crawling 100 yards through a slime-choked drain under the mill foundations to remove an obstruction. He never flinched under harsh bosses, who believed that to spare the damn was to spoil the man, and took the roughest treatment from men who threw his plans into the fire and cracked the whip over him. He learned and constantly practiced profanity himself. Ida Tarbell says that he "never seemed more of a gentleman than when he was swearing."

Above all, Taylor showed from the first his alert inventiveness. Men derided his "monkey mind," which questioned every machine and process. When a boy he had devised a unique sled-stopper and a harness to keep himself from turning on his back in sleep. At Midvale the assertive youngster was constantly making critical suggestions. "Well, they can laugh at Fred Taylor all they please," remarked an associate, "but what I notice is that in the end his ideas are acted on." He improved the design of tools. He built the first steam hammer that did not rapidly batter itself to pieces. This invention was arrived at by a characteristically methodical process—he obtained designs of hammers from all over the world, collected instances in which different parts of various machines had never broken, combined these parts, and added an original design of his own for one part which had always given way. He put up a famous chimney which climbed obliquely towards the sky and then suddenly changed its mind and leaned over in the other direction. Then came his famous metal-cutting investigation and his new cutting steel. Even in trifles he was an innovator. His spoon-handled tennis racket gave his wrist greater dexterity. His forked golf club and unique method of using it made other golfers dumb with amazement, but they had decided merits.

The germ-idea of scientific management was planted in Taylor's mind when at Phillips Exeter he watched the famous mathematician, George F. Wentworth, take time observations to make sure that he was assigning just enough work to occupy the average of his class two hours. He perceived the need for scientific management when as a common laborer at Midvale he had to share in the "soldiering" by the workers, and as a gang boss he had to stop it. The piece-work system had usually failed because it was followed by rate cutting. Taylor had never heard of the pioneer labors of Babbage in England. But in 1881 he began, entirely on his own responsibility, to analyze and time all the separate operations of work in the machine shop; and in 1883 he hired a young man to give his whole attention to this. He found that even shoveling coal could be "scientific." He discovered that the efficiency of a laborer in piling iron pigs could be increased 3.6 times. He learned that workmen's movements could be made efficient, tools and conditions standardized, and superior methods invented. Very importantly, he found that his innovations encountered the angry opposition of men and department heads, and that to introduce them brought on a veritable "hell period" before they succeeded.

Mr. Copley makes an absorbing story of Taylor's gradual development of his system at Midvale until he had perfected a definite technique for all departments and made cost accounting contributory to it; his launching out as the world's first consulting engineer in systematizing shop management, and his tremendous fight at the Bethlehem works. His conflict here with Robert Linderman, the president, and with the host of Linderman's subordinates, who resisted Taylor's revolutionary reorganization, was titanic. Joseph Wharton, the leading owner, flinched at a critical moment, and just as Schwab bought the plant, Taylor was ordered out. Schwab also rejected scientific management. But the men in actual charge of operations found they couldn't get on without it, and it stayed, at first behind Schwab's back, later openly.

Meanwhile it was invincibly making its way elsewhere. The Tabor Company and the Link-Belt Company adopted it. It penetrated into the navy yards and arsenals. Mr. Brandeis' announcement that scientific management would save the railways enormous sums made in 1911 a topic of general discussion. While narrating all this, Mr. Copley gives ample space to the equally fascinating subject of Taylor's character. He never was rough in his attitude to men under him and about him; he cherished a senselessly violent prejudice against Germans, college professors, theologians, and numerous others, and he had no use for labor unions. Yet there was a gentler side to his nature, which is as admirable as his intense devotion to the great principles he was teaching. This excellent biography presents one of the true heroes of American industrial progress.

Taylor a Scientific Revolutionary[1]

By Edward Eyre Hunt[2]

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THE appearance in two volumes of Frank B. Copley's "Life of Frederick Taylor, Father of Scientific Management" is an event. Frederick W. Taylor was one of the great figures of our time, and his published life will help the public to become aware of that fact. His ancestry and boyhood, his work at Midvale in the '80s, his activities as consulting engineer in management, his achievements at Bethlehem in the late '90s, his influence on the American army and navy and his other public services are graphically traced.

The origins of scientific management, better known abroad as the Taylor System, are described in terms which everyone can understand. There was nothing theoretical about Taylor; he was a mechanical engineer, but first he was a shop manager confronted with concrete problems, and his system of management, built at first piecemeal, was the scientific solution of his problems. It was a successful effort to give the machine shop a brain commensurate with its size instead of leaving it, like the prehistoric megatherium, with an elephantine body and a peanut intelligence. Functional foremanship, one of his great discoveries, was a gradual development—what detractors like to call an "accident." His differential wage system was another development. Time study with the use of the stopwatch, which caught the public fancy in 1911, was only one of his management devices. He was the first to bring the scientific spirit completely to bear upon the problems of managing men and materials.

What might be called collateral results of his shop systematizing, such as the great discovery of high-speed steel—a discovery which made possible the cutting of metals at such speed and temperature that the nose of the tool burned a dull red and threw off bright blue chips; his work with Barth on slide rules; his picturesque experiments in growing synthetic golf greens; his methods of removing full-grown trees and plants such as the famous avenue of old box planted in Germantown by du Barry in 1803, or the fifty-year-old wisteria which he transplanted while in full bloom; even his startling inventions of golf clubs, such as his fork-armed putter, filed mashie, and extra long driver, together with his spoon-handled tennis racquet (he was a good golfer and held the National tennis championship one year)—all are given their proper place in the story.

Taylor was a cooperator. His use of the editorial "we" in describing his work was deliberate, for the revolutionary results which he achieved were due in large part to his ability to inspire groups of coworkers, among them such outstanding figures as Barth, Gantt, Hathaway, Thompson, and Cooke.

It is not, I think, a superficial resemblance which Mr. Copley traces between Frederick W. Taylor and that other eminent Philadelphian, Benjamin Franklin. But I felt, as I read his life, a more than passing resemblance to another great American, not in the field of his achievements, but in the force of character which brought them into being; the self-confidence, the strenuous courage, the belief that to do less than one's best is a social crime, the faculty of inspiring others to effort, the prompt and voluble acknowledgment of the achievement of others, the delight in battle for a good cause, and the very human feeling that "he who is not with me is against me"—surely here there is a resemblance to Theodore Roosevelt. And there was something Rooseveltian in the manner of his death. "About half-past four the next morning he was heard to wind his watch. It was an unusual hour, but nothing was thought of it. Not until half an hour later did the nurse enter the room to find that he had died there alone."

In Soviet Russia, in France, in Germany, in Great Britain, in Japan where Barth has just gone, and in engineering circles in America the Taylor System is looked on as one of the most significant developments of modern life.

But Taylor's purpose was not simply to invent novel mechanisms. He was inspired throughout by a high type of social idealism. He was a scientific revolutionary. He worked to bring about a new world, a world in which knowledge shall reign, in which each man and woman shall be trained for his task, in which each shall do his best, and in which each shall be rewarded according to his work, in order that all the powers of men and of nature shall be released for human happiness.

In any American pantheon there ought to be a commemorative tablet to the life and work of Frederick W. Taylor.

[1]Reprinted by permission from *The Outlook*, January 23, 1924. The caption is ours.

[2]Secretary, the President's Conference on Unemployment; editor of "Scientific Management Since Taylor."