What effect does this have on the force necessary to pull the load along? We know that it is harder to pull a load when the wheels sink into the road bed. But why is it? We can answer this by again looking at (1) and (2) Figs. 18 and 18 a. When the wheels sink into the road the load is really being pulled up-hill all the time. If we think of the wheels sinking to the depth represented by obstruction A in (1) and (2), the line DE in each case represents the real road bed and we see that the grade is steeper in (2) than in (1); therefore the pull would be greater for the small wheel than for the large wheel if they sank to the same depth. But we found above that the small wheel would sink deeper than the large wheel, therefore the pull would be greater still for the small wheel than for the large one. This then is a second reason why it is better to use large wheels than small wheels.

What then determines the size of wagon wheels? Let us leave the answer to this question until we have studied the position of the traces.

The Traces.—Should the traces slant downward from the hames to the whiffletree? It is the common practice to have them do so. Is this practice correct?

Let us consider the question first in connection with the wheel. If the road is perfectly rigid; that is, the wheels do not sink in at all, then there is no advantage in slanting the traces, as far as the wheel is concerned, because we wish to pull the load forward, and any upward lift is wasted.

On ordinary roads, however, where the wheels sink in to a certain extent, the wagon is really going up-hill all the time, and it has been found by experiment that the pull is least when the traces are parallel to the grade up which the wagon is going. See (3) Fig. 18 a. DE is the grade and OF the slant of the trace. We can see why the