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MACHINERY FOR MANUFACTURING PAPER.

With the utilization of many new raw materials in the paper manufacture during the present generation, numerous improvements have been made in the machinery used by paper makers. There has been a great increase in the amount of all kinds of paper used—from cheap postage and low priced books and newspapers—but the competition of paper makers has been close, and they have been quick to adopt and fertile in suggesting improvements in machinery, whereby the product might be bettered or hand labor reduced. In this department of the world's industry American paper makers, and manufacturers of improved machinery therefor, now easily hold a leading position.

In the SCIENTIFIC AMERICAN of last week we gave some particulars of the paper manufacture, as conducted by one of the principal houses in that business; and we herewith present illustrations of many of the special machines used in the transformation of rags and other fibrous materials into paper, as they have been improved and are now made by the Pusey & Jones Company, of Wilmington, Del.

In mentioning the several machines as they come in natural order in the paper manufacture, the first would be the rag cutter, a machine which has been only a few years used instead of cutting up the rags by hand. This is a solidly built machine, into which the rags are drawn from an apron by a toothed cylinder, and meet another rapidly revolving cylinder on which are knives that cut them almost as would a pair of shears. The machine works very rapidly, and the bearings are adjustable, so that the shaft on which the cutting cylinder runs can be always kept true in its place without regard to the amount of wear it may have had.

The rotary boiler, to which the rags go after cutting, dusting, and assorting, is strongly made, the clamped covers shown indicating the openings through which the rags are introduced, with a small cock for the escape of steam. The steam is supplied to the boiler through the hollow trunnion on which it revolves. In order that the trunnions may be entirely true, the rotary boiler is placed in a turning lathe, after it is in other respects finished, and the journals are turned to the required size. The occasional explosions of these boilers in paper mills have been the subject of various conjectures as to their cause, as the steam here could not naturally be of greater pressure than that of the generating boiler whence it comes. The company explain these explosions as due to the supply, in such instances, of superheated steam coming suddenly into the boiler and flashing the large amount of water therein at a lower temperature into steam, and they are always careful to advise their customers to use generating boilers which cannot superheat the steam. The three styles of pumps shown are each of a special design, such as found best fitted for the use of the paper manufacturer. The "stuff pump" is that which takes the pulp from the stuff chest and delivers it to the "three-way box." It is very regular in its operation, intended to deliver a very close gauge of the amount of stuff needed, and to allow of such quantity being easily regulated. The "three-way box" nicely regulates the flow of the pulp to the paper machine, and the fan pump and the three-way plunger are used to dispose of the water, which is abstracted from the fluid pulp in its transition into a sheet of the fiber and strength of finished paper.

Although we do not give here a full view of the Fourdrinier machine, to show which properly would require a very large illustration, the machine itself, and all the machinery used in connection therewith, are specialties in the manufacture of the Pusey & Jones Company.

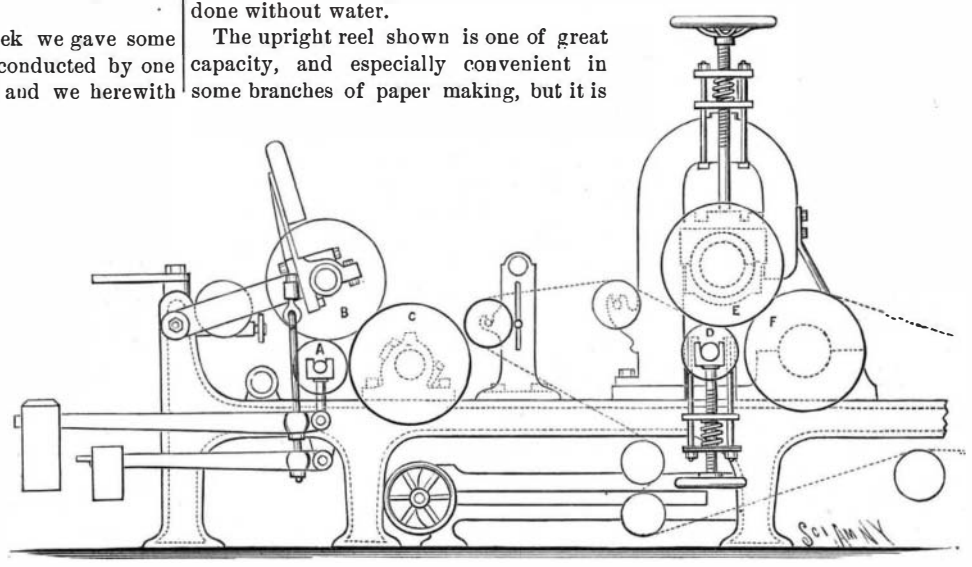
The "Gould screen," shown in one of the first page views, is a quite recent improvement in connection with the working of the machine. It is a substantially built frame, in which the pulp passes, on its way to the wire cloth, through brass plates in which are saw cuts of a width of one-hundredth part of an inch. These plates are vibrated a thousand times a minute, and the dirt and material not suitable to enter into the sheet of paper remain on the plates, not passing through with the pulp.

The couch and press rolls, shown above, indicate the portion of the machine where the pulp has been sufficiently dried to be taken off the wire on an endless belt, and then off the felt to pass over the drying cylinders. Several comparatively recent improvements are shown in these rolls, among which are the setting of the large rolls at the angle shown, instead of perpendicularly, as formerly; and the introduction of the third roll, whereby the moisture is more quickly taken out, and the work of compressing and strengthening the fiber more efficiently performed than was formerly done with the large rolls only.

The calendering machines come properly at the end of the paper making machine, or in the case of super-calendering this operation is performed afterward, to give the hard, polished surface one sees on writing and fine printing papers. There are views given of two styles of calendering machines, between the rollers of which the paper is passed, getting, besides the weight of the rollers themselves, a pressure from the binding force with which these rollers can be held down upon each other by screws in the supports for their bearings.

In the super-calendering machine shown, five of the rolls are of paper and the others chilled iron, each 42 inches long. The chill is given by casting in heavy iron moulds, and extends in about a half to three-quarters of an inch. The paper rolls are made by pressing hemp paper around a mandrel with such pressure as to make the paper roll as solid and almost as heavy as iron, so that the face can be turned and ground down true, though this must be done without water.

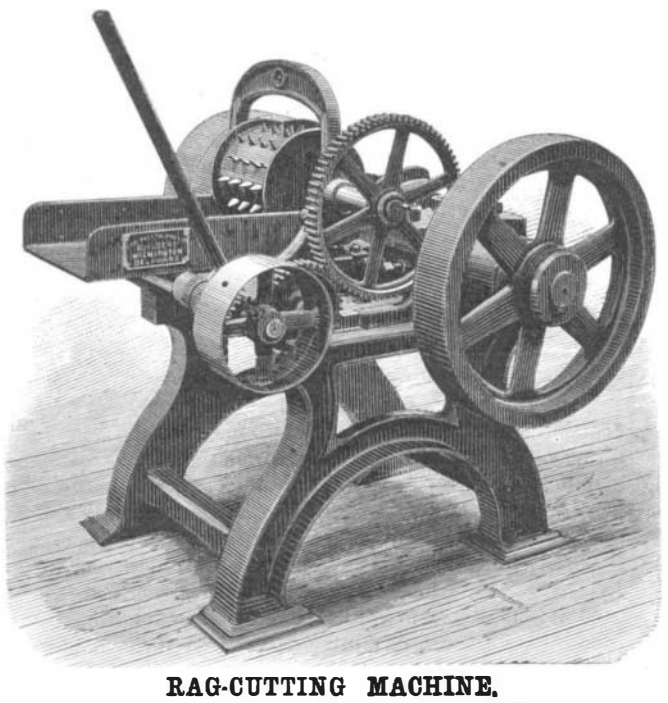
The upright reel shown is one of great capacity, and especially convenient in some branches of paper making, but it is only one of several kinds of reel made for taking the paper as it comes from the machine.



COUCH & PRESS ROLLS.

The expanding pulley is a device of especial importance in the running of a paper machine. As will be seen, it provides for enlarging the circumference of the wheel by adjustable arms from the axis, so the shafts of couch or press rolls, or the driers, or any other part of the machinery, may be run at a speed proportioned to that at which the paper is coming through. This varies materially in different varieties, the paper being decreased in length much more under some conditions than others, and the expanding pulley allowing of the adjustment of the different parts of the machine in accordance therewith.

The roll grinding machine is a comparatively modern improvement for grinding and polishing the rolls. Formerly it was not uncommon to effect this by setting up the rollers in stack, and finishing them by the grinding of their surfaces against each other. The work must, of course, be done very true, as the rollers have to meet each other so nicely at all points that a ray of light will not pass between them. This is now accomplished by the machine shown, in which, the roller being revolved, a carriage carrying swiftly revolving corundum wheels is moved backward and forward along its face.



RAG-CUTTING MACHINE.

The machinery used for making localized fiber, long since adopted by the government, and used for bank notes, bonds, etc., was made at the establishment of the Pusey & Jones Company, and, besides the machinery made here for American paper manufacturers, there is scarcely ever a period when there is not work of this kind under way for foreign customers.

The company has filled orders for paper manufacturers in nearly every part of Europe, and more than one paper mill in Japan now furnishes a practical illustration of the working of the paper making machinery of the Pusey & Jones Company.

Making a Time Card.

To one not familiar with the details of time card making, says the Detroit *Free Press*, the process is an interesting one. As practiced on all the divisions and branches of the Michigan Central, a large blackboard is brought into use as the primary or original time card. This board is ruled perpendicularly into 24 equal spaces representing the hours, and each of these spaces is similarly ruled into 12 smaller spaces, each representing five minutes.

The board is also ruled horizontally, but the horizontal lines are not placed at equal distances, as the perpendicular ones are. Each line here represents a stopping place—station or railroad crossing—and their distance apart is made proportionate to the actual distances on the road. Strings with weighted ends represent trains; light ones passenger trains, and dark ones freight.

A train is to leave Detroit say at 8 o'clock in the morning, and to arrive in Chicago at 6:40 P.M. A pin is stuck in the board at the top at the point where the line representing Detroit crosses the 8 o'clock line, and another at 6:40 P.M. on the Chicago line. The string is suspended from the former pin, swung over the lower, and the weight attached to it draws it taut, causing it to form a straight diagonal across the board between these two points. Now, if the road were perfectly straight and level, and there were no stops, this line would represent the time card of the train between Detroit and Chicago, running at an equal rate of speed the whole distance. But the train stops five minutes at Jackson. By two pins stuck in the line representing Jackson, five minutes apart, the string is carried over one space on a horizontal line. A 20 minute stop at Marshall is indicated in the same manner. Between Ypsilanti and Jackson the train slows up on account of the numerous curves in the road, and this fact is indicated by carrying the string on the Jackson line a little to the right, making it pass more horizontally and to cross a larger number of time parallels. Beyond Jackson, where time is made up, it assumes a more perpendicular direction. So, by placing pins at each station, giving more time where it is needed and deducting time where greater speed may be made, the string is given a more or less irregular or zigzag line across the board, and represents pictorially all the movements of the train.

An east bound train is represented in the same manner, except that the starting point being at the bottom of the board, the string makes a diagonal crossing the other. The point where they actually cross will represent the passing of the two trains.

These time cards, after being so made up, are left hanging in the time card room until the next change. Meanwhile the path represented by the train string is translated into figures, and printed for the use of employes and the public.

The Extinction of Deer.

It is stated by Engineer Phillips (late of the Northern Pacific Railroad) that no fewer than 20,000 elk, antelope, and mule deer are slaughtered every winter in Minnesota, Montana, and Wyoming alone. There is every prospect that three of the noblest game animals on the American continent will soon be entirely extinct. Elk, which formerly ranged from the Middle States to the Pacific, are now never found east of the Missouri River. Twenty-five years ago they were plentiful in Kansas and Nebraska, but civilization has driven them into the dense and uninhabited regions of Minnesota and the Northern Territories. The hide hunters effect the most sweeping destruction. The average price of an elk skin is $3. The hide hunters use repeating rifles, and frequently kill from six to twelve elk in a herd before they get out of range. Mr. Phillips affirms that, besides the slaughter of the animals named, in the year 1882 more than 25,000 buffaloes were killed for the traders between the Yellowstone and the head waters of the Little Missouri.

If there is to be sport in the Great West in the future, those interested will be compelled to move for legislation which will give protection to game in the Western States and Territories. Otherwise there will be very few elk, buffalo, mule deer, or antelope left to hunt in five years.

Correction.—Mercury Intensifier for Gelatine Plates.

We are informed that the formula given on page 352 of current volume is incorrect in some respects. For 10 grains of bichloride of mercury, 60 should be substituted. The correct formula is as follows:

No. 1.

Water	20 ounces.
Bichloride mercury	60 grains.

No. 2.

Water	4 ounces.
Iodide potassium	190 grains.

Pour number one into number two. If it works too fast, dilute with water.