in the country and passed their early days entirely ignorant of cement sidewalks. What a pity we couldn't all have persuaded our parents to move out to the country before we were born. At any rate, it was Billy's good luck to enter the world under such favoring circumstances in the year 1865. In 1886 he graduated from Western Reserve University, receiving the A.B. degree. The next three years were spent at Johns Hopkins University, from which institution in 1889 he received the Ph.D. degree.

It is peculiarly fitting that the Perkin Medal should be awarded to him in this the first year of President Harding's administration, for right well does he represent the return to normalcy, all of his friends to whom I have written emphasizing the fact that from boyhood to the present time he has always been a normal individual. He has cultivated no particular hobby, considered by many to be an essential necessary to distinction, but has carried through life a love of experiment and an ardent zest for the lathe and mechanical tools. It is easy to understand, therefore, that in the environment in which he has worked he not only succeeded in cracking oil but carried the work on to a successful application on a large scale.

He plays no outdoor games, not even golf. This sounds abnormal, but to offset it he recently obtained keenest satisfaction in installing in his home under his personal direction a radiator system at one-fifth the estimate furnished by a contractor, and who wouldn't rejoice at getting the best of a plumber? I insist he is normal.

To him the days of college life and associations are as full of meaning as ever and he wears still his college fraternity pin.

Steadily he has been advanced in that company with which he began work after completing his university training, until to-day he occupies the presidency.

Throughout this advancement he has remained the same sincere, sympathetic, level-headed man to whom his friends and associates come with their problems for his sound advice.

That he has worthily won this great honor from his associates in business all agree, that throughout it all he has preserved his unaffected selflessness all will rejoice; but there is another aspect of his success which deserves not only record here but wide heralding at this stage in the development of American chemical industries. The industry with which he is connected is one of our early and now thoroughly stabilized industries, and it is peculiarly worthy of note that the Standard Oil Company of Indiana has chosen for its chief executive a chemist. Not all chemists are qualified to be executives, but certainly our chemical industries will be placed on a much sounder basis when the chemist of proper qualifications is given opportunity to share in the determination of corporate policies. Billy Burton's record may yet prove the harbinger of a new day.

The Chemist in Industry

By Russell Wiles

The patent lawyer is in a peculiarly favorable position to obtain a bird's-eye view of industry as a whole and of the general tendencies of industrial development. No one is in such close touch with so many industries and certainly no one has had occasion to study the general progress of industry so carefully.

EPOCHS OF INDUSTRIAL PROGRESS

Industrial progress might be divided into epochs almost as distinct from each other as the paleolithic and the neolithic ages and, like those ages, overlapping each other. The first great stride toward modern industry was the steam engine. To it, for many years, inventors have given their best efforts, but so far as great progress in this field is concerned nothing has been done for years.

The steam engine having supplied power, there followed an immense development of power-driven machinery of all sorts, resulting in the production of old articles at lower prices and countless new articles which it would not have paid to make by old methods. While new machines are still being made, very little of a novel or fundamental character has been done for many years. The principles of machine design are well understood, and it is the commonly accepted belief that an auto-

matic machine can be made, which will do anything desired, providing the demand for its product is sufficiently great to justify machine manufacture.

For the last half century the most conspicuous inventions have been those of the electrician. He has given us the telephone, the telegraph, the dynamo, the motor, the electric light, and countless minor conveniences, the aggregate effect of which has been to revolutionize society. The work of the electrician has not ceased, but the fundamental principles of electricity are quite thoroughly developed and, in the main, progress will probably follow lines which are to-day generally predictable.

Of recent years the development of the internal combustion engine has provided us with many hitherto unknown luxuries, conveniences, and necessities.

THE PLACE OF THE CHEMIST

It is only, however, in the last few years that the chemist has begun to take his proper place in industrial development. Great chemical discoveries have been made in the past. Much has been done in chemistry as a pure science, but it is within comparatively recent years that the chemist has emerged from his laboratory and that industry, as a whole, has felt the need of close coöperation with him. Where, ten years ago, big practical applications of chemistry were rare or confined to a few specialized industries, to-day nearly every progressive plant is regularly employing chemical assistance in one form or another, and

WILLIAM M. BURTON

there is scarcely an industry which has not been more or less affected by the progress of chemical science. Chemical inventions, at least as exemplified in my own practice, are at least ten times as numerous as they were a decade ago.

The work of Dr. Burton may well be regarded as an early example of the great things the chemist is to accomplish in the future, rather than as an achievement which is to be unique in history. The epoch-making inventions of the future will probably be those of the chemist and physicist. It is hard, indeed, in this day of physical chemistry and molecular physics to say where one science begins and the other leaves off. Perhaps it is in the border region common to both that we may look for the most startling discoveries.

The chemist is to-day not only giving us fresh supplies of old products, usually in better and purer form than we had before, and at lower prices, but he is giving us new compounds of every conceivable character with which to rebuild our general industrial structure. The time is not far distant when no engineering undertaking will be complete until the chemist has been consulted to ascertain if the structural materials are the best that can be obtained for the specific purpose. It will be as much the duty of the engineer of the future to build out of the right materials, whether synthetic or otherwise, as to build the right size and shape. The arts are to have available for their use not a few dozen basic materials of which everything must be built but thousands of materials, each having special points of advantage for certain particular uses, and chemical processes are sure to replace many complex mechanical ones. The chemist will revolutionize industry, not once but dozens of times. Indeed, it may well be questioned how long the name of your Society will remain distinctive. I expect to see the day when all industry will be more or less chemical industry.

That the oil industry, as particularly exemplified by the Standard Oil Company of Indiana, has been perhaps the first big established industry to be thoroughly overturned by the work of the chemist, is partly fortuitous—partly due to the remarkable ability of him whom we gather to honor to-night, and partly due to the remarkable organization which he has built up.

It was the discovery of the evil-smelling sulfur-bearing oil in Ohio which forced the chemist into the oil business. Dr. Burton was one of the very first thoroughly trained chemists in the oil industry. His solid groundwork in pure science had been acquired under Dr. Ira Remsen, who, perhaps more than any one else, is responsible for what the American chemist is to-day. Bringing a thoroughly scientific point of view and applying to his problems the methods of pure science, with his great natural ability and indefatigable industry, it was entirely unavoidable that Dr. Burton should profoundly affect the industry in one way if not in another. No man has ever had a more promising field—an enormous industry dealing with problems which ought to be handled in an essentially chemical manner and having no chemists at all. Dr. Burton would be the first to recognize his splendid opportunity, and it is characteristic of him that his opportunity never was neglected.

ORGANIZATION OF STAFF OF STANDARD OIL COMPANY OF INDIANA

But Dr. Burton alone never could have accomplished what has been done by the Standard Oil Company of Indiana. There has been much discussion in big corporations as to the best method of correlating the scientific force with the manufacturing force. All sorts of experiments have been attempted and all sorts of systems have been devised. The system worked out by the Standard Oil Company of Indiana, largely at the instigation of Dr. Burton, and of recent years under his guidance, is unique and amazingly successful. None but a scientifically trained man would have dreamed of such a system, and the operations of the Indiana Company are the best demonstration of the industrial value of scientific training.

The system is founded on the premise that a scientifically trained man is a good man for any job; the scientific staff does not coöperate with the manufacturing staff—it has become the manufacturing staff. The practice, so far as concerns chemists, has been to take on trained men for the laboratory force precisely as in many other plants. After brief association with the laboratory, during which the newcomer can become familiar with the peculiar problems of the works and particularly of some special department to whose problems he is assigned, he leaves the laboratory and goes into the works in some subordinate capacity. It then becomes his prime duty to test, on a practical scale, whatever improvements may fall within the sphere of his department. Having once become established in the works, it has been found that almost without exception the scientific men become excellent executives and their promotion is rapid.

The result is that the manufacturing department of the Company not only maintains an excellent research department, but that the whole manufacturing organization from top to bottom is largely dominated and controlled by men of scientific training. The Standard Oil Company of Indiana is unique in this regard and the tremendous success of its manufacturing department must be very largely attributed to the superb organization which Dr. Burton conceived and has built.

The system has been worked out to the fullest extent at the largest plant of the Company. Let it not be understood that the chemists are the only men of scientific training in the organization. There are more chemists here in executive positions than in any other industry of which I am aware, but along with them are a considerable number of engineers holding equally important positions, and whose coöperation on many problems is vitally necessary. We have become accustomed to finding engineers in executive positions; the Standard Oil Company of Indiana is unique in the number of chemists similarly employed. And it is unique, too, in the almost complete control of its manufacturing department by men of scientific college training. A brief survey of the personnel of the Company is extremely illuminating and is one complete answer to the problem of the relation of the scientific man to industry. Of the men I am about to enumerate, the majority hold a doctor's degree, and, those who do not, have had undergraduate training of an extremely thorough character in science or have the training of engineers.

The scientists in the Indiana Company include the president, another director, the general manager of western plants and his assistant, the superintendent, assistant superintendent, refinery superintendent, paraffin works superintendent, assistant superintendent of acid works, and head chemists, all of Whiting, the head of the department of service to licensees, in addition to the usual corps of research men in the laboratory. With such an organization no problem in applied chemistry seems difficult. There is scarcely a man on the manufacturing staff who is not personally capable of solving any ordinary chemical problem, of clearly understanding and passing judgment on any chemical processes submitted, or of putting any ordinary chemical process into practical operation.

Dr. Burton must be given the credit for evolving this system and developing this organization. He has proved by the acid test of practice that the scientifically trained chemist is not only a good theorist but nine times out of ten a first-class executive, and that as an executive he is supremely successful, because of the accuracy with which he can predict results and the speed and directness with which he attains them. This work of Dr. Burton ranks high in importance beside the creation of the process which bears his name.

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In extending to William M. Burton this highest honor in your power, you honor one who has brought honor and credit to your profession, a scientist of scholarly ideals and high attain-