

or confusion, each man being responsible only for the correct production of his part.

Such seems to be the true explanation of the economic principles of the subdivision of labor.

Men have found out *principles*, and that the most progress is made and wealth more rapidly accumulated when the several stages of any piece of work are each guided and controlled by those who have made *that part* their special study.

We have a very limited idea of the subdivision of labor when we think of it only as of a number of men being divided into groups for the several manual operations in forming, say, a pin. This, indeed, is subdivision of labor; but it should mean more than this. It presupposes antecedent skill and varied ability of a high order.

Before the finished product was possible, an intricate piece of machinery had to be built; which further presupposes not only skilled mechanics, but an inventive genius, and an ability, of somebody, to understand the requirements and correctly portray on paper the many parts, in detail, and as a whole. The designer was quite as necessary as the inventor or the workman.

Let it be remembered, then, that the workshop, though necessary for the practical embodiment of the invention, is yet distinct from the invention. The rule of true progress here is plain. The invention must first be clearly conceived and plainly drawn on paper, clearly and in detail, carefully and studiously designed according to the principles governing the particular construction; in short, it should be wholly created and visibly expressed in every detail, by one who is master of the subject, before it is put into the hands of a single workman.

How many ambitious, bright, but over-sanguine men have conceived a general notion of some invention, involving mechanical principles of which, most likely, they knew little or nothing, and have thrown away time and hundreds—perhaps thousands—of dollars in blundering along—time and money that might have been saved had they started aright. Most assuredly it can be said, with emphasis, no matter how great or how small the new work proposed, construct it first on paper!

Progressive manufacturers and machinists everywhere are every year recognizing more forcibly the value of this method, and recognizing it, are growing richer. Look into our best work-shops of to-day; the great foundries and machine works that turn out our exact machinery, our fine locomotives, our floating palaces; in all you will find—not “a rule of thumb” and endless experiment, but a well-constituted, thoroughly superintended drawing room. Here the work is first really constructed, on paper, the varied problems carefully thought out, the many parts fitted and proportioned to their several functions; then the various artisans and workers are given their parts, and the whole structure grows uniformly, rapidly, to perfect completion. This is the new way. It has come to stay.

It might be interesting to some to have described the actual working routine of one of our largest and most successful manufacturing establishments—the great locomotive works, whose world-wide reputation has made the American locomotive famous as a competitor on almost every line of railroad in the civilized

world. One might naturally conclude that the system preferred by such a firm, after years of fruitful experience—the system which turns out two complete locomotives a day—ought to have superior merit; and if any doubt of this should remain in any one's mind, it should be fully dispersed by the further announcement that the virtues of that same system are being appreciated, and as far as possible imitated, by competitive concerns, whose capacity and business are being rapidly enlarged in consequence.

Let us, then, take a swift glance through the said establishment, beginning with the draughting room, properly the starting place for our inspection. Here, in a well-lighted, ample apartment, are a number of draughtsmen, many of them brought up in the service. These are under the supervision and direction of a superintendent, who originally decides upon the plan of each locomotive to be built, estimating its capabilities and requirements. Instructions and a specification are then given to a draughtsman in charge, who carefully constructs on paper elevations and sections necessary to the complete locomotive. The detail drawings are then executed on stiff card-boards, or other materials suited to stand shop wear, and after passing satisfactory inspection of the examiner of drawings, are given out, carefully numbered and registered, to the respective shops. No work can be done in any of the shops until this is done, thus manifesting the high importance which this successful establishment attaches to correct drawings as the starting point for all construction.

In the shops, the many details are each carefully wrought out, in strict conformity to the drawing, and, as completed, sent to the erecting shop, where, under competent foremen, the various parts are rapidly adjusted, each falling into its proper place, and in an incredibly short time the completed locomotive is breathed into by the breath of its steam life, and starts upon its career, a giant of force and monument of engineering skill.

Time was when a complete preliminary drawing was hardly known in a machine shop. Then, men blundered, and blunders are always costly. Time will be soon, when a machine shop without its drawing room, its superintending engineer, will be but a lingering reminder of an experimental age before men had learned the true source of progress and wealth.

Those that still cling, like the smith of old, to the methods of a by-gone age, are falling behind in the race, for while, in a sense, they may be laboriously building up a small trade, others taking advantage of the proved better methods of success, will be forging ahead into enviable wealth.

The former has been left behind, not because of inferior ability, in his line, but because he has lost time in trying himself to do what another could have better done, at less expense to him.

There is another and concluding thought that should give hope to every man in the mechanic world.

As his craft grows into closer relationship with the great world of science about and above him, it will certainly lift him to a higher plane. Men are everywhere realizing, as never before, the everlasting truth of fixed principles and universal law governing all things. If a house falls, a bridge gives way, a dam bursts its confines, it is no longer an unaccountable