

parallel it will probably take years, and it is evidently for this reason that this very inviting field is occupied by so few organizations which are really prepared to do the work justice. Our football players have learned the benefits of concentrated co-operative efforts when applied to their sport much sooner and better than have technical teachers and graduates recognized the same truths as applied to our life work, and yet the advancement of technical progress is certainly more important than the perfection of the game of football. The technical student of to-day is to be congratulated upon having before him such a splendid opportunity in a field which has not been worked harder than that occupied by the Engineer-Constructor.

It will be instructive to study the development of at least one company which is now prepared to play at this new game of Engineer-Constructor.

Ten years ago the president of this company was a consulting electrical engineer,—an expert on electrical questions, and in a consulting capacity only. Then came the natural addition of mechanical problems,—still in a consulting capacity. The introduction of the system of rotary converters for electric railway work, and of an improved system of power plant construction, made it necessary to take two contracts in which the results of these two systems, which were advised by the consulting engineer, were guaranteed.

with the attendant delays, conflicts and "extras," which even the closest supervision will hardly avoid.

The difference between the "cost plus a percentage" and the "cost plus a fixed sum" plans is not generally understood. If an Engineer-Constructor is thoroughly trained in drawing plans, has sufficient actual experience to make a reliable estimate, is absolutely honest in all things, and has complete control of a competent construction organization, then the "cost plus a percentage" arrangement is the better; but if the work is planned by an engineer and architect, and the actual building work is turned over to a separate construction organization, thus maintaining the old relationship of engineer and contractor, then the "cost plus a fixed sum" plan, no doubt, has advantages. The "percentage" plans express a shade more of confidence between the client and the builder than the "fixed sum" basis.

If the duties of making a preliminary report, preparing a careful estimate, drawing up the plans and specifications, purchasing the materials, building the structures, erecting the equipment, and installing the machinery is turned over to one reliable Engineer-Constructor organization on a "cost plus a percentage" plan with the privilege to the client of cancelling the arrangement at any time, if the progress, quality, or cost of the work should prove to be unsatisfactory, it is hard to conceive of a more effective way of getting results, and it is

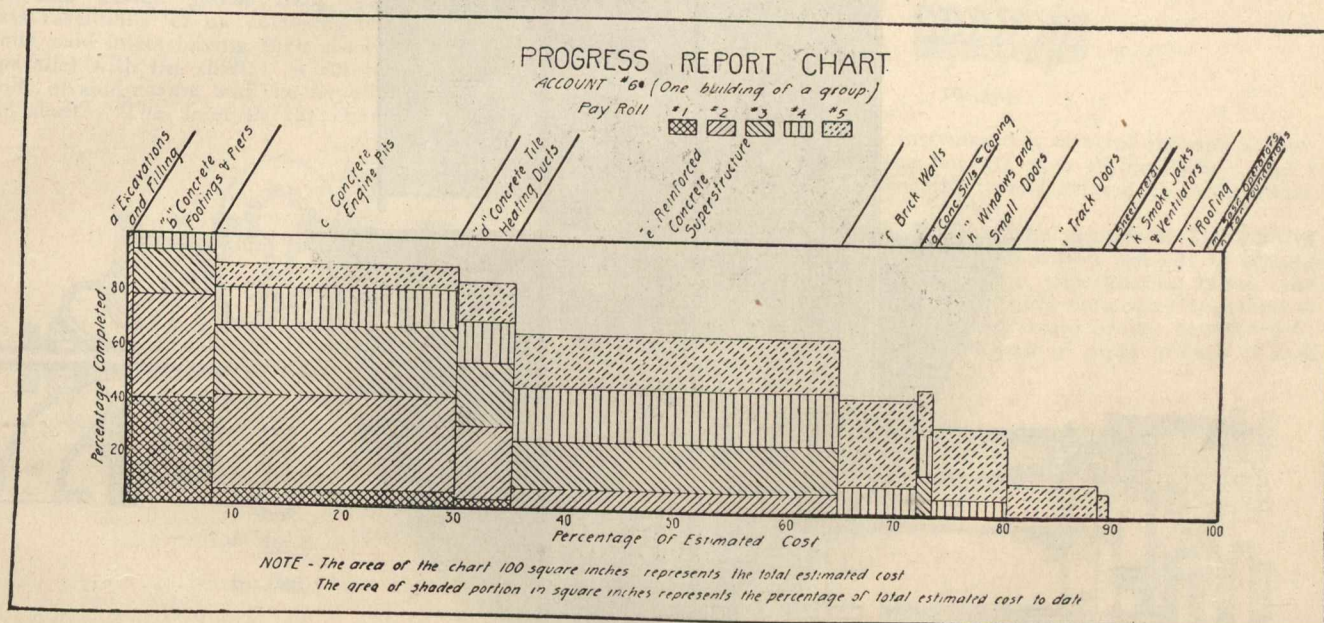


Fig. 3.

Thus a contracting company was formed and a construction department organized. This move developed the fact that the same brains which made the plans for an installation could be mixed with some enterprise and business ability, and thus actually bring about a complete result.

This worked so well that other contracts for complete electric systems were sought and secured,—sometimes as engineers, sometimes as constructors, occasionally as both. Civil, structural, architectural, industrial, and hydro-electric departments were added as the business grew. Systems of carrying on the work were perfected as experience dictated, and weak parts were made stronger. To-day this company has on its payrolls a technical force of over eighty men, and often employs on its construction enterprises thousands of skilled mechanics, experienced foremen, and unskilled laborers.

Most of the work of this company is done on the basis of "cost plus a percentage," that is, the work is done at actual cost, and then the Engineer-Constructor gets a percentage fee for his services. By such an arrangement the client or purchaser is relieved of the necessity of organizing a technical force of his own, or of employing a number of individual specialists. If the actual construction work is turned over to the Engineer-Constructor, then the client is relieved of the inconvenience of obtaining proposals and awarding contracts to a large number of separate contractors,

very probable that much of the important work of the future will be done upon this basis.

Such a business as has been outlined can only be built up by the demonstration of unquestioned ability, and the possession of not only absolute honesty, but also of those qualities which insure what has become known as the "square deal."

IRON ORE IN THE UNITED STATES.

The reserves of iron ore in the Lake Superior district, at present the leading American producer, are estimated at from 1,500,000,000 to 2,000,000,000 tons, of which the United States Steel Corporation is commonly supposed to control over three-fourths. This supply is being drawn to meet a constantly increasing annual demand, and it is conceded that before 1915 the district will probably be called upon to ship over 50,000,000 tons of ore a year. At such a rate the Lake Superior ores can hardly be expected to last beyond the year 1950. But there are enormous reserves in the South; these are estimated at a total, for the red and brown ores of the four States—Alabama, Georgia, Tennessee and Virginia—of over 3,000,000,000 tons. If to this are added ores occurring at deeper levels in the States named, the red and brown ores of Maryland, West Virginia, and Kentucky, and the magnetic ores of the other Southern States, it is assumed that the total American ore reserve will amount to very nearly 10,000,000,000 tons.