

list: (1) time study; (2) job analysis; (3) routing; (4) equipment data; (5) slide rules, charts, etc.; (6) classifications; (7) instruction or method cards. I have found that the development of methods consciousness proceeds more rapidly with the acquisition by the neophyte of a working knowledge of the mechanisms of methods study; in fact certain stages of methods development are often retained in the training program of methods men solely as a step toward methods consciousness.

6. *Control.* I think we are past the stage where control must be justified. Indeed I have found evidence of departments called Control Departments that were still rather devoid of control functions. Control is essentially the function of matching what should be done with what you do. As a corollary to this statement, if you do not know what can be done it is obvious that you cannot have control. Chasing jobs, orders, parts, etc., through processing is not considered control here. Control should prepare a path down which all the work in process flows in an even stream.

Control, as I am thinking of it, includes a bigger picture than just the flow of material through the processing operations. Control is the co-ordinating function of all the activities of the organization. Certain things should be done, and control sees that they are done. Control then is both a mechanism and a spirit. The mechanism automatically presents certain facts and the spirit of control makes use of these facts. In control, as in methods, it is necessary to develop trained habit to a point where the correct action becomes automatic. In setting up controls, however, the human element in any automatic action must be remembered.

What is it necessary to control? That of course will vary with the existing conditions. In starting it is better to try to control too thoroughly than not thoroughly enough. As real control develops the unnecessary features can be eliminated gradually. It requires considerable experience in control and a knowledge of the inter-related features of the organization before the operation of some function can be changed without disturbing others.

The mechanisms of control are varied in form and use. The exact nature of the mechanism is not so important as is its fitting into a definite plan. The following are usually termed mechanisms of control: (1) control boards; (2) charts; (3) route sheets; (4) control tickets; (5) order of work lists;

(6) communication schemes; (7) time clocks and many others. There have been several techniques of control developed all of which have good features. It is much easier to pattern an existing technique to fit a certain set of conditions than to create an entirely new technique.

7. *Supervision.* Supervision is one of the necessary evils of human endeavor. As long as we are dealing with human beings it seems necessary to have some men to see that some more men do what they should do of their own volition. The degree to which a man is trained to perform his function determines the degree of supervision that man will require.

Supervision might be roughly divided into two classes: detailed duties, and general influence. Under detailed duties, we have the thought that the supervisor is responsible for the performance of each facility at its effective capacity, that each man produces in the same manner, that discipline is maintained, that each man conducts himself in a safe and proper manner, that sanitation is observed, that company policies are carried out, and a variety of other possibilities all more or less of a policing nature.

It is when we come to general influence that the real possibilities of supervision are realized. To most men in the ranks the supervisor is the company. He is the man who tells them what the company wants and does not want. His interpretation is what reaches the men; he is the key man. The opportunity for him to use his influence to make bigger men of those working for him is unlimited. As an educator he has an opportunity bigger than that of the pedagogue in the little red school, because he can teach the things useful to know. I am not sure that our present educational system is doing this.

To have effective utilization of facilities, it is evident from this that the supervision of performance must be right. The key men in supervision can make or break some of the best laid production plans.

8. *Definite Product in Definite Quantities.* When one considers the effect of the product itself on effective utilization, the first thought that springs into one's mind is that there must be plenty of product to work on. In other words, the salesman must have done his job—but not overdone it. Too much work may be as bad for effective utilization

as too little. All things being equal, I would rather see a little too much.

By a definite product is meant a completely described product for which there are ample specifications, drawings, etc., showing exactly what should be made, and the tolerance of deviation from the desired condition allowable. Specifically, a good example of incomplete information is a set of drawings for a machine on which the allowances and tolerances are left to the shop. The delays due to misunderstandings and wrong judgments under such a condition amount to quite a figure. The sad part about it is that we frequently consider these delays necessary.

Definite quantity provides a measuring stick for performance. The daily quotas of high production plants are particularly useful in this respect. Where the product is of a more varied nature, the volume of the order provides a definite figure as a task or quota.

9. *Uniform Material Control.* While material control, taken in the qualitative sense, might be considered as a part of control, when viewed from the angle of its effect upon the operation of the facility it becomes an independent condition.

Uncertainty of material quality is the item that slows up the operation of more equipment than almost any other. Take for instance a man operating a turret lathe on a cast iron piece. Where the material is uniformly of one quality he proceeds confidently. But when he strikes a series of castings with sand, blow holes, off center cores and hard spots his confidence is gone and he proceeds more cautiously. He is fearful of being "called" in case something should break. Where there is a wage incentive the incentive may modify his caution, although the general tendency here is to take full advantage of the defective material condition and argue for a higher rate, or a longer task time.

To obtain definite material control, it is necessary to have some means of checking quality as the material is received. Quality should be checked before the material is shipped or it should be purchased from those who are known to give uniform material. Probably modifications of all three systems should be used.

Another and important phase of material control is having the right quantity of material or eliminating unnecessary material. This can only be solved by basic study of each condition.

10. *Payment for Performance.* A piece of equipment can be operated under capacity, at capacity, or over capacity. The method of payment for the work will tend to result in the equipment being operated in one of these three manners.

As a general rule straight day work invariably results in equipment operated under capacity, for the man has very little to gain by running it at capacity. Wage incentives have a tendency to operate the equipment close to its most effective point, but this operation is dependent upon the fairness with which the incentive has been made rather than upon the method of paying the incentive. A close or unfair task will usually result in overburdening the equipment, a high labor turnover or both.

A frequent criticism of piece work is that there is no implied information in the rate established regarding the capacity of the equipment. One cannot blame the operator for getting all he can get, so that whether the rate is close or liberal the equipment probably is worked over capacity. And then again, it may be economical to work the equipment on a one-year replacement basis instead of a five-, ten- or fifteen-year basis.

The important thing to consider in payment for performance is whether the operator can see where he is getting his while the machine is being operated effectively.

11. *Maintenance of Standards.* It should be perfectly obvious that equipment and mechanisms cannot be expected to perform at their rated capacity if certain elements of their construction are permitted to deteriorate. One has only to look into many of our industrial establishments to see the mute evidence of this on all sides.

Maintenance of standards falls into the following classes: (1) maintenance of attitude; (2) maintenance of relativity; (3) maintenance of physical condition.

Maintenance of attitude deals with the mental conditions of the personnel and the steps necessary to prevent an organization from becoming lax, stagnant, sour, quarrelsome, or any of a number of defective attitudes. The laws of this kind of maintenance are as yet vague. We recognize a man as a real human engineer when he is able to keep an organization loyal and aggressive. Our popular magazines are filled with stories of the lives of men who have succeeded as human engi-