One phase of this application of intelligence to the day's work has been technical research, which has resulted in a continual improvement in design of manufactured commodities and the use of more efficient methods in manufacturing, agriculture, transportation, communication and mining. Perhaps the kind of gain most characteristic of this period has been the result of what may be called "operating research" rather than "design research." For instance, the railroads have increased the average number of car miles per day by eliminating delays to trains by better planning, and have thus saved money by having less idle equipment. The telephone companies have improved long-distance service by introducing the so-called combined line and recording method. Many manufacturing industries have increased the tempo of their processes by the use of mechanical conveyors. Coal mines have modified their whole method of operation in connection with the introduction of mechanical loaders. The construction industries have in part ironed out the winter slackness by better planning. In agriculture, the introduction of the combine has made profitable the exploitation of subhumid regions that previously were merely cattle ranges, and has reduced the time required from harvest to marketing.

It is true, of course, that each of these improvements has involved the design and manufacture of equipment somewhat different from that previously in use, but the motive of the change has been to secure economies in operation as much as to produce improvements in the final product or service.

A further major reason for thinking that we have really advanced is the willingness of American industrialists to install new equipment whenever the savings in cost of operation are estimated to justify it. While several references in this report emphasize the value of labor-saving or time-saving machinery, the results of one questionnaire reported by Mr. Alford seem to indicate an inadequate appreciation of what is really required by the free scrapping policy. The question reads: "Has your company a policy against the purchase of new equipment unless the production savings will return the initial investment within a definite period? If so, what is this period?"

Of nearly two hundred replies received in answer to this question, 43.6 per cent of the companies required that their new equipment should return its cost through savings in a period of two years or less and 64 per cent required that it should pay for itself in three years or less. If the question was correctly understood, such answers seem to me a negation of the accepted progressive American policy, or rather, seem to be the answers that are given to equipment salesmen rather than the real basis for decisions. In my own opinion, the decision as to whether or not new equipment will justify itself, should rest primarily on (1) its probable effective life, allowing for obsolescence and inadequacy as well as wear and tear, and (2) the net annual savings in operating cost. The key question is: What rate of return per annum will be earned on the required new investment in addition to providing at an adequate rate for physical and functional depreciation on the new equipment? The line can then be drawn at a certain rate which must then be equaled or bettered for a project to be approved.

Let us test the two years or less requirement on this basis. Certainly a life of at least four years can be counted on for much new equipment, corresponding to a straight-line depreciation rate of 25 per cent. The two-year rule in such a case implies that no new equipment will be bought that does not provide a net return of 25 per cent per annum on the additional investment. Surely there must have been some misunderstanding here; I cannot believe that progressive American concerns would actually refuse to secure new equipment merely because the return on the additional investment promised to be only 15 or 20 per cent. The limitation to two or even three years looks still worse when applied to machinery for which, on the average, ten-year life may be expected and a 10 per cent per annum depreciation rate is therefore adequate. For such equipment an expected return on investment of 10 per cent would seem to justify the investment if other intangible factors also favored it, but in the terms of Mr. Alford's question, this would correspond to a five-year requirement for return of the initial investment, and the latter period, therefore, seems to be indicated as a reasonable minimum limit for the critical point. Each case, of course, should be examined on its merits. My objection applies to the arbitrary setting of a low limit like two or three years to apply in all cases. Perhaps I should list the question. What should be the criterion by which the desirability of additional investment should be tested? as one of the major questions suggested by the Report, even if the Report does not contribute much of a specific nature, and what it does contribute is misleading. If there really are many manufacturers who are refusing to purchase new equipment which would net 15 or 20 per cent on the amount invested, it would certainly contribute to the Hoover stabilization program for them to change their policy. To be sure, the machinery people have their capacity booked up for some months ahead—but there would be room later.

A further reason for believing that conditions have really improved is the more enlightened attitude on the part of organized labor and, in fact, of wage-earners in general, endorsing more extended use of labor-saving machinery and other methods of efficient management. In the well-known Baltimore and Ohio plan put into effect in the repair shops of that railroad, the union shares responsibility for efficiency and output. The Amalgamated Clothing Workers have gone so far as to undertake the opening of new units of manufacture and to share the burdens of supervision. A growing number of unions have come to a clear notion of their stake in the prosperity of the industry over which they claim jurisdiction. While it is easier to point to concrete examples of this changed point of view on the part of organized labor, it seems clear that most wage-earners have shared in something of the same change of attitude.

Accompanying this underlying approval of more efficient machinery and better methods, there is naturally some doubt in the minds of many workers as to just how they would fare individually if their own work should be transformed by some new development. The continuance of a constructive attitude on the part of labor, therefore, depends on making general the accepted policy of progressive concerns of transferring satisfactory workers to other jobs, if possible, when the old job is scrapped. The execution of this policy is facilitated, of course, by the nature of modern factory work in that much of the ability of a successful worker is transferable insofar as that ability consists of readiness to fit into the prescribed organization, steady attendance, adaptability, and willingness and intelligence required to understand and follow instructions.

Still another reason for the basic improvement in the period 1922-27 is the fact that management has accepted the "doctrine of high wages" and provided the workers with certain supplementary advantages in addition to wages. The "doctrine of high wages" may be stated briefly as follows:

Where an appropriate increase in productivity can go along with an increase in wages, the consequent increase in purchasing power tends to reduce cost and to increase wealth, or

Low labor costs per unit of output may often be obtained by putting more money into the employe's weekly pay envelope in return for greater services rendered.

The "doctrine of high wages" as actually practised implies no "generosity" to employes but merely suitable payment for measured accomplishment. Such measurement may be associated with a gang or individual piece-work system or a task and bonus system or simply a system for making sure that each workman performs a certain scheduled task, with the pace set in many cases by a mechanical conveyor.

While I am disposed personally to avoid the rather vague discussion of the "doctrine of high wages," which seems to imply generosity on the part of the employer, or an altruistic desire to increase purchasing power, it must be admitted that many employers may be influenced by such vague generalizations to act logically under certain conditions which might arouse their prejudices. For instance, the first reaction of an old-style manager on finding a workman's pay check two or three times as large as the average would be to try to stop the repetition of such a "waste." If the "doctrine of high wages," even though imperfectly understood, induces such a manager to investigate the man's record of output to make sure that it is actually much above the average and then to talk grandly about paying high wages to deserving employes in order to increase purchasing power, then the results are fairly satisfactory even if the economic theory is not accurately expressed.

1a. The real test of the reality of the improvement which I have just discussed is the increased *productivity of labor* based on comparison between total physical output and number of workers. This increase amounted in total to 27 per cent in the six years 1919 to 1925—20 per cent in agriculture, 27 per cent in mining, 34.5 per cent in manufactures and 9 per cent in railway transportation. This in-