AMERICAN INDUSTRIES.—No. 22.

THE MANUFACTURE OF SILVER-PLATED WARE.

From the plain porcelain and pottery of bygone times we have passed to more and more elegant articles of table furniture and ornament, until neither art nor imagination can suggest anything more exquisite and tasteful than some of the modern articles of silver-plated ware made for use, and for the adornment of the table and sideboard. The large and still growing industry, which we have chosen as a subject for illustration, is one that may be regarded as an index of growth in refinement, for as tastes in household matters are cultivated and manners become more refined, the progress is sure to exhibit itself in the appointments of the table.

Formerly the costliness of solid plate confined the luxury of a beautiful and well furnished table to the wealthy; but since the advent of electro-plated ware, almost any one may possess needed articles of table furniture having the most elegant of modern designs and being equal in appearance to the solid silver ware.

In the manufactory of Messrs. Reed & Barton, located in the quaint little city of Taunton, the work of making plated ware is carried on by an army of men and women, numbering in all about six hundred.

The foundation of this business was laid as far back as 1824, and, after passing through several hands, it came into the possession of its present owners in 1837. At that time the manufacturing was all done in one small three-story brick building, and one of the present members of the firm, who had learned the business as an employé of the original owners, took upon himself the practical direction of the work, and has retained it until the present time. His love for the work is very strong, and he may be found employed now here, now there, suggesting, watching, and showing with his own hands how the work should properly be done.

The metals used in this factory for making the alloys are obtained in pigs as they come from the mines. The white metal, as it is called, is composed of tin, copper, and antimony.

These metals are broken into fragments and purified by smelting; they are afterward mixed in proper proportions and transferred to a large iron caldron, where the alloy is kept at a suitable temperature to prevent the formation of dross. From this caldron the metal is dipped and poured into moulds forming ingots; these are rolled into thick sheets, which are scraped on either side to remove scale, dross, etc., and are then again rolled to the proper thickness for use. Some of the metal is compounded expressly for casting, the mixture being such as to run sharply in the moulds. Metallic moulds are used in casting handles, spouts, legs, etc., and the castings are made hollow by pouring the melted metal into the moulds, then immediately pouring out as much as will run out. This leaves a thin shell of metal of the required thickness adhering to the sides of the mould. The department in which the casting is done is shown in one of the upper views of the engraving.

The first operation in making a piece of table ware is to make a perfect model in wax, then a cast in plaster, from which the mould is made. The artistic part of the work falls upon the designer, the rest is purely mechanical.

The sheets of metal, after rolling, are cut either into strips or disks, according to the use to which they are to be applied. The strips are passed between engraved rollers which press upon them the figures of leaves, vines, flowers, or other ornamentation. The disks are stamped in a drop press, then spun into shape upon a lathe. As the operation of spinning was described not long since in our columns, we will not here give the process in detail. Some of the more complicated forms are spun upon separable blocks or moulds, which are withdrawn from the piece, a portion at a time, after the work is done.

After spinning, the trimmings formed of the ornamental strips are inserted, and the legs, handles, spouts, etc., are soldered on. This operation is carried on in the department shown in one of the lower views. The soldering is done with blowpipes attached to flexible tubes, which supply both air and gas. The solder used is similar to the white metal forming the body of the vessel.

After soldering, the piece is ornamented by chasing or by hand or machine engraving. The piece to be chased is filled with pitch, which, after hardening, gives a solid support to the sides of the vessel; the design is traced by small steel punches, which are rapidly struck by small hammers, quickly developing the pattern by indenting the surface of the metal. Hand engraving is done by the well-known method, and the machine engraving, or engine turning, is done by an intricate piece of machinery which forms those beautiful waved and striated surfaces seen on some of the finer kinds of ware.

The satin finish, now so much in vogue, is produced by a curious device consisting of a great number of steel wires jointed loosely to a spindle which revolves with great velocity. The work is held just below the spindle, so that the ends of the wires strike thousands of little blows upon the article held within the path described by the ends of the wires. The department in which this work is done is shown in one of the lower views, and just above the lathe carrying the satin-finishing tool will be seen one of these tools at rest.

The ware, after these several operations, is cleaned and polished and conveyed to the plating department shown in the larger view. Here the articles are submitted to a further cleaning, and then placed in a striking bath where they receive the first coating of silver. The bath is composed of the double cyanide of potassium and silver; the article is hung from one electrode, and a huge plate of silver from the other. The electrical current for plating purposes is now generated by means of the dynamo-electric machine, instead of the disagreeable and expensive batteries of former years.

After a very short treatment in the striking bath, the articles are washed in both warm and cold water and brushed; they are then placed in the plating bath, where they remain until the desired thickness of silver has been deposited.

The gold lining of vessels is applied by placing the gold solution in the vessel and using the vessel as one pole and stirring the solution about with a piece of gold attached to the other pole.

If it be desired to plate one portion of an article with silver and another with gold, or with two shades of gold, they are taken over to a bench, at which women paint the parts with a "resist," as it is called, of black varnish. After the exposed parts are plated this is easily removed, and other portions treated in the same way, while those at first covered receive another color.

When the deposition of silver is complete the article is removed from the plating vat and plunged into cold water for a moment, and then into hot, and handed over to a polisher, who holds it for another moment against a rapidly revolving fine wire brush, which partially removes the white bloom from its surface, and it is then ready to be burnished.

The surface of the work is burnished by rubbing it over with a set of polished steel tools so formed as to fit into all of the intricate curves in the ornamentation. The surface of the article is kept wet with soap and water. Spherical articles, having a considerable plain surface, are placed upon a lathe and burnished while in rapid motion. In this case the burnishing tool is a piece of highly-polished bloodstone cemented to a wooden handle, and the article is kept wet with stale beer.

After burnishing the articles then go into the papering room, where girls are busy all day long in wrapping the finished ware in several thicknesses of tissue paper, sealing those up in heavy wrappers, and marking them with the number of the pattern and other data. At last they are entered on the stock books and placed in the warerooms, and when sold are packed in tin lined wooden cases, and shipped to all parts of the world.

Some of this ware is represented in the upper central figure of the engraving, and the extensive establishment of Messrs. Reed & Barton is shown below.

We have recently had the pleasure of examining some of the ware made by this firm, and were impressed with the truly artistic character of the work. Their improvements in the construction of the ware, together with new and unique designs, indicate that this firm are thoroughly alive to the demands of trade.

AGRICULTURAL INVENTIONS.

Mr. Adam Hancock, of St. Albans, West Va., has invented an improved feed cutter, which consists of a rectangular box, open at the top and rear, and having a vertically movable front, whose lower edge is furnished with an inclined cutting blade. A lever, one end of which is fast in a rocking shaft fixed between the sides of the box, projects through a central opening in the movable front, and is the medium through which the device is operated.

Messrs. James P. Hall and Henry Jacobsen, of Niantic, Ill., have patented an improvement in check row planters; the rotating marker wheels vibrate the seed slide at the same time that the wheels are free to oscillate and follow the inequalities of the surface of the soil.

An improved check rower, to be attached to corn and other seed planters, has been patented by Messrs. Robert H. and William A. McNair, of Elsah, Ill. This invention consists of two spiders pivoted to a frame eccentrically in relation to each other, and carrying between them spades, which are always kept in a vertical position as they are carried around by the spiders.

Mr. Hiram S. Smith, of Austin, Minn., has patented an improvement in harrows, which consists in a beam and tooth fastening for harrows, formed of two straight parallel bars and two or more socket bands, which latter serve the double purpose of securing the bars together and clamping the teeth between them, so as to permit their adjustment wider apart or closer together, as may be desired.

Uriah A. Boyden.

The well known hydraulic engineer and inventor, Uriah Atherton Boyden, died, October 17, at Boston, Mass., where he had resided for several years. Mr. Boyden was born in Roxborough, Mass., February 17, 1804. His early life was spent on a farm, and in assisting his father in the management of a machine for splitting leather, invented and constructed by the senior Boyden. When he became of age, Uriah removed to Newark, N. J., where he joined his elder brother, Seth, in the manufacture of malleable iron and patent leather. He returned to Massachusetts about the time the first surveys were made for the Boston and Providence Railroad, and was employed on the survey. He afterward took part in the construction of the Lowell Railway and in the construction of the Suffolk, Tremont, and Lawrence mills.

In 1833 he opened in Boston an office, which he occupied until his death. The Nashua and Lowell Railway was built under his direction in 1836-8. For several years he was engaged as the engineer of the Amoskeag Company in establishing their extensive hydraulic works at Manchester, N. H. In 1844 he designed for the mills of the Appleton Company, at Lowell, a turbine wheel, which gave such satisfaction that in a little while that type of wheel was adopted for nearly all the Lowell mills. The Boyden turbines were also widely substituted for the older forms of water wheels in the best mills throughout the country, and Mr. Boyden soon accumulated a large fortune by his inventions and services. He retired from the practice of his profession some years ago, and devoted himself to scientific investigations, making many inventions in connection with philosophical and chemical, metallurgical, electrical, and other apparatus. Latterly the theory of radiation has engaged his attention, a recent number of the Journal of the Franklin Institute containing an advertisement to the effect that he had deposited with the society $1,000, to be awarded "any resident of North America who shall determine by experiment whether all rays of light are or are not transmitted with the same velocity." His other contributions of money in aid of physical research and for the advancement of mathematical studies were many and generous. It is reported that he leaves the greater part of his property for the purpose of making scientific investigations of the properties of heat and the phenomena relating thereto. When such investigations have been thoroughly made, he requests an expenditure for observatories to be built on prominent peaks for the gratuitous use of young students in astronomy and kindred sciences.

Henry C. Carey.

Henry Charles Carey, the venerable publisher, author, and philanthropist, of Philadelphia, died at his residence in that city, October 13, at the advanced age of 86 years. From his eighth to his forty-second year Mr. Carey was engaged in the business of publishing and bookselling, founded by his father. In 1835 he withdrew from trade and devoted himself to study and writing. The next year he published his essay on "Rates of Wages," which he afterward expanded into a large volume entitled "The Principles of Political Economy." This was the foundation of what is known as the American School of Political Economy; and with many of his later works it has been republished in German, French, Russian, Italian, Swedish, and Japanese, powerfully influencing the course of thought abroad as well as at home. Personally Mr. Carey was greatly beloved as well as honored by a wide circle of acquaintances.

Dr. F. Julius Le Moyne

Dr. Le Moyne, so widely known through his advocacy of cremation instead of burial, died at his home in Washington, Pa., October 14, in his 81st year. He was a man of great wealth and learning, as well as of marked eccentricity of character. In early life his decided position in favor of the abolition of slavery brought even more violent enmity than he aroused in his old age by his public efforts to introduce the practice of cremation. He offered to build a crematory for public use in the Washington cemetery, but his offer was declined without thanks. He then built on his own land the furnace in which Baron de Palm and Mrs. Ben Pitman were cremated, and wherein his own remains have since been converted into ashes. He was a large man, weighing 200 pounds; after cremation his ashes weighed seven pounds.

The Philadelphia Elevated Railway.

Philadelphia papers state that the contract for the iron to be used in the Pennsylvania Railway Company's elevated road, in that city, has been awarded to the Edgemoor Iron Works. The contract calls for about five and a half million pounds of iron.

The company promises the completion of the road by July 4, 1880, from the proposed central station at Fifteenth and Market streets, across the Schuylkill, to connect with the Pennsylvania surface road near Thirty-fifth and Market streets. The contract for the bridge over the river has been given to Keller & Goll, of Lancaster Pa., who enter upon the work at once. The bridge is to be what is known as the double intersection Warren girder, wrought iron, an old English style of bridge, improved somewhat by the Pennsylvania Railroad, and similar to the bridge over the Susquehanna river at Rockville, and the one over the Delaware at Trenton. The superstructure will be 30 feet wide, to accommodate three tracks, two for passenger and one for freight traffic. The west span will be 144 feet long, and the other two each 160 feet, making the entire length of the bridge 464 feet.

Electrical Test for the Mechanical Equivalent of Heat.

In a series of experiments recently described to the Vienna Academy, Professor von Waltenhofen has sought to deduce from a direct measurement of the work done in induction of an electric current in a closed circuit of given resistance, the mechanical equivalent of heat. For induction, a magneto electric machine was used, whose electromotive force was ascertained to be proportional to the number of revolutions. A dynamometric handle of the newest construction was attached, and it was furnished with an arrangement for receiving the work diagrams. The induced currents were measured by means of a tangent galvanometer. The results were found to be in satisfactory agreement with Joule's equivalent.

Should Investigators be Teachers?

It has frequently been observed, with more or less of regret, that some of the most capable of our scientific investigators have had to spend the larger part of their time and strength in the drudgery of teaching, apparently to the grievous hinderance of what would seem to be their true work.

In his paper on "Modern Education: its Opportunity and its Perils," read before the Social Science Association, President Porter, of Yale College, ranges himself decidedly in opposition to this view of the case, holding that science gains more in the quality of its work of research and in the value of its results by a close and active contact with living pupils than it need lose by the distraction of its attention or the lowering of its enthusiasm. He says:

"There is danger that the man of research, who is nothing else, will give himself to a single department of thought, and have neither eyes nor ears nor thought for the facts and truths which lie beyond his horizon. It is well for science itself, that when one of its devotees is inclined to shut himself up in the narrow cave of his own studies and now and then pay unlawful honors to the idols which are hidden there, he should be forced to bring his theories into the light of common day by attempting to teach them to others. Many an extravagant hypothesis might have been nipped in the bud had its romantic originator been forced to state and defend it before the scrutinizing judgment of a classroom of not over reverential youth. We do neither dishonor the eminent abilities nor the actual services of either Mr. Darwin or Mr. Herbert Spencer when we express the opinion that they would have rendered far more valuable services to science had their activities in research been arrested by constant challenging from slow-minded and critical pupils. Whatever may have been true in the past, it is certain that science must fail of a healthy life unless its duties maintain a close and constant sympathy with the intellectual life of the on-coming generation, as represented in our higher schools."

MECHANICAL INVENTIONS.

Mr. Henry A. French, of North Orange, Mass., has invented an improved wrench, in which, by pushing on a pin with the finger a lever is caused to raise a pawl, when the jaw can be moved up or down, as may be required, and when the pin is relieved from pressure the spring immediately throws the dog into engagement with the ratchet on the shaft of the wrench.

A lever power, patented by Mr. Mathew C. Franklin, of Lockhart, Texas, relates to improvements in the manner of applying the power and resistance to the lever, so that they will change positions with relation to the fulcrum as the power end of the lever descends.

Mr. Henry C. Forney, of New York city, has invented an improvement in motors for pumping water from wells, the object of which is to utilize the force produced by the gravitation of a weight down into the well or from any height to operate the pump lever.

An improved pawl and ratchet mechanism for mowing machines has been patented by Mr. Hamilton A. Dean, of New Lebanon Center, N. Y. The object of this invention is to furnish a ratchet for mowing machines that shall operate without springs, and with so small a dead point as to obviate the necessity of jerking the machine forward or backward at any time to get it into gear.

Mr. Jacob Inglehart, of East Saginaw, Mich., has patented an improvement in the class of sawmill dogs composed of a series of pivoted hooks which act downward, and an opposing hook which acts upward, so that the log is grasped between them, the two sets of hooks being connected by links and operated by a lever.

Mr. Louis D. Le Nord, of Locksburg, Ark., has patented an improved horse power to be used in giving motion to cotton gins, thrashing machines, and for other similar purposes. It consists of an arrangement of bars and sweeps which cannot be readily described without an engraving.

Mr. John H. Ahrens, of Oswego, N. Y., has patented an improved device for setting circular and other saws, which is so constructed that all the teeth will be set exactly alike, and will retain the set so that less filing and less setting will be required than when an ordinary saw set is used.

Mr. Henry W. Steinsiek, of Jamestown, Mo., has invented an improved millstone dressing machine which for accuracy and rapidity of work is intended to excel those now in use.

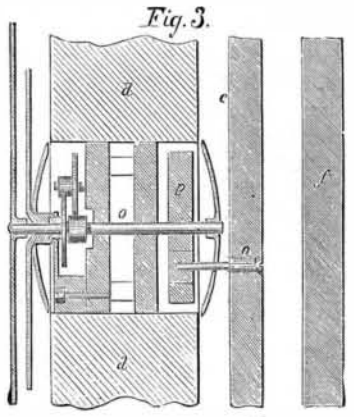
FIFTY thousand gross of watch glasses are sold annually in the United States. Such a statement seems almost incredible, but the figures are from the *Watchmaker and Metal Worker*, which ought to be authentic. One importer alone imports thirty-five thousand gross.

MYSTERIOUS CLOCK.

In M. Théodoré's clock, shown in the accompanying engraving, none of the actuating parts are visible. Apparently it has no works, but a close examination shows that the driving mechanism is concealed in the base. Fig. 1 is a front elevation; Fig. 2 is a vertical transverse section; and Fig. 3 shows the dial wheels and their connection with the movable plate that is carried by the clock mechanism in the base.

A metal frame, *a*, surrounds three rectangular plates, *f e d*, of glass. The plate, *d*, is thicker than the others, its edges are beveled, and upon it is formed the dial. The plates,

Fig. 3.



f and *d*, are fixed, but the plate, *e*, rests upon a grooved bar, *g*, and is guided at its upper edges by two springs, as seen in Fig. 2. The plate, *d*, supports the hands of the clock and the dial wheels, which are concealed by a small tube passing through it.

The grooved bar, *g*, upon which the plate, *e*, rests, is supported by two vertical rods, *i i*, the lower ends of which are carried by eccentrics, *k*, that receive their motion by a train of wheels from the wheel, *l*, on the minute hand arbor of the clock. The plate, *e*, is counterbalanced by the weights, *m m*.

The two eccentrics revolve in the same direction, and the ends of the bar, *g*, are moved in the same direction at the same time, consequently every portion of the plate describes the same circle as the eccentrics. The rods, *i*, which support the plate, *e*, are concealed by the ornaments, *c*. A small screw, *n*, passes through the plate, *e*, and enters a crank wheel, *p*, concealed in the center of the dial. As the plate, *e*, moves this screw carries the crank wheel, *p*, which, being fixed on the minute hand arbor, carries the minute hand. Motion is communicated to the hour hand by dial wheels, which are of the usual form, but very small.

As all of the glass plates are perfectly transparent, they appear as a single plate, and the motion of the plate cannot be discovered by the eye.

Fig. 1.

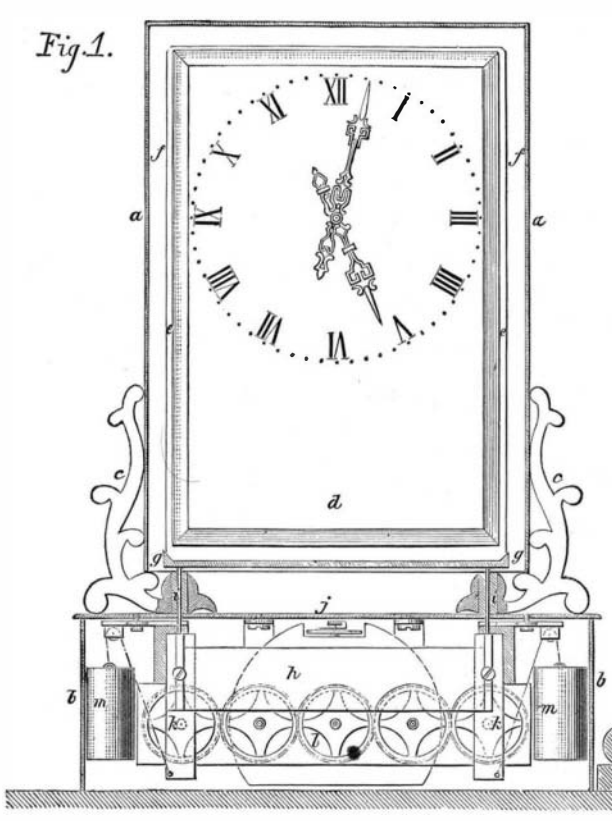
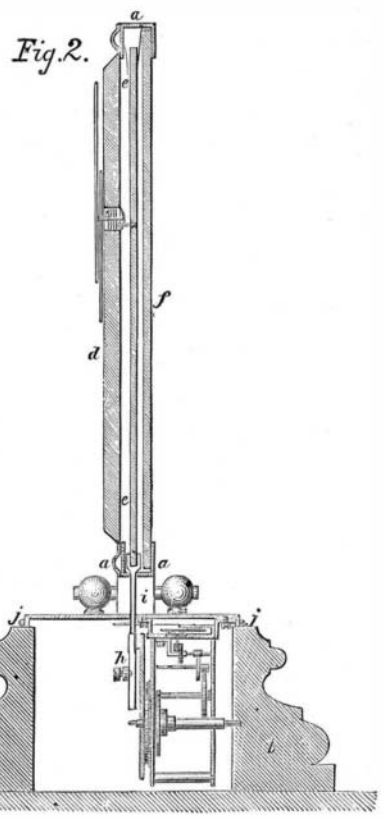


Fig. 2.



THEODORE'S MYSTERIOUS CLOCK.

Bessemer Steel.

The representatives of the Bessemer steel works of the United States held a meeting in Philadelphia, September 3, to consider measures for the regulation of trade, now more active than it has been for several years. Ten out of the eleven Bessemer steel works of the country were represented. Reports from all points showed that the trade is enjoying the highest prosperity and the brightest prospects for the future. Without exception every rail mill in the country has orders for more than it can produce up to the end of the year, and many of them have already taken orders for several months in the ensuing year.

The Metric System in Philadelphia.

After extended inquiry among the druggists in Philadelphia, the *Medical and Surgical Reporter* says: "The introduction of the metric system, so far as Philadelphia is concerned, is an absolute failure. There are many reasons for this, and good ones. When closely examined, there is by no means that simplicity about the metric system, nor is there that fixity about it, which its admirers have claimed. Its unit is notoriously based on a mathematical blunder, the meter not being the ten-millionth part of a quadrant of the meridian of Paris, as was supposed by those who first adopted it. It is wrong one meter in every five hundred and fifty-five thousand. Practically it is found very inconvenient to convert *accurately* apothecaries' into metric weights and measures."

Carriage Building in the United States.

The seventh annual convention of the Carriage Builders' National Association was held in this city, October 15. The association has a membership of nearly 300, in the most important cities of twenty States, and represents a capital of $100,000,000. The importance of the carriage trade and the rapidity of its development are shown by the following statistics compiled by the *Graphic:*

Sixty years ago there were only ninety-two carriage establishments in the United States. They gave employment to 2,574 persons, producing 13,331 carriages of various kinds, amounting in value to $1,708,741. In 1850 it had increased to 1,822 establishments, employing 14,000 persons, and producing carriages to the amount of about $12,000,000. From that year to 1860 the increase was extraordinarily rapid, showing that the number of carriage manufacturers had increased from less than 1,900 to 7,234, employing over 37,000 workmen of various grades, and turning out carriages to the value of $36,000,000. From 1860 to 1870, despite the fact of the loss of our export trade caused by the war, the increase continued at the same ratio, the total number of carriage establishments throughout the Union then numbering 11,944, employing 65,294 persons, paying out $21,834,355 for labor, and producing about 800,000 carriages, amounting to $67,406,548. It is now estimated that there are 15,000 carriage manufacturers in the United States, who employ upward of 100,000 hands, pay out from $25,000,000 to $31,000,000 for labor annually, and produced during the past twelve months upward of 1,200,000 carriages, amounting in value to fully $125,000,000. This makes one carriage to about every thirty-eight persons in the United States, to say nothing of sleighs of various kinds. This does not include the extensive manufacture of axles, springs, wheels, bows, joints, bolts, clips, leather, cloth, and the thousands of articles made in part that are now purchased in a partly finished state by the trade, in which many thousands of men find steady and remunerative employment. These statistics prove without a doubt the claim already put forth that carriage building is entitled to be rated as one of the leading manufacturing industries of the country.

The great manufacturing centers in the carriage line in the East are Amesbury, Mass.; Merrimack and New Haven. The rivalry between Amesbury and New Haven has been spirited during the past three years, but thus far the Yankee town maintains the lead, sending to the market last year 16,000 carriages of different models and of superior workmanship, against 13,000 turned out by the Elm City factories.

New York is the leading center of the Union for the sale of fine carriages, and is rapidly increasing its list of manufactures. Newark and Rahway, N. J., which prior to the war had almost a monopoly of the Southern trade, have failed to recover from the great losses entailed by the struggle, and are no longer great carriage manufacturing cities. Notwithstanding, however, the changed aspect, some of the finest models of carriage architecture are yet sent to the market by their old and experienced builders, and hopes are entertained by them, owing to the extraordinarily large demands made upon them this year, that they will eventually regain much of their lost trade. Reports from Philadelphia and Wilmington, Del., where carriage building has, within the last ten years, assumed large dimensions, show that the past year has been one of the most prosperous that the trade has experienced. In both cities the manufacturers speak encouragingly of the outlook.

Of the Western cities, Cincinnati, South Bend, Ind., and Columbus, O., take the lead in the carriage industry, eight firms in the first named city having manufactured 63,000 carriages and buggies last year. The product of South Bend, where the largest carriage manufactory in the United States is located, was less by a few thousand. There are but few great carriage manufactories in Chicago, but it is the chief center of sale of Eastern and Western varieties of carriages and buggies.