plans considered and while not so simple as the Gantt bonus plan, it is sufficiently so not to be mathematically objectionable in the slightest degree.

3. Like the rest of the premium plans and in common with the Gantt bonus plan, it guarantees a workman his day rate, a perhaps negative virtue, but still one insisted on by most managers and workmen.

4. It offers apparently the easiest way of gradually training a day worker up to the performance of a substantial task; for, while the eventual task demanded would be a saving of two-fifths of the full time from which the premium is calculated, this may be demanded by gradual steps only, as, for instance, one-tenth, one-fifth, three-tenths, and finally two-fifths; i.e., demanding that one-tenth more of the full time be saved every time the job is repeated, until the final task time has been reached.

MUST QUIT GUESSING AS TO TIME

I do not mean to pretend to have exhausted the subject by what I have said, but at the same time I want to be on record as not considering the particular manner in which a workman's reward for accomplishing his task is figured to be of anything but secondary importance. The important matter is that we abandon the old way of guessing at the time it takes to do a piece of work and earnestly set to work to obtain scientific methods for the determination of the best time in which work can be done, and on the strength of this set ourselves and our employes a definite task to accomplish each day, as so strenuously recommended by Mr. Taylor.

Before relinquishing the platform to the next speaker I like to call attention to one of the greatest difficulties that all of the various schemes considered have had to contend with. I have in mind what I call, for lack of a better term, the uneveness of the machine equipment in most shops. To take a simple example, I found one shop with eight drill presses, of which only two had the same feeds and speeds, and still rates made for any of them were unhesitatingly applied to the rest. So, also, a number of gear cutting machines, lathes, etc. The equipment was gradually unified by changes in both feeds and speeds of the majority of the machines in any one class, so as to make them all practically the same as the few already near enough alike.

UNIFORMITY OF SHOP EQUIPMENT

Diagram E[1] is an illustration of one of the drill presses thus changed, the changes consisting in one new set of back gears, new cones, and a double set of speeds to the counter-cone, and finally a completely new feed box secured from the manufacturer of one drill press already so equipped. And diagram F[1] shows the feeds and speeds of all eight drill presses, and it will be seen that these are practically all alike, except that the two largest of them have one speed slower than the rest, and also a uniformly coarser set of feeds, though this is such as to agree quite closely with the smaller drill presses within a certain field.

FIRST STEP TOWARD PEACE OF MIND

I have thought it well to call your attention to this one phase of the standardization of shop equipment, about which so much else has been said and written in connection with both premium and piecework plans, because an experience I had a few years ago taught me how little even tool manufacturers realize its importance. In a shop where we decided to buy two new drill presses, these were ordered and promised to be exact duplicates of two already on hand, and the greatest stress was laid on the fact that we so wanted them. I do not know if you can conceive my disgust when the new presses arrived and were found to be totally different in driving gear and feed motion; and the fact that they proved to be of much superior design, when considered by themselves, did not make me feel a bit better, for the unity of the equipment I had aimed at was destroyed, and this was of more importance than the improvements made by the manufacturer. I look upon such unification of the machines in a shop as the first step toward deriving peace of mind from any mode of paying workmen, and in the ultimate analysis of all our motives, that is what we are all after.

Mr. Gantt asked the privilege of the floor and this being granted he said:

"PIECEWORK BY ANOTHER NAME

"I am very sorry to have to correct one or two statements made by Mr. Barth with reference to the system that I am supposed to stand for; but Mr. Barth has described the tasks and the bonus method system as introduced at the Bethlehem Steel Works about 10 years ago. As introduced there it had certain defects, and did not produce the result that we desired, namely, that of giving a man a continuous inducement to do all the work he could. About a year afterwards we discovered a method of giving the man his additional compensation. We gave him an additional compensation depending upon the amount of time that was allowed for the work; in other words, we practically fixed a piece rate. The time allowed was 10 hours, and that gave him an additional compensation of 3 hours, so that his pay was 13 hours for the work; that was simply a piece rate. If he did not do the work in 10 hours he got his day's pay. We have adhered to the idea of a task bonus instead of sticking to piecework, because there is much objection to the term 'piecework.' Some people are fighting what is broadly termed piecework, but if you can give them the thing in another shape, if you can call it by something else, they do not object to it. The only difference is that we do not allow a 'no account' man to work on piecework. He must first come up to a certain degree of efficiency set by the expert before he is allowed to work piecework; otherwise he gets day pay. If he is not any good at day-pay work, of course, we would get somebody in his place."

Mr. Barth was granted an opportunity to reply to the statement by Mr. Gantt.

FROM PIECEWORK TO THE PREMIUM PLAN

(By F. A. Halsey)

The premium plan as originally published was essentially an addition to the day's-work plan, the workmen being supposed to be continued at an existing rate of daily wages with an additional premium based on an increase of output, and in most, if not quite, all discussions of the plan it has been stated in words, or tacitly assumed, that the method of payment prior to the use of the premium plan was by simple day's work. This has been true of everything that I have written upon the subject. During my shop life I had no experience with piecework and no occasion to devise a method of changing from piece to premium work, and although many inquiries have come to this office asking for details of the methods to be followed in cases of this kind I have always felt that, in view of the above-described situation, I was not competent to offer advice of value.

CARL G. BARTH'S PLAN

Carl G. Barth, who is so widely and favorably known by his work in association with Fred W. Taylor, has had this problem before him and has worked out a solution which in several applications has proved entirely successful. The idea is simply to start with a wages-per-piece limit instead of a time limit. The workman is put on an hourly wage rate in place of the previous piece rates and he is then offered a premium of part of the difference between the wages-per-piece limit and his wages for the time consumed in doing the work.

Thus, suppose the wages-per-piece limit for a given piece of work to be $2.50, the workman doing it having an hourly rate of 25 cents, and suppose he does the work in six hours. Under these conditions the workman's earnings and the new cost would appear as follows:

Wages-per-piece limit	$2.50
Hourly wages for six hours	1.50
Total saving of wages per piece	1.00
piece is $\frac{\$1.00}{3}$ =	.33⅓

If the premium is one-third the total saving the premium earned per

Wages for six hours	1.50
Premium per piece	.33⅓
Total cost of work	1.83⅓
Original cost of work	2.50
New cost of work	1.83⅓
Saving to employer	.66⅔
Workman's wages for six hours	1.50
Premium	.33⅓
Workman's total earnings for six hours	1.83⅓

Workman's earnings per day of 10 hours

$$(183\tfrac{1}{3} \times \tfrac{10}{6}) = \$3.05$$

Workman's new earnings per day	3.05
Workman's old earnings per day	2.50
Workman's premium per day	.55

ADAPTABILITY TO VARYING CAPACITY OF MEN

(American Machinist, Mar. 25, 1909).

A feature of the plan of which Mr. Barth makes a great point is that it automatically takes care of different rates of hourly pay based on the capacity of different men to produce varying amounts of work by, in effect, giving a low-rate man an extension of time before the limit is reached. Thus under the rate assumed above, the workman having a rate of 25 cents per hour has, in effect, a 10-hour limit which must be cut down before he earns a premium; but on the other hand, a workman having, say, a 20-cent rate per hour, has, in effect, a 12½ hour limit—which he must cut down before earning a premium. Or, to put it otherwise, a workman earning 20 cents an hour would, by doing the work in 7½ hours, earn the same premium that the 25-cent workman earns by doing it in 6 hours. This is a distinct advantage over the time-limit plan which handicaps the low-rate workman by giving him the same time limit as that given to the workman getting a higher daily rate.

In Mr. Barth's practice the task idea is introduced by requiring the workman to do a certain per cent better than the base rate before any premium is paid, the premium when paid being, however, based upon the entire saving of time. This feature is not, of course, essential, and may be employed or not as the user of the plan prefers.

THE PROPER PREMIUM RATE

As against a premium of one-third the total saving on which the above tabulation is based, Mr. Barth, like so many others that have adopted the premium plan, pays a premium of one-half the saving. He does this, however, after a preliminary time study which frequently results in the reduction of the wages per piece limits below the previous piece rates. Under these circumstances, a premium of one-half the saving is, I believe, justifiable, but when the limit is simply taken from existing cost records, I believe it to be too high, and that a premium of one-third the saving is all that the manufacturer should pay, and this whether the limits are based on records of the day's work plan or on those of the piecework plan.

There is an appearance of fairness about a half-and-half division which makes it very attractive on the surface. Experience shows, however, that it is an unnecessarily high rate, the incentive under one-third the saving being sufficient in nearly all cases to bring about an increased output and to lead to very substantial increases in the wages earned.

This conclusion is not a new one, as I have advocated a premium rate of one-third the saving from the beginning, and it is no more than proper to add that accumulated observation only serves to confirm the wisdom of the conclusion. I know of one conspicuous case, which ultimately became a local bellwether and was largely followed, in which, against my own advice, a premium rate of one-

[1]Not printed.