and that it is being pulled up a hill that rises 1 foot in 10 ft. Then the pull will be ($\frac{1}{10} \times 2{,}000$) 200 lbs. more on the grade than on the level. If the wagon is drawn 50 ft. up the incline its weight has been lifted 5 ft. above the level. Does the law of machines apply? The law is, "If there is no friction, the force × the distance the force moves equals the weight × the distance the weight is lifted." We find that the law applies in this case because

$$200 \times 50 = 2{,}000 \times 5.$$

We find, in fact, that the law of machines applies to all machines. Let us take one or two practical examples. If you were trying to decide which of two root cutters to buy, and wished to find the force with which the knives would cut if 20 lbs. of force were applied at the handle, you would proceed as follows: Move the handle 12 in. and measure how far the knife moved. Suppose the knife moved just 4 in., the law of machines in this case would be:

Force × distance force moves
= cutting force × distance the knife moves,
or 20 lbs. × 12 in. = cutting force × 4
or cutting force = 60 lbs.

If there were six rows of knives on the cutting cylinder and it were possible for two rows to be cutting at the same instant, the cutting force for each row would be 30 lbs.

The same method may be applied to find the cutting force on a mower. Measure the total distance the sickle moves back and forth when the mower moves ahead 1 foot. Let us suppose the sickle moves a total distance of 3 ft. while the mower is moving ahead 1 foot, then the cutting force is $\frac{1}{3}$ of the extra force the horse exerts when the sickle is in gear. If this extra force is 60 lbs., then the sickle exerts a cutting force of 20 lbs.; if there are 20