

THE BEDAUX-UNIT PRINCIPLE OF INDUSTRIAL MEASUREMENT

ITS ORIGIN, ITS LAWS AND APPLICATIONS

By CHARLES E BEDAUX

(This article is copyrighted by the author, and reproduction in any form is forbidden except by his express permission.)

Ever since industry reached the tremendous proportions afforded by the mechanical era, the need has been felt for a system of measurements permitting the exact determination of the quantitative value of the human physical effort

It is due to the lack of such a system that to-day we meet deeply set differences between management and labor. Either side ignoring the value of a given effort made it possible for the employee to practice, undetected, a restraint in production, while the employer, in some instances, protected by the same ignorance, has been able to arbitrarily decrease the money value of the operation performed.

A correct system of measurement of the industrial effort has many applications:

1. It permits a protective and adequate system of remuneration;
2. It gauges the capacity of the human being or of a group of employees comprising one department, permits an exact comparison between departments, between plants, and automatically indicates temporary or permanent conditions that are conducive to failure,
3. It may be used as a basis for apportionment of the overhead burden;
4. It allows an automatic and constant comparison between the standard and actual labor cost;
5. It renders scientific planning and scheduling of manufacture possible;
6. It is the only foundation on which any form of labor representation in shop management may stand.

The exponents of the piece-work system have recognized that the basic weakness of their method lies in the inability to guarantee the rate set, as it is based on the monetary value of labor, a commodity which fluctuates. To guarantee the

rate is to expose the manufacturer to failure, in case of a general decrease in the labor market. To cut the rate destroys the confidence of the working man and compels a restraint in production

The monetary value of labor, being a variable, cannot be used as a means to measure industrial effort.

Because of fluctuations in this value, not only between periods of depression or growth, but also within each period, among the various classes of labor, it has been impossible for the manufacturer to gauge the respective productive capacities of his various departments, or of his entire plant, in comparison with a competitive or co-operative institution.

The result has been that many plants, sincerely believing that their productivity rate was high, have failed because of their error, the detection of which was impossible without an adequate system of measurement of the human effort applied to industry.

It is also because of the absence of such a system that the monetary value of productive labor has been recorded for cost purposes by the taking of the time of the beginning and the ending of each operation. This performance is generally inaccurate, or, when accurate, necessitates waiting time for recording—a waste of labor, both in the productive and in the clerical forces

To that source also must be traced the erroneous distribution, too often met, of the overhead burden, wherein an operation costing one dollar (\$1.00) in productive labor, performed on a machine worth one thousand dollars (\$1,000.00) and depreciating in twenty years, for instance, will be charged with the same amount of overhead as an operation also costing one dollar (\$1.00) in productive labor, but performed on a machine the cost of which is one hundred thousands dollars (\$100,000.00) with a rate of depreciation that must be absorbed in ten years.

Because of the lack of an adequate system of measurement, incapable operators have been kept in positions that have been refused to men who were best indicated to hold them; promotion has been arbitrary and illogical, thus entailing losses to both capital and labor and creating a state of mind on either side which is wholly destructive.

Part Two

For many years we have seen the need of a unit of measure and our study first led us to determine that such a system could not be based on monetary values which fluctuate. We

UNIT 5 -
 5
 5



1919 JAN FEB MARCH APRIL MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MARCH APRIL MAY JUNE JULY 1920

— THE ROBBINS AND MYERS Co. —

PLANT No 3
 FAN MACHINE ASSEMBLY

then established that industrial effort was surrounded by two constants, i.e., man and time.

While the productive value changes with every human being, the average power of a large group, taken in different generations, remains constant, the variations being caused by difference in facilities and not in men.

Time is, of course, also a constant. It therefore appeared, on first consideration, that time could be used as a unit of measurement for industrial effort.

We experimented with the use of these two factors and found that the function we call "industrial work" is composed of three elements, i.e., effort, rest and unavoidable delays. We first established a system based on the element of effort alone and found it impractical, because erroneous. It brought us to determine that the percentage of rest to effort varies according to the nature of the operation

Further studies brought us to formulate these two laws:

1. *For a muscular effort of a given power, the duration of work and rest periods is inversely proportional to the rapidity of the motion, and*

2. *For a muscular effort of a given power, the percentage of rest is directly proportional to the rapidity of the motion and completion of the cycle.*

By the first law it is meant that the more rapid the motion and the shorter the cycle, the more often the rest periods must be repeated. For instance, it has been found that marching in the army gives best results with fifty minutes' effort and ten minutes' rest, while in an operation requiring fast motion of the fingers, such as packing of very light packages, in one instance, the best results were obtained with routine three minutes' work periods and one minute's rest periods, although the percentage of muscle relaxation to muscle strain is actually greater than one to three.

The practice of setting definite rest and work periods to be observed by labor is not to be recommended except in rare cases. When they are considered it must be remembered that man, who as an average is a constant, as an individual offers a wide range of variation in power as well as in skill.

By the second law it is meant that the shorter the operation and more rapid its motion, because of light weight and scarcity of varied movements, the greater the percentage of rest must be.

We further found that a worker, performing a long operation, had a greater opportunity to increase his efficiency by combination of moves than is permitted to one having to

perform an operation the cycle of which is short, therefore demanding a positive routine of a few movements.

On the strength of the above conclusions, our next step led us to compile tables of all ratios of rest and unavoidable delays affecting the various forms of human physical effort in industry. We found it to vary from 15% of the actual productive time in long cycle hand assembly operations to 150% in mechanical operations, hand-fed, of a cycle of two seconds or less.

Experiments, analysis and practical experience born out of various applications of the above brought us to formulate a third law.

3. In a large group of equally trained workers the average production of the tenth of the total number that is ablest does not exceed the double of the average production of the balance.

The securing of the above information allowed us to establish the Bedaux Point System of Industrial Measurement. The unit was called a "Point." It has the following definition:

A point is a fraction of a minute of work, plus a fraction of a minute of rest, the aggregate of which is always one minute, but the proportions of which vary according to the nature of the operation

An employee, man or woman, taking advantage of the normal amount of rest, produces therefore sixty points in one hour, this being the standard. An operator producing more than sixty points per hour is, at the end of the day, entitled to a reward based on the difference between the total points produced and the standard of sixty points per hour.

The operator, by application, can increase his production beyond sixty points per hour without fear of suffering an arbitrary decrease in his reward. The point value of his operation or operations, being based on time in relation to average human physical energy, two elements that are constant, is not, therefore, subject to change. To be logical, the manufacturer must guarantee the point value of any operation, as long as the said operation is not changed in process or material.

The exact knowledge of the number of points produced per hour by each man allows an intelligent system of promotion and the exact knowledge of the number of points produced per hour by a group of men or department permits an adequate remuneration of the leader or foreman. This protective system of remuneration based on the point is known as "The Point System of Graded Remuneration"

Part Three

The logical industrial enterprise is one which manufactures an article or articles in normal demand, made by normal men, performing under normal conditions.

The rest and delays allowances figuring in the establishment of a point representing normal conditions, the aggregate of the elements forming a point representing one minute, the logical manufacture must be profitable at a production of sixty points per hour.

Whenever operators produce more than sixty points per hour, the difference must figure in the element of reward of the operator and of those directly connected with production and whose co-operation labor seeks, with a view to secure the maximum production.

The gain of the manufacturer is realized in the reduction of the overhead burden per unit.

The industrial enterprise which finds any or all of its departments producing daily at a rate of less than sixty points per hour knows it is in danger and can therefore take immediate steps to bring the point hour to sixty or higher in any or all of its departments.

Manufacturers having branch plants can compare the point hour of each plant each day and thus measure the advance of the various units of their enterprise.

The aggregate point value of an article represents the standard labor cost. The accumulation of all the points charged to a given factory order allows automatic comparison of the actual cost against standard cost, this without the expensive recording of the time of beginning and ending of each operation.

The unit of measurement of the Bedaux system, the point, can be used in the distribution of overhead burden by determining in advance the cost of running one point through each manufacturing unit and multiplying this cost by the point value of all operations passing through, thus giving an exact overhead distribution.

Countless efforts have been made in the past to plan, schedule and dispatch material through manufacture. Many failures have resulted, for it must be remembered that planning is a relation of requirements to capacity.

To determine the time requirements of an article passed through different branches of manufacture, or to determine the time capacity of the various branches of manufacture through which the article is to be passed, one must have at

his disposal a unit of measure, which, in industrial effort, has heretofore been unknown.

With the Point, planning becomes an easy matter. The point value is known on every article in all its operations. The point capacity of all machines or branches of manufacture is known through the point hour. The work of planning thus becomes simply a routine detail relation of point value to point hour.

Part Four

Plans of profit-sharing have been established in the past with a questionable degree of success, only because there has been no way to measure the capacity of each individual when determining the share of the profit to which he was entitled. If the manufacturer sincerely desires to make his labor share in the profits, the amounts can be apportioned according to the point hour of each man in relation to his class of skill, which is gauged by his hourly rate.

Various forms of labor representation in shop management have lately been widely praised as the logical panacea for industrial ailments, but is it logical to organize a labor representation which is formed indifferently by men who are capable or incapable? Has it not always been the rule for man to master the capacity to perform before he assumes the capacity to advise? The point hour record of each man in his daily labor together with his mental capacity should alone determine his eligibility to representation of his fellow workers, whenever the manufacturer feels that he must adopt that form of management.

The most formidable obstacle to overcome in establishing industrial peace is the present restraint of hope caused by the industrial structure of to-day. The bench man remains a bench man. A press operator, an inspector, an automatic screw man, a lathe operator, all remain what they are. It has been so customary for industry to endeavor to keep a man wherever he is doing "fairly well" that labor itself has lost the thought of possibility of individual rise but in turn has reached a state of mind generally indifferent or else bitter and antagonistic.

Under the Point System of Industrial Measurement, an unskilled laborer who, by application, shows a point hour of, say, ninety, or thirty points above standard, this for a period of a year, is automatically entitled to a better position whenever there is a vacancy and he can begin such at a point hour of not less than sixty. If, by further application, he brings

himself, in this new and better position, to a point hour of ninety and maintains himself there, again he is automatically entitled to a still better position, at a higher hourly rate, providing he can begin his performance, through previous study, at a point hour of not less than sixty. This can be continued through all the branches to the very head, so that when a man is given the direction of a department because he has shown fitness in the elemental requirements of the executive position, it will be known that he has also proven himself capable in all the branches he commands.

At the present time the labor unions, knowing that the chances for advancement in productive labor are small because of industrial tradition, have endeavored to raise the scale of wages of the whole strata composed of the various classes of effort, a suicidal move, as if applied it only raises the price of the commodity purchased by the consuming class, which is largely composed of the class of people to which union labor belongs.

As illogical as this labor demand may seem, there is no logical answer to give other than to render possible the advancement of the individual through each class, according to the exact individual capacity, a capacity which to-day can be accurately measured by the Point without increasing but even decreasing the amount of clerical work usually found in most plants.