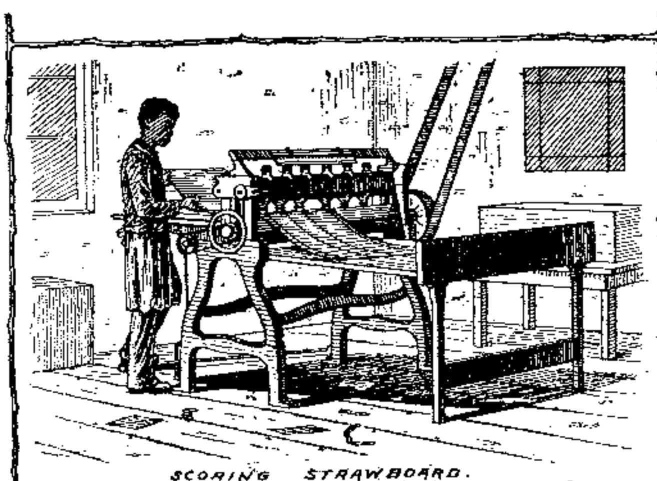
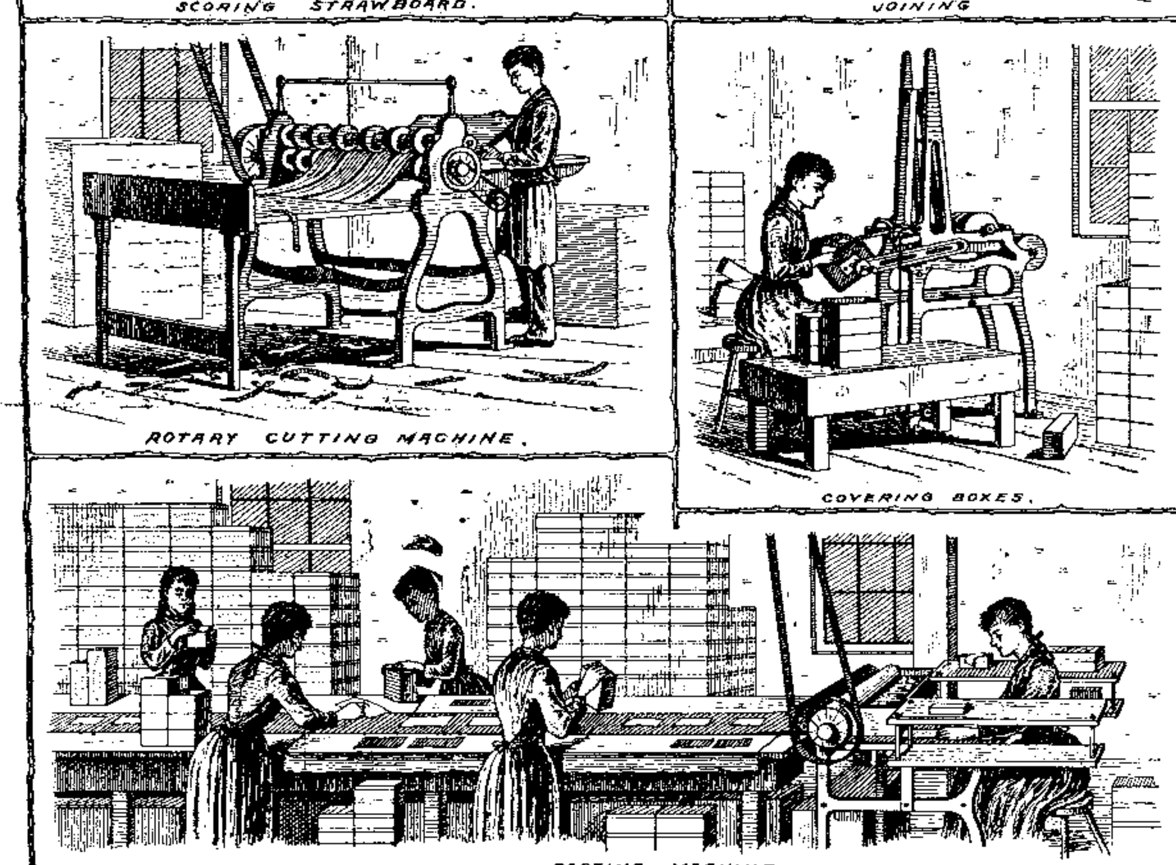
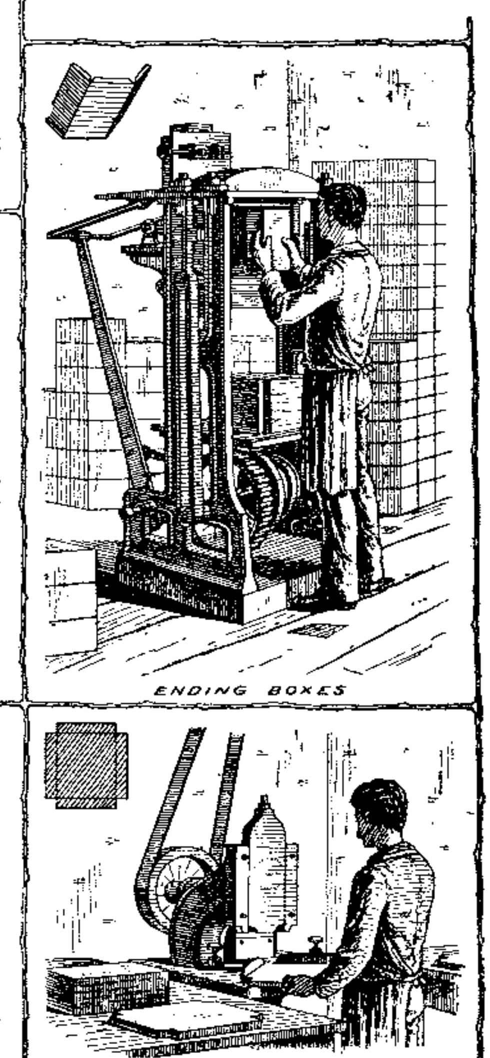
PAPER BOX MAKING.

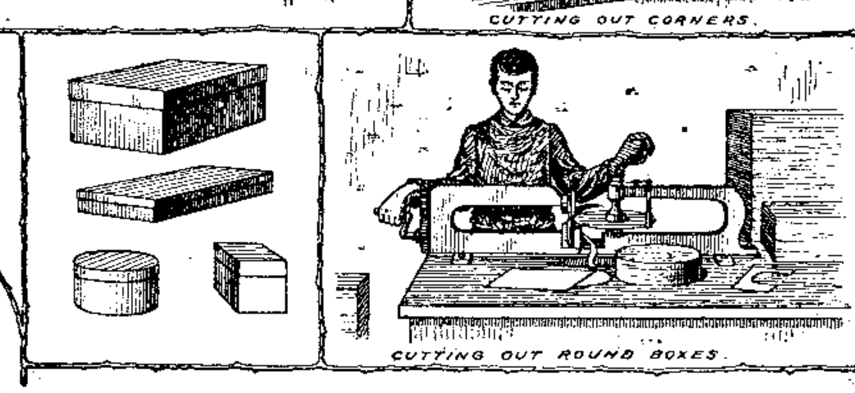
Within a few years a number of paper box machines have been invented that will turn out over ten times the number of boxes that were made on the old hand machines. The new machines run by steam power, and are used in a great many large establishments. Among the number of the machines are the scorers, rotary cutters, corner cutters, ending machines, and pasting and covering machines. The strawboard of which the boxes are made, passing from one machine to the other, is manufactured into a box in a few moments. The first operation in the manufacture of these boxes is the scoring of the strawboard. This is done by passing the sheets of strawboard between a number of scorers or cutters and an 8 inch iron cylinder, the scorers being fastened above to a dovetailed projection on the top and bottom of a movable iron bar. The cutters are about 2 inches in diameter and made of steel and are set on top of the bar (the cutter wheels coming right to a steel scale cut to one-sixteenth of an inch) to the dimensions of the box, then by a reverse lever the cutters are turned down to the cylinder. A back gauge, moved by a carrier under the table of the machine and worked by the foot of the operator, carries the board to the cutters, which score the material about half way through. The cylinder makes about 100 revolutions per minute. From 10,000 to 50,000 boards can be scored daily. The boards after scoring pass to the gluing table. The operator places two or three dozen of the scored sheets one upon another, so that the edge of each sheet projects out about ⅛ inch. A coating of stiff flour paste is then brushed over the lapped edges. The attendant then doubles up the board lengthwise where it is scored and presses the two edges together. The paste causes the two edges to stick. After all are pasted a heavy weight is placed upon them and they are allowed to dry, which takes about half an hour. From the gluing table they pass to the rotary cutter, which cuts the boards into the different sizes. This machine has two steel shafts about 3 inches in diameter geared together. On these shafts are a number of cast iron rotary cutters, faced with Jessop steel, which can be shifted back and forth by loosening a screw. The lower knives are set first and then the upper ones moved close up to the others. This machine will cut three thicknesses of glued sheets at a time, cutting off from 10 to 14 boxes at a cut. It is fed in the same manner as the scoring machine, the knives making about 100 revolutions per minute, cutting about 50,000 boxes per day.

The corner cutter has a steel shaft and connecting rod and hardened stop motion. The balance wheel runs continuously, so that at any time the cutter is ready for instant use. By pressing a foot lever, the knife head makes one cut and stops on the upper part of stroke, giving the operator time to put in the work and remove it. When the work is very small, the foot is kept on the lever and the head runs continuously. The knives are made of steel, the blades of which are 5 inches in length and about 2½ inches in width. The machine can make about 55 cuts per minute, the operator cutting out about 8 corners at a time. A good hand can cut out about 20,000 per day. The ends of a large number of boxes are pasted on to the sides by what is called an ending machine. About 200 pieces or ends are put into a hopper at the top of the machine, on what is called the platen, underneath which is a slide or carrier connecting to a feeding lever which also connects itself with a gearing wheel, pulley and friction clutch to a foot treadle below. When the treadle is pressed down, the bottom end in the hopper falls down on to the carrier, which is carried forward over the top of a form, at the same time a number of spots of paste are applied to the bottom from a reservoir by a number of circular pins. The attendant holds the scored sides of the box over the form in front, the ends of which project over the top of the form about ¾ of an inch. As soon as the pasted end comes into position the form and end of box is pressed up against the platen, which is protected from breaking by means of springs, the pressure of which fastens the ends securely to the sides. A good hand can end about 2,000 boxes daily. Boxes that are covered with fine grades of paper are generally covered by machinery. A strip of paper the width of box is placed on a roller at the back of the machine. A few inches above in a glue reservoir is an 8 inch roller. The strip is passed over this glue-covered roller and under and over a few small ones to the form over which the box is placed. The operator smooths the paper down with one hand and turns the forms with the other. As soon as the box is covered a cut-off worked by the foot of the attendant cuts the strip off. The box is then taken off and another put on to the form to go over the same operation. The boxes are generally covered by girls. About 3,000 boxes can be covered daily by an expert operator. The gumming and pasting machine is an apparatus which glues or gums strips of paper or labels and at the same time carries them on a traveling belt to the operatives to be pasted on to boxes. The glue reservoir rests up against an 8 inch revolving brass roller or cylinder, the flow of which is regulated by screws at the ends. The belt is about 40 feet in length and about 20 inches in width, and made of canvas. It is connected to the machine underneath the brass cylinder. The labels first pass under the roller, the bottom of which is covered with glue which adheres to the strips. They are taken off the roller by means of a number of brass pins which cause labels to drop on to the belt which carries them off to the operatives. The machine glues from 10,000 to 40,000 labels per day. The supply of glue lasts from 10 to 30 minutes, and is then refilled. The sketches were taken from the plant of James Leo Company, Jersey City, N. J., who employ about 250 hands, turning out about 50.000 boxes per day.









SCIENTIFIC AMERICAN N.Y.

THE PAPER BOX INDUSTRY.

EYE TREATMENT OF EPILEPSY.—Scarcely any discovery of modern medical science is more valuable than that treatment of the eye may lead to the cure of epilepsy. In the *New York Medical Journal* (January and February, 1894) Dr. Ambrose L. Ranney, of New York, gives full details of the treatment of the eye, which he has used with twenty-five patients. The correction of the eye muscles has led to the cessation of the epileptic seizures. Most of these patients had been drugged with bromides for years without any cure. Some of the cases treated were of long standing.

One patient had suffered for twenty-four years from epilepsy; seven years have now passed since his eyes were treated, and he has had no return. Another patient had such violent paroxysms that he had to be confined in a padded room while they lasted; he is now cured; a third has been in perfect health and a partner in a large business for three years.

The Cryolite of Greenland.*

BY FRANCIS H. KNAUFF.

The earliest mention of the existence of cryolite that I have been able to obtain is in a mineralogical dictionary published in France in 1809, which says that all the cryolite then known was obtained in small lumps on the coast of Greenland. It appears, however, to have been afterward forgotten. In 1850, during an exhibition of Eskimo tools and products, held in Copenhagen under the auspices of the Danish government, Dr. Gustave A. Hartman noticed a white mineral of which the sinkers for their fish nets were made. He analyzed it, and reported it to be cryolite. The Danish government, in the following year, made investigations and discovered a large bed of the mineral on the west coast of Greenland, in latitude 61° 13'. The bed is equally distant from the small colonies of Julianshaff and Fredrickhaff, at Ivigtuk (often erroneously called Ivigtut), on the Arksuk Fiord. This bay is accessible to vessels only during the early and later parts of the summer, at other times it is full of either pack ice or bergs.

The shores of the fiord are very mountainous, and vessels in harbor there make fast to the rocky walls by their bow, while at their stern they can get no soundings. Such was the place where, in 1865, Dr. Julius Thomsen opened a mine of cryolite. Nowhere else in the world can it be obtained so cheaply, and in large quantities, for it is only found in two other places, Miask, in the Ural Mountains, and on Pike's Peak, El Paso County, Colorado.

The place where the mineral is now worked is about 12 miles up the fiord from the Danish settlement of Arksuk. It is an open cut, 600 ft. long by 200 wide, and may be worked from April to October. The way in which they protect the mine in winter is interesting.

If the mine were left unprotected, the water which runs into it would freeze, as it appeared, and solidify in layers, so that by spring there would be thousands of tons of solid ice, filling the mine, which would take a whole summer to dislodge. To prevent this, on stopping operations in the fall, they flood the pit with water, which freezes on top to about four feet in depth. Then, in the spring, a hole is punched in the ice, the water pumped out, and the remaining ice is easily disposed of. The mineral is found in solid veins in the granite mountains, penetrating upward at an angle of forty-five degrees on one side and down beneath the sea on the other. It occurs in two veins, a central portion, about 500 × 1,000 ft. in section, and a peripheral bed, surrounding the other, and merging into the granite. The line between the two veins is very sharply defined, though there is in some places an intermediate portion, consisting of the minerals of the outer zone, inclosed in cryolite. The outer vein contains nearly all the minerals, including quartz, feldspar, ivigtite, fluorite, cassiterite, molybdenite, arsenopyrite, columbite, siderite, galenite and chalcopyrite. The central portion consists of cryolite, containing pachnolite, ralstonite, quartz, sphalerite, pyrite, wolframite, arksutite (a variety of chiolite), thomsenolite, gearksutite and hagemannite. Crystallized cryolite occurs in cavities in the mass. In this inner vein, the cryolite is very pure, and increases in purity as the miners descend. At a depth of 100 feet from the surface, whole cargoes have been obtained sampling 99½ per cent pure cryolite. The impurities in the cryolite, which reduce its commercial value, are the siderite, chalcopyrite and galenite. The fluorides, such as pachnolite, are entirely unacted upon by the processes to which the cryolite is subjected.

The entire output of the Ivigtuk mines is sold to the Pennsylvania Salt Manufacturing Co., by the Danish government, while the lead and iron ores are sold to an English firm. The siderite is perfectly adapted to use in the recarburizing part of the Bessemer process of making steel.

The name of cryolite comes from two Greek words, *kryos*, ice, and *lithos*, a stone, because when the Eskimos discovered it they said they found a new kind of ice which did not melt in the summer.

In their works at Natrona, Pa., near Pittsburg, the Pennsylvania Salt Co. make the cryolite into carbonate of soda and alum, both of a purity not easily obtained by other processes. The manufacture of metallic aluminum from cryolite has been tried and proved efficient, but is not carried on to any extent at the present time.

About the time that the contract for the supply of cryolite was concluded by the Pennsylvania Salt Co., a party who was in possession of some small fragments made a series of experiments, to test its usefulness in the manufacture of transparent glass. The experiments were unsuccessful, but resulted in the production of a beautiful specimen of opaque glass, resembling French porcelain, and at a cost far below that of any existing process. The recipe consists of the mixing together of powdered cryolite and sand, in the proportion of 1 part cryolite to 2 of sand, with half an equivalent of zinc oxide. The zinc oxide need not be at all pure, and makes the glass readily fusible, as lead oxide does in the flint glass.

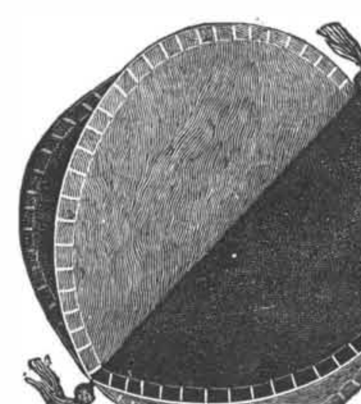
The resulting ware is very hard and tough, so that a vessel of the size of a tea plate, stamped out of this material with the rapidity with which such articles are made, may be thrown down violently without fear of breaking. The advantages of this material over porcelain are easily seen. Porcelain must go through the tedious and expensive processes of mixing and tempering selected clay, moulding on the wheel, drying, baking and annealing, and when finished breaks at sight.

On the other hand, a tea cup, as delicate and beautiful in appearance as china, yet strong as metal, may be made from cryolite as cheaply and rapidly as an ordinary glass tumbler.

* Read before the Students' Mineralogical Club, Philadelphia, July 7, 1893.

A PUZZLE PURSE.

The purse shown in the picture is of kid, strongly sewed, its four semicircular sections constituting a common central pocket of considerable capacity. It is also easily opened when one "knows how," but otherwise this is a matter over which one may long puzzle in vain, for the parts are apparently so put together as to afford no access to the inside without cutting the leather or ripping the seams. For the benefit of the curious, or those who may wish to become possessed of a "secret" with which to entertain a friend, we will explain. Of the four central seams separating the sections, one seam is formed of transverse threads, the ends of which are in the semicircular edge of the section on either side, so that by crimping inwardly the outer edges of these two sections the seam at the bottom may be separated, allowing access to the interior by inserting the fingers between the crossing threads, these threads again drawing the edges of the seam together when the outer edges of the sections are



THE MAGIC" PURSE.

returned to normal position. This puzzle is put on the market by the Wood Novelty Concern, No. 46 Cortlandt Street, New York City.

The Year's Steaming of the Campania and Lucania.

The Cunard steamer Campania has now completed a year's service, having started on her maiden voyage from Liverpool on April 22, and it will interest our readers to have official returns as to the performances during that period. By the kindness of the Cunard Company we are enabled to give accurate details in the two accompanying tables, one of which gives all the round voyages to date of the Campania and the other of the Lucania. These tables scarce require any comment, except, perhaps, to point out that on several voyages the vessels experienced heavy weather, which is reflected in the duration of the voyages and the mean speed. We might have quoted from the logs regarding contrary winds, head seas, and a continuance of bad weather, and demonstrated that on some occasions the vessels were in this respect unlucky. The mean speed of all the passages, however, is really most satisfactory. The mean speed for the round voyages out and home has been as follows:

MEAN SPEED ON ROUND VOYAGES.

	Campania. Knots.	Lucania. Knots.
1	20·00	20·235
2	20·275	20·86
3	21·01	19·42
4	20·495	20·71
5	19·885	19·855
6	20·16	21·285
7	21·00	....
8	20·215	....
9	19·70	....
Mean	20·304	20·394

It will, therefore, be seen that the mean speed for the nine voyages of over 50,000 nautical miles has been 20·304 knots, while the Lucania in her six voyages of over 33,500 miles has averaged 20·394 knots. The mean of all the outward voyages of the Campania was 19·83 knots, and on the homeward voyages 20·779 knots. In the first run, which affects the mean considerably, caution was desirable, owing to the fact that the engines had not been for long under steam. In the case of the Lucania the mean of the six outward runs is 20·202 knots, and of the homeward runs 20·586 knots. It may be added that three years ago we gave detailed returns of performances by competitive liners, and that the highest mean over six or seven voyages was about 19·1 knots, so that on this comparison the Campania and Lucania are 1¼ nautical miles per hour ahead of any of the other vessels, including the Majestic, Teutonic, New York and Paris.—*Engineering.*

Interesting Bullet Experiments.

Dr. Victor Horsley, F.R.S., in a recent lecture at the Royal Institution said that he intended to consider what a cylindrical bullet with a conical end does in its flight, and what it does when it strikes an animal, so that one portion of his lecture would deal with physics and the other portion with pathology. Sometimes the wounds made were such that in some Continental wars or outbreaks the one side had charged the other with using explosive bullets. Melsens, a Belgian physicist, suggested the effect to be due to the compressed air in front of the bullet, and was supported by Laroque, of Lyons; this point was contested by Magnus, of Berlin. Dr. Horsley performed several experiments with the fall of projectiles through liquids differing in viscosity, to show that the theory of Melsens does not hold good. Huguier, a Frenchman of science in 1848, suggested the hydrodynamic theory, which was established by Professor Kocher, of Berlin, in 1874-76. He—the lecturer—had found that it was due to two causes, the amount of fluidity of the solid and to the velocity of the bullet.

The lecturer projected on the screen two photographic lantern pictures representing the effects produced by a bullet from the magazine rifle when it perforates a plate of iron a quarter of an inch thick.

In the first case, the bullet telescopes itself when it hits the plate; so makes a larger hole in its passage. Where it comes out of the same plate the hole is still larger, because it there tears open the iron, which at that surface has nothing but the air behind it for support. When, however, a bullet is fired into a wet, soft substance the conditions are different. When experimenting upon this latter point, he adopted a plan which had been previously in use, of firing a bullet into damp clay, and then filling the hole made by it with plaster of Paris, to obtain a cast of the result, which he found to vary largely with the amount of moisture in the clay. At the lecture he fired a magazine rifle bullet into a block of very damp clay, about two feet long by one foot square, and it made a bulbous hole of about the size and form of an irregularly shaped Florence flask; then with a large knife he cut off the end of the block, revealing the hole, larger than a clenched hand, as if the bullet there had exploded. By means of plaster casts on the table he pointed out that when less wet clay was used the hole was smaller, and more of the shape of a soda water bottle, and with less water in the clay, still the hole was narrower, more nearly approaching an irregular tube in shape, but largest in the diameter near the further end. Sometimes there is a diversion of the bullet inside the clay from its original track, so that the casts are curved, which indicates the reason why surgeons, when probing, are sometimes unable to find the bullet. The greater the velocity of the bullet, the more destructive is it to the soft substance into which it enters. The "spin" of the bullet has little effect on the result. He concluded from these results that the magazine rifle is not a "humane weapon."

The speculation that some of the destructive effects of the bullet are due to the conversion of some of its energy into heat he did not consider to be of much moment; the heat produced is not sufficient to char particles of wool and hair carried in by the bullet. Microbes carried in by a bullet after passing through cloth can afterward be cultivated on gelatine, showing that they have not sustained a temperature above 40° C.

He next projected on the screen a picture that represented the effect of firing a magazine rifle bullet through each of two tin canisters, filled with an equal weight of lint; the relative size of the bullet is also shown. In the one canister the lint was dry, in the other it was thoroughly wet. In the first case the bullet simply perforated the arrangement; in the other the canister was hopelessly damaged, and much of the lint driven out in a kind of column at the top.

He then fired a bullet through dough containing 25 per cent water, and but moderate explosive-like effect was produced. On next firing a bullet through flour containing twice as much water, the dough was scattered in all directions.

He then showed the distribution of the energy produced by the bullet in passing through water, by means of a trough arrangement with glass sides, closed at one end with a plate of iron and at the other with good India rubber, such as "heals" itself after the passage of a bullet. This trough contained an aqueous solution of a colored dye, up to a marked level. A sheet of white paper was suspended so that its lower edge just dipped into the dye. The point at which the bullet perforated the India rubber was three centimeters below the surface of the liquid.

The result was shown by the staining of the paper by the splashing up of the colored water, and shows that the distribution of the energy is about the same as when the bullet is fired into very wet clay.