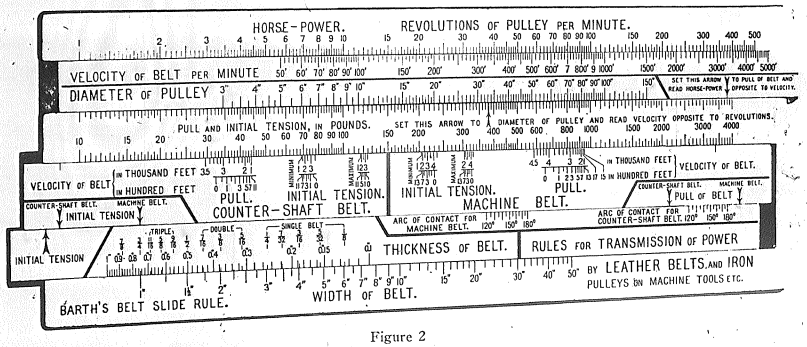

Figure 2

Barth's Belt Slide Rule. Used for computations in establishing and maintaining standard belt conditions.

By the adoption of standards and the use of instruction cards for overhauling machinery, etc., and the use of a tickler, the writer reduced the repair force of the Midvale Steel Works to one-third its size while he was in the position of master mechanic. (There was no planning department, however, in the works at the time).

It would seem almost unnecessary to dwell upon the desirability of standardizing, not only all of the tools, appliances and implements throughout the works and office, but also the methods to be used in the multitude of small operations which are repeated day after day. There are many good managers of the old school, however, who feel that this standardization is not only unnecessary but that it is undesirable, their principal reason being that it is better to allow each workman to develop his individuality by choosing the particular implements and methods which suit him best. And there is considerable weight in this contention when the scheme of management is to allow each workman to do the work as he pleases and hold him responsible for results. Unfortunately, in ninety-nine out of a hundred such cases only the first part of this plan is carried out. The workman chooses his own methods and implements but is not held in any strict sense accountable unless the quality of the work is so poor or the quantity turned out is so small as to almost amount to a scandal. In the type of management advocated by the writer, this complete standardization of all details and methods is not only desirable but absolutely indispensable as a preliminary to specifying the time in which each operation shall be done, and then insisting that it shall be done within the time allowed.

Neglecting to take the time and trouble to thoroughly standardize all of such methods and details is one of the chief causes for setbacks and failure in introducing this system. Much better results can be attained, even if poor standards be adopted, than can be reached if some of a given class of implements are the best of their kind while others are poor. It is uniformity that is required. Better have them uniformly second class than mainly first with some second and some third class thrown in at random. In the latter case the workmen will almost always adopt the pace which conforms to the third class instead of the first or second. In fact, however, it is not a matter involving any great expense or time to select in each case standard implements which shall be nearly the best or the best of their kinds. The writer has never failed to make enormous gains in the economy of running by the adoption of standards.

It was in the course of making a series of experiments with various air hardening tool steels with a view to adopting a standard for the Bethlehem works that Mr. White, together with the writer, discovered the Taylor-White process of treating tool steel, which marks a distinct improvement in the art; and the fact that this improvement was made not by manufacturers of tool steel but in the course of the adoption of standards, shows both the necessity and fruitfulness of methodical and careful investigation in the choice of much neglected details. The economy to be gained through the adoption of uniform standards is hardly realized at all by the managers of this country. No better illustration of this fact is needed than that of the present condition of the cutting tools used throughout the machine shops of the United States. Hardly a shop can be found in which tools made from a dozen different qualities of steel are not used side by side, in many cases with little or no means of telling one make from another; and in addition, the shape of the cutting edge of the tool is in most cases left to the fancy of each individual workman. When one realizes that the cutting speed of the best treated air hardening steel is for a given depth of cut, feed and quality of metal being cut, say sixty feet per minute, while with the same shaped tool made from the best carbon tool steel and with the same conditions, the cutting speed will be only twelve feet per minute, it becomes apparent how little the necessity for rigid standards is appreciated.

Let us take another illustration. The machines of the country are still driven by belting. The motor drive, while it is coming, is still in the future. There is not one establishment in one hundred that does not leave the care and tightening of the belts to the judgment of the individual who runs the machine, although it is well known to all who have given any study to the subject that the most skilled machinist cannot properly tighten a belt without the use of belt clamps fitted with spring balances to properly register the tension. And the writer showed in a paper presented to this Society in 1893, giving the results of an experiment tried on all of the belts in a machine shop and extending through nine years, in which every detail of the care and tightening and tension of each belt was recorded, that belts properly cared for according to a standard method by a trained laborer would average twice the pulling power and only a fraction of the interruptions to manufacture of those tightened according to the usual methods. The loss now going on throughout the country from failure to adopt and maintain standards for all small details is simply enormous.

It is, however, a good sign for the future that a firm such as Messrs. Dodge & Day of Philadelphia, who are making a specialty of standardizing machine shop details, find their time fully occupied.

Does not Taylor seem to have set forth the nature and importance of standards clearly and forcefully enough in this paper to have made an impression on his audience? Again if one may judge from the character of the discussion, they did not get his message. Fourteen members discussed the paper on the occasion of its presentation. The discussion covered industrial relations with special reference to what the speakers conceived to be the principal iniquities of trades unions as of that date; political economy; the natural resources of the United States; the relative merits of various pay systems; lightly touched upon elementary time-study, planning and "system," *but not one word about standards.*

Probably ninety per cent of my hearers have read Taylor's "Shop Management." I wonder how many of them really grasped what Taylor was driving at in the paragraphs I have quoted.

So much for general explanation of what Taylor meant by standards and of their place in scientific management. I shall now endeavor to supply specific and tangible examples to illustrate each class of standards, and, as standards of accomplishment are prone to eclipse all of the others in spite of being dependent upon and in a large measure a natural consequence thereof, I shall discuss them only incidentally.

Standard Tools

In describing the results achieved through the application of scientific management in its simplest form to work of an elementary character—that of handling raw materials—such as iron ore, coal, coke, sand and ashes in the yards of the Bethlehem Steel Company, Mr. Taylor gave an illustration of the establishment of a standard that can be understood and appreciated by anyone. He found that the same size and kind of shovel was being used for all of these materials. Almost any ten-year-old child knows that coal is heavier than ashes. It is obvious (since Taylor called our attention to the fact) that a shovel that will be suitable to hold the most economical weight of one material will not be so economical when used for another material of a different weight and character. Taylor's experiments demonstrated that twenty-one pounds is the most economical weight to be handled as a shovelful, and consequently had shovels built for each of the various materials to handle that weight. Of what avail would time study or differential piece work have been in this work without the standard shovel?

A few years ago I was gratified to see the advertisement of a manufacturer of shovels who announced that he would supply a standard twenty-one pound capacity shovel for any material. I doubt, however, whether it brought him much business; to most managers such a tool is too humble to attract their attention—a shovel is a shovel.

But little above the humble shovel is the bolt, clamp and block used by the machinist in fastening work on the platen of his machine, be it planer, milling machine, boring mill, drill press or lathe. In the ordinary machine shop the management does not consider these tools worthy of its attention, each workman is *supposed* to have in some way acquired and to have on hand at his machine an assortment and supply adequate to his needs. It is taken for granted that they are in good condition; that "is up to the workman." As a matter of fact these suppositions are largely fond delusions.

The time that it will take to clamp a job on a machine depends upon: