opinion, and undertook to base all his actions on knowledge and fact.

In other words, his chief claim to fame, as indeed it was the chief attribute of his mind, was his use of the scientific method and his elaboration of a science for everyday practical things. He was not only a supremely scientific man, but he was bold enough to apply his scientific mind to things for which it was little thought a science could or should exist. As Mr. Copley points out, he thus anticipated a subsequent prophecy made by Mr. H. G. Wells, when he wrote, in one of those delightfully interpolated reflections with which he is wont to add to the fascination of his novels:

> When the intellectual history of this time comes to be written, nothing, I think, will stand out more strikingly than the empty gulf in quality between the superb and richly fruitful scientific investigations that are going on, and the general thought of other educated sections of the community. I do not mean that scientific men are, as a whole, a class of supermen, dealing with and thinking about everything in a way altogether better than the common run of humanity, but in their field they think and work with an intensity, an integrity, a breadth, boldness, patience, thoroughness and faithfulness—excepting only a few artists—which puts their works out of all comparison with any other human activity . . . . . In these particular directions the human mind has achieved a new and higher quality of attitude and gesture, a veracity, a self-detachment, and self-abnegating vigor of criticism that tend to spread out and must ultimately spread out to every other human affair.

Taylor himself realized something of the novelty of his work in this sense, when, in 1912, he said: "A very serious objection has been made to the use of the word science in this connection (that of management). I am much amused to find that this objection comes chiefly from the professors of this country. They resent the use of the word science for anything so trivial as the ordinary, everyday affairs of life."

Taylor, indeed, must rank among the greatest of scientists for, not only did he prove himself an incomparable exponent of the scientific method, but he built, on the basis of his research, a new science, and a science in a new field, far from the laboratories of the universities, where the clangour and smoke of factories strike the air, and men dig and shovel and carry and draw. He made everyday things the subject of thought, and thereby raised them. He lifted the toilsome task of the labourer out of the ruck and muck and "lit it up with a ray from the realm of pure intellect." High tribute, indeed, was it to receive from such a man as Le Chatelier, professor of chemistry in the Sorbonne, the words, "I was somewhat ashamed to find the science of a practical man infinitely more developed than my own . ."

It is strange to think that this man, who began his work in industry on the floor of the Midvale machine shop, who moved from clerk of the shop to work as a machinist, who then became gang boss in charge of the lathes and subsequently became foreman, chief draughtsman and chief engineer successively—this man, who, in his early days, worked from 6:30 to 5:10, who often volunteered to work on Sundays as well as overtime on week days, whose drawings William Sellers flung in the fire, who stopped the daily beer and whiskey wagon driving into the Midvale works—this man, who fought his way from the lowest and lived his life among the hard knocks and rough-and-tumble of the factory, should have, in such surroundings and as a part of such a life, brought to bear on his work a mind so scientific that it has come to command the respect of the whole world of science.

What Taylor achieved, however, could not have been won by a scientific mind alone. There were other mental qualities which contributed to this success. Of these, I should place foremost his determination, persistency, thoroughness, tenacity, and above all, enthusiasm. These are qualities, of course, common to most successful men who have encountered opposition in the pursuit of their ideals. Yet, recurring again, as they do, in the life of Taylor, one cannot but marvel as, at every turn in his life, they loom into prominence. One can quote from this book instance after instance where Taylor, had he been of poorer clay, would have taken the easier road. It may seem a barren field of battle in which to try such highly tempered weapons as Taylor's persistency and thoroughness—this machine shop at Midvale, for example. Yet the story of Taylor's struggle with his men, ending, as it did, in a most solid hold upon them, reads like the yarn of an Arctic explorer. Only infinite determination, inexhaustible enthusiasm and unyielding persistency could have climbed the obstacles which were laid in his path. It was the same throughout his life. Nothing was impossible, if it were necessary. Few men would have won the degree of M.E. when occupied, in the whole-hearted way he was, in the work-a-day toil of the shops. Few men—to take a more domestic incident—would have planned the removal of old box hedges with the thoroughness and disregard for precedent and prejudice with which he undertook it. "We were told," wrote Taylor, "not only by the former owner of the place, but by all the gardeners and landscape architects whom we consulted, that it was an impossibility." Yet, he set to work in his own scientific way to solve this 'impossibility,' as he had solved many another greater one; and, later, one might have seen box hedgerows in huge wooden crates, pulled by horses, running along a wooden track, to their new destination. Where others had failed, Taylor succeeded. It was characteristic of Taylor's whole attitude to things that wanted doing,—whether it was to increase the cutting speed of steel, to ensure the proper care of belting, to learn the content of the shoveler's task, or to elaborate functional foremanship in the Bethlehem machine shops. In big things and small things, there was always the same undaunted persistency and thoroughness, kept going by an enthusiasm, which not only made him a supreme optimist, but drew others along with him. "Why, he would have filled up a corpse with enthusiasm, if only the corpse could hear," said a Midvale executive. His whole work, viewed from this angle, was, indeed, little short of amazing. For years, industry had revolved in the same old way; then, the youth Taylor enters Midvale, and within ten years, not by any great display of mental genius or brilliant discovery, but by sheer drive and tenacity and enthusiasm, coupled with an unfailing belief in and use of the scientific method, this man, between the ages of 22 and 32, set the whole establishment buzzing along lines which had hitherto hardly been imagined. As an example of mental intensity, I know few achievements, whatever the field, to equal it.

In reviewing the mental attributes of Frederick Taylor, moreover, one cannot but refer to those other qualities which formed, as it were, the complement to those we have already noticed. I mean his intensely logical mind, his genius for detail, and his boldness in construction. These were the qualities which enabled him to found his constructive work on fully analyzed bases of fact. In speaking of Taylor's work at Midvale, Carl Barth says:

> He constantly investigated tools and other small appliances that gave minor trouble or fell short of giving entire satisfaction, and in discovering the cause of their shortcomings, was able to effect highly-desirable improvements. Many of these improvements probably could easily have been made by anyone else who had taken the trouble Taylor did to investigate. The basis of it lay in the fact that it was Taylor's genius to recognize the importance of trifles.

To Taylor, nothing was too small or insignificant. It was the little motions, the little adjustments, the little elements which were the basis of his whole philosophy. He realized to the full that, for the average man, invention itself was a question of studying the detail.

> It is thoroughly illegitimate, he said, for the *average* man to start out to make a radically new machine, or method or process, new from the bottom up, or to do things most of which have not already been done in the past. Legitimate invention should be always preceded by a complete study of the field to see what other people have already done.

What Taylor meant by a "complete study" may have differed from what his hearers interpreted it to mean, but to him it meant a study so exhaustive that every detail was laid bare before his microscopic eye. Perhaps what Mr. Copley has entitled, "A Tale of Shoveling," is the supreme example of this Taylor genius for detail, though the work which led up to his discovery of high-speed steel is an equally striking illustration.

> Now, gentlemen (said Taylor in giving evidence before the Special Committee of the House of Representatives in 1911-12) shoveling is a great science compared with pig-iron handling . . . . Under the old system you would call in a first rate shoveler and say, "See here, Pat, how much ought you to take on at one shovel load?" And if a couple of fellows agreed, you would say that's about the right load and let it go at that. But under scientific management absolutely every element in the work of every man in your establishment, sooner or later, becomes the subject of exact, precise, scientific investigation and knowledge to replace the old "I believe so" and "I guess so." Every motion, every small fact becomes the subject of careful, scientific investigation.

Taylor was speaking out of his experience. In describing the method of Scientific Management, he was emphasizing that application to detail which was one of the distinguishing features of his own genius.

As is often the way, this capacity for detail was part and parcel of a highly logical mind. The successive steps which Taylor took in the expansion of his system form a singular picture of lucid, constructive thinking. It is an entire misconception to believe that Scientific Management originated as a theory and that certain mechanisms were subsequently devised for the application of the theory. The story is wholly the reverse. By the singular efforts of a shop foreman to solve his practical shop problems, certain mechanisms were designed and applied, which one by one led on to other mechanisms, each one requiring a further one, till what had grown as need arose became recognized as a system. The system being recognized, there came the final stage of deducing from the specific mechanisms those principles which seemed to be of general application; and thus in the end came a phil-