

element of a man's work," and also, "management should take in the duties of training and selecting workmen, and should co-operate with the workman to see that work is done in accordance with the science developed."

Machinery designed by the better type of engineering shows that these functions have been carried out. Much machinery, however, is evidence that they have not been recognized. This latter class of machinery requires a great deal of unnecessary and undesirable time study work to supplement the work of mechanical engineering. Even though good time study work may point out and partially correct what technical engineering has neglected, its necessity is an evidence of poor engineering. This is particularly true of machinery and methods, but it may also be true of the processes connected with the machine. If the complete function of engineering were recognized, much of this unnecessary work could be eliminated.

The work of the industrial and time study engineer should supplement the work of other engineers, but unfortunately their approach to problems is often from different angles. It is doubtful whether engineers will be able to eliminate the need for much time study work until they understand more thoroughly the time study approach, the purposes behind time study and the wider functions of their own profession. It is natural for the engineer to cope with immediate problems and to neglect the full purpose of his work. He thinks of the solution of problems as remaining the same and develops traditional ways of doing his work, just as traditional methods are developed in the factory. Scientific applications and developments are forgotten—for habitual methods. The industrial engineer seems to have the same failing. At times he confuses definite practices and the whole purpose of his profession.

Just as engineering is changing factory practice, even when products remain the same, so science is changing engineering. Engineering has shown that it can eliminate various operations and at the same time make a better product. There should be a wider application of this principle both in factory operations and in the primary work of engineering.

There has been no intention to underestimate the value of time study. At times one thousand dollars spent for time study may be worth more

than one thousand dollars spent for machinery, even though it is hard for managers to see the value of time study because, unlike machinery, it cannot be entered on inventories. Time study is also very helpful in a great deal of the work of industry that is not mechanical. It properly should deal with such situations and with existing machinery. If engineering, however, will deal rightly with present problems many future problems will be eliminated.

#### Subdivision of Labor and Organization Changes

The newer industrial processes have brought about minute divisions of labor, until one man does only a very small part of the work on a product. Often the mechanical aspects of this subdivision have been considered to the exclusion of its larger meaning. Problems of administration and supervision, as well as changes in workers' duties, have come about as a result of the various engineering and constructive organization forces that have been at work. Three things have happened:

1. Work has been subdivided and mechanical energy substituted for manual.
2. The machine has absorbed many administrative and supervisory functions.
3. Separate departments have been set up for planning materials, products, processes and methods.

In the early days of machine industry, machinery was planned and work apportioned by plant operators. Small plants and limited scientific development permitted this; large plants and scientific developments have made it impossible. It is now necessary for one group to build the organization and another to run it. Each group supplements the other.

Now that some of the engineering and organization problems related to the technique of management and mechanization have been brought out we shall proceed to examples in variable, intermittent and continuous processing. Figure 1 shows the evolution of an industrial organization toward continuous processing, and suggests the consequences of an installation of continuous process machinery and also the influences of allied engineering services. It indicates that these influences, in addition to working out materials, processes and methods, are also, when carried far enough, establishing lines of control, supervision and administration.

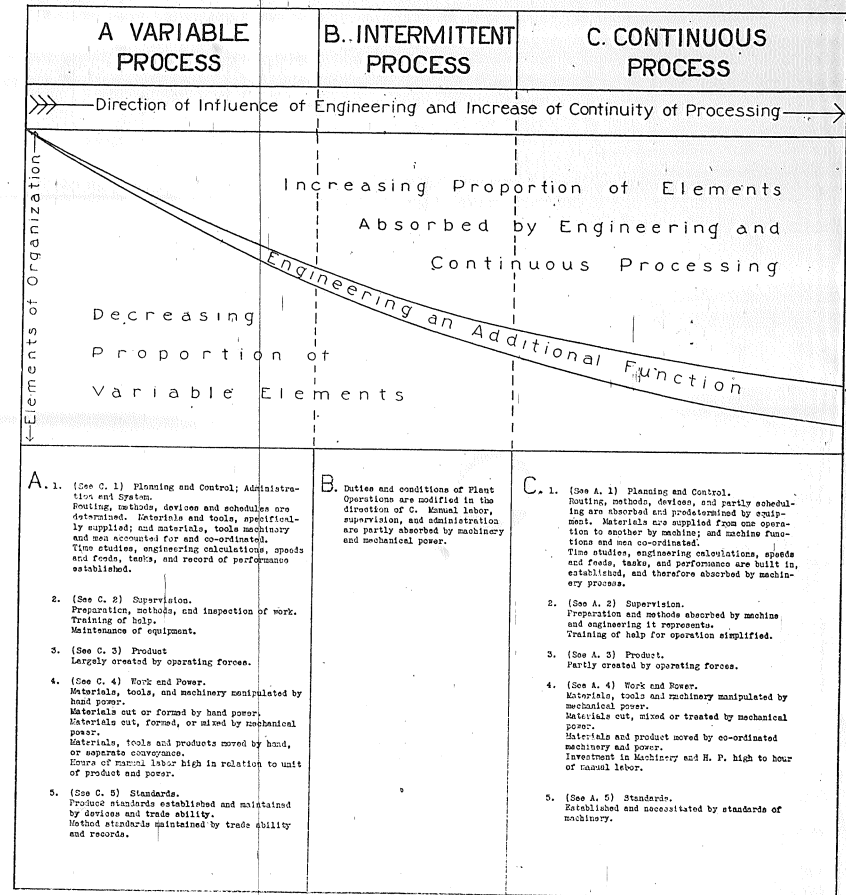


Figure 1. Influence of Engineering and Continuous Processing on Workers, Supervision, Administration and Accounting.

Colonel Hathaway some thirteen years ago said that the aim of industrial organization was to approach continuous processing. The same major problems must be solved whether continuous processing

or other equipment is provided, but the means of solution differ.

In the variable and intermittent processing plant, the following organization and operating problems