simply worked intelligently and persistently. The only chance to get ahead of the job was in the width of the trench, and these he dug as narrow as he dared. Sometimes he overstepped the limit and had to be called back to trim up, and he always did so cheerfully. He was never a "kicker."

Brown was another husky man. He was the equal of Jones in intelligence, but was less shrewd and more conscientious. He knew how to take advantage of his work, and could, for a short time, move dirt as rapidly as Jones could. The trouble with him was that he could not keep from talking, and could not talk and work. As a result, he spent but little more than half of his time in actual work, and though his pay check was up to the average, it was not what it ought to have been if he had only been reasonably diligent.

Davis was probably the best man of the three, physically and intellectually, but he was inherently so abominably lazy that he had never learned to work and was the despair of all foremen. He was kept in the trenches because he was not worth his salt in any other place and we did not want to actually discharge him. Placed where he had to earn his money, he did make an effort to hold his own, but though to all appearances he worked harder than either of the other men, he was barely able to make minimum day wages. He had plenty of strength, but did not know how to apply it. He failed because he had no system, failed to give any thought to the way he was trying to do the work, and was actually too lazy to use his brain to save his muscle. The same condition existed all along the line.

The Results of the Experiment.—The first marked advantage was that noted above, the opportunity that it gave us of weeding out the undesirable workers from the day-wage forces. The next and undoubtedly most important feature was the marked esprit-du-corps that grew up rapidly in the entire force. It started with the emulation among the trenchers and extended rapidly back through the day-wage men. The knowledge that every man would be expected to "make good" or lose his position was very soon disseminated throughout the force, together with the further certainty that each man would be paid according to what he was able to accomplish, whether he worked in the trenches or by day wage, at least so far as we were able to adjust the compensation under the system pursued. This spirit was so marked and the stimulation that it exerted over the entire force was so great that we would have been decided gainers financially even if the actual cost of the trenching had been more than it could have been contracted for. As a matter of fact, the cost was about four cents per yard below what we could have hoped to get it done by contract.

Where Piecework Payment is Practicable.—The unanimous verdict was that the experiment had proved an unqualified success, and the only regret was that we had not applied it farther than we did. It is very evident that it would be impracticable to attempt to put all of the city forces on the piecework basis, but it was the consensus of opinion that, so far as it was practicable to apply the system, it should be done. The city will on the whole get better work for this reason. The foreman or inspector is anxious to keep the unit cost down, and will frequently pass up shabby work rather than put the city to the expense of making it good when it has been done by day-wage men, but if it was done by piecework he would insist on having it made good before certifying the job up for payment. Then the men themselves are much better satisfied. They get pay for what they accomplish. If there are any strikes under such a system it is because the employer is trying to squeeze out that last penny. The unit price should be such that the poorest man in the crew could make average wages. The cost would then be little, if any, more than under the day-wage plan, while the men would be getting so much more that there would be no incentive for a strike, and the indirect gains to the employer would be ample to warrant the adoption of the plan.

METHODS OF HANDLING LIGHT EARTHWORK.

MR. H. C. LANDON, general manager of the Watauga and Yadkin River Railroad Company, in North Carolina, writing in the *Railway Age Gazette*, makes some very useful observations from experience gained in the moving of 330,000 cu. yds. of earth, on 14 miles of his company's line. He includes details bearing upon labor employed and cost of work that should be of value. The article, as it appears, is as follows:—

The equipment necessary to grade a railroad depends largely on its location with reference to connections with other roads, the characteristics of the profile and the yardage to be moved in the several cuts to make the fills. In the construction of the Watauga and Yadkin River Railroad, which is building from North Wilkesboro, N.C., westward toward Boone, the fills are generally light and the cuts are not very heavy, although there are some comparatively heavy side hill cuts with a large percentage of rock. The difficulty of moving steam shovels far into this country on account of the very poor roads and lack of bridges, eliminate them from consideration, and a study of the profile therefore determined that the greater portion of the earth and rock must be moved with drag scrapers, wheel scrapers and explosives.

Scrapers.—The drag scraper can be used for very short hauls, but it was soon found that wheelers should be used for hauls over 60 ft., except in special locations where it is desired to move earth quickly and the distance is very short. A motion study developed the fact that with drag scrapers the speed of the mules was not over 7,200 ft. per hour, with a haul of 150 ft. on account of the frequent stopping to load the drag, and with a scraper force of six teams and a plow team the cost was about $0.20 per cu. yd. When the distance was not greater than 50 to 70 ft. the cost of moving by drag scrapers was not more than $0.12 per cu. yd., and earth has been moved for about $0.11 per cu. yd., where little or no plowing was necessary. Observations made on 110 ft. hauls with drag scrapers indicated that under the best conditions 25½ trips were made per hour, giving a speed of 5,600 ft. per hour and approximately 25 yds. per team at a cost of $0.17 per cu. yd.

As a general proposition the drag scraper is expensive in moving earth and should not be considered. A few drags on the job, however, are valuable and convenient, especially for special purposes. In one instance it was questionable whether it would not be cheaper to make a fill with drag scrapers from a borrow pit alongside and waste earth from a cut approximately 600 ft. away. It developed that the cost to make the fill from the adjoining borrow pit was approximately $0.12 per cu. yd., while the cost of hauling the material from the cut with wheelers was only $0.14 per cu. yd. To waste the cut and make the fill with drag scrapers would have cost not less than $0.24 per yd.