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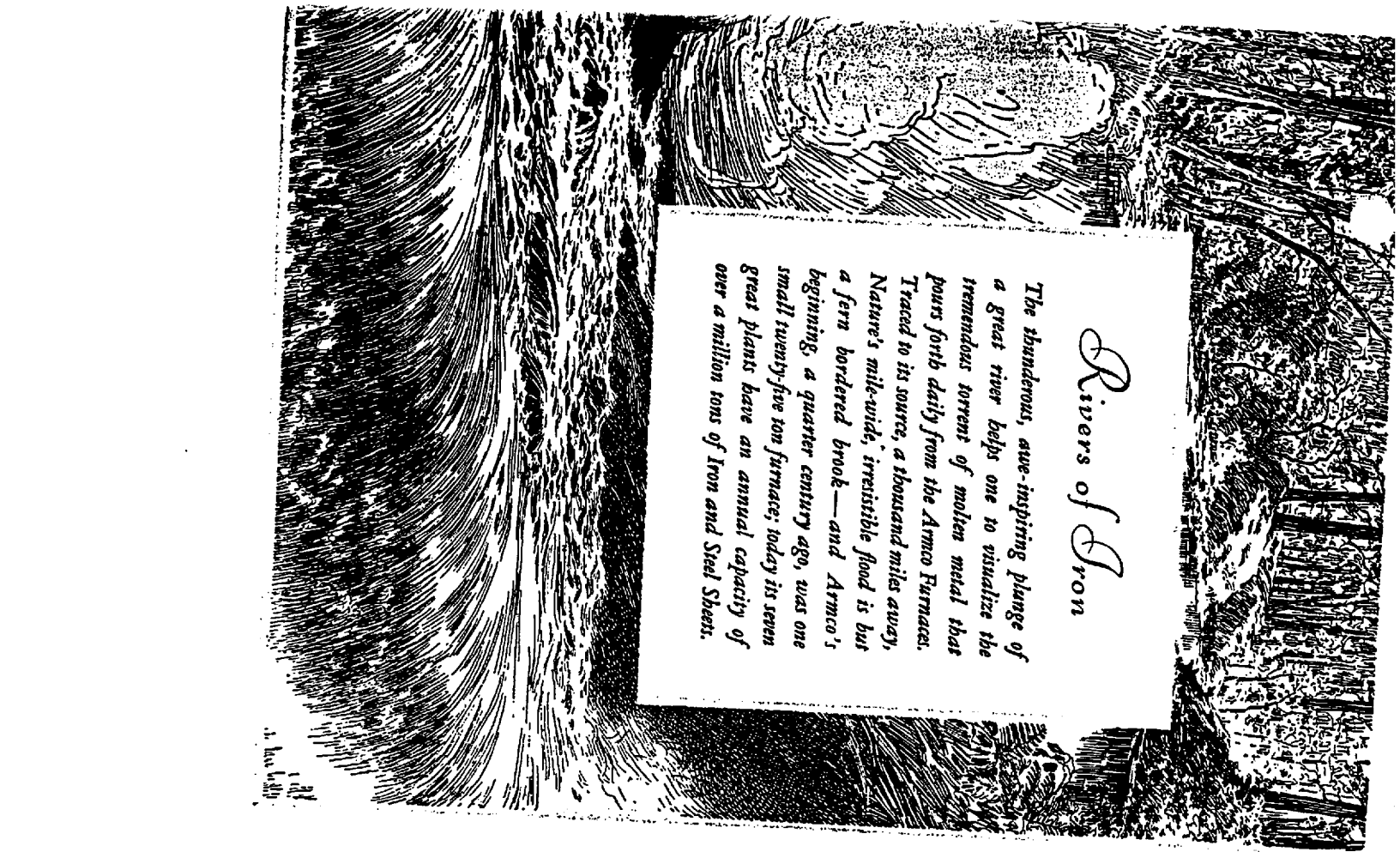
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The Story
of
ARMCO

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THE AMERICAN ROLLING MILL COMPANY
MIDDLETOWN, OHIO



Rivers of Iron

The thunderous, awe-inspiring plunge of a great river helps one to visualize the tremendous torrent of molten metal that pours forth daily from the Armco Furnace. Traced to its source, a thousand miles away, Nature's mile-wide, irresistible flood is but a fern bordered brook—and Armco's beginning, a quarter century ago, was one small twenty-five ton furnace; today its seven great plants have an annual capacity of over a million tons of Iron and Steel Sheets.

born of its belief that everything that makes for better civic, moral, physical, social, and educational conditions, anything that is helpful to the community as a whole, is of the most vital interest to the company and deserves its largest sympathy and most liberal support.

Cooperation is the present-day reward that has come out of the mistakes of the past. It has been bought and paid for by the tragedies and misunderstandings of earlier days. Man has come to know that through cooperation the impossibilities of yesterday become the realities of today, and that without it progress is not possible.

Believing this, it has been the ambition and purpose of the Armco Management, in all its dealings, to combine in proper proportion a spirit of fairness, a square deal always, both in theory and practice, a big broad view of every problem, a spirit of unselfishness, of loyalty, and of courtesy to and consideration for everyone.

A foundation of research and engineering enterprise and of modern industrial management has been laid. Its further development and perpetuation supported by eternal vigilance and high endeavor will be the Armco watchword of the future.

As work becomes more complicated, more training is needed and more instruction must be given either before or after the employment begins. The Armco Training Department gives instructions that have a direct bearing on the manufacture of Armco products; that will contribute to the making of a better product at a lower cost. The relative amount of training varies greatly and depends upon the positions held by the employees receiving it.

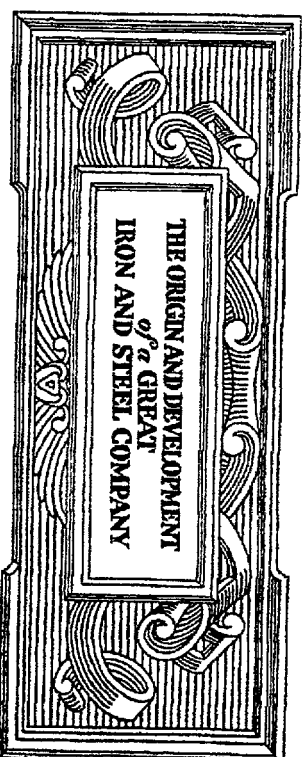
The courses include such branches of study as metallurgy, physics, chemistry, business law, industrial history, correspondence, economics, salesmanship, blue-print reading, typewriting and stenography.

By such procedure, which has encouraged class relationship among the rank and file, there has been built up at Armco an ideal spirit of confidence in and cooperation with one another. The strength of such a bond is better realized when one knows that in all its years of existence Armco has not had one hour of labor trouble.

Moreover, men have labored together in such a close fraternal spirit that they have made history in their safety work, the electrical group at Middletown having gone ten years without a major accident, while Armco, as a whole, was awarded the international safety trophy at the Springfield, Illinois, meet.

From its very inception, Armco has pinned its faith to men. It has admitted and insisted that it must stand or fall according to its ability to gather around it a group of able, earnest, and thoroughly trained men, sufficient in number to meet the need of each succeeding period.

It has endeavored to create a working partnership between the community and industry, to the end that community conditions might as a whole respond to the highest need of that type of the best industrial worker. This policy has been



MODERN INDUSTRY is the servant of economics. Economic law is inexorable. It always demands and exacts its toll of those who do not appreciate it as the key to growth and progress. In these days of mass production, high wages and low prices, no possible economy can be overlooked. Profit must come from an ever-increasing economy in production and distribution making quality and service possible at the lowest price obtainable with the best manufacturing facilities that can be devised, the capital invested, and the hazards involved. Armco's study of economics has been a large factor in building a world-wide Armco service.

The momentum that the iron and steel industry of today has gained is nothing short of tremendous. Millions of tons are in daily use, and increased demands by reason of new developments such as the advent of the automobile and the airplane, act as accelerators in the swifly moving panorama.

With each new market for iron and steel products has come a new need for high-grade special analysis materials, especially in sheet metal manufacture. Scientists and metallurgists have been called upon to spend days and years in the laboratory in painstaking research and study of the problems involved. Meeting this demand is one thing; stimulating it is quite another. It means wider service built upon the pioneering

spirit of leadership. In the more recent progress of the iron and steel industry these two phases of growth have been decidedly marked.

On the side of stimulating iron and steel opportunities by producing special analysis sheets to meet new and exacting uses, the name "Armco" has become preeminent in all parts of the world.

"Armco" is the trade-name of the products made by or under the license of The American Rolling Mill Company whose certificate of incorporation was issued on December 31, 1899. Ground was broken in Middletown, Ohio, early in 1900, and actual operation of the first "Central Works" plant was begun on February 7, 1901.

When the first heat of steel was poured from the original 25-ton open-hearth furnace, the making of steel by the open-hearth process was in its infancy. Today this is the generally accepted method, as approximately 85 per cent of all the iron and steel ingots now being produced are made by the open-hearth process. The open hearth proved to be a very flexible and high powered furnace and to its flexibility is largely due the very great development that has taken place in iron and steel making.

As one of the pioneers in open-hearth practice, Armco early saw its possibilities. The original furnace was enlarged and within the next three years, two additional 50-ton open-hearth furnaces were built in an effort to further reduce the manufacturing cost.

Still more capacity was needed by the young and growing concern. Sheet mills at Zanesville, Ohio, were purchased in 1905, and immediately the available tonnage of finished sheets was more than doubled, and overhead materially reduced.

During the ensuing five years, pure iron—Ingot Iron—was developed, and the demand for this new metal, together

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played, they must already have been trained in chemistry, metallurgy, or the particular engineering science involved. Each summer Armco employs many young men shortly after their graduation from technical schools. In an effort to get acquainted with the most desirable of those undergraduates who are interested in industrial employment, a representative visits the larger engineering colleges during the school year and consults with members of the faculty and meets students who are preparing for industrial careers. Each year a few second and third-year men work during the summer vacation, and get a first-hand knowledge of mill conditions. This helps them reach a decision.

Some of the most important positions—positions of responsibility requiring men with exceptional technical knowledge—are now filled by men selected in this manner.

A history card of every man in the Company's employ is on file. This contains the usual personal description, date and place of birth, the date of employment, and every transfer from job to job or change in rate. In addition, it contains the record of his accomplishments—the outstanding things he has done. It also contains a record of any very serious difficulty in which he has been involved.

Once a year, a labor audit is made. The record of every man above the class of common labor is most carefully reviewed in conference with his superior, and oftentimes his associates.

After the completion of an audit, the information is carded and indexed. When a vacancy has occurred, or is about to occur, the names of the men who have been considered for that position are again reviewed. The more important the position, the more care is taken in the study. When the progress of an individual has been slower than was anticipated, the reason is sought. When it is more rapid, it usually speaks for itself.

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with a minimum of \$1000 of insurance. The "turnover" for men with a year's service is very small.

Work has become so specialized in Armco mills that even men in the regular skilled trades find it difficult to follow their trade until they have served an Armco apprenticeship, which though not a formal one in the narrow sense is nevertheless a real one. So true is this that furnace helpers and foremen meters of open-hearth furnaces, trained in mills making common grades of steel, are unable to fill similar positions satisfactorily in "quality" mills, and, likewise, men trained for these jobs in "quality" mills have almost equal difficulty in mills where the emphasis is placed upon the making of large tonnage of common steel.

The manufacturing processes begin with the raw materials—iron ore, coal, coke, and limestone. They end with the finished sheet. Armco employees, therefore, are required to know how to make pig iron, special analysis iron and steel ingots, bars, billets, plates, and annealed and processed special alloy sheets. The art of mining iron ore, coal, and limestone is largely the same in all mines, and miners can go from one mine to another and do their work satisfactorily. Likewise men can go from one blast furnace to another and quickly fit in, but such is not the case in steel works and rolling mills manufacturing special grades of quality products. The result is that in rapidly increasing numbers these mills are finding it necessary to train and develop skilled employees from within their own organization.

The condition as outlined respecting the selection of the "skilled" employee is quite different from the condition governing the selection of the man with technical education. The value to the company of employees engaged in research and technical work is in almost direct proportion to their knowledge of the processes and problems directly connected with our special products; but when these men are first em-

with that of all other Armco products, increased so rapidly that further capacity became imperative.

The directors of the company approved a plan of progress that provided for the construction of the large East Side Works, where big mill practice took the place of small mill practice at Central Works. The building of this new plant increased Armco's capacity three times and new markets were quickly found to justify the venture.

The World War in 1914 brought many new problems. In order to serve regular customers and still enable the company to take care of the unexpected demands of the United States Government, four new open-hearth furnaces and a large Forge Shop were constructed. At this same time it was also deemed advisable to support Armco's operations through the acquisition of the blast furnaces and other properties—coal, iron ore and limestone—and the Columbus Iron and Steel Company with its large production of pig iron was brought into the Armco organization.

At the close of the world war additional finishing capacity was found to be necessary to enable the Company to utilize the four open-hearth furnaces constructed at East Side Works, Middletown, during the war, to meet the demands of the government.

To meet this need eight additional sheet mills were built at East Side Works and four at Zanesville.

Due to the ever-increasing necessity of maintaining the lowest possible prices on basic products, to stimulate and encourage a larger consumption of sheet metal products and to keep up with the demands of mass production and high wages, the need for new and better methods of manufacture became increasingly apparent as the years went by.

The acquiring of the properties and plants of the Ashland Iron & Mining Company at Ashland, Kentucky, in January, 1922, provided a splendid opportunity for meeting this

need and at the same time it met the ultimate needs of the steady growth of the Company's business.

Armco engineers and operators had for some ten years been working on the development of an entirely new method of rolling sheet metal, a mechanically operated continuous sheet mill.

Two blast furnaces and a modern steel plant were already constructed and in operation at the Ashland works, so it was only necessary to successfully design and construct a new finishing mill of whatever type was desired to enable the Company to realize on the experiments and developments that had been made.

A new finishing mill, most carefully designed to carry out the contemplated development in the whole scheme of manufacture of iron and steel sheets, was constructed and put into successful operation within a period of three years. Armco demonstrated its outstanding leadership by being the first organization in the world to successfully roll iron and steel sheets by a continuous mechanical process from the ingot to the finished sheet. In five years from the time the Ashland properties were purchased every problem involved in the new method of manufacture had been successfully worked out; and every estimate made or hope registered—covering costs, tonnage, and quality of product—had been exceeded.

Heretofore the making of steel sheets had involved the rolling and re-rolling of ingots into blooms, bars and sheets. In rolling bars into sheets the workmen handle the pieces of metal after each pass through rolls. In the continuous mills, an ingot starts in at one end of a train of rolls one-half mile in length, and comes out at the other end as sheets of the required gauge or thickness.

A radically new manufacturing development usually demands further progress. In July, 1927, Armco acquired the

Another policy followed that affects all groups is that of recruiting men through Armco workers. When men are not available within the organization, the employees are asked to recommend some one for the position. Some may think this a questionable procedure, but it is used with complete success. Armco employees know the work and the qualifications required to do it; they know that it will be to their credit if they recommend a man who "makes good", and they have a better knowledge of the character and ability of an acquaintance and how he will fill the job than an employment man can have of a stranger. Men of all classes have been located in this way. Many technically trained men are found by this method.

No one is employed without first being examined by a doctor of medicine. From the examination it is learned for what work a man is best fitted physically. Men being considered for such positions as locomotive engineer or crane operator are required to possess much better eyesight than would be required of one who is expected to operate a wheelbarrow or a shovel. Likewise, a man with strong muscular equipment is preferred for pick and shovel work or a place on the mills. After these newly employed laborers have been conducted to the departments in which they are to work and placed under a foreman, their period of probation begins. Whether or not they become permanent members of the Armco organization depends first: on how satisfied they are with their work, and second: on how satisfied the company is with the way they perform the work assigned to them.

It is then the final tests are made. It is during the probationary period that selection is really made. No one is considered a permanent member of the organization until he has been in the employ of the company one year. At that time, his life is insured at no cost to himself in an amount equal to one-half of his anticipated annual income

in the employ of the company, may be, through sickness or injury, rendered incapable of performing his duties; and to promote the general welfare of the members through social, recreational, and athletic activities. It maintains a sixty-piece concert band which gives free concerts once a week during the summer in one of the parks maintained by the company. This association is financed by dues from the men. The company contributes an equal amount. So, in a way, it is a partnership affair, although the control rests entirely with the employees.

One of the most important policies is that of promotion within the organization. This is done wherever possible and has several advantages; the most important of which is the stimulating effect upon the ambitions of the worker throughout the organization. When men know that they will be considered and promoted whenever there is an opportunity, they naturally not only take more interest in the work they are doing, but are encouraged to prepare themselves, by study and extra effort, for more important work. By this policy, the time and money required to train inexperienced men is saved, and it is no longer necessary to "break-in" men under operating conditions with the accompanying loss of materials and misdirected labor. When a vacancy is filled under this plan, it is by one already trained to step in and do the job with the least delay and confusion. To illustrate: Men working in departments where machinery is served by overhead electric traveling cranes may and do, on their own time, get up in the cabs of the cranes and learn how to operate them. They do this after their regular work. Of course, permission must be had and arrangements made for each student. The result is that trained crane operators are always available, and not only are they proficient crane operators but operators who are familiar with the problems and peculiarities of the department, not only the mechanical ones but the human ones as well.

properties, plants and patents of The Forged Steel Wheel Company, of Butler, Pa., and of the Columbia Steel Company, of Eljyria, Ohio. The Columbia Steel Company had been the first to develop a mechanical process for the rolling of sheets in strip form, and its purchase brought together under the Armco banner the first aggregation of plants, patents and equipment for the continuous rolling of both sheets and wide strips.

This aggregation of three complete production units, Middletown-Zanesville, Ohio, Ashtand, Ky., and Butler, Pa., will, when fully rounded out, give to Armco an annual capacity of not less than one million tons of high-grade finished sheets with which to supply the needs of its ever-growing number of clients.

Armco's commercial progress has, of course, always had to keep in advance of its manufacturing development. In the beginning its business was confined to a territory within a few hundred miles of Middletown, and its products consisted of high-grade black and galvanized sheet steel for general building and commercial purposes. There was practically no such thing as special analysis sheets prior to the days preceding Armco's beginning in Middletown.

Armco entered this new field of special analysis sheets early in its history and has devoted all its efforts and its entire capacity to that end. As a result of the growing demand for new and more highly finished grades of sheet iron and steel, the industry as a whole has grown from a total production of some 800,000 tons in 1900, to approximately 5,000,000 tons in 1927. Armco has shared in this growth. It is today the largest exclusive manufacturer of special analysis sheets in the world and its products are marketed in all parts of the world. Armco has many thousand customers in the United States; it has seven steel company licensees manufacturing its special products in

England and Scotland; it has one such licensee in France and another in Germany.

The foreign sales of ARMCO are carried on through the ARMCO International Corporation, which is separately organized to handle the distribution of ARMCO products in all countries other than the United States and Canada.

ARMCO's exceptional research and manufacturing facilities, together with its working organization, now over 10,000 in number, have been created and developed for the definite purpose of placing the company in position to continue the development and production of the most difficult and valuable grades of iron and steel sheets, and to give such a maximum of service as may be demanded from time to time by a rapidly developing civilization.

Notwithstanding the fact that ARMCO's original investment of \$500,000 has grown to approximately \$100,000,000, and that the total progress of the company represents a growth in tonnage capacity of 5400 per cent in 26 years as compared to a growth of 204 per cent in the iron and steel industry as a whole, never in the history of the company has the factor of getting big for the sake of mere bigness had any place in the solving of the problems of progress.

The pioneer always precedes progress. Habit and tradition become strongly entrenched. Some one must always show the way along new paths into greater fields of accomplishment. ARMCO has pioneered since its earliest days and it has paid the full price that pioneering demands of its adherents. New products, new processes, new and better equipment and radically new methods of manufacture have been the result. ARMCO pioneering has been back of all ARMCO progress and service.

To do the sound, the necessary thing, to insure permanent success, is the factor that has governed all things ARMCO.

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such as employment, medical, training, safety, mutual interest, home service and personal records.

In addition to these regularly organized departments, contact with the workers is also maintained through Advisory Committees. These committees are approximately fifty in number and represent each group in the organization. They are elected annually by secret ballot. Every employee who has been in the continuous service of the company for at least one year is entitled to vote and is eligible for election.

It is the committee's privilege and duty to take up with their department superintendent anything which in their opinion is not being handled properly. It may be a question of production or a personal matter. The superintendent may likewise call upon the committees for advice or to give them information which he thinks they should have. The department committees meet whenever need for their action or services arises. On call, all of the department committees meet as a General Advisory Committee under the chairmanship of the General Manager. The larger committee holds the same relation to the general management that the departmental committee does to the department. Its functions are to advise and learn the policies of the general management, to convey to the employees whom they represent an understanding of these policies, and to reflect the sentiment of the employees on such matters as may be of help to the general management. The committees have no administrative, legislative, or executive functions. They simply constitute another means whereby better understanding between management and men can be fostered.

One other organization has a very great and beneficial influence on the workers. It is the ARMCO Association conceived by and conducted in the interest of all the men and women employed by the company. The purpose of the association is to afford relief to any member who, while

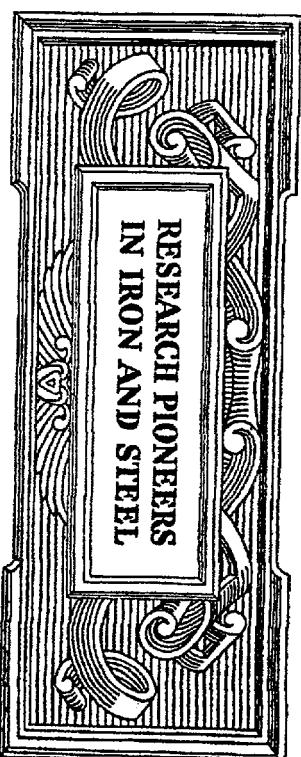
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measure, its organizers believed that it would be necessary to adopt and to practice such policies as would bring about a condition of mutual confidence and create a spirit of sympathy and of real cooperation among the members of its working organization, its customers, its stockholders, and the citizens of the communities in which its plants are located.

Confidence is created when carefully thought out policies are definitely stated so the man on the job knows where his company stands on all matters of prime importance to the organization. In the matter of compensation, Armco's published policy states: "It is Armco's wage policy to pay for every class of service a standard of compensation as high as is current in competitive industries. It is Armco's ambition to develop an organization of such spirit, loyalty, and efficiency that it will be possible for individual members to earn and receive better compensation than if performing a similar service in other fields of effort."

Before workers can have the understanding upon which confidence is built, they must have a knowledge of the relation that wages and production per man bear to costs. Men are "square" and the vast majority of the workers want to do right and will quickly respond to fair treatment. It is the responsibility of management to devise plans whereby the rank and file can secure a clear and simple explanation of the problems of business as they relate to not only production in which they are directly concerned, but in financing and marketing as well.

When the company was small and its management was in personal contact with the workers, it was a simple matter to keep them informed. As the scope of activities and number of employees increased, it was found desirable from time to time to organize departments to direct personnel functions,



DELVING into the unknown in an earnest, systematic search for new truths, new facts, new ways, bringing to light thousands of records and tests made available for the solving of new and difficult problems, this is the part research must play in modern industrial development.

The very foundation of Armco is built on research. For more than twenty years it has carried on iron and steel research work—chemical—metallurgical—magnetical—and mechanical—in large, fully equipped laboratories devoted to the development of products and processes of sheet iron and steel manufacturing.

Research in the iron or steel industry is designed to develop more serviceable iron and steel products. Upon iron rests the solid structure of business. Without it, many industries could not exist at all. In this respect, iron may therefore be called a far more important metal than silver or gold. Consequently, the research work that Armco has done in connection with iron and steel is of great importance. One of the first problems confronting the Armco research department was this: "Can you develop a rust-resisting iron?" That question was brought up in 1905 by complaints from Midwestern farmers to the U. S. Department of Agriculture at Washington that their fence wire was rusting too rapidly.

Many of them said that they had not been receiving service from this wire that they had reason to expect. The problem was turned over to the government scientists with the result that Bulletin No. 239 written by Dr. Allerton S. Cushman was issued. It was broadcast to manufacturers of iron and steel as well as to fabricators of fence wire, pointing out that the failure of steel wire was due to electrolytic action caused by the impurities in the steel. The bulletin recommended an effort be made to lower these impurities.

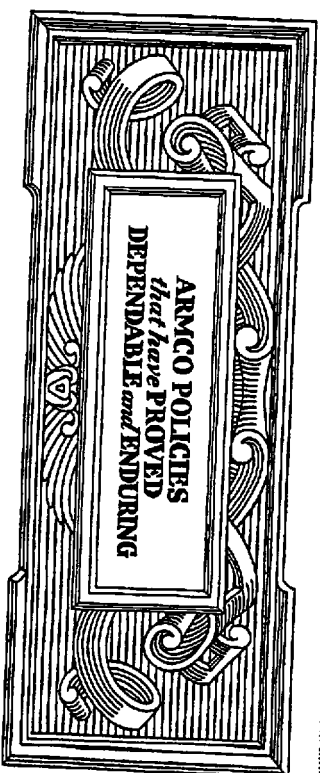
Purer Iron! Here was a challenge which was worthy of Armco's best effort. It afforded an opportunity to pioneer in a new field of metallurgy.

The importance of research in the development of a product to reduce the tremendous losses by corrosion has been a study contributing to the corrosion losses. Here also was applied the electrolytic theory of corrosion which reveals the way tremendous waste due to the rusting of iron and steel. The scientific world was slow to accept the electrolytic theory of corrosion, but it can be said of the research department of Armco that it was one of the leaders in the advancement of this thought which is today generally accepted by chemical and metallurgical bodies.

After many years of experiment, it was found possible to make commercially pure iron by much the same method that steel was made by perfecting numerous improvements in the process.

It was necessary to heat the metal to a higher temperature, to refine it in the open-hearth furnace for a longer period of time, to take greater care to eliminate impurities, and to give it rigid analyses throughout the process.

As the years went on, still other improvements were made. Old methods were discarded for new, and, like the cham-

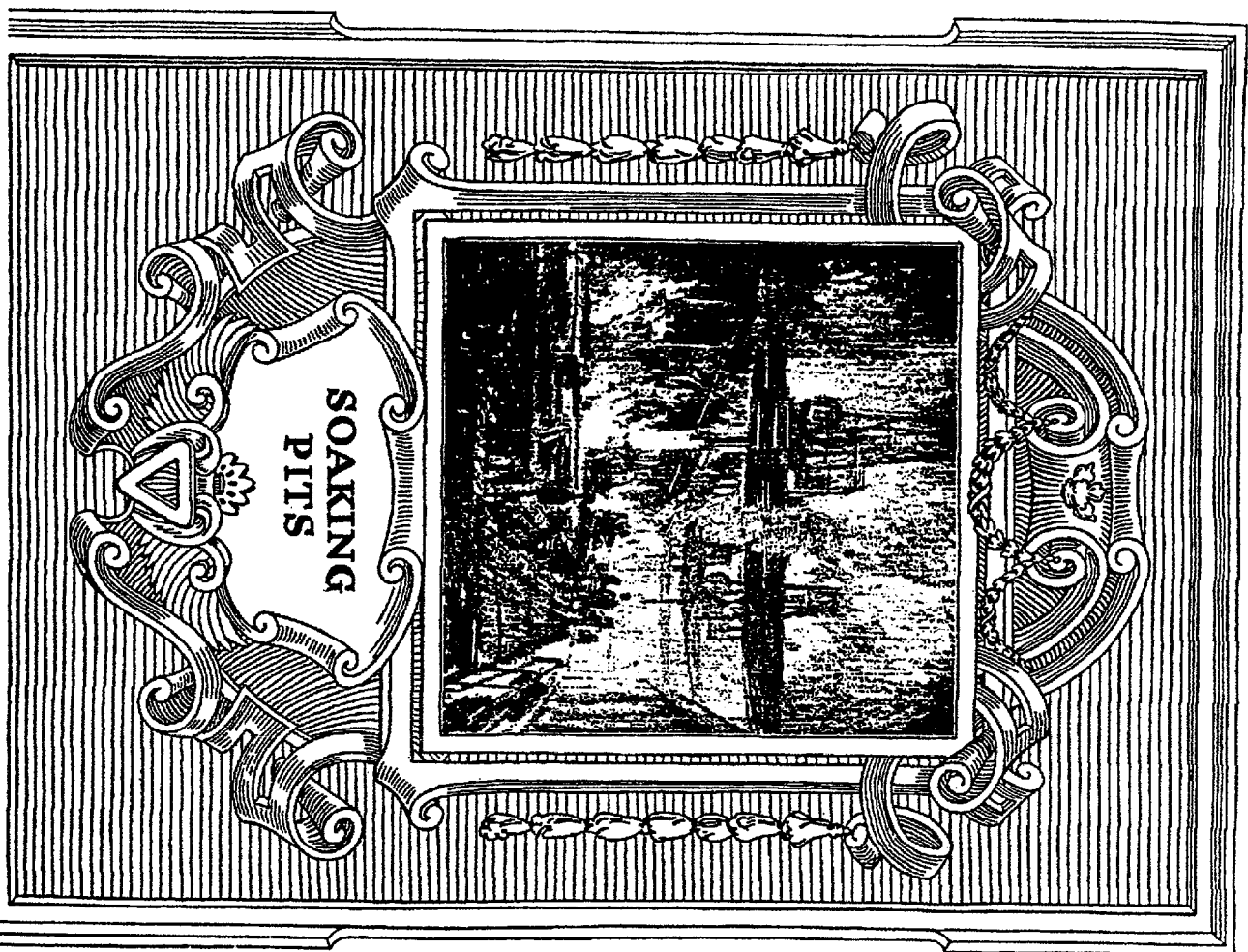


FROM its earliest days, Armco has placed the development and cooperation of men over and above every other problem in importance. Without men, loyal, energetic, trained, enthused, and intelligently directed, machinery and equipment even of the most modern conception are lifeless things. The most automatic and astounding of mechanical processes must be inspired and directed by man, for men are the keynote of efficiency and progress.

Armco men, a coordinated, synchronized, high-spirited army, ten thousand strong, are devoting their united effort to the creation of "service to clients" in all that the word implies.

Every business has a purpose and should be governed by principles and policies through the operation of which it is expected to secure maximum results. Many years ago, the management of Armco recognized this and by formal action of its Board of Directors expressed the purpose and principles which were to govern the management of the company.

This resolution states that Armco was organized to provide a high class permanently profitable investment through the manufacture of such special grades of iron and steel as would be required in the fabrication of high-grade sheet metal products. To secure such a result in the largest



bered nautilus, Armco Ingot Iron gradually emerged from its humble origin into an established and important iron product, known and used the world over.

Only by carefully analyzing the raw materials was it possible to produce such a pure iron in the basic open-hearth furnace. It was necessary to analyze the coal, the hematite ore, the coke, the pig iron, the scrap, dolomite, limestone, everything in fact that is required for the various steps in production.

Materials to be charged into the open-hearth furnace must be carefully weighed in order that the proper amount of each is used. When the heat is almost ready to tap, the open-hearth furnace foreman dips a test spoon into the molten metal and lifts out a sample. He pours this into a test bowl and when cooled, the solidified metal is taken out of the mold and is transferred to the control laboratory where it is drilled. The clean drillings are analyzed and the result of the analysis indicates the exact character of the metal in the furnace.

When the iron is not pure enough to tap, the chemist says "no", and the refining process is continued. Then other samples must be analyzed. This practice is continued until the analysis made by the chemist shows that the metal conforms to the Armco standard of pure iron.

The preliminary analysis is only one of many. It is also necessary to analyze the metal as it runs from the ladle into the ingot molds. This sample is analyzed for such impurities as silicon, sulfur, phosphorus, carbon, manganese, and copper. The chemist adds up all the impurity percentages he obtains and if the total is less than *sixteen hundredths of one per cent*, he reports that the heat meets the commercially pure iron specification.

Additional samples are taken when the ingots are rolled. The test bars are ground and polished until all of the scale

is removed. Clean millings are taken, and these millings analyzed for such traces of gaseous impurities as might be present.

The widespread use of Armco Ingot Iron proves this careful research work has been worth while. More than fifty thousand tons of this pure iron are used every year for underground culvert and flume installations in all parts of the world. Twenty-six thousand tons were used in one recent installation of pipe line to bring water to the city of Sao Paulo, Brazil, from the mountains forty-five miles distant. Huge gas holders in England, America, and Australia, and boats are today being built of pure iron because of its rust-resisting properties. But the world was soon to learn more of the diversified use of this pure iron, developed by the painstaking chemists and metallurgists.

"Give us an *enamel* iron that will hold the enamel tightly." This was another question that was put up to the Armco research department. In the final results the chemist is required to study the minute quantities of impurities and gases which affect the enameling properties. A study of the application of the vitreous enameling to the various metals also led to development of a better and more durable product for ranges, table tops, and kitchen cabinets. Ordinary steel sheets, formerly used did not make a good enameling base. The gaseous impurities in the steel and the lack of uniformity in the sheets caused a great deal of difficulty to enameleers. So it was necessary to produce a pure iron sheet which contained a minimum of entrapped gas, and which provided at the same time a good surface for enameling. It was also necessary to produce an iron sheet which would help to eliminate the "craze" lines or cracks which often appear in enamel usually caused by a lack of uniformity in the sheet. The research department worked

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attached to the product in their plant. The advertising and the wide use of this little label has made this triangle mark universally popular and it enables a woman to buy a product with complete knowledge and full confidence in the quality of the metal used."

The definite effort to put selling information directly into the hands of the retail salesmen has brought together a great army of thousands of sales people interested in the sale of Armco products in all classes of retail stores.

In this day of commercial competition, every factor that enters into the sale of a product is important.

The prestige value of Armco, which has been built up by quality, service and advertising over a long period of years, can be effectively used as a merchandising factor. This has been demonstrated over and over again. Many companies, by changing their product from ordinary steel to Armco Ingot Iron, have almost immediately expanded their business and increased their earnings.

Armco's national advertising campaign has not only aided the company from a sales standpoint, but it has been of material assistance in building up and intensifying manufacturing morale. Men are eager to see that the work they do on the product in its various stages of manufacture results in the standards of quality that are emphasized in advertising.

Since beginning its national campaign in 1914, Armco has been very consistent in advertising and has carried on the campaign whether oversold or not. In season and out of season, it has continued to advertise the advantages of pure rust-resisting Ingot Iron, its many special grades of steel sheets and the service it is organized to provide, because Armco believes that it pays to advertise and to keep on advertising, where one has faith in its products and service.

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These Shops distribute millions of pieces of Armco literature annually, and are doing an effective educational job, which helps the salesman in the retail store.

"There is an association of more than thirty culvert companies with hundreds of sales engineers, selling Armco Culverts for draining railways and highways in every state in the Union. The Association's advertising appropriation is nearly as large as that of Armco and they are unquestionably doing a work that influences many people to check up on the sheet metal in the products they buy for their home use—they are making it easier for you to sell products made of Armco Ingot Iron.

"Thousands of retail stores find that the name Armco and Armco Ingot Iron are well known—that ordinarily a mention of the iron brings recognition of its quality. They use this selling point and many of these stores feature cuts of the Armco Triangle or mention Armco Ingot Iron in their local newspaper advertising. In this way they get a very definite tie-up with the entire advertising force behind this pure iron.

"**HOW TO IDENTIFY PRODUCTS MADE OF ARMCO INGOT IRON.** All sheet metal looks very much alike; in fact a chemical analysis is required to distinguish between the various kinds. How, therefore, can you be sure of the quality of the metal in the products you sell? How can the housewife make sure when she is buying?

"The Armco Triangle is the guidepost: Labels bearing the triangle are supplied only to those manufacturers that buy Armco Ingot Iron, and the labels are

on this problem for years and finally succeeded in producing pure iron enameling sheets which were uniform and flat, and had, when viewed through the microscope, a velvety, tooth-like surface.

"Give us better *electrical steel*", was another demand presented to the Armco research department. This, like the enmeshing iron question, was a matter which required intensive laboratory work over a period of years.

Research work in the development of magnetic properties of iron and steel has been one of the important factors in the development of the marvelous age of electricity in which we are now living. In the development of the magnetic properties of steel for the building of motors, transformers, and generators, the scientific study of the metallurgical combinations to produce the magnetic characteristics desired to increase the efficiency of electrical apparatus, has been one of the big fields of Armco research.

It was known that the magnetic properties could be increased by the addition of a small amount of silicon, but it has taken constant effort and frequent tests to be sure that the analysis is just right. Working closely with the engineers who have made wonderful progress in the development of electrical apparatus the Armco research department perfected many grades of electrical steel sheets of uniform high quality. This enabled the manufacturers to greatly reduce the bulk of the apparatus at the same time adding to its efficiency.

Nor did the service to the great electrical industry end here. Pure iron which was developed originally for rust-resisting purposes was found to be an ideal "harness for electricity". One of the first requirements for an electrical conductor is that it shall be uniform in quality throughout. This is one of the greatest advantages of pure iron over steel. The other properties that make pure iron satisfactory for electrical

uses are: high permeability, low retentivity, high conductivity, resistance to fatigue, and resistance to corrosion.

If it were not for pure iron, we would not have as good a telephone system as is now in existence. Pure iron is used for the relay in modern telephones. Because of its trustworthy character, iron can always be depended upon to function properly in this vital spot.

Another important use for iron is in *signal bond wire* for railroads. It is used to assure automatic operation of the block signals. The wires are used to connect the rails so that the electrical impulse will pass along the track to the signal. Other important uses of pure iron are: radio and telephone receiver parts, magnetic controls for pipe organs, magnetic parts for player pianos, magnetic cores and casings, magnetic shoes or pole pieces, magnetic chucks, relay parts, and motor parts.

Another use for pure iron is in the form of *welding rods*. The use of steel rods has been found to cause considerable bubbling in the weld. But the advent of pure iron made it possible to get a weld which was as solid and as strong as the parts welded. The extra purification of Ingot Iron reduces the welder's troubles, improves quality and increases production. Pure iron flows smoothly and evenly at welding temperatures because of its purity, uniformity, and degasification.

Still another question was presented to the Armco research department: "Can you produce a high finished yet workable automobile sheet?" As the automobile developed into a thing of beauty, it was necessary to have a body material which could be formed into sweeping, graceful lines. The research department answered the question by providing an auto body steel now used in some of the most expensive as well as the more moderately priced automobiles. These high finished sheets are a standard for artistic designs, stream-

"Armco Ingot Iron also has a characteristic velvety-like surface, which enables it to grip and hold the beautiful porcelain finish in a remarkable manner.

"Why So Widely Used In Zinc-Coated Products? Probably the most familiar use of sheet metal in the home is in the form of galvanized products, such as the tubs, pails, gutters, downspouts, etc. The rusting out of these products is a common occurrence; so common, in fact, that it is given little consideration. Here Armco Ingot Iron finds its most practical use.

"The action that takes place when a sheet of metal rusts is identical with the action that takes place in the simple battery that rings your door-bell or starts your automobile. In the battery, current passes from one piece of metal to the other, with a consequent wasting away.

"Impurities in sheet metal intensify the battery action, and the sheet wastes away by electrolysis. Naturally, the purer the iron, the less battery action, and the longer the metal will last.

"A zinc coating, (galvanizing), is applied to sheet metal to add to its life. Pure iron takes a purer coating of zinc than does steel. Armco Ingot Iron, therefore, adds many years of service life to galvanized products.

"ADDITIONAL FACTORS THAT MAKE ARMCO INGOT IRON WELL KNOWN. There are today more than seven thousand sheet metal shops in the United States known as Armco Ingot Iron Shops. They do 'Quality Work with Quality Iron', and as the iron costs more than steel, they must necessarily sell their prospect on the importance of quality and long life.

for iron sheets of even higher quality than the old irons made in the last century when steel was unknown.

"Great care is necessary in the manufacturing operations to secure such high purity, and it starts with the selection of the raw materials that go into the open-hearth furnaces where the iron is refined. A most careful check is kept on the molten metal by expert chemists while it is in the furnaces, and the metal is never tapped until it measures up to the high standard established.

"The same care is exercised throughout every manufacturing operation, with trained inspectors always on their guard for defects that might mar the beauty or usefulness of the finished product. Due to this care, the manufacturer of sheet metal products buys Armco Ingot Iron with complete confidence in the quality of the metal.

"**Why So Widely Used In Porcelain Enamelled Products?** Although nearly every appliance used in the modern kitchen is covered with beautiful porcelain enamel, the application of this finish is a very hazardous operation, due to the possibility of imperfections ruining the finish. Imprisoned gases found in ordinary metals make the use of such metals very expensive, because of the excessive losses in the manufacturing operations. Armco Ingot Iron, being virtually free of these gases, reduces this trouble to the minimum, actually making it less expensive for the manufacturer to use this better iron in his product.

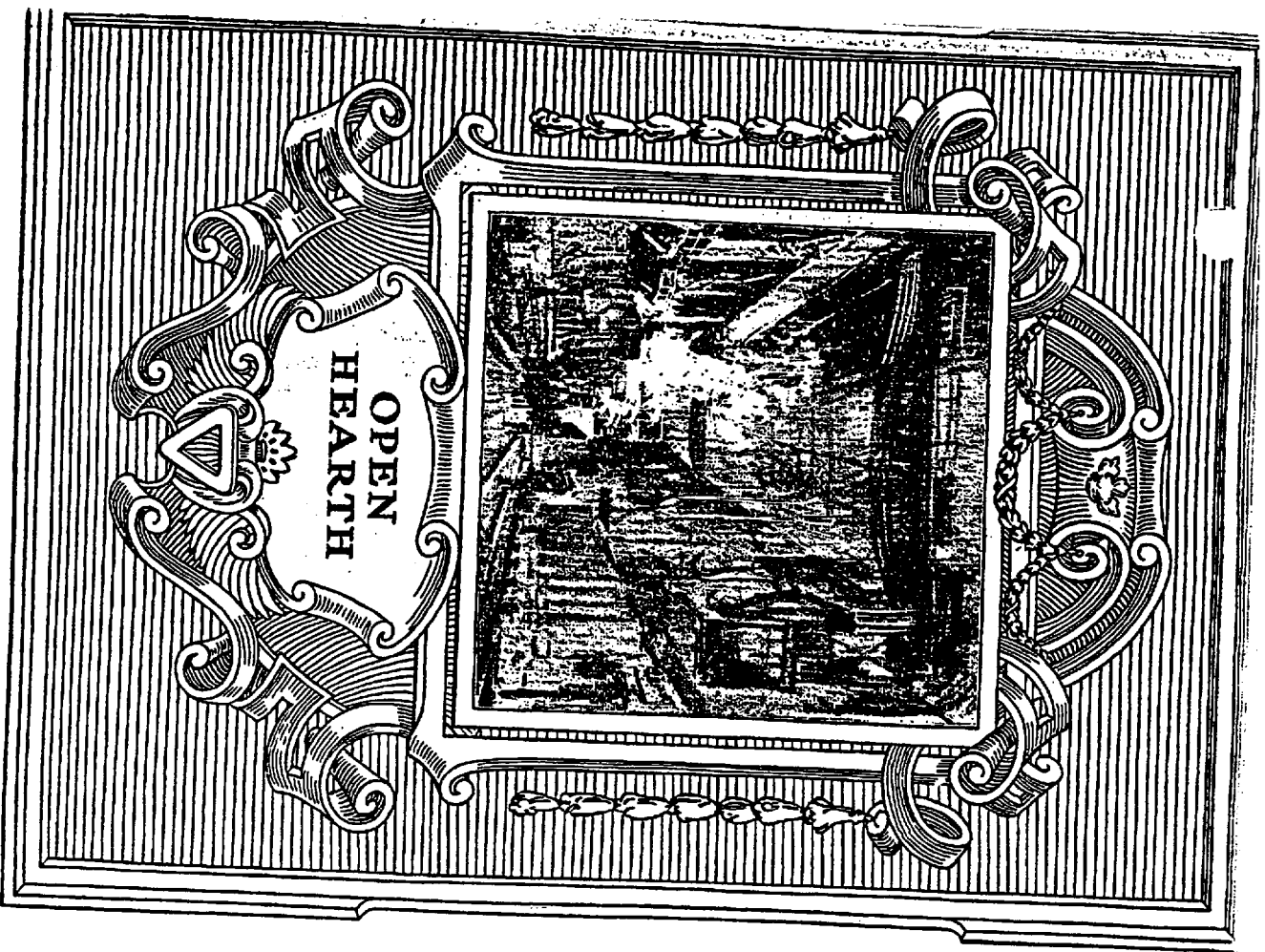
line fenders, artistic cowls, and imposing lamps. Here again Armco's research process triumphed in the way of very definite service to a new and growing industry.

"What are your most difficult sheet metal problems? Let us help you solve them." Such has been the basis of Armco's research service from the very beginning. As soon as designers of new sheet metal products present drawings, Armco inspectors visit the plants and work with the manufacturers to supply the kind of sheets best suited to the need. This is an expensive way to carry on research work but the satisfaction that comes to the customer has proved that it is the most effective. An outstanding illustration of this service is that of The Miami Conservancy District which, after a year of devastating trouble called on the Armco research department to produce a special steel which would withstand the pressure as well as resist the severe abrasion of sand and gravel in long distance sluicing operations.

Enormous levees were built, huge retaining dams were constructed, and the earth was successfully moved by means of sluicing in pipe lines more than a mile in length. The special pipe produced was so successful in resisting abrasion that at the end of its service, much of it was sold for other purposes. This special analysis steel dredge pipe is now in use in many other dredging operations, some of them in foreign countries.

What the future holds out to research now carried on by iron and steel manufacturers can only be guessed. Armco engineers are now working on such modern developments as steel for furniture for offices and homes, structural steel for supports for dwellings, alloys of many and various kinds, and other products with far-reaching possibilities.

Truly the scientific mind is open in a time of great opportunities.



learning to associate highest quality and long life with products made of Armco Ingot Iron.

There is another reason for the use of these labels. Ingot Iron costs more than steel, yet has no outward distinguishing features to reveal its superiority to the eye or touch. While the housewife can easily tell the difference between cotton and wool and judge of its wearing quality by the feel of the cloth, she has only the little Armco triangle to guide her in purchasing sheet metal products. It gives full assurance of quality.

Armco is not only cooperating with the manufacturers who use its product, but it is going further and educating the sales people in the retail stores that sell the finished articles.

Most stores appreciate this service at "the point of sale". It is brought about by the fact that people know more today about more things, and advertising has had a great deal to do with this important change.

Definite questions with definite answers are put into the hands of thousands of retail sales people, which enable them to talk interestingly and convincingly about Armco Ingot Iron in the products they sell. A few paragraphs taken from a pamphlet "More Information Means More Sales" indicate the thorough manner in which this information is presented:

What is ARMCO Ingot Iron?

"Armco Ingot Iron is not cast iron, wrought iron, nor is it steel. It is more highly refined than any of these. Ingot Iron is, in fact, made as nearly pure iron as is possible. It is the modern answer to the demand

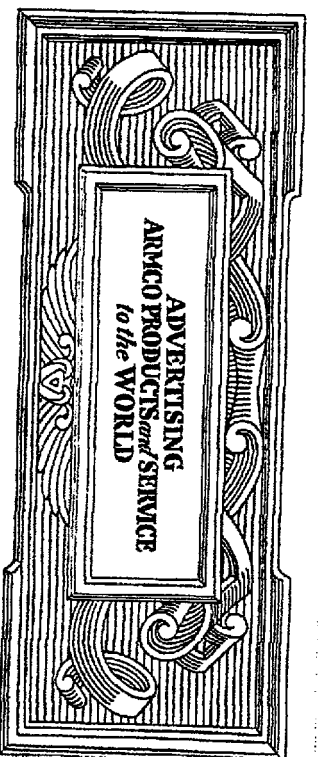
every salesman had to qualify with practical and metallurgical training equal to that of the graduates of the most advanced technical schools. In fact, most of the Armco salesmen have been recruited from the university ranks, although at first, young engineers hesitated to take up sales work. A young Armco salesman, two years out of engineering school, on his return to his alma mater, was inclined to apologize to the president for deserting the ranks of engineering to take up sales work. The president stopped him — "On the contrary you are in the most important branch of engineering, the dissemination of information and facts that link the scientific world with the practical world."

It is this new type of engineering salesmanship that has introduced Armco specialty sheets to the world.

The scientific difference between iron and steel, the electrolytic explanation of corrosion, the nature and influence of various zinc and paint coatings, the mechanical processes in manufacturing different grades of sheets from pure iron to highly specialized sheets for the most exacting uses, the chemical content, the physical characteristics, the weldability, and the rigorous inspection of finished product, all these make up the usual information which the trained Armco salesman brings to the purchaser. Sales are made solely on "service to be rendered" and price has always been a secondary consideration as must always be the case when purchases are made on the basis of engineering data submitted.

The sales activities of Armco spread out like a great fan through nine district offices, each headed by a district manager of wide experience, who has charge of specially trained salesmen.

In the executive offices in Middletown, the sales of all Armco products are handled by separate divisions that con-



ALIGHT hid under a basket makes no illumination. Armco has been a consistent believer in sound publicity. Having had new products, a new and larger service to offer and with confidence in its ability, it has openly and fearlessly explained its products and its service to the world.

In the early part of 1907 when the merits of Armco Ingot Iron had been established through innumerable and severe service tests, the company first began to advertise the superior qualities of Ingot Iron in the trade papers and by direct mail matter to sheet metal distributors, metallurgists, architects, and contractors. The advertising gained proper recognition in trade circles, but it was felt that the story carried with it an interest reaching far beyond this limited field.

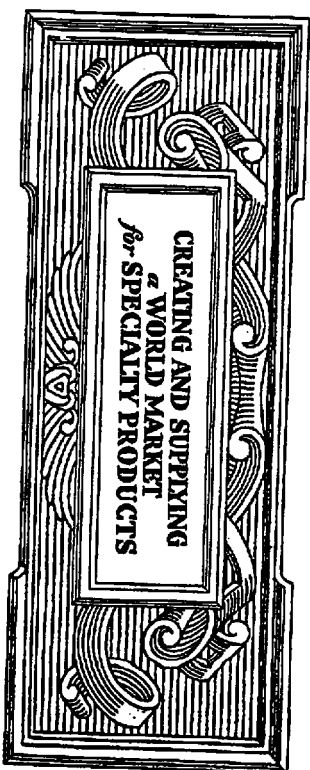
The qualities of Armco Ingot Iron, a combination such as no base metal has had heretofore, rust-resistance, welding and enameling properties, electrical conductivity and chemical purity, destined it to play a part in the life of everyone—the manufacturer, the householder, the housewife in the home. A metal with so many new and desirable characteristics would naturally be used in many different products. This suggested the possibilities of advertising Armco Ingot Iron direct to the public.

The name Armco, coined from the initials of the company, was taken with the addition of the words "resists rust" and made the advertising slogan. The national advertising campaign was launched with a two-page advertisement in *The Saturday Evening Post*, of August 8, 1914.

The advertising was so successful in helping to mold a favorable public opinion that there quickly developed a widespread interest in the iron and its uses, and a demand was created for articles made of Armco Ingot Iron.

Manufacturers of refrigerators, ranges, clothes dryers, and many other household appliances were quick to see the advantages to themselves and to their dealers of featuring in their advertising and printed matter, that their products were "Made of Rust-Resisting Armco Ingot Iron". They marked their products with a label featuring the Armco triangle. Thus, through the cooperation of hundreds of leading manufacturers, Armco advertising is complemented with powerful collateral advertising.

As a result of this related advertising, a range made of Armco Ingot Iron helps to sell a refrigerator made of the same material. A dish washer advertisement featuring Armco helps to sell a furnace. For instance: If a woman enters a modern department store today, she will probably be attracted by a fine range display. A second look will no doubt reveal the Armco triangle under the maker's label. She says, "that is significant", for she realizes that the life of her kitchen equipment, and its appearance depends largely on the quality of its metal parts. Stepping farther down the aisle she sees refrigerators, tables, kitchen ware and other articles with this same label. Wherever the little Armco triangle appears it instantly links the product with the national advertising, even though the particular article itself is not advertised. All the time the public is



THE distribution of Armco Ingot Iron and steel sheets—more than one million tons each year—follows natural channels like a great flowing river sweeping on and ever onward. The valleys of confluence represent the various fields of service where Armco is making its contribution to the world—coal, oil, gas, transportation, power development, mines and irrigation. These largely make up the engineering market for Armco products, whether Armco Ingot Iron or specialty steels.

In addition is the endless stream of fabricated products, with its myriad of branches, made up of the manufacturers of stoves, ranges, refrigerators, caskets, vaults, culverts, and dozens of other products that enter the daily life of the individual, all requiring special analysis materials for most exacting uses.

This vast distribution of Armco Ingot Iron and steel products throughout the world has followed a definite policy, laid down when the business was in its infancy.

Sales pioneering was needed for the problems involved. The market for specialty sheets had not been developed. With a more costly, expensive product to market in a field where such specialties were unknown, new methods of sales approach and sales contact had to be devised. Consequently,

The second powerful factor allied with sales under franchise arrangement is a large group of important sheet metal distributors, known as the Armco Distributors Association which embraces the leading concerns of their kind in America. The salesmen of those concerns, likewise, are sent to Armco headquarters for a technical training in the ramified subject of iron and steel manufacture and special uses.

Through this distributor's organization has been built up a subsidiary group numbering more than 7000 Armco Ingot Iron Shops located in the cities and hamlets where the local sheet metal contractor and his workmen spread further the definite value of "Quality Work with Quality Iron".

Nowhere in the vast network of sales effort has the intrinsic value of technical information been lost. The reasons for the use of special irons and steels are held uppermost and a mass of installation data of actual service in the field supporting the scientific arguments of salesmen is available at all times.

The selling effort back of Armco is more than mere business. It is a crusade—a crusade against waste and inefficiency in the use and selection of sheet metal, and in the introduction of new advanced grades and greater service to customer. When metal rusts it is burning and this fire is costing the world millions. All unseen, it strikes at busy manufacturing equipment, tying up many a plant for needless repairs, piling up overhead that should have been profit. The Armco salesman is a rust fighter. No clanging bells sound the alarm and call for help. His work is unspectacular but he is doing his part to save industry from the ravages of rust, fire and corrosion.

Again, consider the remarkable development of electricity and the experimenting, and perfecting of electrical steel

sheets that have made this phenomenal growth in electrical industry possible. Armco salesmen have been in the vanguard of this movement bringing to the electrical industry the contribution of able scientists and metallurgists.

Or take the expanding market for high finished sheets, brought on by the tremendous growth of the automotive industry. Its needs from year to year has taxed the ingenuity of the iron and steel industry, and the result of Armco research is passed on to the rest of the world by the Armco Sales Department, in the form of deep drawing, special analysis sheets made to do the work. Armco metallurgical engineers virtually live in the great automobile plants to help solve their problems.

Other demands have come, such as the remarkable growth of the enameling industry, bringing still more problems. To produce an iron, uniform and degasified that assured glossy porcelain ware without blemishes and at the same time lower the enameleer's cost, this required new ventures in iron and steel industry. There again Armco salesmen stand at the door offering the latest developments of research and science.

ARMCO International

The Armco International Corporation was organized to handle all export sales along the same general engineering lines. Its representatives, who for the most part have had intensive mill training, are located in all the important cities of the world. Here, more than anywhere else, is the thoroughly experienced salesman required. Long range selling requires most accurate knowledge of all the questions involved in order that delays and misunderstandings may be avoided. In large part, these representatives are native born, educated in foreign universities and brought to Armco headquarters for detailed instruction. The uni-

versal swing back to pure iron on the part of the engineering world is particularly noticeable in the foreign market.

What new product will be required of the sheet iron and steel industry tomorrow? No one knows. But whatever it is of *service*" in the present-day ramified markets of iron and steel, the salesmen of Armco will be alert and vigilant. They will go forth into all parts of the world in a spirit of helpfulness—as true ambassadors of progress.

concentrate their efforts in the promotion and development of specific markets for Armco's special products.

The products of each of these divisions are further classified so that special effort can be thrown to items which, due to the fluctuations and shifts of the market, offer wider opportunity for service and development.

The specialization in the main sales office is also extended to sales work in the field offices, with specially trained men devoting their time to specific markets.

A natural corollary to this specialized service is a department manned by technically trained men who are specialists in Armco products. They are always available for special consultation with customers and prospects at the call of the district managers. These are service men and not salesmen, and yet their work in the building up and development of sales is of greatest importance.

Their work also includes the study of potential markets for Armco products, together with the gathering of data for the promotion of these markets.

While the sales organization is complete in itself, two powerful allied groups are intimately associated with it under franchise arrangement.

The first of these is the Armco Culvert Manufacturers Association which has developed the use of the metal culvert and flume for drainage and irrigation projects. This organization has grown up with Armco. It was the first group to adopt pure iron specifications and make it a factor in the development of their business. Thirty-four separate and distinct companies cover the world with special engineering salesmen of their own, who have been sent to Armco headquarters for technical training. They not only are trained in the metallurgy of iron and steel but are up-to-the-minute on drainage engineering.