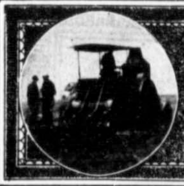

PRACTICAL TALKS TO THRESHERMEN

THE position of the center of gravity or point about which all the weight may be assumed to be concentrated must be rather carefully calculated for each type of machine. For if the weight of the machine is not properly distributed it will not be stable under all conditions. In the last lesson it was shown that for ordinary four wheel tractors the center of gravity should generally be located at a point equal to one-fourth of the wheel base ahead of the rear axle. If much more weight is thrown upon the front wheels, the machine becomes hard to steer and if the center of gravity is moved back until most of the weight rests on the rear axle then again the machine becomes hard to steer because there is not enough

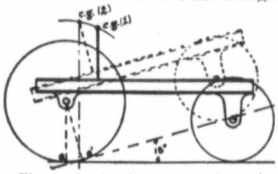

Fig. 1 showing how centre of gravity may shift from position (1) of stable equilibrium to position (2) unstable equilibrium in going up grade if carried too high.

weight in front to hold the wheels to the ground and overcome side draft.

The height of the center of gravity above the ground is another matter that merits consideration. If the center of gravity is high there is more danger that the machine will upset than if it is low. The old law of what constitutes stable equilibrium holds good. If the vertical line passing through the center of gravity falls within the base the structure will stand, while if it falls outside the structure will fall.

This is indicated in Figure 1, where the center of gravity is carried quite high. When the machine starts up grade the vertical line through the center of gravity finally falls outside of the point *a'*. When this happens, the machine will upset of its own weight but in pulling a load it would upset long before the vertical passed outside the point *a'*. It is clear from these diagrams that the height of the drive wheels has an effect upon stability since the higher they are the higher the center of gravity must be carried. It is possible, of course, to employ underslung construction, which is frequently done in order to obtain the advantage of large driving wheels without overloading the front wheels on level ground.

When it comes to the designing of three wheel tractors with two wheels in front and a simple driver in the rear, the condition for stability is that the vertical line through the center of gravity shall not fall outside of the triangle joining the points where the wheels rest on the ground. This condition

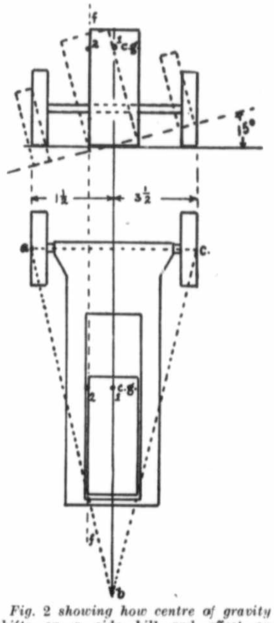

Fig. 2 showing how centre of gravity shifts on a side hill and effect on equilibrium.

is shown graphically in Figure 2. We have shown both a plan view and a rear elevation. The plan shows the base triangle a-b-c. The rear elevation shows the rear wheel and two front wheels on the level ground in full lines and on a fifteen degree side grade in dotted lines. The center of gravity in the first case is at 1 and in the second case at 2. In the plan view, the position of the center of gravity is taken at one-quarter of the wheel base in front of the rear axle and on the median line of the base triangle. When the tractor strikes the side grade, however, it is seen that the vertical through the center of gravity 2-2 comes dangerously close to the edge of the base. If the tractor were pulling a load and should attempt to turn, it would be liable to upset.

In this case two remedies suggest themselves; one is to locate the center of gravity nearer to the base of the triangle, that is, put more of the weight on the front wheels, and the other is to carry the weight as near the ground as possible.

A little figuring in this case may prove interesting. Let us assume that the total weight of the machine is four thousand pounds and that one thousand pounds rests on the front wheels. That would be five hundred pounds on each wheel. Suppose further that the rear drive wheel is two feet wide and that the extreme width from outside edge to outside edge of the front wheels is five feet. Let us suppose further that the machine is on a side hill which shifts the line through the center of gravity until it strikes the line f-f in

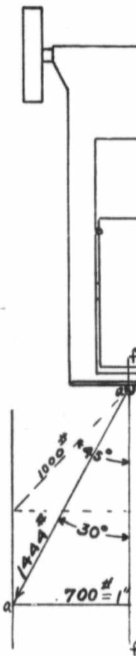

Fig. 3 Graphic method of determining magnitude of forces.

Figure 2 along the edge of the drive wheel. This line divides the front axle in two parts of three and one-half and one and one-half feet respectively. The loads on the front wheels will be inversely proportional to these distances, making the load on the left front wheel seven hundred pounds and on the right wheel three hundred pounds.

If we take moments about the center line we have a positive moment of $3\frac{1}{2}\times300=1{,}050$ pounds, this is the force tending to resist overturning. If the hitch is eighteen inches from the ground it is evident that it will require a force of seven hundred pounds acting at right angles to the center line of the machine and toward the left to disturb equilibrium. The two moments would then be equal; that is, $3\frac{1}{2}\times300=1\frac{1}{2}\times700$.

Since the pull will never come at right angles it may be interesting to do a little figuring to determine just how much of it must be to give us an overturning force of seven hundred pounds or sufficient to overturn the machine. This may be easily computed by resolving the known drawbar pull into

Continued on page 48