wind then appears to come first from the one side, then from the other, of the dune's upheaval. The power which would be needed to effect the augmentation of the ripple-marks is therefore employed instead in altering their position, that is in deflecting them to the one side or the other.

All the same it is an extremely common occurrence for ripple-marks to swallow up one another. When two ripple-marks *A* and *B* (see fig. 192) merge together to form one, *C*, their mass becomes equal to the mass of *A* + *B*.* With regard to the primary origination of ripple-marks, Cornish writes:** »In order that ripples, the ridges of which are transverse to the wind, may be produced, the sand

* Cornish gives in *Geog. Journal*, March 1897, p. 283, an instructive example of this.
** *Loc. cit.*, p. 282.