THE PATENT FACTORY.

By GEORGE ETHELBERG WALSH.

CONTRARY to a rather widespread impression an invention is generally a growth rather than a sudden inspiration. Moreover, it is often the product of several minds working along parallel lines, each contributing its quota of experimental knowledge. Forecasting an invention is not an impossible feat. The need of some sort of time-saving or labor-saving device is felt in an industry. Experts are called in and the ground thoroughly canvassed, impracticable methods eliminated, and the most feasible systematized and described. Then the work of developing the invention is turned over to experts, or rather to professional inventors, who can roughly forecast what they will do.

The conditions of modern industry demand the elimination of chance and uncertainty so far as possible. Inventions have upset business and manufacturing interests more than any other factor in the last ten years. The installation of expensive machinery is a costly undertaking if some inventor comes along with a patent six months later which practically makes the machinery ancient and obsolete.

"Last year," confessed a leading manufacturer of novelties, "my plant was practically knocked out by the invention of a device which makes it possible for my rivals to save \$50,000 a year. I must either go out of business or invest in new machinery and pay big royalties to the inventor. This periodical revolutionizing of conditions by new inventions is one of the disturbing features of manufacturing. Is it any wonder that big concerns keep a sharp lookout for patents and even employ an army of experts to watch the applications for new patents?"

The professional inventor works better in co-operation with others interested in similar subjects, the deficiencies of one thus often being supplied by another. Associations of inventors have therefore become important organizations in this industrial age, and most of our great patents are products of one of these "patent factories" rather than of a single individual.

Edison's patent factory is not an exception to this rule, for while his personality dominates the establishment over which he presides, and credit is given to him for the inventions, he has surrounded himself with experts whose labors contribute to the general cause. Not only is the great "wizard" relieved of a great mass of detail work by his assistants, but suggestions and experiments are constantly coming to him from his associates. In his "patent factory" he employs some of the best chemists and mechanical experts in the country. Work of an experimental nature is intrusted to them which would require years of patient toil from a single inventor without the equipment of the modern plant.

Tesla is another great inventor who conducts his own "patent factory." With one of the best-equipped electrical and experimental laboratories in the world, he has surrounded himself with bright young men who have succeeded in chemistry, electrical sciences, mechanics, and physics, and his labors of inventing are systematized to the point of simplicity. Most of Tesla's important discoveries in electrical science were predicted years ahead of their ultimate perfection, and the work of making good his promises has established for this inventor a unique position in the world of electricity.

Another important "patent factory," which differs from these two in some important respects, is the Ampere Electrochemical Company of Niagara Falls. Instead of a single dominating mind heading this plant, half a dozen inventors compose the company and direct its affairs. The company is not an operating concern, but purely an experimental organization or association of inventors. The object of the "patent factory" at Niagara Falls is to delve into the mysteries of electrochemistry for the purpose of discovering new processes for commercial application; but when a new patent is developed it is turned over to an operating company for exploitation. The inventors themselves have no interest in the applications of their patents.

The founders of this strange "patent factory" are men well known in the world of electrochemistry. Prof. F. B. Crocker, C. A. Doremus, S. S. Wheeler, and C. S. Bradley were the original organizers of the experimental plant, and later they had associated with them A. H. Buch, D. R. Lovejoy, H. E. Knight, N. Thurlow, and Charles B. Jacobs. The results of this "patent factory" are evident in a hasty glance at some of the most important electrochemical industries which have grown up around Niagara, where a vast amount of electric current can be had at small cost.

To this "patent factory" can be traced the discovery of the present method of making artificial corundum by fusing bauxite by a patented process; the work of obtaining nitric acid from nitrogen and oxygen by electrical methods; the different processes of utilizing and producing barium sulphate and barium salts for the purification of our drinking water, and the production of artificial camphor from turpentine at Port Chester, which a few years ago failed after a short experimental test.

The large industrial and manufacturing companies have in recent years established "patent factories" of their own, where experts conduct tests and experiments along certain well-defined lines for mutual interests. These commercial "patent factories" are equipped with the best laboratories in the world, and men of genius and experience preside over them. The association of half a dozen experts in such a plant tends to make the work of discovery and invention simpler and more practical.

The General Electric Company spends tens of thousands of dollars every year in supporting its "patent factory." The presiding genius of this plant is Dr. C. P. Steinmetz, an inventor of world-wide fame. He has to his credit a long list of patents which have helped to bring the generation, transmission and application of electricity up to their present-day efficiency. With him are associated men of almost equal gift for invention and specialists in certain fields. The total output of this factory averages scores of new patents and improvements upon old ones every year. Any employee of the company who has a promising idea is encouraged to present it to the head of the "patent factory," and if considered of value it is exhaustively tested and tried by experts. While the company holds all the patents developed by any of its employees, proper remuneration is made to the inventors, so that each one is stimulated to make suggestions and improvements. Frequently the development of a patent is more dependent upon the opportunities of the inventor to make exhaustive experiments with costly machinery and tools than upon the initiative impulse of the individual. Thus many valuable patents of to-day would never have been perfected had the inventors been forced to rely upon their individual means and work.

The Westinghouse Electric and Manufacturing Company is another representative concern which has a well-equipped "patent factory" in operation in connection with its manufacturing plant. Many valuable patents are taken out by this company, and most of them are traceable to the energy and foresight of the professional inventors employed by the company.

Another important "patent factory" is that of the Western Electric Company, which has to do largely, although not exclusively by any means, with telephone patents.

The various large concerns owning their own "patent factories" are rapidly specializing the work of inventing. The electrical manufacturers confine their attention to inventions in their industries, and the makers of special machines limit their tests and experiments to machinery in their particular line. The Ampere Electrochemical Company makes no efforts to invent dynamos and motors and equipments, but studies only the field of electrochemistry. Iron and steel mills find it more convenient and economical to confine their labors to the perfection of details of their plants and rarely branch out into other industries. In this way inventions are becoming specialized, and the professional inventor devotes his time and genius to certain departments of work.

The possibilities of inventions are probably greater in the electrical and electrochemical fields than in any other to-day. The electrochemist, in particular, has many untrodden paths ahead of him. By the aid of the electric current changes have been effected in the sugar and paint trades which make for efficiency. Electrochemists are to-day working with promise of success toward the manufacture of starch from by-products. Artificial rubber of fair value has also been produced, and the cyanides, silicides and ammonia are all promising products for the electrochemist. Synthetic electrochemistry is generally recognized as one of the greatest future businesses of the world; and that the Falls of Niagara were created for this purpose is the opinion of the workers in this field.

While the individual inventor may find his opportunities somewhat circumscribed by these changes, the gain obtained through the organization of professional inventors is great. Greater results flow therefrom, and the young man associated with a modern "patent factory" secures in time a training which makes his inventive gift of far greater value to himself and the world. In the field of discovery and invention of to-day expensive and elaborate tools and laboratory equipment are frequently essential to success, and the modern "patent factory" supplies these requirements. —Western Electrician.

THE MOTIVE POWER OFFICER OF A GREAT RAILWAY.*

AMERICAN railroads are usually built along the lines of least financial resistance, and improvement problems in grade reduction and curve rectification were handed down to the present generation of managements. Improvements in yards, at terminals, and at points in transit simplify the handling of freight, and soon the locomotive will receive its share of development. Heretofore, it has grown chiefly in size, weight, and power, but there remains another development in the direction of crowding the greatest possible capacity for power within the possible limits of weight and size. Economy of operation, while important, is less important to-day than the provision of the utmost possible capacity of the machine. Perhaps this may be more clearly stated by saying that the greatest need is for that which will extend to the utmost the capacity of the fireman and render the limited physical strength of a man capable of supplying the requisite power.

This is the locomotive problem for the immediate future—to provide more power without greatly increasing existing weights. A secondary, but scarcely less important, field for effort is the improvement of design and method of operation which will reduce road service failures.

Another opportunity for the greatest abilities lies in revolutionizing methods of motive power management to bring them into parallel with those methods which have brought the greatest successes in the management of vast industrial establishments. Altogether the mo-

* Address by Mr. G. M. Basford, of the American Locomotive Company, delivered before the Mechanical Engineering Society of Purdue University.

tive power problem presents possibilities as great as those of any field of mechanical activity, and these are worthy of the efforts of the best of men.

Thirty years ago the head of the mechanical department led a comfortable life. He could safely follow precedent, and the strenuous life had not been invented. Labor wars had not begun and the stirring emergencies of the present were unknown. It was easy to select shop machinery. There was no shop problem, no pooling of locomotives, no piecework price, no heavy locomotive or large capacity car, and no train four-fifths of a mile long. No one cared much about the records of performance or cost of work. Workmen were better trained and good apprentice systems were in force. There was no tendency to go outside of a railroad organization to secure any official, and railroad ways and methods were those of smaller days. There were emergencies, of course, but not the emergencies of to-day. Thirty years ago the railroad official was a good man and as efficient for the time as the official of to-day, but he was a very different kind of official. His facilities were crude and his responsibilities not so great. Locomotives did not weigh 50 tons and other factors were in proportion. The superintendent was his own general manager and he knew every man in the train service. The master mechanic knew all his shop men and the engineers and firemen. He knew their history and he knew all about them and their affairs. Each locomotive had a name and an engineer and fireman were assigned to it. They went into the shop with their engine or they were laid off while it was repaired.

We have no desire to return to the old methods, but those methods are now worthy of a thought, because while all conditions of service have greatly changed, we have not changed enough in our views as to the proper management and organization of the motive power departments. The past has left us a somewhat unfortunate legacy, of which the result only needs attention on this occasion. The result referred to is seen in the tendency for young men to be easily enticed away from railroad service after they have spent years in preparation for it and are fairly on the road to win success. As a legacy of the earlier days of railroads in this country motive power positions are not, as a general rule, made sufficiently attractive. This, however, is to be changed and the power to bring the change lies in the young men who now hold responsible motive power positions and in those who are to hold them in the near future. As motive power problems and possibilities become better appreciated and better understood, the railroads will surround motive power positions with greater attractions, which will eventually render it thoroughly worth while for the very best mechanical talent to prepare for work which, because of its attractions, will preserve this talent to the railroads. There are signs on the horizon to-day that this happy state is coming soon.

As to the locomotive problems of the present we have a few like these: Shall the next lot of passenger locomotives be single or double expansion? Shall we experiment to-day with superheating? Shall we order balanced compounds? Shall we not adopt improved valve gear? For the next very heavy freight locomotives shall we order articulated compounds? Shall we brave the criticisms of those who worship simplicity and order really better locomotives, even if a few complications are involved? In the shop problem, shall we or shall we not organize and operate large plants upon the well understood principles which have made large manufacturing enterprises successful? In the next order for 10,000 cars, shall we use all-wood, all-steel, or composite constructions?

These are live questions and those who are to decide them need to understand the reasons why they are presented and why they are pressing.

Shall the next lot of passenger locomotives be single or double expansion? Compounds, because of their favorable use of steam by dividing the range of expansion and the range of temperature changes in the cylinders, are more economical in the use of steam than are simple engines. This improves the efficiency of the locomotive as an operating unit, which is more important than economy. There is less cylinder condensation in a compound because the division of the expansion between the two cylinders reduces the range of temperature, and, therefore, reduces the amount of moisture condensed from the incoming steam for the next stroke. A further advantage in the use of compound cylinders which applies to the three and four-cylinder types lies in the fact that the steam is divided into smaller installments and not so much steam is required to pass through a given number of steam ports and passages. This renders a three and four-cylinder compound "quicker on its feet" than single expansion locomotives of the same capacity, and, as a matter of fact, the highest speeds in regular train service in the world are made with compound locomotives.

It may seem strange, in view of the superior economy of compound locomotives, that they have not been adopted generally in place of single expansion locomotives. Compounds are apparently increasing in favor at the present time, and this is to be explained rather on the ground of the increased capacity which they render available than because of their superior economy. It is claimed by those who have used compounds and discarded them that the additional cost of maintenance, because of the somewhat increased complication, more than offsets the advantage gained by saving a little fuel. While this may have been true some years ago, it is not believed to apply to the more recent types of compounds, and it may even be claimed at the present time that the feature of econ-