

time ploughing furrows to waste for the lower 5·6 of cut was two hours. Whilst actually at work a wagon was loaded on an average every 65 seconds, including stop for next wagon. This gives an output for the main part of cut, 404 wagons = 505 cu. yds. per day, and for the lower 5·6, 307 wagons, at, say, 1.25 cu. yds = 384 cu. yds. per 10-hour day, which is a very poor showing for the number of teams required.

Whilst of great service in shallow borrow pit, street grading, and open work of that nature, this machine is all that is claimed by the makers, the writer is of opinion that money can easily be lost by trying to use it where boulders or hardpan are encountered, or where cuts are limited in width. Its chief drawbacks are: Too many delicate parts, frame not heavy or rigid enough, and consequently too much lost time for minor repairs, and as there is usually a big outfit waiting on account of the repairs, a series of short stoppages soon make a big loss.

Steam Shovel Work.—Fig. 12 shows the diagram used to stake cuts for this work, giving equivalent quantities to the roadbed used, viz., 22 ft. slopes $1\frac{1}{2}$ —1. It is advisable to stake these cuts to a $1\frac{1}{2}$ —1 also, and cut a grip along this line to induce the bank to break back to the correct lines. If this is not done it breaks away in pockets.

Fig. 13 will be found useful in determining what a given size of shovel will do, and enable one to lay out the most economical lifts which should be taken in making a thorough cut.

The question of water supply for the shovel, its quality and quantity, should never be overlooked, as it materially affects the cost of the work.

The use of heavier steel than the dinkeys and dump cars call for, is not economical, as it costs too much to move around and handle.

An all around shovel on traction wheels with a $1\frac{1}{2}$ or 2 yd. dipper, and $2\frac{1}{2}$ yd. cars on 30 lb. steel, would often be more serviceable than the heavier types of shovels, where the frequency and distance of moves is considered, and if it could be operated by a gasoline motor to solve the fuel difficulty, an almost ideal machine for railway work would be available.

General Notes.—On deep cuts and high fills it is very convenient for purposes of running fence stakes, etc., to have these set out before ground is broken, as great trouble is experienced in setting them afterwards, particularly around curves.