## MODIFIED MILK.

The result of scientific experiment with milk as a food is the successful establishment of laboratories for its modification. The first laboratory for this purpose that has been established in the world was opened in Boston in 1891. There is another now in New York City and a third in Philadelphia, while others are to be opened in several Western cities.

These laboratories are situated in the most healthful localities, as milk is one of the best mediums for the cultivation of bacteria, and are scientifically conducted by men whose knowledge of the subject has enabled them to carry on the work with great success. Every precaution is, therefore, taken for cleanliness and against contaminating influences of any kind.

The interiors are especially arranged that everything may be kept entirely free from dirt or dust. The walls of the rooms where the work is done are of white tiles and the ceilings of material that may be washed and scoured, while the floors are of waterproof asphalt, sloping slightly to the center of the room, so that the water, with which everything is daily drenched, may drain away. In every room a large automatic fan causes the floating particles of dust or any insects to be carried away through large pipes, thus increasing the general cleanliness. Every department of the work has its special room, and various machines for different purposes occupy spaces in the rooms where they are used.

Modified milk is particularly a food for infants and children and has proved a most material aid to physicians, and by saving many lives a great benefit to humanity.

The peculiar process of milk modification is most interesting.

The milk used in this work is supplied by a herd of cows carefully selected and cared for, and is received in large glass jars at the laboratory shortly after milking. These cows have the tuberculin test applied to them every six months by the State, or any other competent veterinarian, as a guard against transmitting tuberculosis.

When received it has a temperature of about 40° Fah., having been kept cool by ice during transportation. It is immediately put into tanks of iced water, in the milk room, so that the same temperature may be maintained.

THE CENTRIFUGAL MACHINE.

THE FAT TESTER.

THE WATER STILL.

MODIFYING MILK.

FILLING NURSING BOTTLES.

This prevents the growth of bacteria. Here it is kept until it is ready to be used, when it is taken to the separating room, where, by the use of a centrifugal separator, the cream is separated from the milk. This machine is one of great delicacy and speed, revolving at the rate of six thousand eight hundred times per minute, and works with such effect that only a small percentage of fat, 0·02 per cent, remains in the milk. The usefulness of this machine is not alone in the withdrawal of the fat from the milk; by its great force it separates dirt and other foreign matter common to milk, from the cream and milk, leaving them as nearly clean as they can be. The cream which is separated is about 30 per cent fat. It is reduced to 16 per cent, which is the stable cream for the modifying clerk's use. Large glass jars are filled with the separated cream and milk, and kept at 40° Fah. temperature, to prevent the growth of bacteria, as milk that is modified from materials free from bacteria is better for the infant than milk in which the bacteria have been destroyed by heat.

This is then ready for the modifying clerk's use, and when desired is taken to the modifying room. The modifying clerk tests the milk each day in order to ascertain the percentage of fat, as it is liable to differ from day to day, as the percentage in different cows changes, and therefore slightly affects the whole. This test is made with the aid of a machine called the Babcock milk tester. It is a centrifugal machine, into which bottles containing acidified milk are placed, and the fat is made to separate quickly and completely by rapid revolution.

The milk is acidified in order that the proteids, casein, and fibrin may be changed to soluble acid, albumens, which offer less resistance to the rising and aggregation of the fat globules. Nearly equal volumes of milk and commercial sulphuric acid of 1·82 specific gravity are put into test bottles having long graduated necks.

These bottles are then put into the centrifugal machine and caused to revolve rapidly for several moments, when they are taken out and filled to the neck with hot water, and returned to their places to be whirled one or two minutes longer. After this they are filled with more hot water, to about the 7 per cent mark, and again turned for a short time, when the fat separates and its percentage is easily noted on the graduated neck of the bottle.

When the modifying clerk is ready to modify the milk, he has before him several pitchers of fluids, arranged in regular order, so that he may readily use whichever one he may need at the moment.

The first contains an amount of the stable cream, procured from the separator, which is used to obtain the prescribed percentage of fat. A second pitcher holds the separated milk, which he uses to gain the different percentages of proteids which the physician's prescription demands. Another is a carefully prepared 20 per cent solution of milk sugar dissolved in distilled water. This is to make up the amount of sugar called for in the prescription.

A fourth pitcher holds a quantity of lime water by means of which the reaction of the food is adjusted.

Distilled water is in another pitcher and is got from a still which stands at one side of the room.

Other vessels contain preparations of oats, barley and wheat, which are added to the milk to be used by infants old enough to have starch in their food.

From these fluids he makes up the prescription, measuring into a large graduate glass the exact number of ounces of each called for, and pouring the whole into a pitcher, which he passes to a second clerk. The milk is thus recombined with greater or less percentages of its parts, or constituents, as may be stated in the medical prescription.

The second clerk pours the modified milk into glass tubes devised especially for use as nursing bottles and for transportation, measuring into each tube the number of ounces prescribed to be given at each feeding. When this is done the tubes of milk, which are held in light willow baskets of different sizes, or numbers of compartments, are passed to a second clerk who stopples them. Non-absorbent aseptic cotton is used for this purpose, a wad of which is forced into the neck of each tube and the refuse end cut off neatly with a pair of scissors, thus making a neat stopper. This having completed the modifying process, the sealed tubes in their baskets are taken to a room where there is a large heater, into which they are placed. This heater is so arranged that the steam passing through it can be regulated to produce any degree of heat required. This is accomplished by means of a regulator connected with the steam pipe. A clerk in charge uses this to keep the heat at some desired degree, which he is enabled to do by watching the thermometer which is fitted to the heater.

The milk is heated to one hundred and sixty-seven degrees when it is to be used within forty-eight hours. This destroys any ordinary bacteria common to milk, but does not cook the milk or coagulate the proteids, and is called "pasteurizing," from the eminent chemist Dr. Pasteur, who claimed this was a sufficient degree of heat for carefully prepared milk. But when the weather is very hot or the milk is to be sent great distances, such as across the continent, or to Europe, and is expected to keep for more than forty-eight hours in good condition, it is heated to 212° Fah., which sterilizes it. It has been found that to let it remain in the sterilizer forty minutes produces the best result. When taken from the sterilizer the baskets of milk are placed in cooling tanks, where the temperature is reduced to 38° Fah. The baskets are then placed in wagons and delivered to the consumers in a short time. The returned baskets and tubes are taken to the wash room where they are placed in a special sterilizer and then washed in a solution of soda and water, thus guarding against all possible infection. All tags and stopples that are returned are destroyed.

The work of modifying milk has thus by scientific means become a most important factor in medical knowledge, and of great benefit to all through its utility in promoting the health of children and saving the lives of many who, by improper nourishment, do not survive the early maladies common to children. The work which has been brought to so successful an issue is sure to grow, claiming for its promoters and originators the gratitude of many parents and the interest which the achievements of science have for most people.

### The Carbon Process: Combination Printing of Clouds, Backgrounds, etc.

BY W. ETHELBERT HENRY, C.E.

When a beginner first undertakes to tackle carbon printing, he finds his chief troubles arise from the fact of being unable to watch the formation of the image upon the black, leathery tissue.

So far as correct exposure is concerned, a photometer proves a ready and reliable means of registration, but when it comes to printing in clouds or figures from one negative, and a foreground or background from another, the beginner is apt to feel at a loss, simply because he is dealing with an invisible image.

There are several well known plans of securing accurate registration of several images upon carbon tissue, all differing more or less one from the other.

The method recommended by the Autotype Company is especially useful when one wishes to use part of the sky of a large negative upon a landscape print from a small one, but unfortunately their directions are hardly explicit enough for a novice. For instance, let us suppose that we have a half-plate negative, interesting in its main features, but devoid of sky; suppose, also, that we have a whole-plate negative containing suitable clouds that we wish to utilize by combining part of them upon the half-plate print.

To do this, we must cut a piece of white paper the size of the half-plate negative, and hold them together toward the light, so that we can distinctly see an outline of the horizon. This outline must be traced in blacklead pencil upon the paper.

We must next lay this tracing on a piece of yellow paper (such as thin canary medium—not fabric), and mark the outlines and the horizon line by going over them with a dull point; the outlines must be the exact size of the half-plate negative.

We must next place the glass side of the half-plate negative upon the film side of the whole-plate, until the sky part covers that part of the whole-plate sky we wish to use. When the correct position is determined (and great care must be taken to have the horizon line level), the negatives must be held firmly together, while a finely pointed crayon is passed over the film of the larger negative, as close to the edges of the smaller one as is possible. This is to mark the correct position upon the cloud negative, the crayon lines being easily rubbed off with a piece of flannel when we have finished with them.

We must next cut the yellow mask the exact size of the half-plate negative, and then divide it along the horizon mark into two pieces; before actually cutting it, it would be well to mark one side of the paper with two small crosses—one at the sky half and one below. This will render it an easier matter to avoid mistakes when fixing the masks in position. We will suppose that these crosses have been made upon the surface of the yellow mask while it is lying upon the film side of the half-plate negative in its correct position as regards the horizon and outlines.

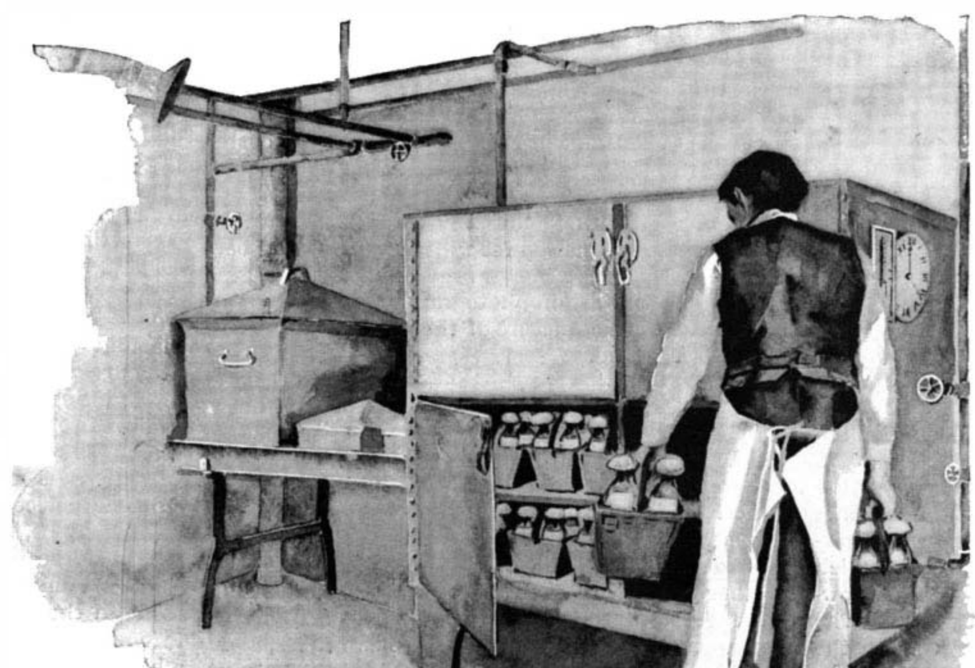
Having now divided the mask into two parts, we must take the lower half and fix it (with its cross still in view) upon the lower part of the outlined space on the film side of the whole-plate negative; the crayon lines of the bottom and sides being the guides as to correct position. The best way to fasten the mask upon the negative is to give the former a dab of thick India rubber solution upon each lower corner; in a few seconds it will be dry enough to stick where it is pressed. I need hardly add that a light pull will suffice to remove the mask without injuring the negative.

We must next take the upper half of the mask and fix it upon the glass side of the half-plate negative, with its extreme outside edges in register with the outlines of the negative; in this case the mask (being upon the glass side of the negative) must be fitted with its cross in contact with the glass, and therefore out of sight.

APPLYING ANTISEPTIC STOPPERS.

We must now cut a piece of carbon tissue to the exact size of the half-plate negative, put a pencil mark upon the lower part, and expose it in contact with the half-plate negative for the necessary time; this must be done in diffused light, in order to avoid the outline that would inevitably be caused if exposed to the sun. The tissue must then be removed and placed within the crayon outline (and over the yellow mask) that marks its position upon the larger negative.

An exposure to light, more or less brief, must now follow, and in order to prevent a visible line of junction between the sky and foreground, we must move a sheet of cardboard over the horizon line during the whole time. To do this, the card is usually held in one hand and drawn downward until the horizon is just passed, and then slowly moved upward to the top, or nearly the top, of the sky. This up and down movement should be continued, more or less slower (according to the desired effect), so that the sky will be neatly graduated.



PASTEURIZING THE MILK.

Of course, it is necessary to use a "safe edge," as in ordinary carbon work; the one on the large negative can be a temporary affair made with a few lantern slide binding strips fixed to the glass side.

Although the foregoing may seem rather an elaborate method, I can assure you that it is extremely simple in practice. As I am writing for beginners, I have necessarily described every minute detail—even as to which side of the negative is to be used. My long experience of beginners and their troubles has induced me to do this, as I know how difficult it is for them to follow the brief directions issued by manufacturers, who seem to take for granted that a beginner can divine by instinct a lot of details known to the writer of the "directions for use."

In order to combine a portrait from one negative with a background from another, we must employ a somewhat different method. First take a print from the portrait negative upon a sheet of printing out paper or albumen paper. The outline of the figure must then be carefully followed with a pair of sharp scissors so that we secure two masks, one of which fits accurately within the other. The two masks are then exposed to light until printed as dark as possible; the background part is then stuck (face down) over the film side of the portrait negative with extreme care, so that all, save the figure, is covered. The top edge of the carbon tissue is then smeared with thick rubber solution, so that it will adhere to the top edge of the mask; then the exposure is made for the necessary time.

After exposure, the negative and tissue are taken together (still in contact) from the printing frame, and a dab of thick rubber solution is put on the bottom (back) edge of the figure cut out. The carbon tissue is then gently raised from the bottom, without disturbing the top (adhering) edge, until the uncovered space of the negative is visible. The figure "cut-out" must now be carefully adjusted until it covers this space and fits the outer mask exactly; the carbon tissue is then gently lowered and firmly rubbed to make the figure "cut-out" adhere. The top edge of the carbon tissue must next be gently pulled from the negative, when the figure "cut-out" will be found covering that part that has just been printed. The tissue, with the adhering cut-out, is now adjusted over the background negative (in a space previously marked, if it is a larger one), and printed for the necessary time. The cut-out is then removed for future use, and development is conducted in the usual way.—The Amateur Photographer.

### Curious Effect of Lightning on a Trolley Car.

A case is reported in New Brunswick, New Jersey, of a trolley car being struck by lightning on the afternoon of May 5, during a thunder storm. The electricity ran down the trolley pole and entered the car, part of the current running on to the lighting circuit, burning out the incandescent globes. So intense was the heat in the lamps that the glass globes melted; most of the glass fell on the floor, but other drops went into the laps of women and more fell on their hats. The ladies thought they had cause for complaint, and demanded that the officers of the company make good the damage to their garments. This singular instance of the effect of a sudden stroke of lightning makes it necessary for some new invention to be devised for the prevention of a similar disaster.

### Percentage of Moisture in Green Wood.

According to M. Deplay, green wood when cut down contains about 45 per cent of its weight in moisture. In the forests of Central Europe wood cut down in winter holds at the end of the following summer more than 40 per cent of water. Wood kept for several years in a dry place retains from 15 to 20 per cent of water. Wood which has been thoroughly desiccated will, when exposed to air under ordinary circumstances, absorb 5 per cent of water in the first three days, and will continue to absorb it until it reaches from 14 to 16 per cent as a normal standard. The amount fluctuates above and below this standard according to the state of the atmosphere. M. Violette found that by exposing green wood to a temperature of 212° F. it lost 45 per cent of its weight, which accords with observations of M. Deplay. He further found that by exposing small prisims of wood one-half inch square and eight inches long, cut out of billets that had been stored for two years, to the action of superheated steam for two hours, they lost from 15 to 45 per cent of their weight, according to the temperature of the steam, which varied from 257° F. to 437° F. (125° C. to 225° C.)

### National Electrical Exposition Notes.

The second week of the exposition finds the whole exhibit in good working order, and the somewhat dim illumination of some of the side aisles, which was noticeable at the opening, has given place to a blaze of light which is fully up to the level of the rest of this excellent display. The great advance which has been made of late in the manufacture of arc lamps is evident from the perfect steadiness of the lighting; and the visitor is also struck with the endless variety of devices for softening and for diffusing the light. Incandescent lamps are shown in soft and pleasing colors, and the display of arc lamps proves how much can be done to render them beautiful, not merely in color, but in the shape of the globe and details of the fittings. The George A. Macbeth Company, of Pittsburg, Pa., exhibit some varieties of what they call the holophane, a glass globe which is cut into a series of concentric angles on its outside surface and on the inside is cut into radial angles. The light is caught and refracted by these angles until the whole surface is brilliantly aglow.

It is unfortunate that a larger percentage of the visitors do not inspect the light and power room on the first floor. It is now in full running order, and, as an exhibit of the best and latest practice, it is a valuable object lesson for the electrical engineer. The Siemens & Halske dynamo, with its outside armature, will attract attention. It is a 100 kilowatt machine, direct connected to a 150 horse power Ball & Wood engine. It is run at 250 revolutions, and the smoothness and silence of the running are remarkable. This engine is built with a telescopic valve, designed to take up the wear. A small model of the valve is shown and explained by the attendant.

Next to this stands a Phœnix horizontal tandem compound engine, direct connected to an 80 kilowatt Walker generator. The high pressure cylinder is in front and the low pressure cylinder is bolted to a subbase. The arrangement is compact and facilitates repairs.

What may be called the popular side of the exposition has been well provided for; and one of the most popular exhibits is that of the Practical Laboratory, which is under the supervision of Mr. Max Osterberg, of Columbia College. Practical demonstrations are made of the various principles of electricity. An arc light is seen burning under water, and this experiment is shown with the apparatus made by Prof. R. Ogden Doremus, of the College of the City of New York, Bellevue Hospital, and used by him in a lecture at the Academy of Music in 1856. The electrolysis of water and the electro-magnet are popularly explained, and a machine is seen in operation which illustrates the action of Fuco's currents.

On the same floor is an extensive exhibit of machines designed by Elihu Thomson, which has been brought over from the Thomson-Houston factory, Lynn, Mass. This contains, among other objects of interest, an oscillating type watt meter; the original welding transformer; a case of three dozen photographs of past and present transformers; and several examples of electric welds, including 3 feet of ¼ inch welded chain, there being two welds in every link, a welded band saw, and a plate iron lap riveted joint, in which the rivets are practically welded into place. There is also a fine exhibit of Mr. Thomson's arc lights of the original T D and K type, and of dynamos built in 1876 and 1878.

Before leaving this floor, a visit will be paid to the exhibit of the electrical wonder of the hour, the Roentgen X rays, which are shown by Mr. Edison by means of his fluorescent screen. The crowd of sightseers is passed in single file into a dark room, where the screen is arranged inside a railing, in much the same way as an ordinary ticket window. The crowd passes one by one, in front of the screen, which is about 18 inches square, and the hand is passed up within the screen and placed against it. The current from the powerful Ruhmkorff coil, of 25,000 volts, is turned on, and immediately the screen glows with a pale light, upon which is seen the ghostly shadow, or shadows, of the hand, the flesh showing up in faint shadow, the bones in darker shadow, and the ring, if one is worn, showing out in black. One must confess that a result which is merely interesting on paper becomes a little grewsome when seen through one's actual living flesh. The arrangements were so well carried out that, in the course of an hour, some four or five hundred persons must have taken a look at their anatomy.

On the main floor, the latest developments in the manufacture of wire and cable and various improved methods of insulation are shown at the two booths of the Safety Insulated Wire and Cable Company and the Washburn & Moen Manufacturing Company. A curiosity in the latter exhibit is a coil of copper wire which is 15½ miles long and weighs only a trifle over 2 pounds. The wire is $\frac{29}{10000}$ of an inch in diameter.

The John A. Roebling's Sons Company show a bimetallic wire—a steel core with a copper jacket—which combines the conductivity of copper with the strength of steel. A wire, $\frac{32}{100}$ of an inch in diameter, has a strength of 5,700 lb., and weighs 1,620 lb. per mile.

Across the way from these booths will be found a display by the Fort Wayne Electric Company. They show a single phase alternating current motor, of 10 horse power and 16,000 alternations; also a 5 horse power single phase alternating motor driving a 7 kilowatt bipolar 110 volt dynamo.

The attendance at the exposition has been very gratifying and is increasing.

### A NATURAL MOUSE TRAP.

Mr. W. H. Marris sends us the following curiosity, says the Amateur Photographer:

From time immemorial the mouse has been classed with the pests with which mankind has had to deal. The little animal has three leading and discreditable characteristics, i. e., thief, trespasser and destroyer of property. It is therefore not surprising that human ingenuity has been ever actively employed against the unwelcome creature's life.

Besides the chemist with his poisons, and the wood and wire workers with their clever devices, the mouse has had a natural foe in the cat; but notwithstanding all kinds of snares, mice are not yet exterminated. But since the creation there has surely not been known a more curious enemy to mice than the one that has recently distinguished itself at the fishing metropolis (Grimsby), on the night of March 28.

An oyster was on that day placed on a pantry floor, and during the night (feeling thirsty) it opened its shell. Three silly, wandering mice were near too, and smelling fish, all placed their heads just inside for a taste. This intrusion was instantly resented by the occupant of the shell, and hastily yet silently a relentless grab was made, and those foolish mice were suddenly executed prisoners.

Such a thing has been known on oyster boats here

OYSTER AND MICE.

as the capture of a single mouse by an oyster, and rats have suffered injuries to legs, etc., but the trapping of three mice simultaneously is a record for an oyster, which I think at present is acknowledged a unique feat.

Has the oyster firmly conspired to oust the cat from the legitimate occupation for which it has so long been renowned?

Thanks to the art of photography, our readers are able to see an exact picture of the captor and the captives just as found.

### New Method for Measurement of High Temperatures.

M. Daniel Berthelot has devised a plan for the measurement of high temperatures which depends on the refractive index of the heated gas. It has recently been ascertained that if you bring a given gas to a given density it will have the same refractive index whether you reach this result by varying the pressure or the temperature or both, says the Progressive Age. Consequently, M. D. Berthelot takes two tubes, along which he passes two beams of light obtained by splitting up a beam of light from a single source. When these two beams are made to fall on the same spot, they produce certain fringes, due to interference. If one of the tubes be heated, these fringes are displaced; but they can be brought back to their original position by varying the pressure in the colder tube. This alteration of pressure then produces exactly the same alteration of density in the colder tube as is effected by the heat in the hotter one; and this enables the temperature in the hotter tube to be calculated. After settling that this could be done, M. Berthelot proceeded to simplify the method by working with only one tube, filled with ordinary air; and he expects to be able to make the method one capable of being readily applied for manufacturing purposes.

### Notice.

A premium of $250 is offered by the SCIENTIFIC AMERICAN for the best essay on

THE PROGRESS OF INVENTION DURING THE PAST FIFTY YEARS.

This paper should not exceed in length 2,500 words.

The above-mentioned prize of $250 will be awarded for the best essay, and the prize paper will be published in the Special 50th Anniversary Number of the SCIENTIFIC AMERICAN of July 25. A selection of the five next best papers will be published in subsequent issues of the SCIENTIFIC AMERICAN SUPPLEMENT at our regular rates of compensation.

The papers will be submitted for adjudication to a select jury of three, to be named hereafter.

Rejected MSS. will be returned when accompanied by a stamped and addressed envelope.

Each paper should be signed by a fictitious name, and a card bearing the true name and the fictitious name of the author should accompany each paper, but in a separate sealed envelope.

All papers should be received at this office on or before June 20, 1896, addressed to

Editor of the SCIENTIFIC AMERICAN,
361 Broadway, New York.

## Correspondence.

### The New Hudson River Bridge.

To the Editor of the SCIENTIFIC AMERICAN:

Your beautiful illustration of the proposed new bridge over the Hudson River at New York, in the May 2 number, excites everywhere intense interest.

The central span, 3,254 feet, may, perhaps, be impossible to diminish, but the cost of the bridge itself, $25,000,000, could certainly be diminished one-half, for it is intended that there shall be six railroad tracks, and the bridge be strong and heavy enough to carry all the tracks, loaded with trains (including, of course, 100 ton locomotives) from end to end, or a total live load equivalent in weight to 30,000 tons.

May I not modestly suggest to the engineering fraternity that by limiting it to two tracks only (or four at most) with two or four cars to each train and no locomotives, the bridge would be perfectly capable of doing all the work and even more than the system as at present proposed, at the same time the cost could be diminished to within eight or ten millions, and make a much stronger and more beautiful structure.

Strickland Kneass, Esq., the engineer of the Pennsylvania Railroad some seven or eight years ago, deferred recommending such a structure to Thomas A. Scott, then president of the Pennsylvania Railroad Company, because his estimate of eight million dollars for the cost was too stupendous to undertake, and that included taking one hundred acres of the southerly end of Central Park for a grand international depot. HENRY DAY.

New York, May 8, 1896.

### Valuable Patents.

American inventors will have their ambition excited by the recent sale, by the Diamond Match Company, of Chicago, Illinois, of patent match making machinery and rights to European governments. That company received $600,000 from the French government and $800,000 from the Italian government, and it is reported that they will receive similar sums from Germany, Austria-Hungary and other countries, says the American Woodworker. Five years ago the science of converting logs into matches was said to be a finished science, incapable of further improvement. But American ingenuity has shown that what was "perfect work" in 1891 will not answer for 1896. Even now the machines used in making matches, wonderful though they are, are not to be left unchallenged, as inventors are working on new ones, whose capacity will, they claim, far excel that of the best machines now in operation. He is a bold, or a very ignorant, person who will in these days assert that any process, tool, machine or device is incapable of further improvement. There may be, there are, many absolute failures in the works of the inventors, but it is an open truth that there are many satisfactory successes also, and that through the labors of these ingenious persons everything in the shape of machines is gradually coming to a higher plane.

ON April 20 Senator Cannon introduced a joint resolution which if it is enacted into law would give the city of Washington a remarkable attraction. Mr. Cannon proposes to have constructed an enormous map of the United States showing every hill, mountain, valley, river, lake, village, city and railroad. All this is to be done in miniature, but on such a scale as will give a map about two-thirds of a mile in length by one-third of a mile in breadth. The map is to be constructed on such a scale that one foot of map surface would represent one square mile of the actual area. The proposition is a serious one, although it is not likely to be received as such. The value of such a map would be very great.