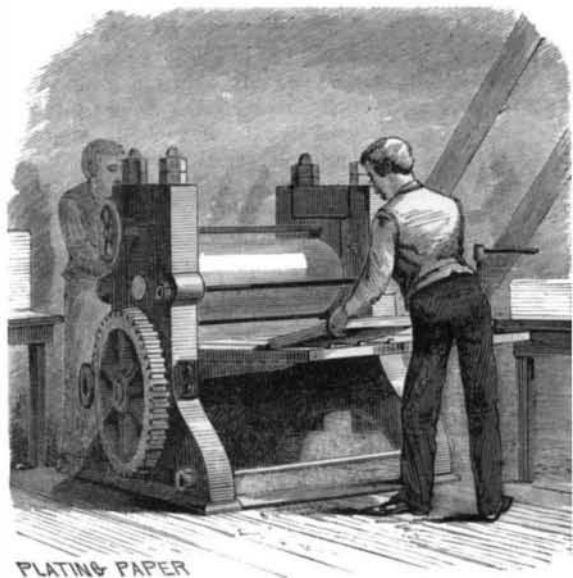


AMERICAN INDUSTRIES.—No. 72.

THE MANUFACTURE OF WRITING PAPERS.

While it is pretty generally known that the American people use more paper in proportion to their number than any other people in the world, there are few who realize how large is the amount of capital or the number of hands employed in the manufacture of paper, to say nothing of the more extended industries involved in book and newspaper making and general printing. It is acknowledged that more than one-third of the paper now made in the world is manufactured in the United States, and it is estimated that over \$100,000,000 of capital and 40,000 persons are engaged in its manufacture. The business has shown a wonderful growth in the past ten years, and American skill, inventive genius, and business capacity have each found admirable illustration in the prosperity of this trade. In 1869 we had no export busi-



ness in paper worth mentioning, while our imports amounted to more than half a million dollars, and in 1873 the imports had increased to \$1,326,460. For the last fiscal year, however, our exports amounted to \$1,183,140, while our imports had fallen to \$235,051, the most of this being in fancy wall papers, writing paper representing only \$28,167 of the total. In the finer kinds of paper the progress made by our manufacturers has been particularly marked, and the productions of American mills now find a steadily growing demand in nearly every foreign market.

In the first page illustrations of this number we represent the manufacture of fine and staple writing papers of all kinds, as conducted by a firm from the commencement of whose business dates back more than half a century—the Owen Paper Company, of Housatonic, Mass. When their business was established, in 1822, paper making in this country was in its infancy, and very little paper was made anywhere except by hand, the Fourdrinier machine, which was destined to work a revolution in the business, having then been but little used in England and France. The first employment of one in this country was in 1833, but the machine has been greatly improved since its first introduction, and is now used in making the finest papers, the improvements made in it having been quite as much in the direction of perfecting the goods as in lessening labor and cheapening the product. There is little or no paper now made by hand in this country, the Fourdrinier machine having been so adapted to the necessities of the business that it works with a nicety of adjustment and an exactness of detail which gives a more uniform and perfect quality than can be found in handmade papers, while another invention, known as the cylinder machine, has been carried to great perfection in this country in the manufacture of book, news and cheap papers for various uses.

The first detail in paper making is the sorting of the rags, or the stock from which the paper is made. These are classified by the dealers, according to color and fiber, so that the manufacturer is able to select and purchase his raw material with close regard to the exact kind of goods he proposes to make. In this establishment nothing but the best linen and cotton fiber is used. If the rags are dirty when they come to the mill they are first passed through a duster, where they are thoroughly thrashed and beaten by a machine, of which there are several varieties, but in all provision is made for the dust dropping out or being blown out through a wire screen. The rags then go to the sorters and cutters, who stand at a table covered with wire cloth, and provided with knives inclined a little from the perpendicular, as seen at the left in one of the small views, entitled

“Cutting Rags.” Against these knives the rags are drawn and torn, to open seams and dislodge dirt, remove buttons, buckles, etc., and, while a close assortment is being made, the rags are cut to a suitable size for the engines and the dirt falls through the wire cloth to a receptacle below. Only the rags for the finer grades of paper are cut by hand, those of the coarser kind, for lower qualities of manufacture, being cut by machines.

The next process is boiling with alkalis to loosen dirt, remove grease, coloring and glutinous matters, etc., before washing. For this purpose lime, soda ash, or caustic soda is used, in water. Sometimes the lime solution only is used, while in other cases lime and soda ash are used. The boiling is effected now generally in rotary boilers, of a capacity to hold 3,000 to 6,000 pounds of rags, the solution being poured in upon the rags, and the heat supplied by steam at a pressure of 30 to 50 pounds, which is admitted at a point below the top of the liquid.

The rags, after being boiled a longer or shorter time, according to their condition, are then ready for treatment in the washing engine, shown at the bottom of the page. This machine is an oblong kind of vat, with rounded ends, divided lengthwise in its center by a midfeather. There is a constant flow of fresh water, only the purest water that can be obtained being used in this, as in all other processes of paper making. On one side of the midfeather is an inclined plane on the bottom of the vat, leading up to the bottom of the dip of a revolving roll, whose circumference carries steel faced blades; the bottom of the vat then so conforms to the space in which the roll revolves that the rags, passing in with the water, are carried partly around the roll against other knives in the bottom, and dropped on the other side of the roll, to be then carried around the end and through the other side of the vat until they come again to the roll, the action of which washes, rubs, and disintegrates the fiber. In the other side of the vat, is an eight-sided cylindrical frame, covered with fine wire cloth, through which the wash water strains to the interior, where it is gathered by buckets and discharged over the side of the vat. After the rags have been submitted to the process for a time, the roll is so lowered that its blades reduce the stock to finer fibers than would be effected in its first position, different kinds of stock requiring different treatment, but it being indispensable, in all first-class papers, that the pulp should be fine and even. The bleaching agent, usually a solution of the ordinary bleaching powder of commerce, is applied when the stock is in the condition of half stuff in the washing engine, and, after the pulp has again been thoroughly drained in the drainers below, it is subjected to the action of the beating engine which operates on the same principle as the washer, but runs faster and has knives which are not so blunt. There is great difference in the treatment of the pulp in the engine, according to the quality of the stock and the paper that is to be made, coarse paper requiring but 4 or 5 hours, while fine writing paper takes 15 to 24 hours, strong bond and bank note papers, where the fibers must be long, requiring sometimes as much as three days and nights.

The sizing and the coloring are the last operations in the preparation of the pulp, except in the case of super-sizing, which consists in putting on a coat of size after the paper

sired. The pulp is fed into a regulating box, where any excess of what is required is taken by an overflow; the pulp is kept constantly agitated, and flows upon an endless wire cloth, upon which the paper is formed, the water straining through and leaving the pulp as a thin sheet upon its surface. Guide bands at the side, called deckles, determine the width, and, after traveling about forty feet, what are called couch rolls, remove the paper from the wire cloth, the pulp being previously subjected to a shaking motion laterally to interweave or felt the fibers, the motion being greatest where the pulp is most fluid, and diminishing as the web becomes free from water. Letters, figures, etc., are impressed upon the paper in the soft web by a wire cylinder, called a dandy roll. When the dandy roll is



covered with plain woven wire cloth, what is called “wove” paper is made. When the roll is covered or laid over with wires running parallel and at some little distance apart, it impresses lines in the soft web, producing what is known as “laid” paper. All the water draining off, with its coloring matter, sizing, particles of fiber, etc., is taken back to the mixing box to be again incorporated with the pulp, so that absolutely nothing is wasted. The web, after leaving the couch rolls, is delivered to an endless felt apron, and passes between rolls to press out the water, and, when its moisture is largely diminished, it passes between and around a number of steam-heated drying cylinders. The paper may now be passed through calendering cylinders, if desired; these are accurately ground, and have polished surfaces, the paper in passing through them being subjected to great pressure, which compacts the fiber and gives a hard, smooth surface. This operation also charges the paper with electricity, which is drawn off by a simple device; in case this is not done the sheets are very likely to stick together.

In cutting the paper for the many different sizes of fancy goods in which the finer qualities are sought, the operation is conducted as shown in one of the views, the paper having first been cut from the web in sizes approximating those to which it is finally to be trimmed, or so that it will divide with but a minimum of remnants to be reworked. This, and also the ruling, folding, and stamping, shown in separate views, are very particular details in the making of the finer grades of paper, an important specialty with the Owen Paper Company. On many of their styles and machines they have patents, the goods having attracted wide attention



and having commanded a large sale. For bank-note, bond, and other fine writing papers, the drying is not completed on the Fourdrinier machine, but in steam drying lofts, as shown in one of the views. After drying, the sheets are subjected to a powerful pressure, which gives them a dead finish, without disturbing the grain of the surface. Subsequently the finishing is continued by different methods and different machines, according to the use for which the paper is designed, or the caprices of the users, who demand sometimes an excessively smooth surface (which is obtained by rolling between polished metal plates, as shown in one of the views); sometimes a surface of medium smoothness, and sometimes a rough “antique” finish—the finishing process being necessarily different for each.

In all the papers of the Owen Paper Company, the stock consists of the most carefully selected white linen and cotton rags, and especial care is taken that nothing shall be

used in the washing or bleaching to impair the strength of the fiber.

The Owen Paper Company was incorporated in 1862. The business was commenced at Lee, Mass., in 1822, by a firm of which Charles M. Owen was the senior partner. In 1849, Edward H. Owen, a son, became a partner, and soon succeeded to the practical management of the business. The firm built, in 1857-8, the mill at Housatonic, shown in our sketch as the "Old Mill," which, with various enlargements, is now 320 feet in length, its internal arrangements being admirably adapted for saving labor, the bales of rags being taken from the cars at one end of the mill, and reloaded as finished stock ready for transportation from the other end. The company formed in 1862 included Edward H. Owen, Henry D. Cone, and Charles M. Owen, the former of whom died in 1864, and the latter in 1873, leaving Mr. Cone treasurer and manager of the business, of which he is now, also, the sole proprietor. He has continuously made it a specialty to manufacture only first-class paper, made from the best linen and cotton fiber, without any of the adulterations and make-weights in the shape of clay, china clay, kaolin, and other substances used in cheap papers. As a result, the business has developed with great rapidity, the foreign demand for the goods of the company being felt in most if not all the civilized countries of the globe, large orders being received from abroad, frequently without solicitation. The new mill just erected, about half a mile lower down the river, will be, when fully equipped, one of the largest and most complete paper manufacturing establishments in the world. Mr. Cone owns all the houses, with two exceptions, with the land both sides of the river, for a mile and a half; and the two main buildings of his factory, connected by a central building, have a frontage of 500 feet. In the rear, and adjoining them, is an auxiliary building 400x30 feet, and an ell 200x40 feet; also boiler and engine house, store houses for stock, and the like. A good idea of the plan and elevation may be obtained from our illustration. A considerable village has arisen in the neighborhood, the result of this industry, in which most of the workmen live in houses occupied by only one family each, and educational and social advantages have been generously supplied by the liberality of Mr. Cone. There is an admirable library of several thousand volumes, free to all, with salary of librarian and all expenses of library and a well-furnished reading room paid by Mr. Cone. The place is, of itself, one of great natural attractions, and to see it so occupied by a flourishing industry, making happy homes and intelligent, well-to-do workmen, is no less a matter of personal pride to Mr. Cone than is the business success he has achieved in a department of manufacture where we formerly depended so much upon foreign labor and capital.

#### The Cattle Car Prize.

During a recent visit to Chicago we saw the collection of models of cars and plans of cars which have been sent to Mr. Brown as chairman of the judges. There are 480 of the former and 243 of the latter.

A careful description of each is being prepared for the use of the judges. It will be apparent, at a glance, that this must be done in justice to each competitor, and also that careful work and much time are required for it. This explains the delay; a delay which must be protracted for some time longer.

Then in several manuscript volumes are copies of every patent issued so far by our Patent Office for an improved cattle car, numbering now 116; the first, in time, bearing date in West Virginia, May 29, 1860. It will require much careful consideration to determine how many of the new plans were already protected by one or other of these numerous patents.

We were curious to know whence the competitors came. Nearly every State is represented, and also England, Switzerland, and, of course, Canada.

Illinois has 51 models and 18 plans, being the highest numbers from any one State; Pennsylvania is second, with 47 models and 27 plans; New York is third, with 43 models and 15 plans; Ohio is fourth, with 37 models and 18 plans; Indiana is fifth, with 21 models and 13 plans; Massachusetts is sixth, with 19 models and 26 plans; Michigan is seventh, Iowa eighth, Missouri is ninth, and Minnesota is tenth. Among the competitors are eight women, from the same number of States.

Some competitors have more than one model, and others more than one plan.

The collection represents a great amount of thought and labor and ingenuity, as well as skilled workmanship. That a better car will be the result no one doubts who has full information on the subject. There are cars which came into existence in consequence of the offer of the prize, which are not there, because their inventors think them too valuable to part with for the prize; but their points will be known to the judges, and they are, of course, a part of the valuable results already secured by the offer.

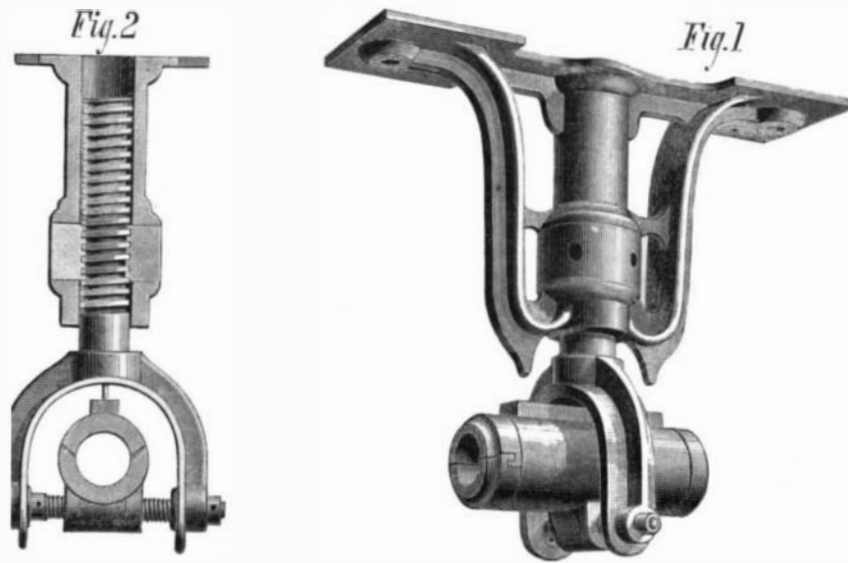
It is, also, beyond question that the judges will have before them a more complete exhibition of all that ingenuity has done so far in this direction, than has ever before met the eyes of any man or any body of men.—*Our Dumb Animals.*

#### HANGER FOR SHAFTING.

Next in importance to the shaft itself are the supports which sustain it, and in putting up a shaft of any length the duration of its usefulness depends on the manner in which it is supported, and on the truthfulness of its alignment. It is useless to provide large and perfect journal bearings for a shaft without providing means that will permit of its automatic adaptation to any flexure of the shaft without binding or heating, and it is also essential that the bearing be capable of adjustment in all directions in the plane of the shaft's rotation.

The hanger shown in the annexed engraving meets these various requirements, and presents a shaft support as nearly perfect as human ingenuity can make it.

Fig. 1 shows the hanger complete, and Fig. 2 is a perspective view showing the various adjustments.



#### IMPROVED HANGER.

The journal box proper is made in two parts, held together by means of rings or nuts screwed on at the ends, and forming a chamber to receive hempen or other packing, and when properly screwed up effectually prevents all dripping of oil or other lubricants from the ends of the journal box. These rings or nuts may, if desired, be divided and interlocked so that they can be readily taken off the shaft after they are unscrewed from the box.

The box is provided with an automatic oiler at the top, and is supported by a steel pin or pivot passing through the two arms of a fork formed on the lower end of a screw extending upward through a sleeve forming the central portion of the fixed part of the hanger, and a threaded sleeve (of proper length to work between the two arms of holding fork) which is screwed through the lower section of the box; and the proper alignment of shaft is made by turning the threaded sleeve on the pivot and thereby driving the box to one side or the other of the holding fork of hanger, as may be required. A cylindrical nut fitted to the bisected portion of the sleeve receives the screw of the forked support. This invention will be understood without further description. It was lately patented in the United States, Canada, and Great Britain, by Mr. Henry D. Cone, of Housatonic, Mass., to whom inquiry in relation to the same may be addressed.

#### The Telephone in China.

The Chinese language is so peculiar that there is great difficulty in devising any practicable system for conveying telegraphic messages. The telephone, therefore, is received with peculiar favor by the Chinese Government, which has at length decided to establish a complete system of telephones throughout the country, commencing north of the Yang Tse Kiang. The work will be conducted under the charge of J. A. Betts, the American telegraphist, under whose superintendence the telegraphic line was built from Tientsin to Taku.—*L'Ingen. Univers.*

#### Mechanics to the Front.

There has been no time since the exactions of the war from 1861 to 1865, says the Boston *Journal of Commerce*, when good workmen were in such demand as the present. It would be well for interested readers to notice the adjective "good," the writer adds, for pretenders and half-learned apprentices will get the cold shoulder at every shop where good workmen are obtainable. One of the great hindrances to the pushing forward of mechanical enterprise just now is the need of competent workmen. Only a short time ago the country was swarming with good workmen, excellent mechanics, some of whom were strongly tempted to take to the road as tramps because of their trouble of procuring employment. All this is changed, and if there is any mechanic who believes himself to be a workman and can prove his faith by his works, now is his opportunity.

It is a matter of frequent, almost daily, surprise to hear

the inquiry from manufacturers: "Do you know of any good workmen?" But now as always, it is of little use for a fly-away apprentice or a slouchy workman to apply for work; the demand is for first-class workmen, not for shop hands or pretenders. In machine shops the requirement is for good tool makers, good planer men, lathe men, filers and fitters, floor men; and there is less room for fill-gaps, and mere operatives and would-be-apprentices have a poor show. But if one of this latter class can get a position, he has now a much more encouraging show for advancement than for many years past.

Our tool manufacturers and machine builders are at their wits' ends to meet their orders in time; not so much for lack of material and need of room as for want of good, sensible, steady, competent workmen. This is one of the periods when the earnest and honest mechanic can go a peg bigger, and the industrious apprentice can have unusual opportunities to improve himself in the finer work of his department.

#### RECENT INVENTIONS

In canning fruit, etc., much difficulty and inconvenience are often experienced in introducing the cans or jars into the vessel of water and withdrawing them, and great care must be exercised to prevent the contact of the jars, if they be of glass, with the bottom of the vessel or boiler, lest the jar be broken. A simple, inexpensive, and convenient device for overcoming these difficulties has been patented by Sarah W. Brown, of Hudson, N. Y.

An improved adjustable spring bed bottom has been patented by Mr. Henry A. Scott, of Athol, Mass. The object of this invention is to furnish invalid bed bottoms having head and foot sections capable of easy adjustment in horizontal or inclined positions, which may be used with and easily removed from ordinary bedsteads.

An improved fountain for soda and mineral waters has been patented by Mr. Charles Jackson, of New Bedford, Mass. The objects of this invention are to permit connection of the two parts of the fountain by a brazed joint, whereby strength and security against leakage are obtained; to permit inspection of the interior of the fountain; to

permit of their being readily washed out and retinned without separating the joints.

#### First Gold in California.

General Sherman has given this account of the first discovery of gold in California: "I remember one day that two men, Americans, came into the office and inquired for the Governor. I asked their business, and one answered that they had just come down from Captain Sutter on special business, and they wanted to see Governor Mason in person. I took them into the Colonel and left them together. After some time the Colonel came to his door and called me. I went in, and my attention was directed to a series of papers unfolded on the table, in which lay about half an ounce of placer gold. Mason said to me, 'What is that?' I touched it, and examined one or two of the larger pieces, and asked, 'Is it gold?' Mason asked me if I had ever seen native gold. I answered that in 1844 I was in Upper Georgia, and there saw some native gold, but it was much finer than this, and that it was in phials or in transparent quills; but I said that if this were gold it could easily be tested—first, by its malleability and next by acids. I took a piece in my teeth and the metallic luster was perfect. I then called to the clerk (Baden) to bring an ax and hatchet from the backyard. When they were brought I took the largest piece and beat it out flat, and beyond doubt it was metal, and a pure metal. Still, we attached little importance to the fact, for gold was known to exist at San Fernando, at the south, and yet was not considered of much value."

#### Tea Two Hundred Years Ago.

While investigating the history of tea an English writer came across a rare manuscript in the British Museum, giving as below a quaint summary of the virtues of "the herb called tea or chee." It bore the date of October 26, 1686, and purported to be a translation from the Chinese.

1. It purifies the Blood that which is grosse and heavy.
2. It vanquisheth heavy Dreames.
3. It easeth the brain of heavy Damps.
4. Easeth and cureth giddiness and Paines in the Heade.
5. Prevents the Dropsie.
6. Drieth moist humors in the Heade.
7. Consumes Rawnesse.
8. Opens Obstructions.
9. Clears the Sight.
10. Cleanseth and Purifieth Adust (*sic*) humous and hot liver.
11. Purifieth defects of the bladder and kidneys.
12. Vanquisheth superfluous sleep.
13. Drives away dissines, makes one nimble and valient.
14. Encourages the heart and drives away feare.
15. Drives away all paines of the Collick which proceed from wind.
16. Strengthens the inward parts and prevents consumptions.
17. Strengthens the memory.
18. Sharpens the will and quickens the Understanding.
19. Purgeth safely the gaul.
20. Strengthens the use of due benevolence.



# SCIENTIFIC AMERICAN

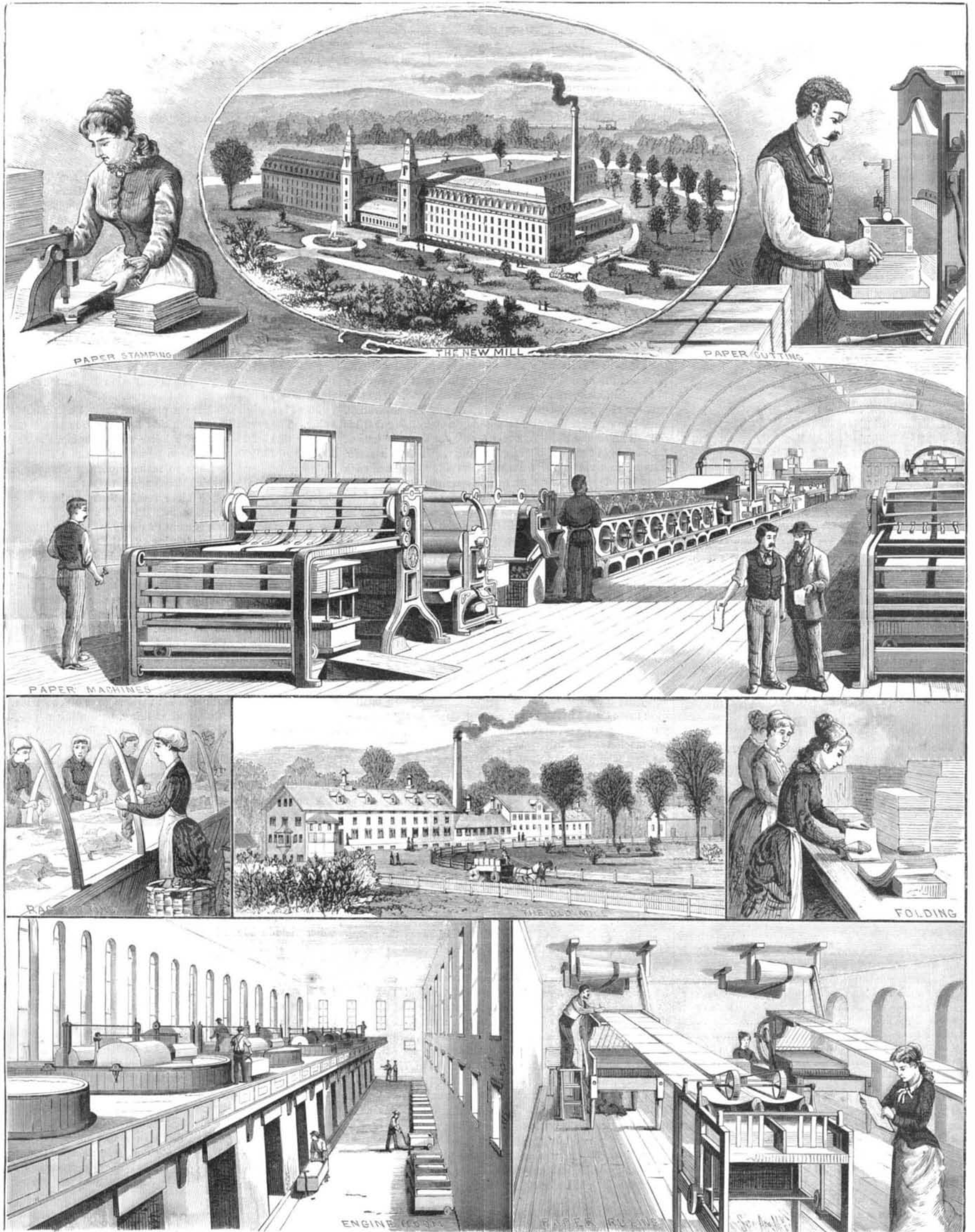
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THE MANUFACTURE OF WRITING PAPERS.—OWEN PAPER COMPANY HOUSATONIC MASS.—[See page 275.]