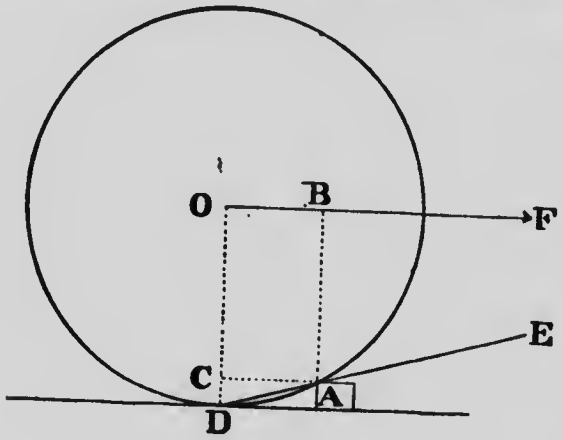
fulcrum to the line along which the weight acts. We see that the force arm is much greater than the weight arm, therefore the force is much less than the weight. Wheels then make it easy to draw a weight, because each wheel acts as a lever to lift the weight over obstructions.

Friction at Axle.—There is, of course, some friction at the axles, but this is small, because (*a*) the bearings are smooth and fitted to one another, and (*b*) they are oiled.



(1)

Fig. 18.

The oil clings to both surfaces, filling up the small hollows and covering the small projections, so that the motion really takes place between two surfaces of oil. It has been found by experiment that the friction at the axles of an ordinary wagon amounts to about 20 lbs. per ton of load, or only 5 lbs. per axle for the quarter of a ton on each axle.

Size of Wheels.—Is it better to use large wheels or small wheels on a wagon? We can answer this question by examining (1) Fig. 18, and (2) Fig. 18 a. Wheel (1) is twice the size of wheel (2), and the obstruction at A is of the same size in each case. Examine the weight arm AC