

leaves out all the capital. What would be thought of an accountant who pretending to give the resources of a bank or a building society, should leave out the whole capital? And yet this is precisely what *Leonidas* has done, and done for the purpose of founding long-drawn arguments upon. The foundation having crumbled away the whole structure falls. We are told that when the Grand Trunk built a competing line against the Great Western, it did not set the example which the Canadian Pacific has followed. The Great Western, however, complained as bitterly of the opposition as the Grand Trunk now complains, and the two companies as a consequence of that opposition continued at enmity nearly the whole time from the construction of the Grand Trunk from Toronto to Sarnia to the time of the amalgamation. The puff of Mr. Hickson, with which *Leonidas* winds up, taken in connection with his berating the Canadian Pacific Railway, shows the true animus of the writer. Having no interest in abusing one set of railway magnates and belauding another set, we must decline to go into their respective merits, when the occasion does not call for a criticism of management or an analysis of character.

MECHANICAL POWER IN AGRICULTURE.

In years gone by the use of motive power on farms was thought to be a very unimportant matter. It was considered to be quite unnecessary for any purpose beyond threshing out grain. To-day the matter wears an entirely new aspect and the farmer is often called upon to debate the question to what extent he shall use mechanical power for doing the work of the farm. The steady rise in the value of labor during the last generation, and especially during the last decade, has forced the agriculturist to face the question with all the earnestness which so hard a reality demands. From horse power the farmer has stepped to steam, and in many cases to water, where it is more economical, while in not a few instances the energy of the electric current has been enlisted in the service of agricultural work. Just as generations ago small manufacturers in towns learned to do many things by machine which they had formerly done by hand, and to operate machines by water or steam power rather than by hand; and in proportion as these factories increased and developed into larger and more complete mechanism each pursuing its own specialised department of work, so also must agriculture be organized to do its work cheaper and more efficiently than hitherto. One frequently hears the story that farming does not pay; and how, it may be asked, can it be made to do so under a system which contemplates a greater outlay of capital? Farm work is already undergoing a process of reorganization, and is therefore in a transition state. As knowledge of fundamental principles strikes deeper, a better appreciation of right rotations will follow; and as experience determines what crops shall be grown a more mixed system of farming will result. Agriculture will become more intense.

As most farmers of standing use from one to two hundred acres of their land, an

estimate of one horse power for each forty acres is surely modest enough for practical purposes. In practice many farmers use as much as one horse power for every twenty acres, and find it very economical. It must be added that these are men who have learned the value of organization and have so arranged their business as to increase the capacity of their acres twenty to fifty per cent., while the amount of manual labor employed, as in some cases, remained stationary, and in others was increased only to a small extent. On every farm there is, besides threshing, a great variety of work to be done, such as hoisting, wood cutting, feed cutting and grinding, separating milk and churning, pulping and slicing roots. Besides these there is much work of a purely domestic character which might be done by mechanical means and thus the drudgery of the farm house be lightened. Bread making, sausage making, and the family sewing, could all be done by the steam motor. All this requires much organization, and can only be done efficiently by those who have an adaption for mechanical work. The more domestic operations may need to be removed to the dairy so as to be connected up to the main shafting, distributing the power. How all the work will be so organized as to be capable of such control, is a question to be settled by the farmer himself. Some have already solved the problem; it is only a matter of arithmetic and experience for others to do likewise.

On many farms there are more horses than are really needed for the work to be done, especially in this the case in winter. Now boilers and steam engines can be bought at very moderate prices varying according to size from \$250 to \$500 for a combined boiler and engine occupying but a few square feet and capable of giving out from three to ten horse power of energy. For about a cost of \$60 per horse, a man may have an engine of from five to six horse power and do from four to ten hours work every day. Every one who has thirty cows would separate his milk, churn every day or on alternate days, and work the butter. Fresh feed must be ground, cut, and roots sliced; and wood must be had for the house, water must be pumped to supply the wants of the house and the cattle. It will be asked who will attend to all this work and what will it cost to operate an engine running so many hours? As the fuel consumption of these small engines seldom exceeds eight pounds of coal per horse power per hour we may assume the cost at \$5 per ton for coal or a quarter cent per pound. Some of the work done would require only about one and a half to two horse power, but the fuel consumption for a circular saw would reach four or five. Assuming the engine to be worked at four horse power on the eight pounds of coal basis it would require about 32 pounds of coal at a cost of 8 cents per hour or forty cents for half a day. If run all day it would cost less than five dollars a week. Most farmers would use wood, which we may take at \$3.00 a ton on the farm although less would be nearer the mark. Assuming a consumption of 15 lbs. of wood per hour per horse power, we shall have to provide 60 lbs. of fuel at 9 cents per hour. Horses

cannot be fed, housed, and attended for less than \$2.00 per week, and their presence on the farm is often a burden inasmuch as there is not work for more than half of them in winter.

It is quite possible to conceive a condition of organization in which the farm work could be so completely arranged and controlled as to render useful employment for both horses and men a certainty during winter. To succeed in the conduct of a business on such lines implies a high degree of intelligence and a mastery of details. Wherever we meet with conspicuous successes these qualities invariably underlie them. Farming is becoming more and more a process of complex manufacturing operations, whose rewards are highest to those who plan best and execute with the greatest efficiency.

It may be that the coming decade will see many installations of electrical motors for farm work as well as for city manufactures, generating two hundred or more horse-power in some central station and distributing it over an area of two or three miles for the service of some seven or eight thousand acres. Wherever the electrical system of mechanical power is adopted there will of necessity follow further reorganizations of farm labor, which will reduce its employment to the narrowest limits. The farm hand of the future will probably be as much a skilled laborer as the artisan and mechanic of the city.

The enormous increase in the mechanical power used in the United States since 1870 is amazing. Forty-five per cent. in ten years means a great deal, and indicates a high expenditure of energy, but on further examination we notice something still more surprising and significant. While the number of water-wheels increased 860 per cent. the increase of power was 8.4; steam engines showed an increase of 40.54, while the increase of power was not less than 79 per cent. It will be more readily understood if it be stated that in 1880 there were in use seven machines for every five in 1870, but the power of these was increased to 900 horses for every 500 employed in 1870. These facts afford a pretty good indication of what may take place during the present decade. In 1880 the dynamo electric machine was but a novelty and no large scheme of electric power transmission had been worked out. Now, however, the case is different. Since 1881 we have had continuous electric exhibitions in Paris, London, Vienna and Philadelphia. At each of these various appliances have been shown for locomotive purposes, besides the several important installations for commercial uses. Then, in the larger cities, regularly appointed stations are being opened for the supply of power to users from house to house in the same way and over the same wires as current for light is distributed. It is quite possible that the first large installation of electrical plant for power may be made out west, where people are not scared of novelty, nor afraid to face the possibility of a failure. The economical results however will be great. Not drudgery, not even intelligent toil from early morning till late at night, unless it can use cheap energy to do purely mechanical work, will avail us in the future. Every year sees