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# A critical analysis of the 100% time premium wage plan

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BOSTON UNIVERSITY

College of Business Administration

THESIS

A Critical Analysis of the 100% Time Premium Wage Plan

by

Andrew H. Spencer  
(A.B. Williams College 1932)

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## CHAPTER 1

### INTRODUCTION

Thus the heavens and the earth were finished  
and all the host of them. And on the seventh  
day God ended His work which He had made.

Genesis Ch. 2

Since the beginning of history, a specific task has been associated with a definite period of time. This is the basis on which the majority of people are paid and is probably the best way of allocating economic goods.

Harrington Emerson, whose book<sup>1</sup> is full of Biblical allusions, says that the first and one of the longest strikes in history occurred as a result of a cut in piece rates. Moses led the Children of Israel on a forty year walk-out in protest when they were given less straw with which to make their bricks.

Emerson also quotes the parable of the owner of a vine-yard who had hired some grape pickers on a day rate basis. When noon-time came and he saw that the job was progressing slowly, he went into the market place to hire some more help saying, "Whatsoever is right I will give you." This second group of workers were paid the same as the first since they picked the same amount of grapes,

<sup>1</sup>Harrington Emerson, Efficiency as a Basis of Operation and Wages, The Engineering Magazine Co. 1914, pg.346

but they only worked one half as long.

2000 years later, human nature is still the same. In the absence of a financial incentive, little work is done. Rebecca now wastes her employer's time telling Rachel about the boy she met at the drug-store instead of the stranger she met at the well.

Probably the first scientific approach to wage incentives was that of Frederick W. Taylor in 1881 at the Midvale Steel Works. Taylor, who later received a degree in mechanical engineering from Stevens Institute as a result of studying at night, made a great contribution by using scientific means of determining a fair day's work. Using this as a basis, he built up a wage payment system that paid a generous reward (60 percent above day wages) for any worker who attained the predetermined daily task. This system, combined with the savings made from motion studies, reduced the cost of handling material over 50 percent.

Taylor's wage plan is the basis of many modified plans that are used in industry to-day. However, plans of this type are generally opposed by labor unions for several reasons, one of the most important being the inability of the average worker to understand them, and it does not appear at this time that they will ever supersede the basic piece rate type of wage plans. However, the

tools that Taylor developed for analysing jobs and the measurement of output are the basis for the modern forms of piece rate wage payment systems.

The modified form of the piece rate system that will be discussed in this paper is the 100% Time Premium Wage Plan with a guaranteed daily wage. A plan similar to this was used in a plant making radio tubes where the writer was employed in a supervisory capacity between 1943 and 1947. This plan worked out well under both war and peace time conditions and in unionized plants as well as in non union plants.

The majority of the illustrations that will be used in this paper will be taken from a plant in which the writer was employed as plant manager in 1946 and 1947. The problem consisted of completing the re-conversion from war-time to peace-time operation which entailed the construction of different products although the operations were similar.

These operations consisted, for the most part, of the welding of small nickel parts and their assembly with mica spacers and grids into the "mount", which is the mechanical element of a radio tube before the sealing on of the "bulb" and "base" to make the complete radio tube. Tolerances were very tight and deviations as small

.002" were sufficient to scrap the entire assembly. On the average day, 10,000 units were assembled.

Quality control was of the greatest importance and this was accomplished by having each team of three or four operators mark their symbol on their work. Later, when the defective tubes were analysed, these symbols were used to identify the persons responsible. "Scrap Bogies" were set up on the basis of experience and this bogie, together with the corresponding "actual" figure, was posted daily on the team's blackboard. If bogie was beaten, a star was chalked up for the team.

These "actual" figures were the basis for many contests, each one of which lost its appeal after two or three months. One of the most successful was a plan of allowing the team which had the best accumulative score for the week the privilege of picking out their favorite phonograph record. This record was then bought by the company and played over the plant's public address system. It was customary to play records over this system about twenty minutes out of each hour and the music appeared to help the operators maintain the rhythm of their work.

The plant was composed of one hundred women operators, three supervisors, two inspectors, one stores clerk, one production clerk, one payroll clerk, one nurse, one mechanic, two men for heavy floor work and cleaning,

and the plant manager. He was responsible for the whole operation: maintaining the working force through hiring and firing, requisitioning materials and shipping the completed work, planning and scheduling, production and quality control, and one hundred and one other jobs.

Standard times for all jobs were set by time study and a ten percent allowance was made for delay and fatigue. It was customary to make an allowance in addition if an operator was idle due to factors beyond her control for over three tenths of an hour in any one day. If new jobs were set up, rates were determined as quickly as possible, generally within two weeks.

Employee turnover was low and averaged four percent per month. Half of this was due to sickness and operations; the other half being for cause, generally chronic absenteeism or tardiness, or failure to come up to the standards set after a reasonable length of time, i.e. two months. A relatively high percentage of operators secured "leaves of absence" for operations probably due to the Company sponsored "Blue Cross and Blue Shield" plan.

Attendance averaged ninety five percent and, on those days when transportation facilities were normal, ninety five percent of the operators were at their workplaces within five minutes of the scheduled starting time.

The wage plan used was similar to the One Hundred Percent Time-Premium Wage Plan and it is the purpose of this paper to discuss the characteristics of this plan giving illustrations from the writer's own experience.

This wage plan is a modification of the straight piecework plan with the standards expressed in time per unit of production rather than money. In view of this fact, the plan retains all of the advantages of the piecework plan and eliminates many of the disadvantages of money rates.

For example, if a job has a base rate of 70 cents per hour and standard performance is .6 minutes per unit, an operator who makes 1000 units per day is paid for 600 developed minutes (10 hours) for a total of \$7.00. If he works 4 hours on this job, which we will call job A, making 500 units and is then transferred to job B, which has a standard of 1.2 minutes and a base rate of 80 cents, we will assume he will produce 250 units in the rest of the working period. His pay will be computed as follows:

Job A, 500 X .6 ÷ 60 = 5 hours X \$.70 =	\$3.50
Job B, 250 X 1.2 ÷ 60 = 5 hours X .80 =	<u>4.00</u>
Total (8 hours).....	7.50

Another example will show the adaptability of the plan to different operator rates on the same job. Because Mary Smith is experienced in a number of jobs

having base rates of 60¢, 70¢, and 80¢, she has been given the classification of "Spare operator" and a base rate of 80¢ per hour which will apply to any job to which she may be assigned, even the 60¢ per hour job. Assuming Lucy Jones is the regular operator on a certain job, we can set up the following example:

Job C (base rate 60¢, standard .6 minutes)  
Mary Smith:  $1000 \times .6 \div 60 = 10 \text{ hrs.} @ \$ .80 = \$8.00$   
Lucy Jones:  $1000 \times .6 \div 60 = 10 \text{ hrs.} @ .60 = 6.00$

In a situation such as the above, the foreman must be careful not to leave the spare operator on the job more than two or three days since Lucy Jones, seeing the same amount of work being done, will naturally feel that she should be paid 80¢ per hour too.

One of the advantages of expressing the various jobs in a plant on the basis of minutes per unit is in the facilitation of planning. If an order is received calling for 40 units of Assembly A per minute and if this assembly involves sub-assembly B with a standard of 2.0 minutes, sub-assembly C with a standard of 1.0 minute, and sub-assembly D with a standard of 0.5 minutes, it is easy to see that 80 operators will be needed on Job B ( $40 \times 2$ ), 40 operators on Job C ( $40 \times 1$ ), and 20 operators on Job D ( $40 \times \frac{1}{2}$ ).

Since each of these jobs may have different base rates and hence different piece rates, it would be more difficult to plan this job if the rates were expressed

in money values. For, assuming the piece rate on Job B is 2 cents, it can be seen that this operation will cost 80 cents per minute (40 X 2) but we have no direct way of knowing how many operators this represents.

This constitutes an important advantage as far as management is concerned and, in addition, the 100 % Time Premium Wage Plan, through its establishment of the "standards" sets a goal of achievement for the operator and a benchmark by which the individual may judge the amount of his work against that of his fellow employees.

Failure of wage incentive systems in the past can generally be traced to a few causes which are the fault of management rather than the system. Since these faults are not inherent to the systems, they will be discussed briefly as a whole rather than as faults of any one system.

If wage incentive systems have a bad reputation with workers, it is because management has established rates, promising workers that these rates would not be cut, but then has cut the rates when the operator by unusual effort earns a day's pay that management thinks is too high. This near-sighted view of management was more prevalent when incentive systems were in the experimental stage and rates were set by estimation rather than by scientific time study. If a rate is properly worked out, there is little chance that the operator can "kill it".

However, so much damage has been done to the workers' morale that the fear of rate cutting is ever present. If this fear can be removed by building up the workers' confidence in management, amazing increases in production can be accomplished. The L. C. Smith and Corona Typewriters, Inc. has met this situation by giving their operators a written guarantee "to make no reduction in the rate of wage payment as long as the given operation conditions, instructions for operator, class of labor required and quality of work specified, remain in effect."<sup>1</sup>

Stanley B. Matthewson has written a very interesting book giving examples of restriction of output among workers and has found the fear of rate cutting to be a major cause.<sup>2</sup> This attitude is especially prevalent among workers of the older generation and is, of course, passed on by them to new workers coming into the plant. It will take extensive education plus a confidence building campaign by management to modify this attitude. Furthermore, once management has installed an incentive system it should not be used in busy seasons and dropped in dull times as a method of wage reduction.

A second characteristic of management which hurts all wage incentive systems is its failure to make allowances

1. R.H. Lansburgh and W.R. Spriegel, Industrial management, 3 Ed., John F Wiley & Sons, Inc. New York 1946 pg. 408

2. Stanley B. Matthewson, Restriction of Output among Un-organized Workers, The Viking Press, New York 1931

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when an operator's production, and consequently his pay, drop due to circumstances beyond the operator's control. This is a common occurrence, especially in war-time, when materials have to be used that have different physical qualities than the materials used when the standard was set on the job. For example, in spot welding, the degree of oxidation of metals may change considerably speed of the welding operation.

Another common practice of management is to ask for special work to be done, either for the engineering or sales departments, for which no standard can be set in a short time. In cases such as the above, the foreman is generally so busy trying to cope with the special work that the adjustment of the worker's pay is forgotten until the next pay-day when the worker's check is short and a grievance is created.

This is due to the fact that most systems provide for paying workers in situations such as the above at their base rate. But this is not satisfactory if the operator has been averaging 20% over his base pay, which is the usual case. The writer found that paying an average of the worker's past average earnings instead of the base rate paid dividends in employee good-will that far outweighed the few extra cents added to the pay-roll. No one, unless he has been a foreman himself, can appreciate the grievances and

loss of morale that can occur on pay-days if three or four workers in a department receive less than they expected, even to the extent of 20 or 30 cents.

An indictment of all wage incentive systems is the difficulty of maintaining quality. This is seen in the advertisements of a few companies who still cling to the day rate method of payment. They claim, to enhance the appeal of their product, that their workers put out a higher quality product because they are "unhurried". However, speed itself can be a means of securing quality. An operator can usually only make standard or bonus by following the written standard practice for the job. This tends to give a higher quality product than if the operator dawdles along making "improvements" on the engineer's way of doing the job.

In the writer's experience, he found that there was a high correlation between speed and quality, i.e. the faster workers turned out the better quality work. Of course, some of this effect was due to the non-financial incentive for quality that has been mentioned previously, i.e. the scrap bogies and the blackboards. If the pressure for quality work was taken off, it is probable that the correlation between speed and quality would no longer exist.

Lillian Gilbreth<sup>1</sup> has listed six points of psy-

1. Lillian M. Gilbreth, Psychology of Management, Sturgis and Walton Co. New York, 1914, pg. 280

chological significance that are applicable to all types of wage incentive systems. She calls them "Characteristics of Reward" but they are readily modifiable to financial incentives. They are as follows:

1. Positive i.e. not taking away something that was a draw-back
2. Predetermined i.e. before a man goes to work
3. Personal
4. Fixed, unchanged i.e. he must get exactly what he was promised beforehand
5. Assured i.e. he must be positive he will get the reward
6. Prompt i.e. he must know at once he has gotten the reward and the reward object should be given him as soon as possible.

Practical applications of these points will be evident to anyone with supervisory experience. For example, an operator exposed to unusual heat should not have a fan put at her workplace as a "reward". The company should furnish the fan as a matter of routine. Secondly, an operator going on a new job should be told the standard on the job and when he gets his pay-check, it must be in accordance with this standard. The operator should have confidence that this standard will not be changed. If the operator cannot compute his own pay, he should be told the amount of his earnings daily. The output of the ordinary type worker should be posted or announced hourly. Finally, to be most effective, the incentive pay, the "reward", the excess over his guaranteed wage should be in the form of a separate pay envelope or check.

The ability of wage incentive plans to increase production has been studied by many investigators. Some of these reports are undoubtedly colored in favor of incentives so it is wise to find out what an impartial survey has shown.

Edith M. Olsen, of the Department of Labor Statistics, U. S. Government, wrote a report<sup>1</sup> in 1943 concerning the effect of incentive payments on hourly earnings. She found that an analysis of statistics on hourly earnings of time and incentive workers in identical occupations in three important industries, machinery manufacture, cotton textile manufacture, and primary fabrication of non-ferrous metals, reveals a definite and substantial margin in favor of workers paid under the incentive plans.

The data on median earnings showed that this advantage ranged from 12.1 percent in the primary fabrication of non-ferrous metals to 18.2 percent in the manufacture of machinery.

Edith M. Olsen concluded that on the basis of fragmentary evidence available for individual industries that the incentive wage advantage is to be found in both union and non-union establishments, in both the north and south, and among women workers as well as men.

1. Edith Marie Olsen, Effect of Incentive Payments on Hourly Earnings, U N 3 No. 742 U.S. Gov. Print. Off. 1943

## CHAPTER 2

### ATTRIBUTES OF A SOUND WAGE INCENTIVE PLAN

If an incentive plan succeeds in holding average production at a higher level of efficiency, the moderately constant overhead is spread over more units of production, unit overhead is lower and thus total cost per unit is less. This is the principle by which wage incentive plans reduce industrial costs and is the basis of comparison of the many different types of plans.

There seem to be ten attributes of a wage incentive plan that will best carry out this principle.<sup>1</sup> They are the following:

1. A spur to the worker to reach a set task
2. A guaranteed day rate
- 3 Unrestricted as to amount of earnings
4. Provision for learners
5. Flexible to a change in product
6. Not complicated to aid the employee to compute his earnings
7. Not complicated to allow the employer to compute his pay-roll easier
8. An aid to predetermination of labor costs
9. An aid to supervision
10. Popular with management and unions

The following chapters of this paper will discuss these attributes in detail.

1. C. W. Lytle, Wage Incentive Methods, Rev. Ed., The Ronald Press, New York, 1942, pg. 71

## CHAPTER 3

### A SPUR TO THE WORKER TO REACH A SET TASK

Few people realize, or at least little has been written, about the importance of consistent day to day production in an assembly plant. Consistent operation can bring about great savings in direct labor, substantial increases in the workers' pay, higher production from the same number of workers, higher morale on the part of both worker and supervisor, and a substantial reduction in size of the work in process inventory.

This is due primarily to the fact that parts and assembly jobs can be balanced and operators can be more or less permanently assigned to one job. This enables an operator to increase his skill and thus his production and earnings. Inconsistent operation fosters the building of excessive work in process inventories which leads to the transferring of some operators to jobs in which they have less skill with the resulting loss of pay to them and an increase in cost to the company. This constant changing of jobs is also psychologically unsound since it breeds a feeling of insecurity in the worker.

Insecurity is one of the basic fears of mankind. It seems to be one of the few fears with which we are born, the other fears being learned as we grow older. For example,

a baby will cry and exhibit other evidences of fear if he is dropped a short distance but he remains emotionally undisturbed throughout a discussion of a possible drop in stock market prices.

The importance of fear is that it brings about actual physical changes in the internal conditions of the body which are beyond the control of the individual. These changes include an increase in blood pressure and blood sugar, increased activity of the adrenal glands and sweat glands, and a cessation of the churning movements of the stomach.<sup>1</sup> These effects were valuable in primitive days since they helped a man to fight harder or run faster but for the present day man, who must live on a plane of respectability far removed from animal instincts, these bodily changes are a source of great inconvenience.

During the period that a person is subjected to these stimuli, he is literally not himself. His self confidence is lessened, his perspective distorted, and his ability to think clearly is inhibited. It is easy to see that everything possible should be done by management to prevent fear of insecurity on the part of a worker.

If a wage payment system can eliminate sources of the feeling of insecurity, it is a good system. One method of doing this is by the medium of a guaranteed wage which we will discuss in a later chapter. A second method is

by providing an incentive to reach a predetermined task consistently day after day. This will allow for the proper balancing of various parts and assembly jobs and thus prevent the excessive transferring of workers to other than their regular jobs.

Unfortunately, the 100% Time Premium Wage Plan does not provide a strong incentive to reach a predetermined task. Under this system, a worker whose production is only 60% or 70% of standard will receive the same pay as the one who is 100% efficient since both of them will get their guaranteed pay. It is only after the operator has exceeded the standard that he starts to earn bonus.

This places an unnecessary burden on supervision whose task it is to bring the laggards up to standard. In the plant under discussion this was done in the following manner:

1. The foreman, in a conference with the worker, established a definite period, usually two or three weeks, at the end of which time the worker would be expected to have attained 100% efficiency.
2. Daily schedules, gradually increasing from the operator's present level up to standard, were prepared.
3. These schedules, broken down into hourly quotas, were posted on the individual black-board, visible to both the operator and the others in the department. Each hour the supervisor would post the worker's actual output against the predetermined quota.

4. Additional records were kept in the foreman's office and the operator was called in for a further conference if she failed to make her quota on two consecutive days.

5. At this second conference, the operator was told more specifically that she must improve her production and a written notation was made on her record card that she would be discharged on a certain date if her production was not up to standard by that time.

6. At the expiration of this warning period, the operator was discharged. This is the point at which the system is most apt to break down. The average foreman seldom has as much help as he needs and the loss of even a sub-standard worker will hurt his production schedule. It is an unpleasant task for the foreman, if he is of the right type, to tell some-one that the end of the line has been reached and that he is being fired. But for the example to the other 99 workers in the plant, the decision must be put into effect.

This system worked 90% of the time but, as we have shown previously, it is psychologically unsound since it is based on fear.

However, in addition to the disciplinary effect on the rest of the workers, the foreman has the satisfaction of seeing an improvement in his cost records. If the proper

system of wage control is in operation, the amount of money required to "make-up" the sub-standard operator's earnings to her guaranteed pay has been charged against the foreman's record daily and he has the satisfaction of seeing this item disappear from the sheet the day after the sub-standard operator leaves.

The above discussion, incidentally, illustrates the importance of a foreman being familiar with time-study procedure and the setting of rates. Unless a foreman has confidence in the fairness of his rates and realizes that they contain allowances for rest and delay, he may be influenced by the worker's arguments that the rates are too "tight" and he himself may become resentful towards the management. For this reason, management should include the fundamentals of time study in the indoctrination of their foremen. The writer absorbed his knowledge of rate setting in the plant by chance rather than as the result of any plan of his superiors and has known foremen who have told their operators that a rate was too "tight" but that there was nothing that could be done about it. If a foreman doesn't have confidence in his rates, certainly his workers will be confused and resentful.

Westinghouse Electric and Manufacturing Company once used a Standard Time Wage System<sup>1</sup> and one of the devices

1. Hugo Diemer, Wage Payment Plans, McGraw-Hill Publishing Co. New York, 1929, page 47

they employed to bring workers up to standard was a "Fall Down" card. This card was filled out daily when a worker was not 100% efficient and gave the reason for not making the standard.

The virtue of this or similar devices is that it "makes an issue" of the failure to make standard and serves to emphasize its importance to the individual worker. Its danger lies in the fact that additional routine work is placed on the supervisors who are apt to develop stereotype excuses for the workers such as "poor material", "machine trouble", which tend to conceal the basic trouble.

However, to sum this chapter up, the 100% Time Premium Wage Plan does not provide a strong incentive to reach a carefully set task and thus contributes to a feeling of insecurity on the part of the sub-standard worker and an increased burden for supervision. Other wage plans such as the Gantt Task and Bonus System which pay a bonus of from 20% to 50% for making standard are probably more effective in this respect.

## CHAPTER 4

### A GUARANTEED DAY RATE

The 100% Time Premium Wage Plan usually provides for the payment of a guaranteed base rate in the event that the operator fails to make standard performance. In this way it differs from the straight piece rate plan from which it is derived.

Guaranteed day rates are so universal in production jobs at the present time that it may seem to be a waste of time to review their importance. Of course, all industries engaging in interstate commerce are subject to the minimum wages established by the Fair Labor Standards Act and many individual states have minimum wage laws affecting commerce within the state itself.

However, the distribution industry circumvents these laws through the use of agents who work generally on a commission basis which is in effect a piece rate plan. Undoubtedly, the admitted high cost of distribution is due to this factor since, by refusing to pay a guaranteed day rate, this industry must generally content itself with the cast-offs of the productive industries.

In addition to attracting a higher type of employee, guaranteed day rates lend stability to both labor and management. By partially satisfying the workers' basic needs for a feeling of security, they reduce the rate of labor turn-over and facilitate planning and scheduling of

production.

The worker knows that if he attends his job every day, he will be guaranteed the essentials of life: food, shelter, and clothing. These elements of security will be his regardless of the amount of work that he does. But, if he is ambitious for a single house, two pairs of pants with his suit, and dessert with his dinner, these items must be bought with the proceeds of his incentive pay, which is the measure of his productivity above the average.

In setting up a wage payment system, care must be used in establishing the minimum wage. It must, of course, conform with any state or federal law that may apply and the prevailing rate in the community but it should not be set un-necessarily high. If the pay that can be taken home without exerting much effort is more than enough to maintain a minimum standard of living, many workers will be satisfied to do the least amount of work possible in order to keep their job. The average man is not ambitious to the point that he will endure unpleasant working conditions or hard physical work purely for the extra money to be earned, especially if he has only himself to provide for. For his own satisfaction he needs additional motives: the desire to send his children to college, to imitate the example set by people he admires or to drive a better automobile.

This can be partly accomplished by keeping the guaranteed pay at a minimum, low enough so that to enjoy

anything beyond the bare essentials of physical existence a man must drive himself to do things that he does not want to do.

From a practical point of view, the guaranteed day rate is generally set by the prevailing hiring rate established in the community. The average plant, in normal times, is constantly hiring to replace workers who leave to get married, or to have children, or to go to different jobs. The hiring rate must be high enough to attract new workers and this hiring rate necessarily sets a minimum for the base rate. In other words, you can not hire a trainee at 70 cents per hour and then after two months tell her that her guaranteed rate will only be 60 cents since she will quit and get a job at another plant where she can start over again at 70cents.

The 100% Time Premium Wage Plan has an advantage over other wage plans in that it provides a system for using different base rates for different jobs or operators without complicating the computation of the pay-roll.

A variable base rate , of course, has many advantages. It can be used to differentiate between jobs in accordance with their difficulty, working conditions, degree of responsibility involved, and other factors considered in job evaluation; and it can also be used to

differentiate between workers due to length of service with the company or exceptional ability.

Westinghouse Electric and Manufacturing Company had established five classes into which all their jobs were segregated and a definite range of basic day rates were set up for each class.<sup>1</sup> A similar company for which the writer worked set up four categories of job classification which were known as A, B, C, and D with each successive rate paying two cents more per hour since the jobs were of increasing difficulty and responsibility.

This system worked out satisfactorily and about the only trouble was occasioned when an operator was transferred to a job which appeared to her to be similar to her previous job but which carried a lower base rate. A foreman must be aware of the different base rates in his department and at the time of effecting a transfer remember to explain the reason for the lower rate. Sometimes in the confusion of transferring a large group of operators this aspect may be over looked and will not come to light until a week or ten days later when the operator gets a pay check which may be a dollar or so less than was expected. This can be not only a cause of hard feeling on the part of the operator but her complaints to her fellow employees may have

1. Hugo Diemer, Wage Payment Plans, McGraw-Hill Publishing Co., New York, 1929, pg 47

an upsetting effect on her whole department for at least the balance of the day.

Every effort should be made to prevent an operator from being disappointed on pay day. The average woman operator has generally planned how she will spend every nickle of her check and if her pay check is as much as a dollar short, it constitutes a major catastrophe. It was not an unusual occurrence for the writer to spend half an hour checking records and trying to explain to an operator why her pay was less than she expected, even to the extent of differences of only twenty cents.

This type of complaint ties in with the observation of Lillian Gilbreth, whom we have previously quoted, that "a worker must get exactly what he was promised beforehand." In the event of a transfer or other occurrence that is apt to effect the pay rate, the worker may assume that his rate of pay will be unchanged unless his foreman tells him differently.

Base rates may also be varied between operators to adjust for specific differences, the most common of these being seniority. In the way of an example, it was the practice in the plant under discussion to have three classifications called X, Y, and Z depending on the length of service. Each step meant a two cent per hour increase in the operator's base rate. Although the amount was small

it gave the employee something to look forward to.

The following points will summarize this section of the discussion: guaranteed day rates are desirable since they give a feeling of security to the worker and lower costs to management by lowering labor turn-over and training expense. The 100% Time Premium Wage Plan provides for a guaranteed base rate and the method of computation is such that base rates may be varied to compensate for differences between jobs and seniority among workers without extra clerical expense in the pay-roll department.

However, guaranteed rates should only be high enough to provide for the actual physical needs of the worker so that he will have an incentive to strive for the luxuries he may receive by earning more than his standard wage.

## CHAPTER 5

### UNRESTRICTED AS TO AMOUNT OF EARNINGS

In order to unleash the latent ability of the average worker, he must be thoroughly convinced that he will not be penalized if he does twice as much work as he has been doing on a day rate basis. This is the hardest point to get across, especially to the older age groups. They have had long and generally bitter experience with management especially in the 'Twenties when they were run over by half trained "Efficiency Experts" who set rates on an unscientific basis and then later cut these rates as the workers reached out for the additional rewards that had been promised to them. Then, more recently, they have observed the policy of top management for constant change which brings a procession of new industrial engineers with new schemes into their factory. Even though the worker may feel secure under one foreman and produce to the extent of his ability, he has no long run guarantee that the next manager may not change the policy and rob him of any gains he has made.

However, the advantages to be gained on the part of management are so large that every conceivable effort should be made to secure the confidence of the worker to the point that he will produce to his capacity. I have

personally seen productive workers on assembly jobs increase their output 100% over a period of two weeks after a standard had been set for their job and they acquired the confidence that they would be paid for their increased output and their rates would not be cut.

In the assembly plant in which the writer worked during World War II, the management established the policy that the top bonus that could be earned was 140% of standard. This cut-off was set up on the assumption that if an operator exceeded this amount, the quality of her work would be inferior. But this did not prove to be the case, as the writer has previously pointed out, since the work put out by the faster workers was, on the average, better than the work of the slower workers.

This cut-off was established on a shift basis. That is, assuming a standard of .6 minutes, the cut-off performance was figured  $8 \times 60 \div .6 \times 140\%$ , a total of 1120 pieces. The operator was allowed to leave the plant after she had made this quota even though she only took five or six hours to make the schedule. Those operators who were able to complete their work in six hours (about 10% of the operators in the department) actually worked at a rate of 187% efficient for the hours they were in the plant. The quality of the work produced at this high rate of speed was better than average but the question of

quality if they were allowed to continue for a full eight hour shift was never officially established. In other words, could these operators make 1496 pieces at good quality with a standard of 800 per day?

Some of the sub-assemblies made were very small (the complete assembly was smaller than the terminal phalanx of your little finger) with the result that it was common practice for the faster operators to do work in excess of their out-off and hide it from their supervisor. In this fashion, they could save up two or three hours work which they would have in to their supervisor some Friday afternoon when they wished to get out of work earlier than usual.

The supervisors were aware of this fact and did what they could to discourage it for several reasons. One of the most realistic reasons was the fact that changes were frequently made in the parts and unless the operators were given at least a day's notice that the change was coming, they were unable to get their hidden inventories into production before the work was scheduled to come along with the new part. If this happened, that is if the workers were unable to get rid of their inventories with the old part, supervision had to maintain 100% inspection for an indefinite period thereafter to prevent this inventory being fed into the regular production. It was not an

unusual occurrence to find a part which supposedly had been changed a month ago turn up in current production.

This then is one of the reasons against limiting the amount that a worker can make in a day. The effect is not to limit the amount actually made in the day but to limit the amount of work turned in to the supervisor. The hidden inventories can be a source of poor quality and also the cause of poor morale. The operator who does this sort of thing, knowing that it is contrary to company policy, has a feeling of dishonesty and resentment against management.

The main reason for not restricting output is one of productivity and costs. After all, we are installing an incentive for the purpose of decreasing our overhead per unit made and if an operator can make 1496 units in the same length of time the standard operator is making 800, her overhead per unit is about one half. This is because most overhead consists of salaries, depreciation, and bond interest which vary as a function of time rather than as a function of output.

At this time, the need for productivity to fight inflation is almost as vital as the need to fight the Japs three years ago, but the patriotic motive which spurred many workers to high levels of productivity is lacking. Especially during the War, it was hard to condone letting an operator leave her job after six hours work when the

material she was making was needed for shells to blast the Jap suicide pilots out of the air before they could sink our ships.

The plant under discussion was a favorite visiting spot for disabled heroes during the War and it was often the writer's privilege to show them through a department. Some of the more observing saw operators leaving their workplaces an hour or two before the shift ended and asked the reason why. The answer that "they had finished their day's work" was hard enough to justify and I never got up courage enough to tell them the truth, i.e. that they had produced the limit that the company allowed them to make in one day.

Needless to say, the subject of "cut-off" was the favorite topic of lunch table discussion among foremen. Few arguments could be found in favor of it except the argument that it was the company's wage policy and should not be changed for that reason. The arguments against it could well be summed up by saying "Why should you send your best workers home after a six hour day and let the poorer ones work for eight hours."

An inequality in the cut-off type of system is found in a department using machines to pace operations. In accordance with company policy it is impossible to set a rate which will exceed 140% efficiency; i.e. if a machine's daily capacity is 1120, then this figure can be taken as 140% efficient in determining the operator's rate but you

can't call it 150% because you have told your operators that anything over 140% is conducive to poor quality. Therefore, the best the operator of this machine can do is 140% and it will take her the full eight hours of the shift to do it. She may be a better worker than some of the others on unpaced operations who can make top production and go home an hour or two early every day.

The answer to the above may be in proper job evaluation and in setting the proper base rates. However, in the plant under discussion, both these jobs fell in the highest category of direct labor and both had the same base rate. Thus at the end of the week, both operators would have the same gross pay; the girl on the machine paced job worked forty hours whereas the unpaced operator may only have worked thirty or thirty five hours. Conditions of this sort are the kind that breed grievances.

If, and when, the writer establishes a plant of his own, he will probably establish some kind of an upper ceiling for earnings but it will be in the vicinity of 160% efficiency and will be flexible to the extent that it can be revised upward but not downward. Wechler has said<sup>1</sup> that the best worker is 100% better than the poorest but if our standards are properly set, the poorest worker will

1. David Wechler, The Range of Human Capacities, Williams and Wilkins, Baltimore, Md. 1935 pg. 73

probably not exceed 80% efficiency. Only those of the so-called super-skill category, probably between one and two percent, will be able to exceed 160% if the rates are properly set and these few should be allowed to go home early as a psychological effect on the others. The ability to go home ahead of time as a reward for good work has high incentive value.

In summation then we have three good reasons why management should not set a limit on output:

One, limitation on output may become a limitation not on actual output but on reported output with the chance of poorer quality work and lowered employee morale due to "hidden inventories".

Two, limitation of output is harmful to employee morale and a source of grievances unless special efforts are made to iron out base rate difficulties especially between machine paced and unpaced operations.

Three, limitation of output causes higher overhead unit costs and loss of worker productivity which is badly needed in case of war or inflation due to a shortage of manufactured goods.

The 100% Time Premium Wage Plan does not limit production. The worker's earning depend on what he produces without any limitation.

## CHAPTER 6

### PROVISION FOR LEARNERS

Provision for paying new workers during their training period under the 100% Time Premium Wage Plan is through the guaranteed day rate discussed in a previous chapter. The new employee is hired at the base rate and is assured of regular automatic increases as his length of service accumulates.

However, the basic plan does not provide incentives for gradual improvement up to the point at which the employee is ready to earn bonus. In other words, if the daily standard is 1000 pieces, there is no financial incentive for the trainee to increase his production from 600 to 800 pieces per day. This is due to the fact that he will receive his same base pay for both productions.

There are two ways of attacking this problem: the first is indirectly through cost records for the foreman, and the second is through the use of so-called training curves for the employee.

It is reasonable to charge the wages of a new employee against an account for training for a period of two weeks or a month depending on the difficulty of the job. However, after this period, the foreman should be given each day a statement of the wages paid to each new

employee as contrasted with his actual earnings and the foreman should be held accountable for the difference. A policy should be established as to how long a new employee should be given to attain standard performance and a decision made to keep or fire the employee should be made at the end of this deadline.

By calling the foreman's attention daily to the cost of training his new help, he will devote more time to improving his trainees and the records put out by the cost department give him a powerful tool to use with the individual worker. For example, he can call Rachel into the office and show her that on the previous day she actually earned only \$3.58 but she was paid \$5.60, her base pay, and the difference of \$2.02 was a red mark against the department. The new employee is generally unaware that records of this sort are kept by the company and she is more likely to strive for steady improvement if she is aware of their existence.

The second, more direct approach to the problem consists of the use of up-grading curves and training curves. These curves are simply daily schedules of improvement that the trainee is expected to maintain. However, in the later stages of training some small financial incentive may be added. At the time of the trainee's indoctrination to the

plant, she should be given a general idea that she will be expected to attain standard by the end of six weeks or whatever period is needed for the job she is being assigned to. Then, about two weeks later, after she has become somewhat familiar with her job and the plant she should be told more specifically what her daily improvement should be.

The supervisor keeps daily records of the trainee's progress comparing it with the up-grading curve and calling the foreman's attention to substantial deviations from the normal progress. These curves are generally set up on the basis of experience in training other girls on similar jobs.

There is one important aspect to be considered in the construction of a learning curve and that is the fact that the rate of learning is not constant for the so-called "motor skills", i.e. skills involving training the fingers, hands, and muscles of the body. Many tests have shown that learning is rapid at first but then reaches a plateau during which for a period of a few days or a week increase in efficiency practically ceases.<sup>1</sup> This is apparently something beyond the power of the learner to control and several explanations have been offered of the possible cause. These plateaus appear more often in the learning

1. L. P. Alford and J. R. Bangs, Editors, Production Handbook, The Ronald Press, New York, 1944, Pg. 1218

of complex jobs.

Bryan and Harter<sup>1</sup> observed these plateaus in experiments on learning to send and receive telegraphic messages and they suggest that the plateaus represent periods in the course of learning where the lower order of habits are being thoroughly organized and established. This mastery of simpler habits, they believed, was necessary before the learner could pass on to higher units of performance. However, as foremen, we are not so much interested in what causes these plateaus as in the fact that they do exist and are beyond the power of the individual to control.

The writer observed plateaus in learning to assemble small metal parts with spot welders in the construction of radio receiving tubes. Girls of average ability would progress to a point of about 75% efficiency in three or four weeks' time and then all forward progress would stop for ten days or two weeks. Then, just as mysteriously, progress would begin again and continue up to about 110% of standard and stop again. In some cases, after a lapse of progress for two or three weeks, the increase in speed would reappear and continue up to 130% or 140%. Some individual operators eventually reached 185% efficiency.

At the time, the writer was unaware of the experimental studies by psychologists and attributed the

William L. Bryan and Noble Harter, Studies on the Telegraphic Language, The Acquisition of a Hierarchy of Habits, Psychological Review, 1899, 6, pg. 345-375

the resumption in the rate of progress to other factors, such as talks to the operators and other pressure brought upon them to increase their speed. The writer made much use of blackboards on which the daily production of each operator was posted with stars being given to those who did an exceptionally good job. These blackboards probably supplied the incentive for the improvement but this improvement had to wait upon the neural changes in the worker to consolidate the results of the previous learning before going ahead to attack the next higher level of learning.

The unfortunate thing about these plateaus is that the foreman is likely to lose potentially good workers unless he is aware of their existence. The writer can recall two or three cases in which a trainee had made no progress for a week and was called into the office and given an ultimatum to the effect that she either show substantial improvement within the next week or be fired. At the end of the week, since there was no improvement, the trainee left the company. It may well be that these girls were experiencing the "plateau" described above and, if they had been given a little more time, would have broken through the consolidation period and emerged into the area where their speed would have picked up again.

Several girls left the plant of their own volition during the plateau period when they became discouraged with

not being able to show any improvement.

It would be well then for the foreman in planning the up-grading of new operators to take this factor into consideration, especially on the more complex jobs. Specifically, he should allow for a period at the point where the operator has attained about 75% efficiency for a period of a week in which no improvement will be expected or required. The main trouble the foreman will have will be in convincing his superior of the wisdom of this plan since the common assumption among production executives is that a trainee is capable of maintaining a steady increase in efficiency.

Confirmation of this theory is reported by Alford and Bangs, editors,<sup>1</sup> who say

It is often assumed, in working out plans for remunerating new employees, that a steady increase in efficiency should be expected from them. It is a fact that for the average worker, when he or she has exhausted about one half of the normal training period, there must be expected a period of time, depending on the nature of the work, where progress or skill practically ceases. Then after a short while he attains the balance of average proficiency very rapidly. Especially in plants employing female labor, loss of operators before they have become fairly efficient is a serious problem, due largely to the fact that their remuneration is based upon a required constant increase in proficiency which is practically impossible for the "average worker" to maintain.

1. L.P. Alford and J.R. Bangs, Editors, Production Handbook, The Ronald Press, New York, 1945 pg. 1218

Day on Curve	Scheduled Efficiency (percent)	Scheduled Production (gross)	Hourly Pay if made (cents)	Hourly Pay if not made (cents)
1	5	40	65	65
2	10	80	65	65
3	15	120	65	65
4	20	160	65	65
5	25	200	65	65
6	30	240	65	65
7	35	280	65	65
8	40	320	65	65
9	45	360	65	65
10	50	400	65	65
11	55	440	68	65
12	60	480	68	65
13	64	512	68	65
14	68	544	68	65
15	72	576	68	65
16	76	608	68	65
17	78	624	68	65
18	78	624	68	65
19	78	624	68	65
20	78	624	68	65
21	78	624	68	65
22	81	648	72	65
23	84	672	72	65
24	87	696	72	65
25	90	720	72	65
26	93	744	72	65
27	96	768	72	65
28	99	792	72	65
29	102	816	72	65
30	105	840	74	65

Fig. 1 A Sample Learning Curve

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Taking the above factor into consideration, it is possible to construct a learning curve and pay the trainee a small bonus, like two or three cents an hour over the base rate for the days on which the schedule is made or exceeded. But, one more word of caution, this curve should bring the operator to a point of about 105% efficiency so that when she completes her learning curve, her earnings, based on standard will be at least as high as she has been earning while she was undergoing the training period.

Fig. 1 is a sample of such a curve for a trainee receiving a guaranteed rate of 65 cents per hour whom we wish to train in 30 days for a job that pays a base rate of 70 cents per hour. This curve gives some financial incentive after 50% efficiency is reached, provides for a week's plateau period, and then a decided bonus, i.e. seven cents an hour to help bring the operator up to 100% efficiency. It should be noticed also that the earnings on the last day are the same as the operator will earn if her pay is computed by the regular procedure.

To recapitulate, the 100% Time Premium Wage Plan provides for trainees through the guaranteed base rate but needs to be supplemented by financial or non-financial incentives to allow for progress within the training period. Training curves should be carefully thought out with due

consideration for the "plateau" period which is likely to occur about half-way through the training period during which time progress stands still due to factors beyond the control of the trainee. The foreman should be aware of this phenomenon so that he may restrain the impulse to fire the trainee and instead encourage the worker to prevent his giving up the job through discouragement.

Cost accounting records may be used to good advantage to remind the foreman of and to show the worker the cost of training.

## CHAPTER 7

### FLXIBLE TO A CHANGE IN PRODUCT

A plant using the 100% Time Premium Wage Plan takes advantage of the guaranteed day rate feature of the plan to provide for its employees during a change over period. Change is the concomitant of growth and any plant whose wage plan does not provide for frequent changes in product and processes is badly handicapped.

A variation of the above plan to the extent of guaranteeing the employee an average of his past earnings computed over the immediately preceding ten weeks is gaining favor, particularly among employees and unions. This plan is based on the idea that the employee should not suffer wage decreases for reasons beyond his control but at the same time it does not seem right that the employer should be called upon to bear the full cost of a change over which will ultimately benefit both the employee and the management. Bonus wages are paid for productivity above the average and the worker does not come up to standard for two or three weeks following a change in product or process.

However, if workers are paid their past average wages, it should be understood in advance that this policy will exist for only a limited period of time, i.e. two weeks, and at the end of that time, the employee will be paid on

the basis of his actual production on the new job. Otherwise, there will be no incentive to learn the new job and the operator can coast along while receiving the same rate of pay he enjoyed when he was working hard on his old job.

Payment of past average earnings has the added disadvantage of requiring considerable extra work on the part of the pay-roll department which must go back through its records and average the earnings of each individual employee for the ten week period. This is necessary since, in the average plant using an incentive system, an employee's pay for successive weeks is seldom the same and may vary substantially from week to week.

## CHAPTER 8

## BASE OF COMPUTATION OF PAY BY EMPLOYEE

All writers in the field of wage payment systems agree that the system should be simple enough so that the average worker can understand the system and compute his own pay.

Fred Joiner<sup>1</sup> has summarized this aspect very well as follows:

In computing workers' pay for their output, the more complex systems make use of formulas that are confusing to most of the workers. Their pay is not calculated by the mere number of pieces produced but by means of some special unit such as a "manit" or a "B-hour". Workers claim that the use of a complex formula for wage payment facilitates rate cutting, because changes in the production standards that affect the unit of measurement may be concealed from them. Whether the rate cutting occurs or not, the worker finds it difficult to check the relationship between his pay and his output or effort.

The 100% Time Premium Wage Plan, being as it is a derivative of the piece rate plan, is one of the easiest plans for the computation of wages. The worker need only multiply his day's production by the standard and divide by 60 to get his total standard hours. This he multiplies by the base rate on the job, or by his own base rate as explained in the example of the "spare operator", to find his day's pay.

1. Fred H. Joiner, Incentive Wage Plans and Collective Bargaining, U.S. Gov. Printing Off., Washington D.C. 1942 #717 pg.6

This computation can be shown in the terms of a commonly used formula:

$$E = H_s R_h$$

where E is earnings, H<sub>s</sub> is standard hours, and R<sub>h</sub> is the rate per hour.

For example, if production is 1000 units and the standard is .6 minutes with a base rate of 70¢

$$E = (1000 \times .6) \div 60 \times .70 = 10 \times .70 = \$7.00$$

Simple as the system appears, some workers still have trouble in computing their pay. The writer received so many inquiries such as "How many an hour do I have to make to earn 80¢ per hour?" that he prepared schedules for each job showing the hourly production necessary to earn various amounts of pay. A typical schedule was as follows:

Job A	Standard .6 minutes	Base rate 70¢
Hourly Production	Hourly Pay	Weekly Pay (40 hours)
100	70¢	\$28.00
108	75	30.00
115	80	32.00
121	85	34.00
129	90	36.00
143	100	40.00

Another factor which is common to all systems except the day rate system is the computation of pay for any idle time due to factors beyond the worker's control, for example, waiting for material. Generally, time wasted in this fashion is paid at the base rate and must be added

to the amount earned by the worker plus the payment for his relief period. Since time of this sort is usually in decimals such as .7 hours and the base rate some odd figure like 74¢, the average worker has trouble in computing his pay.

Another fairly common problem arose when an operator with a base rate of 70¢ per hour who had been averaging \$7.00 per day due to her bonus (roughly 88¢ per hour) had waiting time of .8 hours, payable at 70¢ per hour. If the operator asked the supervisor how many additional pieces per hour she would have to make to compensate for the difference, the supervisor herself would have trouble in finding the answer.

The above examples are given to illustrate the difficulty the average woman worker has in computing her pay and to emphasize the necessity of keeping the mathematical computations on the lowest level possible. The writer experienced difficulties with a simple type of wage plan and can imagine the troubles of a foreman of a plant which uses one of the more complex types.

Another type of schedule that worked out well was a daily listing of the amount earned by each worker on the previous day. This also served as an incentive, particularly in cases involving group bonuses. Most of the jobs in the plant involved teams or units ranging from three to fifteen operators with the pay of each individual being set by the daily output of the group to which she was attached.

The pays of the best teams could exceed that of the poorest by 40 percent and it gave the foreman a chance to emphasize the larger pay received by the more productive workers.

If a worker complained to her foreman about her pay being poor, he could refer to the schedule and point out to her that another girl doing the same type of work had earned 15 cents more per hour and explain the fact that if other girls could make this money, she could if she tried.

The only trouble with such a schedule is that it gives additional work to the pay-roll department and, when the inevitable slash comes in the indirect pay-roll, services such as the above are among the first to be cut out. However, if the pay-roll department can give the production department such a list daily, it not only keeps the worker informed as to his daily pay but also brings to light mistakes in pay that can be corrected immediately rather than waiting a week until the pay-check is issued.

To summarize this chapter, we have two main points; one, workers can figure out their earnings immediately and have the feeling that there are no hidden factors that the company can change if the computation of wages is made easy, and, second, with the exception of the simple day rate plan, the 100% Time Premium Wage Plan is the easiest system for the employee to figure his own pay.

## CHAPTER 9

### EASE OF COMPUTATION OF PAY BY EMPLOYER

The employer, too, finds the 100% Time Premium Wage Plan easy to compute. He, of course, uses the same basic formula but finds his computations slightly more complicated due to the necessity of making adjustments for differences in the job base rates and the rates paid to individual workers for their "relief" and "downtime" periods.

"Downtime", which has been referred to before, is the waiting time of a worker due to lack of material, breakdown of machines, and other interferences with production beyond the worker's control. For example, a new employee whose guaranteed wage is 65¢ per hour may be earning 70¢ by making standard on a rated job. But if he has downtime he is paid at the 65¢ rate.

Assuming that relief time is .3 hours, the job base rate is 70¢, standard is .6 minutes, amount of work produced is 800, and downtime is .5 hours, the pay will be computed as follows:

(800 X .6) ÷ 60 = 8 standard hours @ .70 =	\$5.60
Relief period .3 hours @ .65	.20
Downtime .5 hours @ .65	.33
Total	<u>6.13</u>

The Pay-roll Department can further simplify its computations by expressing the standards as decimal hours

that is, .6 minutes equals .01 hours. The computation of the above example then becomes:

$$800 \times .01 = 8 \text{ Standard hours @ } .70 \text{ ..... } \$5.60$$

The system of cost accounting control outlined in the chapter on "Training" consists of subtracting the actual earnings from the guaranteed base pay and listing these amounts by the names of the sub-standard operators. A total for each department can be prepared daily as a control for a top-executive who can thus easily follow the progress of the various departments in their efforts to bring sub-standard operators up to 100% efficiency. This control also shows the cost of making changes and may be a tool to train higher executives to think twice before they order a production department to change a process just to satisfy the whim of the engineering department.

The basis of any pay-roll system is the attendance book and the time card. Time cards are generally made up two or three days ahead of time and contain the employee's name, date, department, pay-roll number, and the employee's classification as regards automatic increases for seniority, i.e. 0-6 months, X, 6-18 months, Y, and over 18 months, Z. This card is placed in a rack arranged by pay-roll number and the operator, on entering the department to go to work, inserts the card into a time clock which prints the time of

day expressed in decimal hours. For example, if the shift starts at 7:00 a.m. the time clock might well be adjusted to print 0.0 from 6:57 to 7:03 inclusive.

During the course of the day, the operator writes on her time card, subject to the instructions of her supervisor, the description of her job and the respective time spent on each job if she works on more than one job during the course of the day, and the code number of the job. For the new employee, this code number would indicate that her wages were to be charged against "training" and for a stores clerk the code number would represent a charge against "indirect labor". The day's production may be entered on this card but in the plant under consideration the worker's output was recorded on a different form by the supervisor. At the end of the shift, the operator reinserts her time card into the clock which again punches the time, i.e. 8.8, assuming a 45 minute lunch period, and drops the card into a box beside the clock.

The cards are then picked up by a representative of the pay-roll department and, the following day, the pay is computed from the information on the card supplemented by the supervisor's report of the operator's output. The computer, using the job description, finds the standard in his rate book and the job base rate which he uses to compute the pay as outlined above. The charges are made to

the proper accounts on the basis of the various code numbers appearing on the time card. The times recorded by the clock are only considered in the event an operator was late or left the plant early. However, if he had made "cut-off" production, he is paid for the full eight hours regardless of the time his card was punched "out".

Overtime is allowed only on rare occasions and the card must be signed by the foreman if any overtime is claimed. In the event of work in excess of 40 hours in one week, the average hourly straight time is determined, divided by two, multiplied by the number of hours in excess of forty and added to the total straight time as the overtime premium. In this way, the employee receives the benefit of his higher production over the regular forty hour period and is not penalized in his overtime premium for his production which is generally lower after the forty hour point has been reached in any one week.

Various methods have been devised by operators to beat the above pay system but an experienced foreman can generally ferret them out. One of the most popular methods is for an operator to punch "in" the card of a friend who he knows will be late. The way to beat this is to have the foreman and the supervisors on the floor at the beginning of the shift and within five minutes determine who is absent by a physical check. Then the unpunched cards can be taken

from the rack and compared. If any discrepancies are found, the foreman can watch for the offender to come in and watch his actions. If an honest mistake has been made, the worker will go to his supervisor or foreman to get his time card, but if the plan has been prearranged, he will go to his workplace as inconspicuously as possible. This system will trap one half of the team, but it is virtually impossible to find the operator who punched the other's without watching each worker as he punches the time clock.

This habit of picking up time cards within five minutes of the beginning of the shift also discourages tardiness since it means the worker who is late must go to the foreman's office to get his card. The foreman also has the advantage of being in a position to make plans quickly for changes in his schedule or operators to compensate for the absentees.

Another way to beat the system in a poorly run shop is to steal back work that has been previously turned into the supervisor and reporting it again as new production. This can be overcome by the supervisor's picking up and recording the amount of work at the end of a definite period, usually every hour, and then physically removing the work to an enclosed area or store-room from which it can only be removed by some authorized person. Unless this is done, the foreman may find himself in the embarrassing

position of having reported a certain number of units as having been made according to his pay-roll sheets but not being able to produce them when a physical inventory is taken.

Another type of stealing occurred in the writer's experience but there was never sufficient evidence to put the blame on any particular operator. A certain small sub-assembly was made in the parts department which occupied a corner of a large room which was used for assembling the whole unit in such a fashion that the operators in the parts department had access to the whole room. The work would be picked up at the end of each hour, taken to the store-room but at the same time similar sub-assemblies were being issued out to the assembly department. On several occasions, after the lunch period, an operator in the assembly department would ask her supervisor for additional quantities to replace material which had disappeared during the lunch hour. One parts operator was suspected because she was in the habit of returning to her work-place early, apparently to write letters but she was never caught in the act of stealing the material.

One way to attack a problem of this sort is by the use of standard waste ratios for each part and assembly. Waste ratios are a necessity for planning and scheduling especially in the manufacture of radio tubes where many

parts are small or fragile. If the usage of a part is exceeding its standard waste ration without any assignable cause, such as excessive scrap, the answer may well be that some one is stealing the part. Another solution is to have a person of the supervisory level stay in the department during the lunch period to restrain petty thievery of this type.

One male clerk was able to handle the computation of the pay-roll for 100 operators using a plan similar to the 100% Time Premium Wage Plan. In addition, he was able to handle the telephone switch-board, act as receptionist, and handle claims under the company's group accident and health policy.

To summarize then, we find that the 100% Time Premium Wage Plan is comparatively simple for the employer to compute and that a few simple precautions on the part of the foreman can prevent any dishonest attempts of the employees to "beat" the plan.

In the average plant using this system, one pay-roll clerk should be able to compute the pays of at least one hundred employees.

## CHAPTER 10

## LABOR COST PREDETERMINATION

In a period of high competition, the management which can accurately and quickly predict its labor costs in bidding for new business has a distinct advantage, and the tools for such predictions are to be found in the 100% Time Premium Wage Plan.

As has been pointed out before, this plan presupposes the setting up of standards for each job in the plant which serve as the basis for determining the number of employees, at definite predetermined base rates, that will be needed to fulfill the contract.

For example, let us suppose that a bid is requested for an assembly which upon analysis is broken down into 1000 standard hours of class B work at a base rate of 70¢, 600 standard hours of class C work at 75¢, and 300 standard hours of class D work at 80¢ per hour, the computation is as follows:

1000 hours (B) @ .70.....	\$700.00
600 hours (C) @ .75.....	450.00
300 hours (D) @ .80.....	240.00
Total cost at standard.....	<u>1390.00</u>

If the proposed work is simply a continuation of jobs already going on in the factory and the operators have attained standard efficiency, the above figure will be an accurate guess of direct labor costs. However, if

transfer of workers and training of operators is involved, an additional allowance must be made, possibly ten percent, to cover the make-up pay for the operators during the transition period. This percent will vary, of course, depending primarily on the size of the order since a very small job may be completed before the operators can learn their new job.

The allowance for make-up pay may be 100 percent in some of these instances and should be determined in conference with both the foremen involved and the methods group. The foreman will tend to guess too high as he foresees some of the trouble he may run into whereas the methods department will tend to guess too low.

The important thing to remember is that just as surely as the sun arises in the morning, make-up costs will rise if there is any transferring of workers or training involved and this factor must be considered in making up estimates for bids.

The advantage of the 100% Time Premium Wage Plan in labor cost predetermination is that, after separating out the make-up pay, which is the result of the guaranteed wage, direct labor cost is constant no matter what the speed of the operator may be. Whether the operator makes 100 or 200 per hour, the direct labor cost remains the same. This is in direct contrast with the straight day rate in which

the cost per piece falls as the speed of the operator increases. It is also contrary to some of the more complicated wage systems such as the Gantt, Merrick, and Halsey in which direct labor costs are lower per unit after standard is attained since the employer takes back some of the savings occasioned by the higher speed of work.

The attribute of the 100% Time Premium Wage Plan of paying the full premium for work over standard can be used to some advantage in bolstering employee morale. The common concept among workers and supervisors is that the company saves money when an operator performs over standard. Actually this is true for overhead costs but not for direct labor costs. This argument can be used effectively with a certain type of employee who would like the premium of the extra pay for exceeding past performance but hates to think that he is saving the company money by so doing. The foreman can point out to him that the worker gets the entire saving from the extra production and that the worker is not being exploited on this account.

The above point was brought to the writer's attention several years ago when he, as a foreman, started to attend a series of budget meetings held by the department head. Like other foreman, the writer had only a vague concept of cost accounting and had assumed that he was saving money for the company as he helped his operators

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increase their production above standard and that these operators compensated for the sub-standard workers. However, when actual direct labor costs were discussed, he saw that the good workers did not make up for the poor ones and that once a foreman had brought a worker up to standard production, there was nothing to be gained from a direct labor cost point of view in trying to induce the worker to continue to increase his production.

In connection with the above point, it might be well to point out the weakness of one of the common systems of comparing departmental efficiencies. This consists of dividing the day's production by the hourly standard to get the "standard hours" and dividing this into the total "actual hours" consumed in making this production to compute the percentage efficiency.

For example, consider Department A doing a job on which the standard is .6 minutes with three operators working 7.7 hours each and making a total of 2350 units. This is the equivalent of 23.5 standard hours whereas 23.1 hours were actually worked, an efficiency of 102%. The executive looking at this record makes a mental note to give the foreman a raise but first calls in the cost department. However, the cost department says that on the day in question, department A had make-up pay of \$1.56. The executive, unable to understand the discrepancy, asks for the

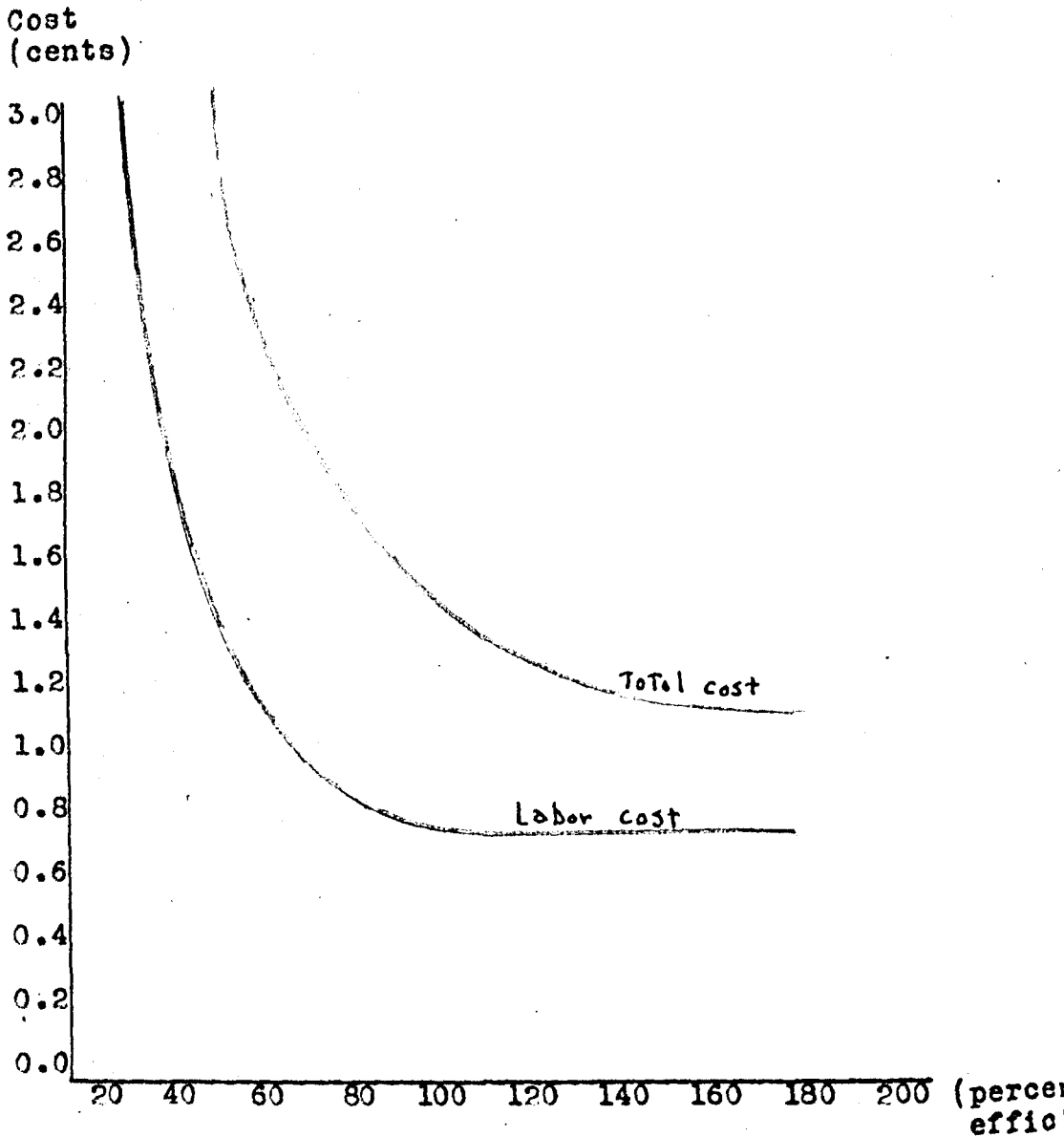


Fig. 2 Unit cost for 100 % Time Premium Wage Plan

Production		Direct Labor (cents)	Unit Labor Cost	Over-head (cents)	Unit Over-head	Total Unit Cost
Units	percent effi'cy					
160	20	560	3.5	560	3.5	7.0
320	40	560	1.8	560	1.8	3.6
480	60	560	1.2	560	1.2	2.4
640	80	560	.9	560	.9	1.8
800	100	560	.7	560	.7	1.4
960	120	612	.7	560	.6	1.3
1120	140	784	.7	560	.5	1.2
1280	160	896	.7	560	.4	1.1
1440	180	1008	.7	560	.4	1.1

break-down of the figures:

Op.	Prod.	Standard Hours	Actual Hours	Eff'cy	Earned Pay	Guar. Pay	Make-up Pay
1	700	7.0	7.7	91%	\$4.90	5.38	.48
2	1050	10.5	7.7	136%	7.36	7.36	.00
3	600	6.0	7.7	78%	4.20	5.38	1.18
	<u>2350</u>	<u>23.5</u>	<u>23.1</u>	<u>102%</u>	<u>16.46</u>	<u>18.12</u>	<u>1.66</u>

The foreman of Department A, instead of the raise, gets a reprimand since two of his three operators are sub-standard. The executive would have been badly misled had he depended entirely on the record which showed only the total departmental efficiency.

It should be noted here that the discussion relates only to direct labor costs. From the overall point of view, taking overhead costs into consideration, the operator should be encouraged to exceed standard production. Most overhead costs vary directly as a function of time and if an operator produces 400 units per day instead of 200, the unit overhead costs are cut in two.

A graphic presentation of these relationships is shown in fig. 2 which shows the behaviour of direct labor costs, and total unit costs as an operator's efficiency increases.

For the purposes of this chart, overhead charges were assumed to be 100% of direct labor at standard. The data which has been plotted represents a job with a base rate of 70¢ per hour and a standard of .6 minutes, the same

job which has been used as an example in other sections of this paper.

The chart illustrates the rapid decline in direct labor costs as the operator approaches 100% efficiency and the subsequent leveling off after standard performance is attained. Total unit cost falls less rapidly but continues to fall after standard has been reached. For all practical purposes, it reaches a limit at 180% where unit costs are 1.1¢. Increasing efficiency to 1000% of efficiency will only bring an additional saving of 23% in total unit costs.

To review briefly the arguments that have been presented in this chapter, the 100% Time Premium Wage Plan is ideally suited to the predetermination of direct labor costs due to the fact that it is built up on a basis of standards that facilitate an accurate estimation of how much direct labor and how much direct labor wages will be required to complete a contemplated job.

However, these estimates must be supplemented on a percentage basis to accommodate for transferring and training of help, if necessary, and the amount of this supplement is an inverse function of the size of the order.

This wage plan is superior to others inasmuch as direct labor costs are constant no matter what the speed of operations and does not vary after standard has been reached.

Departmental efficiency should not be judged on the ratio of total standard hours produced divided by the total number of actual hours consumed.

## CHAPTER 11

### AID TO SUPERVISION

One day at the plant while the writer was discussing the hardships of being a foreman with particular reference to production problems, his division head pointed out that the wage incentive plan automatically took care of production as far as the operator was concerned and that actually the foreman need only worry about personnel problems, material, planning and scheduling, and costs.

This was a new idea entirely to the writer but if one analyses the problem, the truth of the statement becomes apparent. When production falls down in a department, it is generally due to one or a combination of three main causes: lack of material, excessive absenteeism, or machine trouble. It is very seldom that a foreman can truthfully say that production is low because the operators do not want to work; these few occasions being possibly the day before a holiday or a Friday afternoon. Once an operator has been brought up to standard and has started to earn some extra money, the wage incentive system automatically takes over much of the production head-ache. As soon as a foreman learns this lesson, he can worry less about production and spend more of his time on personnel and scheduling problems to keep his department running smoothly.

However, there is just one word of caution to be added. The first hour of the shift is tremendously important in any wage incentive plan. If for some reason the first hour's production is poor and the operator feels that it will be impossible to make any bonus for the day, the tendency will be for the operator to do the minimum of work possible for the day. This is the reason why it is so important for a foreman to be on the production floor at the beginning of his shift in order to see that adequate material is available, that machines are operating properly, and that the operators start to work promptly. Especially if group bonus is involved, it is important to be very strict as far as tardiness goes since if one operator is ten or fifteen minutes late, the production of her group may be so poor for the first hour that they will be discouraged from trying to earn bonus for the rest of the day.

In view of the above fact, we should amend our original principle to say that if the workers in his department have satisfactory production for their first hour's work, the foreman can then safely turn his attention to some of the more indirect activities associated with the running of his department.

The 100% Time Premium Wage Plan possesses this attribute of aiding the foreman in production but probably to no greater extent than other wage incentive plans. The

greatest fault of the day rate system is that it offers no such aid to the foreman who must rely on non-financial incentives or the "whip".

There is one aid available to supervision offered by some incentive plans that the 100% Time Premium Wage Plan definitely lacks and that is the assurance of consistent day to day production. Consistent production is greatly to be desired to avoid the creation of excessive inventories of sub-assemblies which may be extremely sensitive to physical deterioration or obsolescence as in the radio tube industry. Since the plan does not furnish a strong incentive to make standard and, secondly, has a relatively strong incentive above standard, there is a tendency for production to vary from day to day from the same group of operators. For example, it was common in the plant under discussion to have production 10% higher on Tuesdays and Wednesdays simply because the workers felt more like working on those particular days. About 50% of the operators could be depended on to turn out the same production day after day but others might be 140% efficient on Tuesdays and Wednesdays but only 120% efficient on the other days of the week.

If these variations are consistent week after week, the foreman can anticipate them but, other things being equal, a wage incentive plan that encourages even

production is to be desired. This point is stressed by R. H. Lansburgh and W. R. Spriegel<sup>1</sup> who point out that "Incentive wage systems which are developed to have workers make a set task rather than to excel a set task are best suited to the demands of modern managerial controls." It is claimed that some wage systems such as the Gantt which pays from 20%-50% of the base rate as a bonus for making standard have the effect of causing the operator to reach standard practically every time. This has the advantage also of aiding the predetermination of overhead expense as well as the direct labor costs. But there is no evidence that any of these plans control the ceiling of the worker's output except through an arbitrary "cut-off" such as was used in the plant being described and which has been discussed previously. Unusually high production can cause almost as much trouble as low production because of its upsetting effect on inventories and planning and scheduling in other departments.

Briefly to summarize this chapter, we can say that all wage incentive plans aid supervision in getting out the production but that the systems such as the Gantt which pay a high bonus for making standard probably aid in making the amount of production more consistent. An

1. Richard H. Lansburgh and William R. Spriegel, Industrial Management, John Wiley & Sons, Inc. New York, 1940 pg. 426

arbitrary "cut-off" may be used to set an upper limit on production which may be necessary to maintain the proper ratio of inventories.

Good production in a plant depends on a good first hour and the foreman should be on hand at the beginning of the shift to make sure that the workers have the proper material, that their machines are operating properly, and that they start their jobs promptly.

## CHAPTER 12

### POPULARITY WITH MANAGEMENT AND UNIONS

The ultimate test of any wage plan is in its being accepted and used; and statistics show that wage plans based on piece rates are the most popular with management. There is also evidence that these types are more popular with labor unions both for the comparative simplicity, which has been mentioned before, and also as a basis of establishing standards among competing plants, a point which will be discussed further.

In 1940, the National Industrial Conference Board made a survey of 2,700 companies<sup>1</sup> which employed approximately 5,000,000 workers in plants which were representative of all kinds and sizes of business in the United States. 51.7% of this miscellaneous group used wage incentives but of the 900 manufacturing companies included in the group, 75% used wage incentives.

Of the 313 companies which furnished more specific information, 60.3% of the employees who were on some incentive plan were on piece-rate plans in contrast with 30.9% of employees who were on various premium or bonus plans.

A somewhat smaller sampling survey was made by the American Management Association in 1943 which covered

1. National Industrial Conference Board, Studies in Personnel Policies, No. 19

50 representative manufacturing companies. In these plants, 62% of the direct workers were on an extra-financial incentive basis. 51% of the wage plans used were of the piece work type: Piece rate, 28% and Standard Hour, 23%. Of the other plans, 17% were Bedaux, 17% were Halsey and other premium types, and 15% were miscellaneous.

One of the factors influencing the use of the piece rate type of plan seems to be that unions favor this type over the more complicated forms. The early hostility of labor organizations to any type of speed up has been replaced in some industries by an attitude of tolerance and in other industries by an attitude of some co-operation.

An example of the latter is in the apparel industry where the Dress Manufacturers' Association and the International Ladies' Garment Workers Union co-operated in the establishment of a "Test Shop".<sup>1</sup> Standard times to make a garment of any style or material were set on the basis of time studies made chiefly by the union's industrial engineers. In this manner, the element of piece work prices resolved itself into negotiations as to the base rates. There was no haggling on individual piecework prices and from the data collected it was possible to set up standards applying to different conditions in different shops.

1. L.P. Alford, and J.R. Bangs, Editors, Production Handbook Ronald Press, New York, 1945, pg. 461

Fred Joiner<sup>1</sup> has made an extensive study of the apparel industry and the use of piece rates. He reports:

There are economic factors inherent in certain industries which seem to make piece-work or other incentive plans logical forms of wage payment. Unions in these industries are aware of the problems and have made little effort to eliminate such plans. For example, piece work in general has been acceptable to unions in the apparel trades because of the importance of manual skill and control, which results in wide variations in the individual worker's productivity. Thus there is always a sizable group of faster workers who may feel that a change to time work would cause a decrease in earnings. In addition, the apparel industries are subject to wide seasonal fluctuations in production and employment. Unions in these industries practice rigid work sharing during slack seasons. The piece work method makes work sharing possible since employer's are assured of a fixed labor cost regardless of the amount of work to be done. Unions realize that without this fixed labor cost per unit of output, very few employers would consent to the rigid work sharing which both the union and the workers feel to be desirable in these industries.

Also these unions have adopted a policy of stabilizing labor costs among competing employers. Piece work facilitates stabilization since unit labor costs can be determined in advance and do not depend on the relative efficiency of the individual worker or establishment.

The writer regrets that so much of the material in this section is quoted from outside sources but his experience with unions has been restricted to contacts with them while both the A.F.L. and C.I.O. Unions were trying

1. Fred H. Joiner, Incentive Wage Plans and Collective Bargaining, U.S. Gov. Print. Off. 1942 No. 717, pg.5

unsuccessfully to organize the workers in the plant under discussion. However, it is interesting to note that the campaign of the C.I.O. emphasized the "speed up" approach. The following is quoted from a flyer<sup>1</sup> passed out at the company entrance shortly before the balloting:

X Company's hunger for more and more production has resulted in a terrific speed up for the girls. Tube L 12 has been changed to F 12 and a higher standard rate has been set on exactly the same tube.

The maddening speed-up has resulted in Mr. Spencer acting tougher and driving the girls. He is constantly looking over the shoulders of the girls in an attempt to put pressure on them for faster work. He is always calling in girls to the office and asking them to work faster.

You see girls--- Mr. Spencer has a quota to make that doesn't take into consideration your health or welfare. Mr. Spencer is not worried about your beefs. All he is worried about is PRODUCTION.

To summarize, we can say that reliable surveys of a large group of manufacturers indicate a preference in actual use of the piece rate type of wage plans of which the 100% Time Premium Wage Plan is a modification; and we can say that it is probably least offensive to labor unions. The indications are that in the apparel industry, the piece rate type of plan is favored by labor unions since it offers a basis for sharing the work and standardizing wages and costs.

1. United Electrical, Radio and Machine Workers of America, affiliated with the Congress of Industrial Organization, 50 Trumbull St. Worcester, Mass. Flyer, 1946

## CHAPTER 13

## CONCLUSION

The purpose of this paper was a critical analysis of the 100% Time Premium Wage Plan. However, although analysis has its place in the scientific approach to any problem, it is of little value until it has been a factor leading to a logical conclusion.

The preponderance of the evidence is in favor of the plan. It has several advantages that outweigh the fact that in a few specific instances it may be surpassed by other wage plans. The general trend in industry is towards a more liberal policy to employees and there is little doubt that this plan offers more to the employee than other plans now in use in industry.

From the point of view of the worker, this plan offers a feeling of security and at the same time provides an opportunity for advancement both through step increases in the base rate and through earnings that are limited only by the employee's ability to produce. The plan is simple and clear; the worker can compute his earnings himself without a calculating machine. There is little opportunity for the employer to lower the rate by the manipulation of hidden factors. Rates are fixed by time study and are not subject to the personal opinion of a supervisor.

From management's point of view, the plan offers several advantages:

First, since it is generally liked by the employees it aids morale and makes for better understanding;

Second, it provides for differences between jobs and operators by variation of the base rate;

Third, it provides for paying operators during their training period and during a period of changing over of products or process;

Fourth, it provides a strong incentive above standard with the resulting lowering of total unit costs;

Fifth, it facilitates planning and scheduling and the predetermination of direct labor costs;

Sixth, it is easily computed and readily adaptable to cost accounting methods;

Seventh; it aids supervision by relieving the foreman and supervisors of part of their production problem.

The disadvantages of the system can all be blamed on one factor, the fact that the plan does not provide a method of keeping individual production within a narrow range. These disadvantages are:

First, an added burden on supervision to bring workers up to standard and keep them there.

Second, a wide range of output which produces unbalanced inventories which may necessitate transferring operators to different jobs with resulting higher labor cost and lower morale;

Third, the need of the imposition of an arbitrary ceiling to maintain good quality which is contrary to the principle that earnings should be unlimited and which, in some cases, results in the limitation of "reported" output but not "actual" output and tends to lower quality.

Fourth, the inability to predetermine indirect labor costs as accurately as some other wage plans.

One incentive plan alone cannot be expected to fit all production situations. The executive who has the responsibility of selecting the proper plan needs to take many factors into consideration. For example, if the degrees of skill involved are not high and the inventory is not of a perishable nature, there will not be the need for controlling output within a narrow range. As a result, this defect of the 100% Time Premium Wage Plan when it is used in the construction of radio tubes may cease to be a liability.

However, the plan certainly has many strong points and it certainly should be considered seriously by anybody looking for an incentive plan.

It was not the purpose of this paper to discuss

incentive plans generally as contrasted with day rates. There are several factors such as quality, material usage, cost of material, and others which are general problems of all incentive plans. That is, if we can make a further generalization, if quality is poorer as a result of wage incentive plans, it will be no poorer under the 100% Time Premium Wage Plan than under the Halsey or Gantt plans; and similarly, if material usage is higher under the Halsey plan, it will probably be just as high under the Gantt or the 100% Time Premium Wage Plan. These are problems that management must solve whatever wage incentive plan it may choose.

Rather it was the purpose of this paper to illustrate some of the practical problems that arose from the use of a plan similar to the 100% Time Premium Wage Plan in a small factory and to show some workable methods of dealing with them. Some of the books previously written on the subject have been written from an "ivory tower" but in this paper the writer has tried to take the reader out onto the production floor, into the front line trenches, so to speak, and show him the working of the plan both from the point of the worker and the foreman.

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