

THE ROMANCE OF STEEL AND IRON IN AMERICA

THE STORY OF A THOUSAND MILLIONAIRES

BY HERBERT N. CASSON

XIII—THE FUTURE OF STEEL

Opinions as to the Direction of Future Development—The Vastness of the Industry To-day,
and Its Expansion Through the Discovery of New Uses for Its Product—Cities
That May Become Capitals of Steel—The Battle Against Conservatism

WE have seen how a great business grows; how it enriches those who are loyal to it; how it builds cities, creates new industries, and pushes forward the progress of civilization. And now the final question is, What about the future of the American steel trade?

On this subject there are bulls and bears, as Wall Street would say. There are some who think that the steel business has been overstimulated and overcapitalized—that the great corporations will fall apart because of their size and their monopolistic nature. "Modern directorship is too irresponsible," say these men. "Directors do not direct. They watch the price of stocks and forget the making of steel. After this stock-company phase of our industrial evolution is ended, we shall go back again to one-man ownership and free competition."

Others—the large majority—think that the present situation is satisfactory and likely to continue for a long time. "There is enough of the trade organized to give stability," they say, "but not enough to create a monopoly. To go back to one-man plants is impossible, because of the competitive pressure that would destroy profits. And complete consolidation is not advisable, in spite of

its economies, because it would put the whole trade into the power of a single bureaucracy."

A third opinion—the most optimistic of all—is that of Carnegie. None but he is so idealistic. His dream is of a national, non-governmental, cooperative steel business, "with every workingman a capitalist and every capitalist a workingman." He describes this communism of labor as "the only safe system"—"a splendid vista."

A fourth possibility was suggested seriously by one of the Buffalo steel barons. "Carnegie is out of the steel business," he said, "but his millions are not. Suppose his heirs should take their income of fifteen millions a year and invest it in United States Steel stock whenever there was a slump in the price, how long would it take them to get control of the big corporation? Carnegie holds a first mortgage on the Steel Trust for perhaps one-third of its value, and it is not to be expected that the immense Carnegie fortune can be pushed easily out of the steel trade."

With regard to these varying opinions, the facts show, in the first place, that the greatest glory of the Steel Age is yet to come. We have climbed to a

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place where the American steel man says "The world is my market." We produce nearly half the steel of the world. We are selling other nations a hundred millions' worth a year, in spite of their cheaper labor. We have swept to the front with such gigantic strides that no other country has to-day any hopes of becoming our equal. Germany, which is far ahead of foreign nations, is plodding along where we were eight years ago.

WONDERS OF STEEL MAGIC

To sum up once more the wonders of American steel magic, let me give a few final illustrations. If all our five hundred and eighty-seven rolling-mills were arranged in a circle around Pittsburgh, the circle would be a hundred miles in diameter. Inside this might be a circle three-quarters as large, composed of our five hundred and thirty-two smaller steel-mills and our three thousand one hundred and sixty-one puddling furnaces. The five hundred and seventy-seven open-hearth works would make a third circle, fifty miles across. The four hundred and ten furnaces would form a fourth, thirty-five miles in diameter. And in the center would be a flaming hub of one hundred and three Bessemer converters, a mile in circumference, pouring out a fiery river of molten steel at the rate of two and a quarter million pounds every hour of the day and night.

Put the whole American nation on the scales and, at a hundred pounds apiece, they will weigh no more than the iron that our furnaces are making every two months. In the last three years we have produced enough to outweigh all the men, women, and children in the world.

King Steel has dethroned King Corn and King Cotton. There are men now living who can remember when the United States produced no steel at all and very little iron, yet to-day our furnaces annually make enough iron to put a belt around the earth ten feet wide and an inch thick. This, the iron-men say, is a fair year's work. As we have seen, we use six times our own weight of iron in one year—three thousand pounds per family. We feed our furnaces every twelve months a mountain of ore that would tower a hundred feet above our highest sky-scrapers.

Gather together all the families that depend directly upon the iron and steel trade for their living, and they will make a State more populous than Illinois, which is the third largest in the Union. This "iron and steel world," as it justly calls itself, has its own literature—technical books that are as mysterious as Sanskrit to the ordinary reader, and magazines whose advertising brings a small fortune with every issue. It has its own laws, its own perils, its own rewards. If we consider it with regard to these three factors—its numbers, its wealth, and its organization—there is no trade to equal it on the face of the earth.

How do we know it will grow? Because of the increasing number of new uses for iron and steel. It is only a matter of time until railroads will have to buy steel *ties* as well as steel rails. The heavier traffic and the increased cost of wooden ties will make the steel tie a necessity.

THE NEWER USES OF STEEL

Steel ties are not an experiment. The Carnegie Company has been using them for six or seven years on one of its ore railways. The Erie, Baltimore and Ohio, Pennsylvania, New York Central, and Lake Shore railroads are already throwing out wooden ties and laying down steel ones. Such an improvement will enormously increase the steel bills of the railroads. They are to-day buying one-eighth of all the steel, and a ton of ties will not go half as far on a railway as a ton of rails. At the Homestead works there is already a steel-tie department—the germ of a new industry.

As for the pressed-steel car business, that has been an established success for half a dozen years. One company reports earnings of fourteen millions in that time. England has not yet started in this line. When Charles T. Yerkes was equipping his new underground London railway he was obliged to place an order for four hundred steel cars with an American firm, as no English manufacturer could make them. Steel trolley-cars are now running on the streets of American cities. Six months ago the first steel baggage-car was placed on the rails of the Erie Railroad. The fre-

quent loss of life in wooden passenger-coaches, which are easily "telescoped" in the event of a collision, is compelling railroads to consider the steel-car proposition. It was noticed by railway men that among the cars exhibited at the St. Louis Exhibition not one was made of wood.

Then there are to be the new steel cities of the future. We have already built our cities twice—once of wood and once of brick. For nearly twenty years we have been building a few high city structures of steel; but steel-makers declare that the private houses of the coming generation will contain a surprising amount of steel in various forms.

"I'm building a new house at Pride's Crossing, Massachusetts, and I'm astonished to see how much steel it takes," said Mr. Frick.

"Expanded steel," which resembles a mesh made by steel ribbons, is replacing lath. Ornamental steel ceilings are replacing plaster. Corrugated iron in thin sheets is replacing wooden siding in the building of factories. In England and Germany, many new uses are being found for steel in connection with cement—an absolutely fireproof combination. As steel plants are now manufacturing cement from their slag, they will reap a double profit if this method of building is adopted in the United States.

THE DAY OF STEEL IN ARCHITECTURE

Wood has had its day in the building of cities. The recent disastrous fires in Buffalo, Baltimore, and San Francisco have shown that the steel frame is not enough. As long as wooden floors, partitions, doors, window-frames, etc., remain, there is danger. Our total fire loss is between one and two hundred millions a year. In the last twenty-four years more than three billions have gone up in smoke. And experts tell us that our timber supply is approaching the point of exhaustion at a perilously rapid rate. So it is not unlikely that the boys and girls now in the public schools will live to see the passing of the frame house, and the substitution of a structure made of cement and steel.

Several American cities can now boast steel-frame churches of the largest size. New York's magnificent Subway is prac-

tically a thirty-mile tube made of steel and cement, just as its elevated railway is a thirty-mile steel bridge. That colossal structure, the new twenty-million-dollar Williamsburg Bridge, between New York and Brooklyn, required forty-five thousand tons of steel. In a sky-scraper of the first class, such as the new First National Bank Building, of Chicago, for instance, with its eighteen acres of floor space, ten thousand tons of steel are riveted together.

Take another item—wire. It is hard to realize, but true, that there are twice as many millions in wire as there are in structural steel. At its present rate of increase, wire will soon require more steel than rails. Out of every ten pounds of steel produced, one is manufactured into wire. Nothing else takes so many forms. It can be made into a Brooklyn Bridge cable, with six thousand four hundred strands, or into an almost invisible thread, one-tenth as thick as a hair from your head. It may be woven into a cage-front for a tiger, or into a fine-spun gauze with forty thousand meshes to the square inch. You will find it in your piano, sustaining a tension of about twenty tons, and in your watch, made into the tiny hair-spring. In fact, when we sum up the almost innumerable uses of wire, we can understand the enthusiasm of John W. Gates, when he exclaimed "There's millions in it!" and forthwith made himself the wire-king of the United States.

To-day, even in the most insignificant items, there are millions to be made. Last year former King Cotton paid about two and a half millions to King Steel for cotton-ties alone—thin strips of sheet-iron used to bind the bales of cotton. A carpet-tack is not an imposing article of commerce, yet a single factory in Chicago is producing three million pounds in a year. A wire nail looks unimportant enough, yet any one who owned the thirteen million kegs of wire nails that we produced last year would possess a fortune that would make him a figure in the financial world.

Many an order for a single steel article carries in itself a competency. To name a few, there are—the new steel dry-dock at New Orleans, five hundred and twenty-five feet in length and one hun-

dred feet wide; the three-hundred-and-ten-foot steel chimney of the Nichols Chemical Company, Brooklyn; an engine in the United States Steel Corporation's plant at Youngstown that weighs nearly a million pounds; the Manhattan and Blackwell's Island bridges, in New York; the three enormous steel flumes, eighteen feet in diameter and a mile in length, which have recently been laid at Niagara Falls; and J. J. Hill's group of steel elevators at Superior, Wisconsin, holding three million bushels of grain apiece.

NOVELTIES IN STEEL CONSTRUCTION

There has been for several years a block of steel roadway in New York City, the necessary steel plates having been donated by Mr. Schwab. To equip a road with these steel plates would cost, it is said, not more than fifteen hundred dollars a mile; and it is being freely predicted that the road of the future will be of this kind. "I expect to see a road of this sort from New York to San Francisco, and around the suburbs of all our large American cities," said Winthrop E. Scarritt, the well-known New York automobilist.

Almost every week the newspapers announce a new use for steel. Steel bathtubs are being stamped out at the rate of a hundred and fifty a day. Steel furniture is worrying the furniture-makers of Michigan. Barrels, so one manufacturer says, are henceforth to come from the steel-mill and not from the cooper-shop. As we use about three hundred million barrels a year just now, this one item may mean new plants, new multimillionaires.

Now that steel is being used in construction work, there is scarcely any limit upon the novelties that we may expect. We hear of an aerial ferry in Duluth, by means of which a car is swung in mid-air from shore to shore; and of an aerial hotel in Switzerland, above the Lake of the Four Cantons, hanging two thousand feet above the water.

If the great war of the future, long predicted, should come—if the idle armies and navies of Europe should suddenly rush together in the old undying game of war, the two decisive factors in the conflict would be money and steel.

In their assault on Port Arthur, the Japanese fired two thousand tons of shells. Both nations combined fired away sixty million dollars' worth of death and destruction in the struggle over a single fortress. The death of every soldier cost more than his weight in iron.

In the long stretch of American iron-making, from 1645 to 1860, there was not one vast fortune made in the trade. It was the Civil War that created the first multimillionaires of steel and provided the capital for the giant plants of to-day. And, as Bloch, Atkinson, and other statisticians have shown, the wars of the past were inexpensive little quarrels when compared with the wars of the present or the future.

Most of the facts point toward an enormous foreign trade in the near future. No degree of growth in this line should be surprising, for the reason that the history of our iron and steel exports has been nothing but a series of surprises, both to ourselves and to foreign nations. To-day we are selling the other countries more than a hundred million dollars' worth of iron and steel every year. The checks our steel men get from their foreign customers in sixteen months would pay the whole cost of the American Revolution.

WHAT A FEW YEARS HAVE DONE

Yet it is only a century ago since not a pound of iron was made in Ohio—since Pittsburgh was a frontier village, without a rolling-mill or a bank—since Jefferson wrote to his friend John Adams: "We cannot make iron in competition with Sweden or any other foreign country."

It is only a quarter of a century since Andrew Carnegie, himself—the most sanguine and optimistic of men, said: "Steel is made in England for one-half of what it costs in the United States. Not in our day will it be wise for America to leave the land. It is a very fair division as it stands—the land for America, the sea for England."

In 1898 an American bridge company got the contract for building the great Atbara Bridge on the Khartum railroad, to the astonishment of the British steel men. The following year locomotives made in Philadelphia were running on the Midland Railway, in England. At

the Glasgow Exposition it was admitted that the best exhibit of tools, lathes, drills, etc., was not from Sheffield or Newcastle, but from Milwaukee. Then the Glasgow *Herald* appeared with a notice that it was now being printed upon a "Hoe" press. In 1900 four British steamers sailed from Conneaut laden with steel for Liverpool—the first all-water shipment from Pittsburgh.

TO THE UTTERMOST PARTS OF THE EARTH

Five years ago Londoners were startled to see the steel frame of an American sky-scraper towering above Chancery Lane. Then the Duke of Marlborough, having married an American wife, gave an American firm the contract to build his new steel-frame house on Curzon Street. Schwab, being in England, made a few remarks which added to the uneasiness of British steel-makers:

"We can sell steel billets, delivered in Great Britain," he said, "for \$16.50 a ton—\$2.69 cheaper than the present British price."

Some one else figured out that the labor-cost of a ton of iron in Pittsburgh was reduced to forty-one cents, as against seventy-two in England, although Pittsburgh wages were double those in Sheffield.

Last year we sent over twenty million dollars' worth of iron and steel goods to Great Britain. The rest went to various parts of the world. At the Alexandria docks, in Egypt, you may see coal unloaded by American machinery into American pressed-steel cars. It will be drawn on Pittsburgh rails by Philadelphia locomotives to Khartum.

On the banks of the Jordan, in the Holy Land, you may see an American bottling-plant, made in Cleveland, which is shipping the water of the sacred river to all Christian countries.

In remote parts of India, Burma, Persia, Madagascar, you may find structural steel from Homestead, Pennsylvania.

The rails and bridges over which the Russian armies rode from Moscow to Port Arthur, and the steel ribs of the depots and the Dalny houses, were for the most part made in Pittsburgh and put in place by American machinery.

It was a strange fact that immediately

after the Spanish-American war Spain became for a time our best customer for railway material and machinery. One Spanish importer in Barcelona had the words "American machinery forever!" engraved on his note-paper. Germany, our chief competitor, opened her eyes recently when a Connecticut firm shipped to Berlin a complete foundry. This firm, it appears, makes foundries of different sizes and sells them by number, as though they were collars or shoes. Even the European farmers have caught the habit; they have been paying us over a dozen millions a year for our agricultural machinery.

To-day our iron and steel supremacy is questioned by no one. Lord Rosebery tells a London audience to take heed to "the American disdain of finality." American young women, on their way to Dresden to study music, are passed by German young men who are on their way to Pittsburgh to study steel. One English writer has summed up fourteen points in which the American steel trade is superior to the British, as follows: More ore; cheaper coke; cheaper transportation; tariff; superior skill of workmen; greater efficiency of superintendents; larger scale of operations; more enterprise; promotion by merit; larger scrap-heap; higher wages; bonus system; employment of younger men; and more complete organization.

THE NEED OF A MERCHANT MARINE

Two things we lack—a better knowledge of what foreign nations want, and an American merchant fleet. The Pittsburgher too often assumes that what suits him will suit the rest of the human race. Even steel-men have some national prejudices and customs.

"When I first shipped iron to China," said William A. Rogers, of Buffalo, "my agents had difficulty in selling it. The Chinese said, 'Melican iron tloo hard.' After a while we discovered that they had been accustomed to buy iron in tiny bars that could be broken by hand, while our bars were so thick that it was half a day's work to break one. We made our bars thinner and there was no more trouble."

As to our need of more American ships, it has been stated that ocean freights can

be cut in half by the establishment of an American merchant-marine. No freight is easier to carry than steel, yet at present the rate from Pittsburgh to Liverpool is equal to the cost of making the steel from the pig iron.

As to where the Pittsburgh of the future is to stand, no location is ideal. There are so many factors necessary to success in the steel trade that no one spot contains them all. At present the trade is scattered between Birmingham and Chicago, and between Worcester and Pueblo, with the vast bulk of it in the Pittsburgh region. Since 1645, the center of the industry has moved from Lynn, through Connecticut to New Jersey, then *via* Philadelphia to Pittsburgh, where it has remained for fifty years. But since Minnesota has become the principal storehouse of ore, there has been a growing conviction that the steel-mills and furnaces of the future will be nearer to their base of supplies. The point in dispute is whether the ore should be brought to the coke, as at Pittsburgh, or the coke to the ore, as at Duluth.

THE CONFIDENCE OF THE PITTSBURGHER

The Pittsburgher, of course, laughs at prophecies. The roar and smoke that he loves will continue, he thinks, until the last trump shall sound. He feels that even then the response of Pittsburgh will be: "Can't go—too busy."

If you remind him that Pittsburgh is four hundred and fifty miles from tidewater, he replies: "That is a disadvantage of only two dollars a ton, and it will be still less when we build our ship-canal to Erie and deepen the Ohio River to Cairo."

If you say that Pittsburgh is a thousand miles from its ore, he replies: "It is not the distance that counts, but the cost of mining and freight. We can dig fifty tons in five minutes, and we bring it to our furnaces in our own ships and on our own railroads, at the lowest cost ever reached in the history of transportation."

If Carnegie had been twenty years younger in 1901—and this was the unanimous wish of his forty-five thousand men—the pivotal point of our steel trade would to-day be Conneaut, on Lake Erie, about a hundred and twenty miles north

of Pittsburgh. Many of the forty young ex-partners of Carnegie express regrets that the "chief" did not remain in command and carry out his original plan to build an immense steel-mill at Conneaut. Carnegie had bought five thousand acres near the Conneaut docks. He had paid two hundred farmers half a million to leave their homes. He had given Conneaut real estate such a boom that its citizens have been stranded ever since on the high banks of expectation. "We had the men, the money, the raw materials, and the location," say the Carnegians. "Conneaut was the hub of the wheel, and in five years we could have made the Carnegie Company irresistible."

"Conneaut is the central spot," said Carnegie when I asked him concerning the future of the steel trade. "It is the place where all the raw materials can best be assembled." Looking further ahead, as usual, than other steel men, he spoke of "the movement toward the lakes." There is no doubt that the threat of Conneaut added fifty or a hundred millions to the price which he demanded and obtained from Morgan.

If, as a few suggest, the railroads should decide to enter the steel-making business, now that there is a prospect of their having to buy not only rails but steel ties and steel cars as well, the probability is that they would select Ashtabula as their manufacturing spot. This is five or six miles from Conneaut, with a much larger harbor. Until recently, Ashtabula has been the busiest ore-port on the lakes. To-day Conneaut stands first. The Ashtabula ore-docks are owned mainly by the Pennsylvania and Lake Shore railways, so that if these railways should decide to make their own steel as well as their own cars and locomotives, which at present is not likely, they would naturally choose a site which would be as near as possible to the ore.

Chicago, of course, is second only to Pittsburgh as an iron and steel city. If there were no Pittsburgh and no Carnegie Company, we should still have much to boast of in Chicago and the Federal Steel Company, not to mention the great works that the Steel Trust is building at its new town of Gary. One-third of all our steel rails are made at Chicago.

The unique feature of Chicago's iron and steel trade, so far as the future is concerned, is that the corporations which manufacture agricultural machinery have bought their own ore-mines, coal-mines, timber-lands, furnaces, and rolling-mills. Two-thirds of all the agricultural implements in the world are made in Chicago, but the steel that is used adds nothing to the profits of the steel-kings.

Milwaukee is destined to be the "machinery city" of America. When the great Allis-Chalmers machinery works is completed, if it ever is, it will be unapproachable in its line. And another city which will not allow itself to be forgotten when the conversation is upon the future of steel is Duluth. Hitherto, indeed, so far as the making of iron is concerned, the record of Duluth is a story of calamity and failure. The unparalleled ore-supply of the Mesaba Range is practically in Duluth's back yard. It has ten square miles of harbor. The St. Louis River flings itself at the city's feet in a series of torrents which might provide unlimited electrical power. And the ore-ships that come back from Lake Erie without cargoes might bring coal and all other imported necessities at the lowest of freight-rates.

Yet in this year, 1907, Duluth can point to only one small furnace, making two hundred and fifty tons a day. There is not a steel-mill in the State. The Pittsburgh vikings sail up to the iron ranges and carry off the loot—millions of dollars' worth every summer week. And all the while, for some reason which no outsider can understand, the men of Duluth and Superior—twin cities—have been satisfied to run errands and quarrel, like a couple of messenger-boys.

DULUTH'S OPPORTUNITY

Some day Duluth will awake and make her dream come true. She will unite with Superior, as Pittsburgh will with Allegheny. The two cities are really one in financial interests. Now that less and less coal is needed to produce a ton of iron, Duluth's opportunity to build profitable blast-furnaces is growing better year by year. Geographically, Duluth is located so that she cannot escape being an important iron and steel community. She stands at the western doorway to the

Great Lakes—almost in the exact center of the continent. One of the few possible sites for a grand city is hers, and she has her face toward the rising sun.

Texas and Puget Sound are also mentioned as probable iron and steel centers. At present, neither region is to be found on the map of the iron business. Texas has a couple of little charcoal furnaces, one being owned and operated by the State, and Seattle has one small furnace and rolling-mill. It is reported that immense deposits of fine iron-ore have been found in Llano County, Texas; and since the discovery of oil at Beaumont, which could be used as fuel, the door of opportunity has been opened to the Texans. Beaumont is near the sea, northeast of Galveston, and the ore mines of Llano, Cuba, Venezuela, and Colombia are within a thousand miles. Here is a hint for some embryonic Carnegie of the Lone Star State.

That there is a chance for a second Carnegie cannot be doubted, unlikely as the outlook may seem to the steel-workers of Homestead and Duquesne. It is the unexpected that happens in the steel world. Any one who had predicted a Carnegie and a steel fortune of a quarter of a billion to the Pittsburghers of thirty years ago would have been regarded as an unbalanced enthusiast. One thing is certain—that the "American disdain of finality" will prevent the formation of a perpetual dynasty of steel or any sort of monopoly.

When Cræsus, King of Lydia, showed Solon his golden treasures, Solon said: "If another comes who hath better *iron* than you, he will take away your gold." The same warning may be given to our steel-kings. As long as American workmen continue to think while they work, there may come some revolutionary idea that will pull down the old dynasty and set up a new one.

The battle against conservatism and self-complacency is not ended. Fifty years ago, when Kelly and Bessemer pointed out the path to millions, they were treated like impertinent meddlers by the steel men of America and Europe. Sheffield sneered at Bessemer until he built a plant of his own and cut prices in half. Pittsburgh lost twenty-eight years by its disdain of Kelly and his

"air-boiling process." And in my hundreds of conversations with the chief steel men of to-day I have found the same conservative attitude in many instances.

There are still heart-sick inventors tramping from one corporation to another, flouted by clerks and bullied by superintendents. The steel trade was never so well organized, but as yet it has no department of invention, in which original suggestions would be treated with respect and fairly tested. It is an erroneous notion that any large body of men will be unanimously progressive. All innovations must be forced through by the aggressive few. In spite of all that has been accomplished by invention in the American steel trade, there is not yet any prospect that a peace treaty will be signed between the men of ideas and the men of experience.

One innovation which is running the gantlet just now is James Gayley's "dry blast." Gayley needs no sympathy. He is one of the Carnegie multimillionaires and a vice-president of the United States Steel Corporation. Seventeen years ago he broke the world's record for making the most iron with the least coke, and he has kept in the front rank ever since. He will be the "pig iron king" of the world when his invention is fairly appreciated.

Gayley's aim is to take the moisture out of the air that is blown into the furnace. This is not a small item. The air blown into a furnace in one hour will contain from forty to three hundred gallons of water. Gayley's plan is first to carry the air through an ammonia chamber, which takes out the moisture in the form of frost. When the chamber is clogged with frost, hot brine is forced through the pipes. This dry or Gayleyized air produces a hotter fire with less coke. At its first test, this process made eighty-nine tons more in one day—a gain of about twenty per cent.

"This method can be applied to the making of Bessemer steel," said Mr. Gayley. "It will prolong the usefulness of the converter, because it will make the Bessemer process quicker and surer." His invention is not absolutely new to iron and steel men, but he has made it

workable. "We have all thought over it and talked over it," said John Fritz; "but Gayley has *done* it."

This "dry blast" is no longer an experiment. It has been in use since August, 1904, at one of the Pittsburgh furnaces. But the high financiers of the Steel Trust have been slow to recognize its value. Already they have lost the chance to monopolize the invention, as Gayley has recently allowed it to be installed by the Warwick Iron and Steel Company, of Pottstown, Pennsylvania, and the E. & G. Brooke Iron Company, of Birdsboro, Pennsylvania.

Another innovation which has only reached the "pooh, pooh!" stage, as it has been called, is the making of steel *direct* from the ore. This was Kelly's dream. He believed that both the blast furnace and the converter would be abolished, as a couple of unnecessary middlemen. During the last ten years of his life he studied this problem, and succeeded in smelting the ore by electricity. But the cost of making steel by this short way proved to be more than the cost of making it the usual long way. He maintained that the day would come when ore would be smelted for fifty cents a ton, and up to the time of his last sickness he was engaged in experiments to cheapen his process.

This endeavor is less of a dream today. At Gysinge, Sweden, high-class steel, said to be equal to crucible steel, has been made direct from the ore by an electrical process, water-power being used to cut down the cost. The Canadian government, which has been remarkably generous to steel-makers, has recently appropriated fifteen thousand dollars for experiments in electrical smelting. Edison has given his genius and a large fraction of his wealth to the solution of this problem. Consequently, it is not now to be classed among the will-o'-the-wisps, but among those improvements that may be expected in the near future.

So many dreams have come true in the wizardry of steel-making—so many ideas have mastered the obstinacy of custom, that it has become a futile and unprofitable thing to declare that any proposed improvement is impossible.

(To be concluded)

AMERICAN PROGRESS SINCE APPOMATTOX

BY CHARLES M. HARVEY

A STORY OF AMAZING CONTRASTS—THE LONG STRIDES MADE BY
THE UNITED STATES IN FORTY-TWO YEARS—NORTH, SOUTH, EAST,
AND WEST HAVE GONE FORWARD WITH UNPARALLELED RAPIDITY

OMAHA and Sacramento saw stirring things in April's early days of 1865. Oakes Ames, Sidney Dillon, and Thomas C. Durant at the one point and Leland Stanford, Mark Hopkins, and Collis P. Huntington at the other were starting, the one group toward the sunset, the other toward the sunrise, to push their divisions of America's first continent-spanning railroad toward the meeting-place of four years later, many hundred miles distant in northern Utah's desert.

Time and conditions stood behind the undertaking. A regenerated nation, more powerful, progressive, and expansive than the old, and with immeasurably greater prestige all over the world, was born. Foreign immigration and capital, repelled by the war, began to flow in with greater volume than ever before. The United States surged with the pulsations of a new youth. Eager, confident, exultant, the country, with its energies released from the work of destruction, turned to construction. It was America's new era, and its earliest and most direct concrete expression was the Union-Central Pacific Railway.

At the climax in 1869, when the rails met at Promontory Point, in Utah, Stanford and Durant driving in the golden spikes, the strokes were registered telegraphically at Washington, New York, Chicago, and other points in the United States, and the news was flashed to Europe by Cyrus W. Field's Atlantic cable—which itself appeared just a year after Appomattox. The actors in the scene held, for the moment, the center of the

universe's stage. The cannon salute which greeted this joining of the Atlantic to the Pacific in bands of iron—soon to be replaced by steel—was a shot heard round the world. Jay Cooke's Northern Pacific Railway, which wrecked him in 1873, was already beginning. It was completed by Henry Villard in 1883, the exercises being attended by ex-President Grant and by other eminent personages, many of them from Europe. In the Cascade Mountains in 1893, James J. Hill's Great Northern road had its last spike driven, and another transcontinental line—there are five to-day in the United States, as compared with none in 1865—was completed.

THE BONANZA DAYS OF SILVER

The roads themselves were partly the consequence and partly the cause of the gold, silver, and copper discoveries in the West. It was in 1872 that Mackay, Flood, Fair, and O'Brien made their strike on the Comstock lode in Nevada, a discovery which put bonanza in the English tongue, added \$600,000,000 to the world's silver stock in a few years, sent silver plunging downward in price, dislocated the currency of every nation on the globe, incited William J. Bryan's "cross-of-gold" speech in the Chicago convention of 1896, convulsed American politics in that year as it had not been convulsed since 1860, and swung all the world to the gold standard except China and a few petty republics in Central America.

One day in 1891, in a locality which had been trodden over by thousands of