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APR 12 1921
30TH

ANNIVERSARY NUMBER
**INDUSTRIAL
MANAGEMENT**
The Engineering Magazine

APRIL 1, 1921



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Vol. LXI

No. 7

30TH
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Containing a series of reviews
and forecasts, by notable authori-
ties and experts, of the various
phases of management science.

The Pioneer Journal of Management Science

Founded April, 1891, by John R. Dunlap



MR. HENRY R. TOWNE, "the Pioneer of the Science of Management," was born in Philadelphia in 1844. He began his active career in 1862 as draftsman for the Port Richmond Iron Works, and during the Civil War was in charge of important engineering work for the gun boats of the United States Navy at these shops. After the Civil War he became a special student of engineering and took an advanced course in physics at the Sorbonne, Paris. In 1868, Mr. Towne became associated with Linus Yale in the manufacture of locks and later in the same year, after Mr. Yale's death, became president of the Yale & Towne Manufacturing Company. Since 1914, Mr. Towne has been Chairman of the Board of that company. He was for five years a member of the Board of Directors of the Federal Reserve Bank of New York, is Chairman of the Board of the Morris Plan Company of New York, is a life member and past president of the A. S. M. E., a past president of the Merchants' Association of New York, etc., etc.—THE EDITORS.

The Evolution of Industrial Management

A review of the developments which have resulted, during the past three decades, in introducing functional management and in crystallizing empirical managerial methods into a definite and logical science. A notable contribution to the historic record.

By Henry R. Towne

Chairman of the Board, The Yale & Towne Manufacturing Co.

I HAVE often been told that my paper of 1886, "The Engineer as an Economist," printed in the *Transactions* of the American Society of Mechanical Engineers, was the first publication relating to Industrial Management. Whether so or not, it is a fact that almost immediately thereafter information and data previously inchoate began to take form and to find publicity, through the technical press and through the meetings and publications of the American Society of Mechanical Engineers.

I had long noted the entire absence of any forum or medium for the exchange of data and experience in the field of industrial management, except as accomplished

by the occasional interchange of friendly visits, notwithstanding the vast fund of experience already accumulated, and the rapid evolution due to new machines and processes, and to the solving of problems presented by the increasing number of new products. I perceived that a new Science was being born, which as yet was not only unorganized, but even unrecognized.

Referring to these facts, in my paper of 1886, I said, "A vast

amount of accumulated experience in the art of workshop management already exists, but there is no record of it available to the world in general, and each old enterprise is managed more or less in its own way, receiving little benefit from the parallel experience of other similar enterprises, and imparting as little of its own to them; while each new enterprise, starting *de novo* and with much labor, and usually at much cost for experience, gradually develops a more or less perfect system of its own, according to the ability of its managers, receiving little benefit or aid from all that may have been done previously by others in precisely the same

field of work." On this argument I based a plea for the recognition of the *Science of Management*. Evidently the time was ripe for the recognition of this plea, no matter by whom made, for almost immediately there began the publication in the technical press of data and discussions relating to this subject, which showed that it appealed to many interests, that the field was already under active cultivation, and that a great amount of valuable information was even then available. During these years Frederick W. Taylor was conducting the studies and experiments which formed the basis for the theories and rules of practice which he subsequently formulated and gave to the world, and which now constitute his most enduring monument; but with characteristic patience and modesty he withheld all publication of the results of his work until satisfied beyond question that the conclusions he drew were sound and would stand the test of practical adoption and use. His splendid contributions to the new Science began with his paper on "A Piece Rate System" in 1895, and culminated in his monumental treatise on "Shop Management" in 1903,

both appearing in the *Transactions* of the American Society of Mechanical Engineers. Coincidentally, Dr. Taylor and his associates began the introduction of "Scientific Management" in numerous industrial plants, and thus the new Science began to take form and grow. To Dr. Taylor must always be accorded the honor of being its earliest apostle and teacher, and of doing the earliest work, in this new field, which merited the title of "scientific." During the following years several national and numerous local organizations were formed for the study and promotion of the new Science, and increasingly engineers and others began to specialize in it.

Henry R. Towne is unquestionably the pioneer of management science. He began, as early as 1870, the systematic application at the Yale & Towne works, of what are now recognized as efficient management methods. In 1886, his paper "The Engineer as an Economist," delivered before the American Society of Mechanical Engineers, probably inspired Frederick W. Taylor, then a young man of twenty, to devote his energies to the labor that formed his life work.

Still young at the age of seventy-seven, Mr. Towne has lived to see the world-wide acceptance of his industrial precepts, and the complete fulfillment of his economic prophecies.—The Editors.

These processes have continued until to-day, greatly promoted and aided by the coöperation of the technical press, some of which is devoted exclusively to this branch of engineering.

To one whose experience covers both the old and the new eras, the contrast between them is most interesting and striking. Prior to 1886 the "military" (as contrasted with the "functional") system of shop management prevailed almost universally. Under this the shop foreman was responsible for almost every detail of his department, and often was an autocrat. He hired and discharged the employees, he fixed their rates of pay, whether day-work or piece-work, he assigned the jobs, and he usually directed all work relating to upkeep of machines, shafting and belting, to tool-grinding, to designing and making special tools, etc., etc., within his domain. Each mechanic under him did the work assigned to him in the way he thought best, did all of his own tool-dressing, his lathe or other machine standing idle while he made any necessary repairs to it or its belting, and depended chiefly on the favor of his foreman for his position and advancement. Empiricism and rule-of-thumb prevailed throughout. In contrast to this we have to-day *functional* management, under which trained specialists are employed, each of whom plans and controls, in all of the shops or departments composing the plant, the operations or "functions" assigned to him, all operations thus being conducted and controlled by a central organization, each of the various divisions of which direct similar operations throughout the plant, the function of the shop foreman, while still important, consisting essentially in giving effect to the plans and instructions of the various functional managers, and to maintaining the discipline of his department. Using the language of the diagram, the old system divided on *horizontal* lines, of location, of product, or of kind of work; whereas the new system divides on *vertical* lines, of functions, such as purchasing, employment, stock control, tool design, methods of work, time-studies, inspection, etc.

Coincidentally with these developments the subordinate but closely related science of "Industrial Accounting" has passed through a similar period of evolution, has won a recognized standing, and is furnishing a lucrative field of practice to a constantly increasing number of specialists, whose work goes hand in hand with

that of the industrial engineer, and is essential to the successful conduct of the latter.

Early in the nineties, believing that the new science should be recognized, promoted, and taught by our technical schools, I presented the subject to the late General Francis A. Walker, then the honored President of the Massachusetts Institute of Technology, and urged him to authorize the starting of a course in industrial management for his students. Doubtful at first, he finally was converted to the plan, and authorized its undertaking by Professor Schwamb, as a part of the course in mechanical engineering. Two years later I urged the matter on Professor F. R. Hutton, who soon became

f a v o r a b l y impressed, and thereupon initiated a similar course in the mechanical engineering department of the School of Mines, Columbia University. A few years later a similar course was established by Professor Spangler in the Towne Scientific School of the University of Pennsylvania, quickly followed in the succeeding years by similar action in most, if not all, of the technical schools and colleges; so that to-day, under various names, a

"It will probably not be disputed that the matter of shop management is of equal importance with that of engineering . . . The one is a well-defined science, with a distinct literature, with numerous journals and with many associations for the interchange of experience; the other is unorganized, is almost without literature, has no organ or medium for the interchange of experience, and is without association or organization of any kind. There already exists an enormous fund of information relating to such matters based upon actual and most extensive experience. What is now needed is a medium for the interchange of this experience."—Henry R. Towne, "The Engineer as an Economist," May, 1886.—The Editors.

course in Industrial Management has become a recognized part of the curriculum in practically all of them.

At the present time the work thus done in the training of engineering students to qualify them for positions of responsibility in the management of organized industry, is continued and **greatly promoted by the presentation and discussion of papers contributed by members and others to numerous technical societies, and by the increasing coöperation of the technical press, as an exponent of which in this new and important field "Industrial Management" is a recognized leader.**

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Editorial Addenda

No record of Mr. Towne's potent part in the development of the Science of management, can be complete without quotations from his eloquent and feeling tributes to Frederick W. Taylor's great achievements. Thus, in 1915, when Dr. Taylor died, in a most impressive letter which appeared on the editorial page of the *New York Evening Post*, Mr. Towne said:

"One of the world's discoverers and creative leaders has closed his career. The world is greatly enriched by what his genius accomplished. The world is grateful that he lived and for what he did."

Prompted by this tribute, Mr. Towne was at once invited to enlarge upon his theme and in a notable leading article in these pages, in May, 1915, he wrote this:

"Among the names of those who have led the great advance of the industrial arts during the past thirty years, that of Frederick Winslow Taylor will hold an increasingly high place. Others have led in electrical development, in the steel industry, in industrial chemistry, in railroad equipment, in the textile arts, and in many other fields, but he has been the creator of a *new science*, which underlies and will benefit all of these others by greatly increasing their efficiency and augmenting their productivity. In addition, he has literally

forged a *new tool* for the metal trades, which has doubled, or even trebled, the productive capacity of nearly all metal cutting machines. Either a *chievement* would entitle him to high rank among the notable men of his day;—the two combined give him an assured place among the world's leaders in the industrial arts. Again he wrote:

"Measured by originality and comprehensiveness Mr. Taylor's paper undoubtedly is the most important

thus far contributed to the *Transactions* of this Society. With perfect modesty it makes no claim to sole credit for the achievements it records, awarding due praise to all who were associated in the work, and recognizing that the work itself was made possible by the rapidly developing opportunities which modern materials, processes, and machines have made available, but which previously had not been fully appreciated or utilized. To Mr. Taylor is due all credit for being among the first to perceive these opportunities, to appreciate their possible significance, and, with endless patience and consummate skill, maintained through 26 years with unflinching persistence and despite all discouragements, to carry forward his undertaking to its successful issue.

* * *

"Mr. Taylor's other and still greater achievement was in the field of industrial management, for here he was the creator of a new science where previously was only tradition and empiricism. Others without number have been organizers of industry and commerce, each working out, with greater or less success, the solution of his own problems, but none perceiving that many of these problems involved common factors and thus implied the opportunity and the need of an organized science. Mr. Taylor was the first to grasp this fact and

to perceive that in this field, as in the physical sciences, the Baconian system could be applied, that a practical science could be created by following the three principles of that system, viz., the correct and complete observation of *facts*, the intelligent and unbiased *analysis* of such facts, and the formulating of laws by *deduction* from the results so reached. Not only did he comprehend this fundamental conception and apply it; he also grasped the significance and possibilities of the problem so fully that his codification of the fundamental principles of the system he founded is practically complete and will be a lasting monument to its founder.

"The benefits of Mr. Taylor's great contributions to applied science in both the arts, metal cutting and industrial management, will be shared increasingly by every industrial community throughout the world, by every organized industry, and equally by the employer and the employee."

Mr. Towne's early recognition of Doctor Taylor's great work is also indicated in his discussion of Doctor Taylor's paper on "The Art of Cutting Metals" before the American Society of Mechanical En-

gineers in 1907. In Mr. Towne's discussion he said:

"Mr. Taylor's paper on 'The Art of Cutting Metals' is a masterpiece. Based on what is undoubtedly the longest, largest and most exhaustive series of experiments ever conducted in this field, its summary of the conclusions deduced therefrom embodies the most important contribution to our knowledge of this subject.

"About 60 years ago, American invention lifted one of the earliest and most universal of the manual arts from the plane on which it had stood from the dawn of civilization to the high level of modern mechanical industry. This was the achievement of the sewing machine. About 30 years ago, American invention again took one of the oldest of the manual arts, that of writing, and brought it fairly within the scope of modern mechanical development. This was the achievement of the typewriting machine. The art of forming and tempering metal tools undoubtedly is co-eval with the passing of the stone age, and therefore in antiquity is at least as old, if indeed it does not outrank, the arts of sewing and writing. Like them, it has remained almost unchanged from the beginning until nearly the present time. The work of Mr. Taylor and his associates has lifted it at once from the plane of empiricism and tradition to the high level of modern science.

"To insure the best results, the organization of productive labor must be directed and controlled by persons having not only good executive ability, and possessing the practical familiarity of a mechanic or engineer with the goods produced and the processes employed, but having also, and equally, a practical knowledge of how to observe, record, analyze and compare essential facts in relation to wages, supplies, expense accounts, and all else that enters into or affects the economy of production and the cost of the product. There are many good mechanical engineers—there are also many good 'business men'—but the two are rarely combined in one person."—H. R. Towne, "The Engineer as an Economist," May, 1886.—The Editors.