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THE MANUFACTURE OF WOOD WORKING MACHINERY.—J. A. FAY & CO., CINCINNATI, O.

In any review of the growth and progress of a great manufacturing house during a period of nearly a half century, much that is interesting and suggestive must of necessity be omitted, and many things treated superficially.

A brief history of the house whose name heads this article is illustrative of the progress of this country, especially in respect to its manufacturing industry in every branch of business connected with the manufacture or use of lumber. In no department of mechanics has the advancement been more rapid and the improvements more radical than in the machinery for working wood. Up to the beginning of the last quarter of the eighteenth century, the wood worker, with the ax, adz, pit saw, chisel, and rasp, did his work, and it may be said that, with the exception of a few saw mills, there was in that day no machinery for working wood. That saw mills were rare at that time may be gathered from the fact that one established in Limehouse, in the western district of London in 1767, was destroyed by a mob of sawyers, who considered their craft in danger. Many of the old residents of this country distinctly recollect when logs and tree trunks were sawed from end to end, to work them into dimension stuff, by two sawyers, one standing on the log and the other in the pit beneath with a veil over his eyes to protect them from sawdust. These sawyers were truly hard workers. The top sawyer, while he swung his weight upon the handles above, invariably bossed the wretch in the hole who pulled down.

Now there are hosts of saw mills of various kinds in all great lumber centers of the country. They are driven by steam and water power in gangs on the most gigantic scale, and there is no end of wood working machinery in use in manufactories, also machines for special work in all cities where the stuff thus roughly "got out" into square stuff or merchantable lumber is sawed into plank, dimension lumber, slats, veneers, and worked into thousands of forms.

In the invention, manufacturing, and introducing of wood working machinery, J. A. Fay & Co. have been the pioneers; their name is known all over the world, and their machines are in use in every land. They are still as full of the pioneer spirit as ever, being constantly on the alert to accede to the demand of the times by introducing everything new or useful in their department of manufacture. This business, which has made the name of Cincinnati known at the remotest corners of the earth, was not built up in a single day. Its growth has been like that of the oak from the acorn, slow but sure, until its trade and trade ramifications are enormous. Successive years only add to and increase its volume.

We present to our readers an engraving of the extensive plant of this house, with an inside view of a few leading departments, together with facts of its history, which will be to many very interesting. (See our first page.)

In 1834, George Page, of Keene, N. H., invented and began the manufacture of foot mortising machines. These were the first machines of the kind made in this country, if not in the world.

In 1835, Mr. J. A. Fay, of Marlboro, Mass., associated himself with Geo. Page, and under the firm name of Page & Co., Mr. Fay introduced the Fay tenoning machine for tenoning and coping doors, sash and some other wood-working machines. The country was not then opened up by railroads and was sparsely settled, and Mr. Fay found a market for his machines by taking them in a wagon over the hills and through the valleys, introducing them in various sash and door shops.

These machines were so wonderfully labor-saving, as compared with the old tedious and laborious hand process of working, that it was but a short time before their merits became established, and a rapidly increasing trade followed. In the mean time, Mr. Edward Joslin, of Keene, N. H., who had been in the employ of the company as a workman from the beginning, joined with Mr. Fay, and bought out the business of Page & Co. He was of a quite inventive turn of mind, and from this time the firm introduced various labor-saving wood working machines. This was in 1841. In 1848, their business having increased beyond the capacity of their works, they started branch manufactories at Worcester, Mass., and at Norwich, Conn. In the manufactory at Norwich, Mr. C. B. Rogers, now deceased, had a large interest and was the resident partner. The business increased rapidly and steadily, until, eleven years later, or in 1852, the enterprise was so great that they felt they must have a Western connection.

This was before there were railroads traversing the West and Southwest, as now; and in this year they established, at the corner of Augusta and John Streets, Cincinnati, another branch house of J. A. Fay & Co., with Mr. John Cheney and Mr. E. Reed as resident partners. Later in the same year, while Mr. Fay was in Richmond, Va., with a view of establishing a branch house in the South, he died. In 1855, his executors sold out his business at Norwich to C. B. Rogers & Co., and later, in 1862, discontinued the Worcester house, and still later, in 1863, discontinued the parent house at Keene, N. H., transferring most of the important machines to the Western house at Cincinnati.

In 1861, 21 years ago, Mr. Cheney retired, and Mr. W. H. Doane, who had been several years with the company, became the leading member of the house and manager. Its history during these 21 years is marvelous. And to recount its progress would involve the history of Cincinnati itself.

In 1860, the establishment of J. A. Fay & Co. was considered one of the largest in the West, but since that time it has more than quadrupled its size, and now it covers more than six acres of floor space, and furnishes steady employment to about 400 skilled artisans and mechanics, who, aided by the most improved labor-saving machines, are able to turn out the work of more than 2,000 men. The buildings are five stories in height and of the most substantial character, and are provided with four power elevators. The motive power is supplied by a Corliss automatic cut-off engine, which takes its steam from a battery of Babcock & Wilcox sectional wrought iron boilers of 250 horse power. Over 2,000 feet shafting and 5,000 feet of belting are in use in the different departments. The strictest system pervades the whole establishment; there are all together 15 divisions, each with its own foreman and all under the immediate supervision of a general superintendent. The foreman are especially selected from among the most skilled workmen of a department, and all vie with each other upon the general excellency of the product of their different departments, the aim of each being to excel the other.

To form a correct opinion regarding the immense number and variety of the machines made at these works, they should be visited; but for the benefit of our foreign readers, we will enumerate a few of the principal ones and the uses for which they are designed.

Of car building machines for railroad shops, they make about thirty-five different varieties. Of planing, including matching, machines, over twenty, adapted to all kinds of work, from the smallest cigar box and cabinet making machines to those for the largest possible requirements, and weighing many tons. The number of wheel and carriage making machines, including machines for making and finishing every part of the wheels and carriage, is between thirty and forty, and of sash and door machines about the same number. Of cabinet making, including furniture, machines, twenty-five or more; agricultural implement machines, about twenty-five; and bridge building machines, about twenty-five. Of band sawing machines, they build ten sizes, from the largest costing two thousand dollars with a capacity to saw a log six feet in diameter to the smallest size, costing one hundred and fifty dollars and suitable for all common scroll and curve cutting.

To describe the capabilities of the machines would require a volume, but their utility and power may be inferred from a brief description of a few. Among the more ponderous and massive are those designed for railroad car building. In fact, it may be stated that these are of a special character, particularly designed to decrease very materially the labor and cost of handling heavy timber; and to such perfection have these devices attained, that in dressing car sills, where formerly several machines were required to dress and square up fifty in a day, one machine will now do the same amount of work in an hour. The power of a large timber dressing machine is so great and its execution so precise that timbers even up to twelve inches square and of any length can be finished on all four sides at one cut at the rate of thirty feet per minute. If required, it will reduce one inch by the top cutting cylinder and the same with the heads which cut upon the sides. This, exclusive of the cut of the lower or under head, would make three inches off the surface of a timber, or equal to more than one inch reduced at one cut from a timber twenty-four inches wide. The vertical car tenoning machine, which takes the sill or timber from the machine first described, makes single, double, or triple tenons, first on one end, then on the other, without reversal. This one machine alone, it is said, saves the labor of sixty men. Another machine, the car gaining and boring machine, is capable of automatically traversing back and forth over timbers, and at each passage cutting grooves of any desired depth or width.

Stops regulate the precise distances apart, so that exact duplicates of the gains can be made in any part or number of pieces of timber without laying out. A vertical boring attachment completes the holes in the timbers for joint bolts while it is on the carriage of the machine, thus saving the labor of additional handling and separate machines. This machine is capable of doing the heaviest class of work required. Heavy mortising and boring machines are constructed that will "beat" mortises up to two and a half inches in width and of any ordinary depth, the peculiarity of which is the graduated movement of the chisel bar, which commences from a still point above the upper extreme throw of the chisel mandrel, and working down gradually into the wood without jar to the operator. In this department alone are turned out machines for boring with one, two, or three spindles either vertically, horizontally, or radially, that will finish a piece of timber in from four to five minutes. In all these machines, the quality as well as the quantity of the product are the leading features attained, and these remarks will apply with equal force to every class of machines made in the factory, regardless of the grade of work for which they are intended. Had we space, we might extend our review of the capabilities of the different machines to an unlimited extent. It is, however, a fact that the largest variety of machines for wood working purposes to be found in any manufactory in the world is made at this establishment, and its facilities rank it among the most extensive establishments of the kind in the world. To this house the manufacturers of the United States look for their best equipments. Here, furniture makers, wheel and carriage makers, planing mill owners, and other users of labor-saving wood working machinery look for the highest standard of excellence and perfection. The striking originality of the machinery, possessing as it does all that is desirable in accuracy of workmanship, precision of action, strength of construction, solidity, and uniformity, has attracted not only the attention of manufacturers, but also the executive departments of foreign governments, who have given the firm many orders.

The house of J. A. Fay & Co. have many established agencies and correspondents throughout the world. The following is a partial list of their principal representatives:

Messrs. Cayley & Cayley, Brackley St., Golden Lane, London, are the agents for Great Britain and Ireland. The same extensive house has also a branch in Hamburg, and are also agents for Germany, Austria, Norway, Sweden, and Prussia. The well-known house of H. P. Gregory & Co., of Sydney, represent the company in Australia.

In the city of New York, the George Place Machinery Co. are the general agents. Utilles Baird, of Water St., Pittsburg, Pa., is the agent of that city. At Detroit, Mich., the house is represented by James Jenks, Nos. 48, 50, 52, and 54 Randolph St. At Chicago, the firm have a branch house at 207 and 209 Lake St., over which Mr. John A. Roche, a mechanical engineer of reputation and ability, presides.

At St. Louis, Mo., the company have their own warehouse at 720 North Second Street, under the management of Mr. C. C. Harris, well known in that part of the country. On the Pacific coast, both at San Francisco, Cal., and at Portland, Ore., the house is represented by H. P. Gregory & Co., Market Street, San Francisco, who have extensive houses at each place. The general agents have also many minor agencies under their management and jurisdiction.

Large shipments are constantly being made to Great Britain, Russia, Germany, Italy, Sweden, France, Japan, Africa, South America, New Zealand, Mexico, and other countries. In all of these countries, their machines are looked upon as unrivaled.

The many displays of machinery by this house at the international expositions have done not a little toward bringing the excellence of their manufactures before the public, especially as at all of the expositions they have received the highest awards, which was the case at Paris, Vienna, Australia, etc.

The prominence gained for this house during twenty-one years, from 1861 until the present time, is undoubtedly largely due to the most indomitable energy, sagacity, mechanical skill, and executive ability shown by its president, Mr. W. H. Doane, and Mr. D. L. Lyon, secretary, who have lived to see the business of the house increase to the most extraordinary dimensions, with its reputation extending throughout the whole earth.

Absorption of Volatile Substances.

T. Schloesing has attempted, in *Comptes Rendus*, p. 1,187 to explain the fact that when air containing hydrochloric acid has been passed through ammonia, it is filled with clouds of salammoniac vapors. He says that solid and liquid substances floating suspended in gases possess so little power of motion that they do not come into contact with the liquids through which such gases are conducted, and hence are not retained by them. This mobility, however, is attained by vaporizing the substance and converting it into a gas.

If air containing vapors of sulphuric acid is passed over common salt at ordinary temperatures, the hydrochloric acid given off always contains sulphuric acid. But if the salt is heated to 350° C. (632° Fahr.), so as to convert the sulphuric acid into vapor, it will be completely retained by the salt.

If air containing hydrochloric acid is passed up through a vertical column, and water trickles down through it continuously, the acid will not be entirely absorbed; but the solution is perfect if the temperature is raised to that of boiling water.

If air containing carbonate of ammonia in form of dust is conducted through a small tower of coke, with sulphuric acid on it, the alkali will not be completely retained by the acid until the temperature is raised to 212° Fahr. Schloesing therefore recommends heating instead of cooling as favorable to absorption.—*Ind. Zeitung.*

Coal Mining in Ohio.

In his report for the year ended last June, the State Inspector of Mines of Ohio states that the annual production of coal has increased since 1872 from 5,315,294 tons to 9,450,000 tons in 1882. The increase upon 1881 was over 1,000,000 tons. The undeveloped coal of the State is estimated at 85,000,000,000 tons. The amount mined thus far is about 70,000,000 tons. The Inspector is of the opinion that an equal amount has been wasted on account of a lack of accurate mining plans and engineering skill.

Professor Koch's Discovery Disputed.

At a meeting of the New Orleans Pathological Society, November 20, the President, Dr. H. D. Schmidt, made an important microscopic demonstration to disprove the reported discovery of Professor Koch, in Berlin, as to the bacilli of tuberculosis. Dr. Schmidt claimed to demonstrate that the bacilli thought by Dr. Koch to be the cause of tubercular consumption were simply fatty crystals. Dr. Schmidt's researches have been long and minute, and he is confident that Dr. Koch is in error.

Lead Pigments.

The manufacture of lead paint was begun in America by John Harrison, of Philadelphia, a young man, who, according to the *Glassware Reporter*, believed that a large number of chemical products which were being procured from abroad might be made here as well. Having finished a thorough education in chemistry under the celebrated Joseph Priestley, of England, Harrison started a factory of sulphuric acid and white lead in Philadelphia in 1798, and prospered from the very first. The house of John T. Lewis & Brothers, founded in 1807, afterward went into the same business. The manufacture soon extended all over the country. It became particularly successful in Brooklyn, N. Y., owing to the growth of the communities in that immediate vicinity. At the present time there are 145 factories engaged in the production of paints, the manufacture of lead pigments being a part of their business. They employ 3,000 hands, and produce $17,000,000 worth of goods annually, in average years. Of the total number, 34 are in Pennsylvania, 16 in Massachusetts, 11 in New York, 14 in Ohio, 10 in Missouri, and 4 in Illinois.

The principal pigments made from lead are minium or red lead (which is easily produced by exposing litharge at a continued low red heat to the action of the air), white lead, a carbonate of the metal, chrome red, and chrome yellow. They are all beautiful, brilliant, and valuable pigments. Oxide of zinc now contests with white lead the favor of builders; but the importance of the pigment is scarcely affected by the competition.

White lead was originally made in Holland; and invention has thus far failed to supersede the "Dutch process" of its manufacture. Some variations in the details have been made in America, but the process is essentially the same in principle as that invented by the people who taught Northern Europe the arts of industry.

To prepare the pigment, the purest metallic lead is obtained. Originally it was subjected to the chemical operation in the form of loose rolls of sheet lead. The American method is to cast the lead into circular gratings looking very much like shoe buckles. In whichever shape prepared, the lead is put into earthen jars, with a little vinegar at the bottom, the lead being supported by earthen ledges from coming into contact with vinegar. Sometimes the pots have openings in the sides to permit a free circulation of the vapors set free in the process. An immense collection of the jars, tens of thousands in number, is then packed in alternate layers with layers of some fermenting material which will give out carbonic acid gas. Originally stable manure was employed. Now tan bark is preferred. The layers of jars and bark are carried up sometimes twenty feet high, the bark being kept out of the jars by sheets of lead and by boards. A large building being filled in this way is then closed. The fermentation sets free a large quantity of carbonic acid. Basic acetate is first formed on the surface of the lead in the pots, which is decomposed by the carbonic acid gas, forming carbonate and free acetic acid. The latter acts again on the lead. Very little vinegar is required; and the process goes on continuously, assisted by the heat of the fermentation, until, at the end of ten or twelve weeks, fermentation stops. The process is then at an end. The stack is taken to pieces, and the lead is found in its original form, though increased in bulk and weight, and converted into a very white and soft carbonate. If the conversion has not been thoroughly done, a can of metallic or blue lead will be found in the interior of some of the pieces. The pieces of lead are now thrown into large tanks filled with water, in which they rest upon shelves of copper full of holes. They are beaten to separate and pulverize the carbonate, the water preventing the fine dust from poisoning the air and injuring the workmen. Grinding and washing in water then follow, until the carbonate is reduced to an impalpable powder. It is then dried in steam pans or upon tile tables, and put up for the market. The carbonate obtained in this way is superior to that obtained in any other; but a very fair article is made by boiling solutions of nitrate or acetate with litharge, and precipitating the solution with carbonic acid. White lead is not alone employed as the best white paint; but it constitutes the body of almost all other paints, it being colored by intermixture with other pigments.

Chrome yellow is obtained by precipitating a solution of nitrate of lead with chromate of potash, and washing and drying the product. The red, a bright powder, is obtained from the yellow by boiling it with lime or some other alkaline; also by digesting levigated litharge, by boiling with neutral yellow chromate of potash, etc. A green lead is also made.

Considering how far a pound of oil paint goes in coloring a house or fence, the consumption of pig lead in paint making must be regarded as enormous. It now amounts in the United States, yearly, to about 50,000 tons. Notwithstanding the cheapness of lead paint, it is largely adulterated for the market, by small dealers, with sulphate of baryta. This is absolutely white and is not easily affected by gases, but it does not make so brilliant a paint.

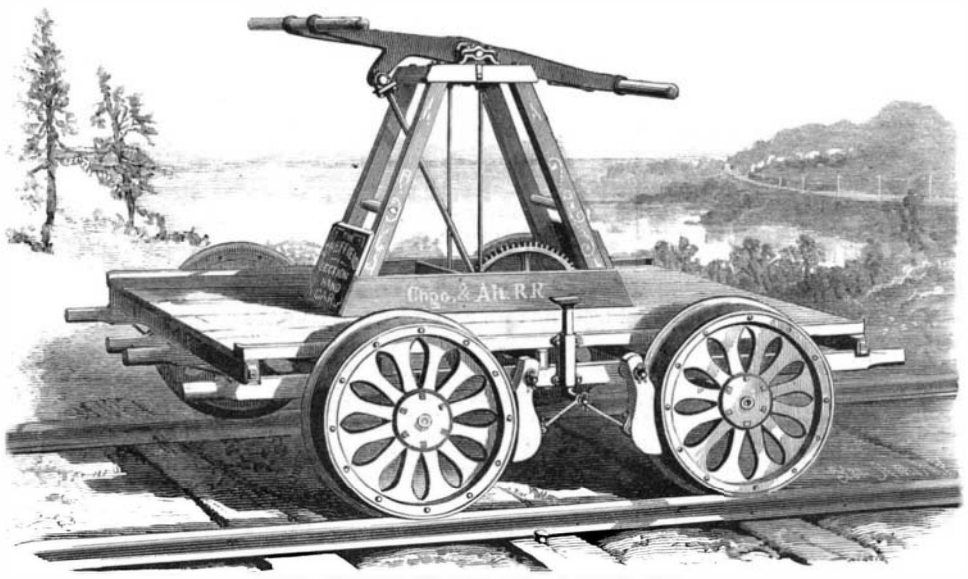
Litharge, frequently alluded to above, is protoxide of lead, produced by exposing melted lead to a current of air. It fuses readily, and, on cooling, forms a mass consisting of glistering, semi-transparent, yellow or reddish yellow scales. It generally contains more or less red lead, whence the variations in its color. It is used in the composition of flint glass.

Solar Cannon of the Palais Royal.

Strangers in Paris who have happened to be in the garden of the Palais Royal at noon on a fair day, will have noticed groups of persons watching intently at a not very conspicuous object in the garden, but all eyes seem turned toward it. The object which attracts their attention is a small cannon of antique pattern, which is automatically fired at midday by the arrangement of a sun glass so adjusted as to concentrate the sun's rays upon the priming powder, and produce an explosion at exact noon. Referring to this little cannon *L'Astronomie* says it dates from a greater antiquity than is generally known. It thundered during the Commune, under the Empire, during the days of '48, under Louis Philippe, under the Restoration, during the wars of the Grande Armee, during the guillotines of the Reign of Terror, on the day when Camille Desmoulins harangued the people, under Louis XVI., under Louis XV. In his charming "Journey from Paris to St. Cloud, by Land and by Sea," published in 1751, Néel makes his young tourist regulate his watch by it. The pillar on which it is fixed stands at the point where, in 1641, a year before his death, Cardinal Richelieu established a bound between the manors of St. Honoré and of the Archbishopric.

SHEFFIELD SECTION HAND CAR.

The Sheffield patent section hand car shown in the engraving is superior in many points to other section hand cars now in use. It is made light, yet very strong and durable.



SHEFFIELD SECTION HAND CAR.

It is easy to handle, and at the same time serviceable. The walking beam or hand lever of this car is of wrought iron, and is connected to the drive gear by a rod provided with devices which enable all lost motion to be readily taken up.

The rock shaft of the walking beam is removable and adjustable. The crank shaft is attached to the crank by a new method which dispenses entirely with the use of the ordinary key and key way, thus obviating all trouble relating to that style of fastening. The axles, 1¼ inches in diameter, are made from the best open hearth steel, and run in brass boxes.

The construction of the brake is readily understood from the cut. It brakes both wheels, and is very efficient. The wheels are made under a patent granted September 5, 1882, and combine lightness with great strength and durabilty.

Though placed on the market less than six months ago, this car has already gained great popularity, and has been adopted by such roads as the Chicago and Atlantic, Central Iowa, and many others.

For further particulars address the Sheffield Velocipede Car Company, Three Rivers, Mich.

Heavy Rainfalls.

It is a heavy rain in this latitude when an inch of water falls in one day, yet this amount is occasionally exceeded. According to the Signal Service Bureau, the greatest falls in the last twelve years have been as follows:

March 24, 1871, 2·37 inches; July 26, 1872, 3·80 inches; August 21, 1873, 2·24 inches; September 17, 1874, 2·41 inches; August 12, 1875, 3·34 inches; March 25, 1876, 3·45 inches; October 4, 1877, 4·2 inches; August 1, 1878, 2·39 inches; May 19, 1879, 1·11 inches; July 22, 1880, 1·81 inches; March 19, 1881, 2·40 inches; September 23, 1882, 6·17 inches.

A FEW weeks ago, during a heavy storm, the Rio Grande River suddenly changed its course by cutting through a bend near Camargo, and thus placed several acres of inhabited territory within the legal limit of the United States.

A Nitro-Glycerine Factory.

Near the village of Tweed, Ontario, and at the water's edge of Stoco Lake, is a fair sized, unpretentious, isolated, wooden building, the appearance of which would cause a stranger to inquire why such a good building was erected in such an isolated locality, and why it was so closely guarded, as a solitary watchman, day and night the year round, checks the steps and inquires the business of the curious as they stray near. As the eye passing upward reads "Nitro-glycerine factory, very dangerous!" in big letters above the door, the use for which the building is intended and the necessity for watchful care over it is apparent. At the door were seen lying iron casks sheeted inside with lead, and in these casks are imported the pure glycerine and mixed acids used in the factory.

A cask of mixed acid is hoisted by machinery to the upper story and dumped into a mixing tub, in which the mixing blades are moved by a crank turned by a man who is stationed in a tight box and has in front of him a thermometer. As the glycerine runs into the acid, a vapor is engendered in which life is scarcely supportable, hence the man turning the crank is stationed in a close box. The acid and glycerine in their admixture rapidly heat, and the compound has to be toned down by cold water or ice, hence the greatest watchfulness is necessary at this point; as the heat is allowed to run up to 80°, and as nitro-glycerine explodes at 90°, there remains but 10° of heat between the known and eternity, or, as the manager remarked, if the heat was allowed to run up to 90° they would not have time to pucker their mouth to say good-by.

It is needless to say that, while the work is going on, strangers are never allowed to enter the building, as it is necessary that every man should have his individual attention at such times upon his work. "Strict rules govern our men," remarked the manager, "as the least venture at experimenting would leave no one to tell how the accident happened." The nitro-glycerine thus manufactured has an explosive force ten times greater than that of blasting powder, and is used on very heavy work, but we sell very little in that shape, remarked the manager, as it is run down a tunnel to the room below, where it is manufactured into dynamite, dualin, or vigorite, all of which have nitro-glycerine as their basis, but are known by different names to designate the degree of power. As rapidly as possible the nitro-glycerine is mixed with charcoal, wood pulp, or other mixtures, and reduced into a commodity more readily handled; for although dynamite is understood to be extremely dangerous to handle, it is rammed into the cartridges with a stick, with as little apparent fear of the result as would be the case were the substance so much dirt.

The cartridges are made to hold from a pound to two pounds each, and are carefully packed each day and taken to an isolated magazine owned by the company. The output of the factory is about 1,000 pounds daily now, but the owners expect shortly to increase the capacity to meet the requirements of a rapidly increasing demand, as this is the only factory of the kind in Ontario, and the development of the mines has rapidly increased the demand, as blasting with powder has been almost entirely superseded by the use of dynamite, which is not only more efficacious, but also safer to handle. The manager remarked: "I have to pay my men large salaries, although the work is comparatively light, as a very slight accident would put them out of the way of drawing their salaries. I have worked at the business for the past seven years, and own a mill in Algoma as well as this one here, but in this business life is the result of vigilance."—*Manufacturers' Gazette.*

How to Stop the Echo.

A subscriber in Mississippi writes: "We have a large hall in this city, one hundred feet by fifty, twenty feet from floor to ceiling; the echo is so great that conversation cannot be understood. We have tried stretching wire across the hall, but it does not have the desired effect."

Where the rectangular form of a hall cannot be changed to advantage or economically, much may be gained by hanging draperies at the ends of the room for preventing reverberation. The rostrum should be placed in the middle of one side of the room for the best effect. This arrangement is supposed to break up the reflected waves of sound, which is the cause of reverberation.

Our correspondent might make a trial by hanging a few pieces of cheap goods upon the end walls.

SINCE referring to the death of Mr. Desnos a few weeks ago in these columns, we learn that Madame Desnos will continue the business established by her late husband at 11 Rue Magenta, Paris. Mr. Chassenent will have the direction of the engineering department, and Mr. Guion is advanced to the post of administration director, as well as secretary. The latter position he held under Mr. Desnos for more than twenty years.