little ammonia and potash, but it took some lime, and allowed some silica to pass away. Professor Way ascribed his results to purely chemical causes, and supposed they were obtained in consequence of the decomposition of certain double silicates which existed in the soil; but there was no proof, the lecturer said, that these double silicates were really present in soils. The lecturer believed the cause was partly chemical. Lime, which was present in all soils, would fix phosphoric acid, and hydrated sesquioxide of iron would fix both potash and ammonia, and in general all compounds having the formula $R_2 O_3$ would fix alkaline substances. The lecturer then referred to the harm resulting from having the mineral constituents of plants in too soluble a condition, and explained how this was controlled by the rain-fall. He then referred to Liebeg's latest work, and said that the statements made therein were true only in special cases, and had no bearing on general practice. In attempting to give too comprehensive a view, Liebeg had missed the truth. His statements, however, did not deserve ridicule. The office of the soil was not merely to support the plant, but to manufacture the food into a condition for assimilation; it was the workshop in which the food of plants was prepared. The chemistry of agriculture was a subject full of practical interest, but also full of difficulties, which, however, might be overcome, by extended observation and study. Professor Voelcker then referred to the threatening exhaustion of the soils of England, and said that that was a matter about which we need be in no great anxiety at present. Although phosphoric acid was very minutely distributed in our soil, yet there were large deposits of it in various parts of the globe, which English enterprise was converting to use. English soil had wonderfully improved within the last fifty years, and was improving still, notwithstanding that our sanitary laws compelled us to waste much of that which ought to be returned to the soil. In 1775, Norfolk produced fifteen bushels of corn to the acre; it now produces from thirty-two to thirty-six bushels. In some other counties there was an equal improvement,—the result of proper drainage, proper manuring, and the selection of proper plants. In everything concerned with agriculture, from the plough-boy upwards, there had been a most marked progress in the last fifteen years. Superior mechanical skill and knowledge had been called into action. Still, however, the primeval curse remained, that man must earn his bread by the sweat of his brow. But if man be only be true to himself, the promise also remained that "seed-time and harvest should never fail."

OSCILLATION OF LOCOMOTIVES.*

Few subjects connected with the locomotive have met with more attention than its oscillation at high speeds. Careful experiments have been conducted, long treatises written, and discussions seemingly endless carried on, to ascertain its cause, its amount, and its remedy. In the infancy of the locomotive, regarded as a matter of little importance, we find it of late looked upon as a matter of increasing moment, concerning not alone the stability of the permanent way, the wear and tear of the engine, and the economy of fuel, but even the lives and limbs of passengers: many of our most deplorable railway accidents being doubtless the result of an oscillation so excessive as to force out a rail, or break a leading wheel-flange. Nevertheless, all that has been hitherto said, written, or done, has not only failed to give us a steady engine, but even to give a satisfactory answer to the question, "What causes oscillation?" At the present moment three parties may be found, each representing our highest talent and scientific skill —one holding that its sole cause must be found in the want of balance in the reciprocating masses of the engine; another, that it is wholly due to imperfections in the permanent way; and the third, and by far the most numerous, that it is the result of both these disturbing causes. Although the opinions of the last party are doubtless correct as far as they go, still they are faulty in that they almost totally disregard one or two disturbing forces of considerable but much underated importance, to which we wish to call the attention of our readers.

Mr. D. K. Clarke conducted a very valuable series of experiments some years ago—we forget the exact date,—to determine the effect of want of balance in the reciprocating machinery of a locomotive. In order to obtain accurate results, he suspended the engine by long ropes from the roof of the workshop, and fixed a pencil to the front or back buffer beam in such a manner that the oscillation, when the driving wheels were put in motion was duly registered on a cord suitably placed. The resulting diagram, with an unbalanced engine, was about $\frac{5}{8}$ of an inch long, oval in shape, and about $\frac{1}{2}$ inch wide. Weights were then applied on the trial and error system, and the result was, that the oscillation decreased by degrees, as proper weights were better distributed, until the diagram from a perfectly balanced engine dwindled down to a mere point. Such a locomotive was found to run much steadier in regular work than before it was balanced, although a ride on the foot-plate demonstrated plainly enough that it was still far indeed from being perfectly steady; better it certainly was, so much better, indeed, that it became practicable to run at speeds which it would have been madness to attempt had it not been balanced. The remaining oscillation was attributed naturally enough to imperfections in the permanent way; much of it is due to this cause, no doubt, but not all.

There are some points worthy of note in these experiments—one, that the pressure in the cylinders never exceeded the few pounds on the square inch necessary to overcome the friction of the engine, the driving wheels resting neither on the rails or a brake; another, that there was no propelling thrust whatever on the axle boxes. The experiments were perfect, and attended with the happiest results, as far as they dealt with want of balance as a cause of oscillation; but dealing as they did with an engine under abnormal circumstances they were utterly useless as far as any other disturbing causes were concerned. They could give us no idea of the effects produced by the drag of a loaded tram, itself oscillating violently, the imperfect state of the permanent way, the want of truth in the diameters of the wheels, or many other things—

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