SCIENTIFIC AMERICAN

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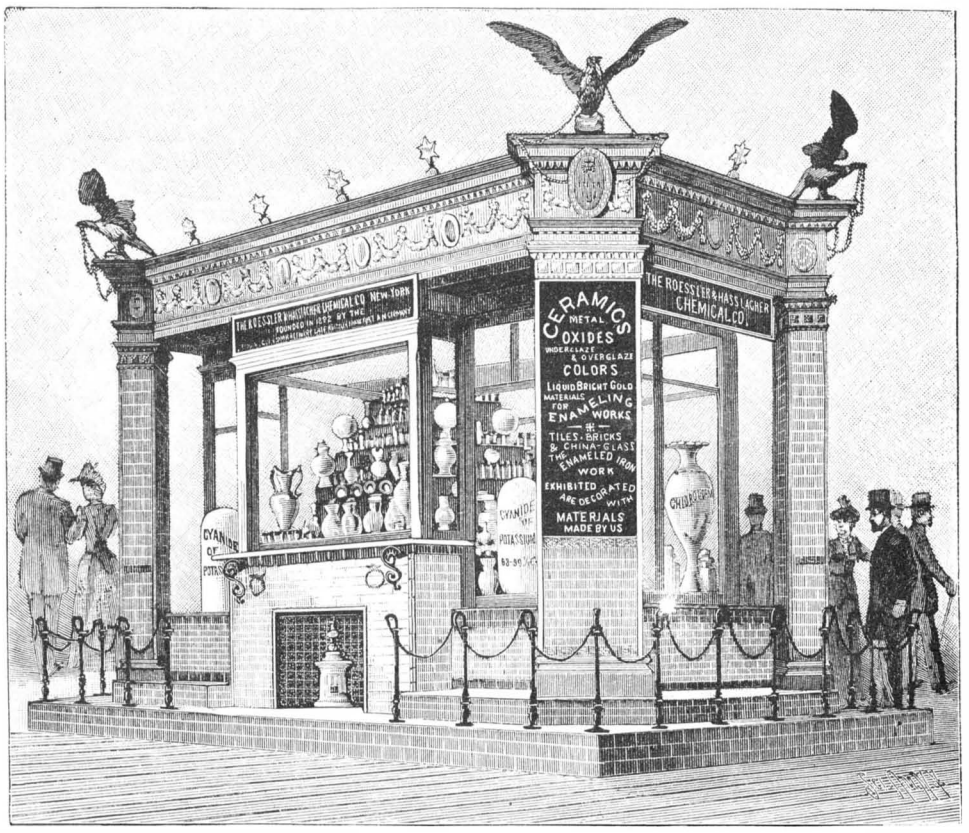
THE WORLD'S COLUMBIAN EXPOSITION—THE BABCOCK & WILCOX BOILER PLANT.

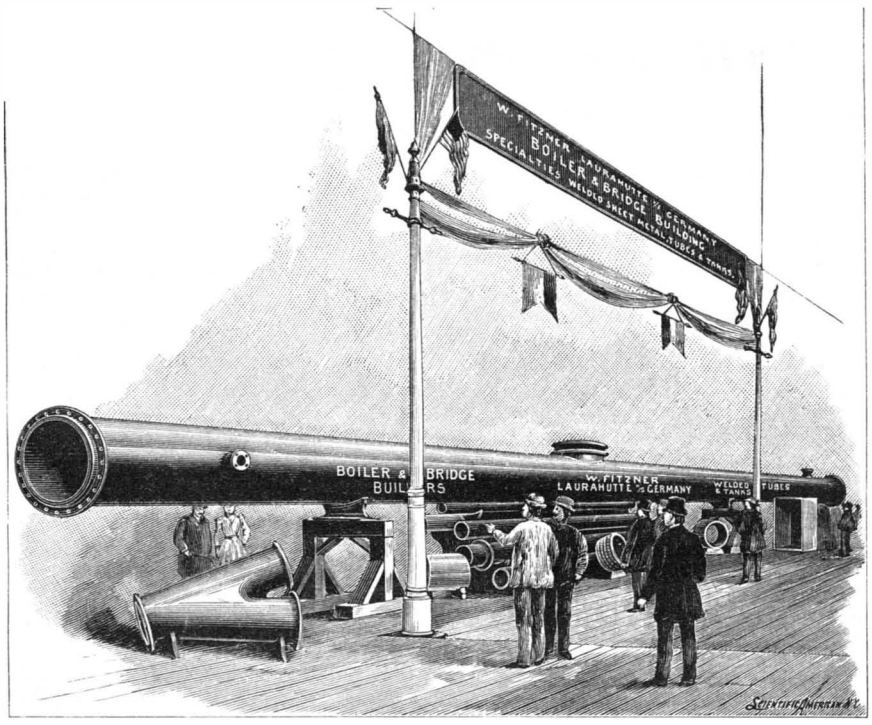
In the SCIENTIFIC AMERICAN of July 8 we illustrated the manner in which the great Exposition was supplied with power by an assemblage of oil-fired, water tube boilers, the greatest in number and operating power ever before collected in one locality. Occupying a conspicuous place in this immense plant are ten boilers, of 3,000 horse power, of the Babcock & Wilcox Company, whose exhibit is shown in one of the views. It is now about twenty-five years since the original Babcock & Wilcox water tube boiler was first put upon the market, and the distinctive type of boiler known under this name, with the improvements made in it along the original lines adopted at the start, has attained a world-wide reputation for efficiency, safety, and practical economy under nearly all conditions, which only a well equipped engineer can fully understand and appreciate. The Babcock & Wilcox boilers at the Exposition have 126 four inch tubes, 18 feet long, arranged in courses 14 feet wide and 9 high, a mud drum 12 inches in diameter and 8 feet 6 inches long, and two steam drums 36 inches by 18 feet. They are supplied by Hancock inspirators and Snow pumps, and the oil fuel is afforded by thirty Larkin burners, of which we give an illustration.

The construction of this boiler is so generally understood that a brief description only is necessary. It is composed of lap-welded wrought iron tubes, placed in an

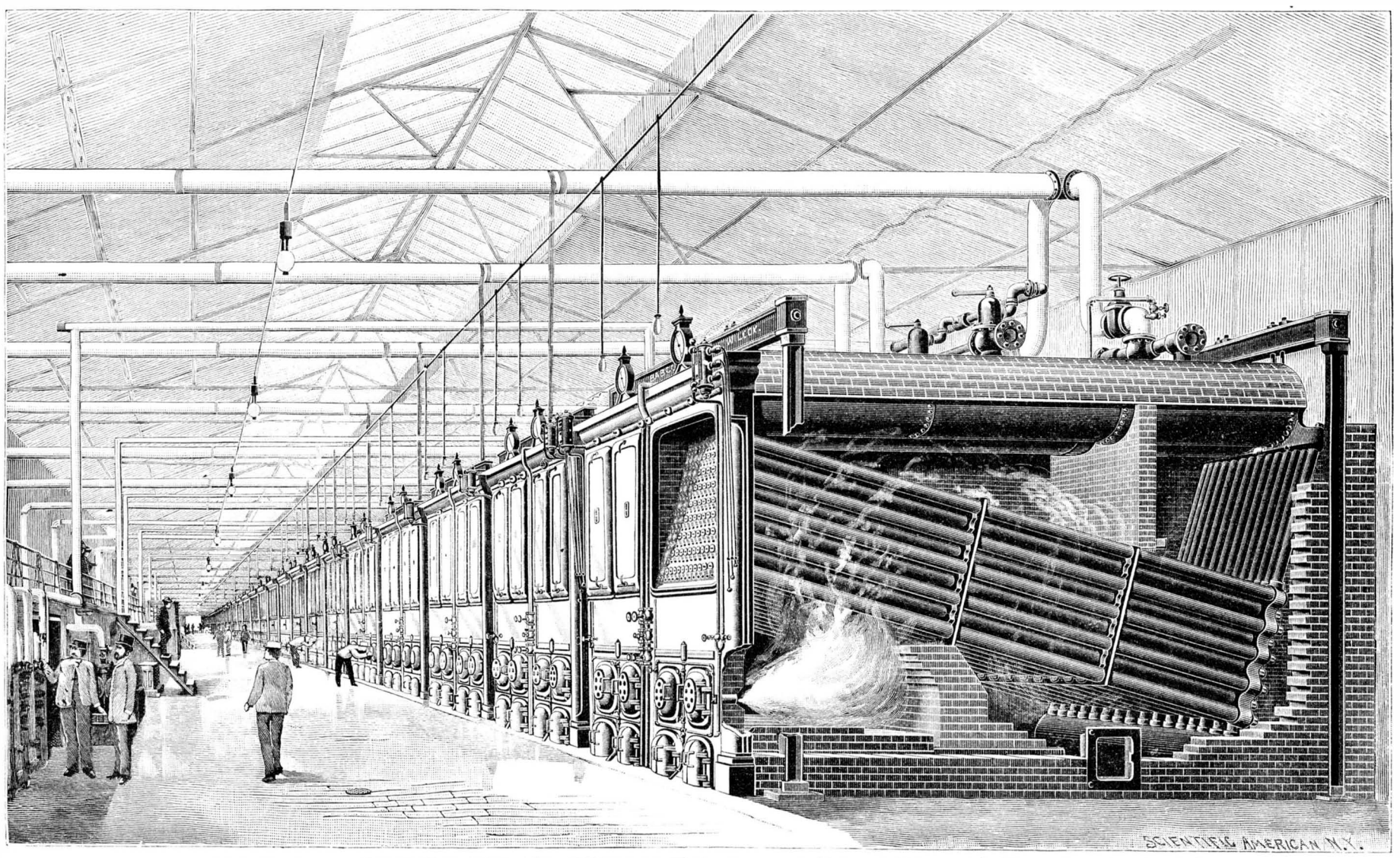
(*Continued on page 103.*)



GROUP OF AMERICAN CHEMICAL AND PHARMACEUTICAL PRODUCTS.



A GERMAN EXHIBIT OF WELDED AND BENT TUBES.



THE BABCOCK & WILCOX BOILERS.

THE WORLD'S COLUMBIAN EXPOSITION—ENGINEERING WORK AND THE INDUSTRIAL ARTS.

Scientific American.

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NEW YORK, SATURDAY, AUGUST 12, 1893.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 919.

For the Week Ending August 12, 1893.

Price 10 cents. For sale by all newsdealers.

NEW INVENTIONS FOR STREET CLEANING WANTED IN NEW YORK CITY.

It is really sickening to see how lazy and dishonest men become as soon as they are employed on public works in New York City. If it is street sweeping, they make a pretense by moving their brooms, without pressing hard enough to lift the dirt. If it is raking leaves on the grass, the men give one pull at the rake, then stop to rest and talk for a few minutes. If it is the laying of cross walks, five men will spend three days in adjusting six stones, and so on. The sense of honor and honesty in doing work seems to have left the men.

This is the main reason why New York City has suffered so long from dirty streets. Hundreds of men are employed to do the work, but they cheat the city. They pocket their wages, but evade the labor. They require to have overseers who will stand by to watch and whip them up to duty. These overseers the city does not furnish. If they did, the men would rebel at the polls.

Mr. W. S. Andrews, recently appointed in New York City as commissioner of street cleaning, expresses the opinion that the streets will not be thoroughly, properly and economically cleaned until some machine is adopted which will sweep the streets and at the same time take up the sweepings and carry them away to the place of final deposit, so as to avoid a second handling. He objects to any system which involves shovelling or dumping the sweepings from one cart to another, as it is impossible in doing that to avoid dust and a certain amount of scattering. He might have added it is impossible to make the shovelers do honest work.

The only hope of success in New York street cleaning is through the invention of new machinery for doing the work, and the elimination of manual labor. It would seem as if there were here a chance for inventors. Mr. Andrews is an enterprising man and will doubtless be glad to avail himself of any practical plans that may be brought to his notice. Steam rollers are now quite generally employed on city pavings and there is no good reason why steam street sweepers and dumpers might not be introduced.

THE NEW CONGRESSIONAL LIBRARY BUILDING.

The Fiftieth Congress made a liberal appropriation for a new Congressional library building, at Washington, and a square, consisting of ten and a half acres of ground, situated about 1,000 feet east of the Capitol, was purchased at a cost of $585,000 for a site. Here a magnificent structure is now quite rapidly assuming shape. The work has been going on for the past four years, at times greatly delayed because the stone could not be furnished as fast as wanted.

The building is of Italian renaissance architecture, and will be 365 by 470 feet in size, with cellar, basement, and two stories. The material of the outer wall consists of granite, more or less beautifully carved and ornamented. A prominent feature will be a gilded dome, 100 feet in diameter, surmounted by a tolus or lantern. A balustrade will surround the base of both the dome and the lantern. The base of the latter will be about as high as the top of the vertical portion of the dome of the Capitol.

This great building, with a larger area than that of the Capitol itself, gives promise of being one of the handsomest of the many fine structures in Washington.

The reading room will be 100 feet in diameter and 90 feet in height, inclosed on the top with great skylights admitting a flood of light. Radiating book repositories, nine galleries high, and capable of holding over 8,000,000 volumes, will communicate with the reading room. The present Congressional library, for years greatly overcrowded, contains 650,000 volumes and 250,000 pamphlets. Only about one-fourth of the new building will be occupied by the library.

The cellar of the building is completed, and the heating apparatus all in place. The dome will be finished some time during the summer, and the walls of the building by next fall. The interior work, consisting of marble, woodwork, decorating, etc., will occupy several years more. The building will be especially well lighted, for, besides the great skylights, there will be about 1,500 windows.

With its snow-white walls and conspicuous gilded dome—the latter forming a pleasing contrast to that of the Capitol—its beautiful grounds, walks and driveways, the new Congressional Library will be a fitting companion for its grand and stately neighbor across the way.

Wave Power Pumps.

Two wave motor pumps have been in operation some time out near the Cliff House, not far from San Francisco, that have raised 1,000,000 gallons per day into a reservoir at an elevation of 100 feet. The *Pacific Lumberman* says: This appears to be the best result that we know as having been obtained from the various wave motors that have been tried during the past six or seven years.

John Stephenson.

John Stephenson, the inventor of the street car and one of the fathers of transportation, died at his home, in New Rochelle, on July 31. Mr. Stephenson was born in 1809, of English and Scotch parentage, at Armagh, Ireland, and was apprenticed to a New York coachmaker at the age of seventeen. In 1831 he began business for himself, and he designed the first vehicle known in New York as an "omnibus." Mr. Stephenson secured a patent for the first street car in 1832, the new cars being run on the New York and Harlem Railroad. The first car was named John Mason, after the president of the road. This car is now regarded as a historical curiosity. The first trip of the John Mason was made with the mayor and common council as passengers from Prince Street to Fourteenth Street. Other orders poured in, and he soon had a very flourishing business. In 1843 the Stephenson Works were built in Twenty-seventh Street, near Fourth Avenue, where they still turn out magnificent specimens of the car builders' art. It is curious to note that the original patent was signed by Andrew Jackson and members of his cabinet.

Street railroads are essentially American, and the fame of the car builder was carried into all civilized countries. New York must have always remained within certain limits if some means of transit had not been devised which should be cheap and at the same time fairly rapid. The street car filled the want for a long time, and a period of over forty years elapsed before they were obliged to give place, in New York, to the elevated railroad, and it is only within the last two years that cable and trolley cars have begun to displace the street car propelled by horses. At the present time the majority of the cars in New York are horse cars. The street car systems of New York appear to be particularly identified with Mr. Stephenson, and many hundreds of them still bear the words "John Stephenson's patents."

The perfection of the overhead trolley system has done a great deal to advance rapid transit and render it possible for people with small means to live in the cheap and generally attractive suburbs. Already the trolley lines, which are cheaply built and cheaply run, are successfully bidding for traffic with the elevated and other steam railroads, and in Brooklyn the elevated railroads have asked for a reduction in their assessment for taxation on the ground of loss of business caused by the number of passengers carried on the trolley roads. It is only a question of a few years when the whole State of New Jersey will be gridironed with trolley roads. The growth of street railways in the last five years has been phenomenal, and John Stephenson has borne an important part in this development, as he did back in the thirties, when the odd-looking little cars toiled painfully up Murray Hill. In some countries the memory of John Stephenson would be honored by a public funeral.

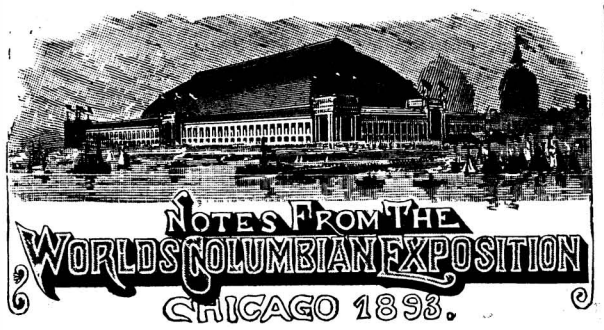
Electroplated Gauze Work.

Any one who has had experience with the thin glass globes used for covering delicate objects and instruments will be aware of the many accidents that are liable to befall them in the workshop. By covering them, however, with wire gauze, they may be in a measure protected.

Much ornamental gauze work is now being made by a large firm of electroplaters in the following manner: Instead of wire gauze being used directly, ordinary mosquito netting or fine lace is employed as the base, afterward electroplated.

To prepare a covering for the glass globes, it is but necessary to fit a lace or netting bag over the outside and remove it to coat it with a varnish to receive the conducting material. Almost any medium slow-drying varnish may be used, or plain shellac in alcohol, if nothing better is available. The lace cap must, as soon as the varnish is perfectly dry, be slipped over the glass globe, and fitted carefully around it. This precaution is taken so that when the plumbago is dusted on none will adhere to the glass and thus give a deposit where it is not wanted. As soon as it is well in place some of the solvent used must be sprayed upon it. This will soften the shellac or whatever material is employed upon the threads, preventing it from spreading to the glass. The graphite may now be safely dusted on from a fine-meshed stocking, being careful afterward to obtain a close-grained contact surface by rubbing with a soft brush well immersed in the conducting powder. Three or four wires should now be attached at different places and the whole immersed in the copper plating solution. A cyanide is preferable, as the deposit thus obtained is even and fine grained. The slower the deposit the better will it prove as a resisting material, and the finer will be the surface resulting.

To finish the outside of the meshes and give it a neat appearance, it is advisable to dip it in or brush it with a dilute solution of nitric acid, afterward exposing it to the fumes of ammonium sulphide to give it a dense black coating. It is best to lacquer the gauze, which will now be found to present a resisting surface to many of the strains and jars that the globe or shade is liable to have while in the laboratory.—*Elec. Review.*



In the Leather and Shoe Trades building a shoe factory with a capacity to make 1,000 pairs of shoes a day is in operation in the gallery. All of the latest improved machines and devices for making shoes are exhibited here in full operation, each serving its part as it would in a large and complete factory. Many of the machines shown are of quite recent invention, and the most ingenious machines used in the business here can be seen. Among the most interesting of these machines is the welt machine, which will sew a welt more skillfully and at much less expense than by hand, so that "hand-sewed shoes" do not possess the superior merit they did a few years ago. There are sewing machines that make shoe button holes, and other machines that "sew on your buttons while you wait." The shoe goes from one machine to another until completed. This gallery also contains considerable machinery in operation relating to harness work and other industries in which leather is used. The Singer Sewing Machine Company has a large and handsome pavilion where many sewing machines are exhibited, designed for working on leather.

The galleries of the Agricultural Palace are occupied very largely by exhibits of food stuffs, some of which are very striking. One of the most unique is the pavilion erected by the Imperial Mills, Duluth, Minn. It is a reproduction of an old flouring mill, built near Reading, Pa., 150 years ago, and which is still in operation. The structure is of hewn logs, and at one end is an overshot water wheel; a supply of water keeps the wheel in motion. Within this structure is a model of the plant of the Imperial Mills. This establishment has a capacity of 6,000 barrels a day, while the original mill, which the pavilion represents, could grind but three or four barrels of flour a day. The contrast shown by these two models is striking when it is considered that the old mill would require about four years to make as much flour as the new mill makes in one day. Adjoining this exhibit is a fine display of flour made by the South Dakota Millers' Association. At one end of this pavilion is a windmill, the structure of which is made by piling up bags of flour. This represents the flour mill of 1492, or the "old process mill." At the other end sacks of flour are piled up to represent a modern or the "new process mill." Adjoining this exhibit is another flour display, in which is a large barrel of such ample size as to be used for an office of the exhibit, but which is open to visitors. Pancakes are given away here, and the exhibit has the appearance of a free lunch counter all day.

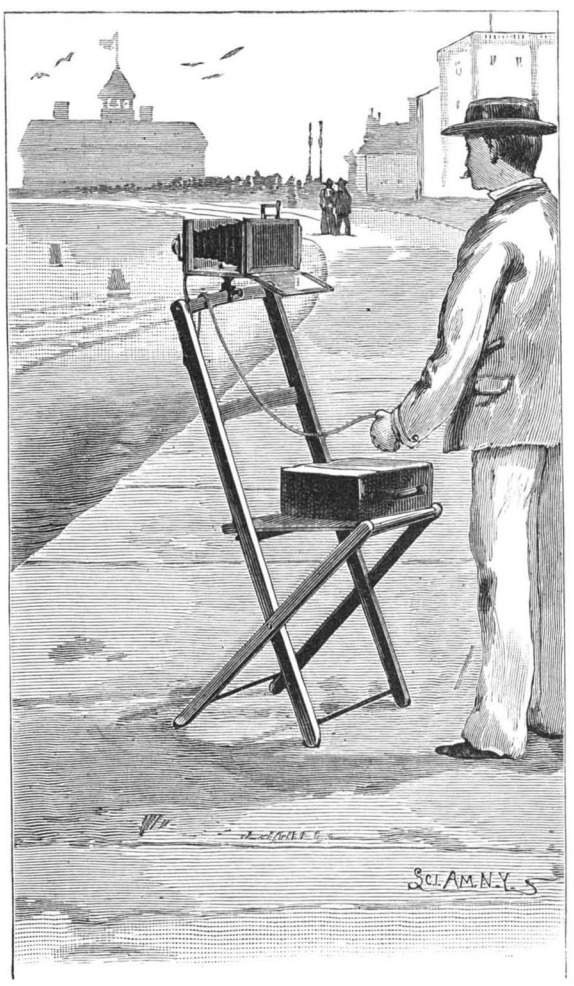
The immense mills of Washburn, Crosby & Co., at Minneapolis, are reproduced in miniature, and 10,500 barrels, about 2 inches in size, are piled up in the form of a barrel to show the number of barrels of flour that these mills manufacture every day. An interesting feature of this exhibit is a large painting, showing a farm of 2,500 acres, in which the various operations of harvesting wheat are depicted. Other parts of the galleries are devoted to food stuffs, gelatine, breakfast cereals, yeast, baking powders, pickles, preserves, soups, and beef extracts. Many of these exhibits give away samples, and there is a constant crowd of visittors, especially women, filling these galleries, tasting first of soup, then munching a roll, piece of bread or pancake, later on sampling butterine and pickles, then ending the repast with a small dish of oatmeal or other breakfast cereals. The galleries in the western part are given over mostly to milk and bakery exhibits in one, chocolate and confectionery in another, and tobacco, mineral waters, liquors, etc., in the others.

An exhibit in the Palace of Mechanic Arts that is particularly attractive to women is a display of dish-washing machines. These machines are in constant operation, and are the source of many dreams of halcyon days yet to come, when kitchen drudgery is done away with.

On the ground floor of the Agricultural Palace is an exhibit of Swift & Co., consisting of a car in which fresh meat is transported. This car is made entirely of plate glass and the arrangement of the interior is an exact reproduction of a meat car, showing how meat is hung when transported. It gives an excellent idea of the manner in which Chicago beef is carried to all parts of the country. The temperature of this car is kept at about forty degrees at all times. Surrounding the car are barrels with glass heads showing the manner in which salted meat is packed and also different grades of meat. Pepsin, beef extracts, glue, articles made of horn and bone and other things are exhibited by this company, showing the complete manner in which every particle of the animals slaughtered is utilized. Similar exhibits are made by other packing companies. The Cudahy Company occupies a large pavilion filled mostly with packages of lard, hams, sausages and canned meats. Nelson, Morris & Co. make a large show of hams, beef extract and other provisions, while in the center of the pavilion is a golden chariot, the wheels of which are in operation. A small pig occupies the chariot and is driving four pigs abreast, the whole affair being in miniature. The Anglo-American Company shows provisions that are exported largely. Armour & Co. have four showcases, one at each corner of their pavilion, exhibiting glue, lard, sausages and hams, luncheon delicacies of meat in glass jars, beef extracts, soups, etc. In the center of the pavilion is a counter where samples of beef extract are given away. The Fairbank Company has a pavilion constructed entirely of canned meats and provisions of all kinds, which is an object lesson in the extent to which the canning business is carried.

Free popular concerts are given by the Exposition orchestra in Festival Hall every day at 12 o'clock. This orchestra comprises 114 pieces and is under the leadership of Mr. Theodore Thomas.

In one of the towers of the Palace of Mechanic Arts is a chime of bells which is rung every day, morning, noon, and evening. Within the Palace of Manufactures and Liberal Arts are the chimes of the Self-Winding Clock Co.'s tower, which are played at regular intervals and which were fully described in the SCIENTIFIC AMERICAN of July 29.



PHOTOGRAPHING AT THE FAIR WITHOUT A TRIPOD.

In addition to this music, band concerts are given every day from music stands in the Court of Honor and from the stand east of the Manufactures and Liberal Arts building on the lake shore. Another musical feature is concerts by a band of Indian students from the government Indian school at Lawrence, Kan. This band is stationed at the Indian school near the Krupp building at the south loop of the Intramural Railway.

About the only vehicle seen in the Exposition grounds outside of the watering carts and an occasional appearance of an ambulance or police patrol wagon is an electric carriage, exhibited in the Electricity building. This is an ordinary covered carriage with three seats and is operated by storage batteries. This vehicle makes occasional runs on the promenade adjacent to the Electricity building. To a casual observer there is nothing extraordinary in the construction of this carriage. The electric energy is derived from storage batteries placed under the seats.

One of the most absurd and disastrous rules made by the directors of the Fair prohibited the taking of any photographs by visitors except very small pictures by hand-carried cameras. For license to do this two dollars a day is charged, and a tripod must not be used. A correspondent writes as follows:

"While on the Fair grounds the other day I saw an ingenious way of setting up a camera without the use of a tripod. The camera was mounted on the top of a small folding chair, which are let on the grounds for ten cents a day. I approached the gentleman, asking him if that was his invention. He said it was simply a bicycle clamp used for holding cameras on bicycles. As I was leaving he said: 'I expect to be put in the Bastile before night for using this, but I am sure it is not a tripod.' I send you a little picture."

When recently the Liberian pavilion in the Agricultural building was opened, the extent of the display was unexpected. Considerable taste was manifested by the arrangement. A fence of rope of Liberian manufacture surrounded the section. This rope was held in place by posts, on the tops of which were cones of fine ivory, and the draping of these posts with mottled skins of wild animals was both effective and suggestive. Immense stacks of coffee represented one of the chief agricultural productions of Liberia. The display of domestic utensils and other furnishings was good. The collection of weapons used in war and in the chase was very large, and, in some instances, of fine workmanship. It is said that the Liberian commissioners lately received the offer of a handsome amount from the officials of the Armour Institute for the purchase of the complete exhibit. At the conclusion of the opening day a dinner was given at the Park Gate Hotel to celebrate the anniversary of the independence of Liberia.

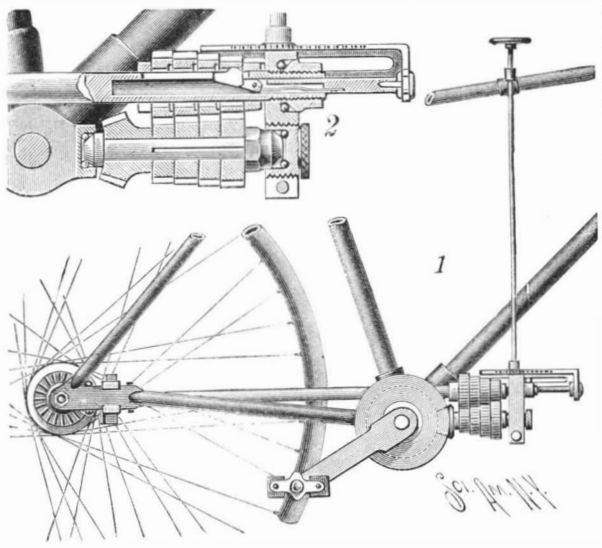
In the East India building the atmosphere is decidedly Oriental, as one who has ever had the fortune to live a long or short time in India will perceive at once. To begin with, the nostrils are greeted with fragrant odors of spices and naturally scented wood, while a refreshing feeling steals over one from the coolness at which the temperature is preserved. In the tea room divans and not chairs are the comforting places where the weary limbs may find rest. Hospitality is not unrepresented, for the faint and thirsty guest is offered a delicious cup of tea, and no one has been heard to complain of the price for it costs nothing, and frequently, at the guest's own option, a second and a third cup will be cheerfully supplied at the same rate. The only return asked of those thus entertained is that the quality of the tea be remembered, and that the addresses of the firms where India teas may be purchased may not escape the memory, a neat card is presented as a souvenir. Thus soothed and recuperated, the Oriental rugs, cotton goods, pottery, and carved and engraved articles combining utility and beauty can be inspected with satisfaction, and souvenirs for gifts to friends selected and purchased. Nor is this the only place in the Fair where, in spite of all that has been wantonly said about the cupidity of exhibitors, similar generous surprises may be experienced.

There is one place in the Midway Plaisance that one likes to visit, and where, while almost every time learning something new and interesting, there is little indeed to shock or offend. That place is the Javanese village. The uniform cheerfulness of the small brown men and their still smaller wives is contagious. As they cheerily smile, whether at work or at leisure, the visitor is ashamed of any petulance or complaining on his part. One must observe for himself the dignity and courtesy of these remarkable little people to appreciate them fully. No doubt much may be learned from books of the Javanese and their manners and customs; but to go to the village and make personal researches, supplemented by the information of the courteous manager, is, it may easily be imagined, the best possible substitute for a visit of exploration in Java itself. The Javanese work in their village just as they do in their native country. They spin and weave, and paint upon their cloths complex and beautiful designs. They carve wood also; if not so artistically as the Swiss or Swedes, in such a way as to afford themselves pleasure. The mats, sunshades, and hats which they make out of split bamboo are wonderful in design and striking in color. The manager kindly gives an account of the Javanese at home. An attempt to introduce Western methods and implements in agriculture in Java has been a failure. For one reason or another, the Javanese resumed their ancient customs and primitive tools. At harvest time marriages are most frequent. Both women and men do out-of-door work on farms; but the men take great care to assign the lighter labor to the women, and do all the heavier work themselves. When a woman marries, her teeth are blackened by a process so tedious and painful that some girls for this reason refused to be married. This is how the manager said that the rite is performed: The bride is delivered over to the hands of the native surgeons. Of course the enamel has to be removed from the teeth to permit the dye "to take." For this purpose coarse-grained flinty stones are used. The operators, working by turns, rub off the enamel with these barbarous tools from each tooth of the poor woman. When the osseous structure is exposed, the dye, made of the juices of certain plants, is freely applied and the teeth remain black until time causes them to come out by the root. Both women and men are inveterate cigarette smokers, and their custom is to cause the smoke to be emitted from the nostrils as well as from the mouth. Of all the out-of-the-way people that have been brought to add attractions to

(*Continued on page 102.*)

A NEW BICYCLE GEAR.

A differential gear, which may be readily applied to a safety bicycle, dispensing with the ordinary sprocket and chain, has been patented by Mr. Ernest H. P. Taylor, of No. 222 North Main Street, Waterbury, Conn. Fig. 1 in the illustration represents the application of the improvement to a machine and Fig. 2 shows a longitudinal section of the shifting mechanism for changing the speed. The gear may be made very light and strong and may be quickly and easily ad-



TAYLOR'S BICYCLE GEAR.

justed to drive the bicycle fast or slow as desired. On the end of the rear hub is a bevel gear wheel meshing with a pinion on the driving shaft, which extends horizontally forward above the crank shaft, to which it is connected by the differential gearing. The rear end of the drive shaft is supported in a ball bearing and its forward end is hollow, having a reduced extremity journaled in a ball bearing supported in a split hanger. An extension plate from the same support has an upturned flange, to which is bolted a slotted sliding rack, actuated by a pinion on the lower end of a shaft, on whose upper end is a wheel within easy reach from the saddle. The rack moves a rod sliding in the bore of the driving shaft, and on the inner end of the rod is a latch adapted to engage a recess in either one of four different sized gear wheels journaled loosely on the shaft, so that either one of such wheels will revolve with the shaft. The gears of this series form practically a cone gear, with the gears independent of each other, and they mesh with a cone gear on a short shaft supported in ball bearings just below, there being on the latter shaft a bevel pinion which meshes with a pinion on the pedal shaft. By turning the hand wheel the drive shaft is locked to either one of its four different sized gears, and is thus operated by a corresponding gear on the short shaft actuated by the pinion on the pedal shaft, to give a rapid motion with comparatively little power or a slower motion with correspondingly increased power. In this way the speed of the machine may be regulated to suit the strength and weight of the rider and as may be desired on account of the difficulties of the road.

DUPLEX LATHE FOR CRANKS.

We illustrate an exceptionally large duplex lathe completed by Messrs. Hulse & Co., of the Ordsal Works, Manchester, specially for dealing with marine crankshafts of the heaviest class, but suitable also for turning other large forgings and castings. For our engraving and the following particulars we are indebted to *Engineering*. It admits 12 feet in diameter and upward of 30 feet in length between centers, and is arranged so that four cutting tools may be in operation simultaneously, viz., two at the front and two at the back of the lathe. The sliding carriages are entirely independent of one another, in order that not only all may be traversed at different rates of feed, but any one or more may be surfacing while the others are sliding, and *vice versa*, and this in either direction.

The bed, which exceeds 50 feet in length, has four longitudinal box girders in pairs, united by numerous transverse box bars, and a large non-rotating steel guide screw is placed between each pair of girders, by means of which the front and back carriages are respectively traversed longitudinally without cross-straining.

The quadruple geared fast headstock has sixteen readily effected changes of speed, uniformly graduated, and the face plate chuck is 10 feet in diameter, cellular in form, of great strength, and externally geared at the back, cast steel jaws worked by independent screws being fitted in front for gripping the objects to be operated upon. The main spindle is of Siemens-Martin steel with hard gun metal adjustable bearings of square outline, the back bearing being multiple grooved for resisting, without undue friction, the end thrust.

The movable headstock has a large steel cylinder actuated by screw and worm and wheel for forcing the center into the work, and by handwheel direct on the screw for quickly moving in and out. It is adjustable along the bed by worm and wheel and rack and pinion, and is prepared to receive a special rest for turning and facing the flanges of crankshafts at the same time as the bodies are being operated upon.

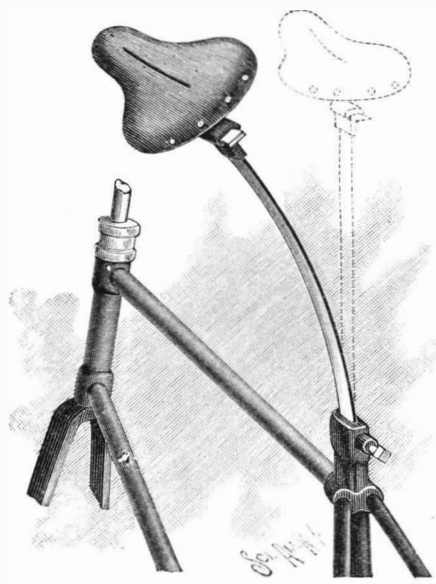
The sliding carriages, of which there are four, are each fitted with a rotating nut, reversing gear, and swing frame with change wheels, these latter not only imparting the various rates of feed longitudinally for sliding, but transversely for surfacing also. Rotary motion is transmitted to the "feed" mechanism of the carriages from the main spindle of the fast headstock by means of vertical and horizontal steel shafts and bevel gear, affording constant (not intermittent) feed traverses both for sliding and surfacing.

There are provided two compound slide rests and two special narrow rests for turning the crank pins and inside webs, one of each kind being interchangeable between the two front carriages, and one of each between the two back ones; the compound rest at the back has an inverted V slide in order to satisfactorily resist the upward pressure of the cut and prevent "jarring."

The lathe, which is one of the largest of its type ever made, is very massive in all parts, and well proportioned, and weighs upward of 100 tons.

A NOVEL SUPPORT FOR VELOCIPEDE SADDLES.

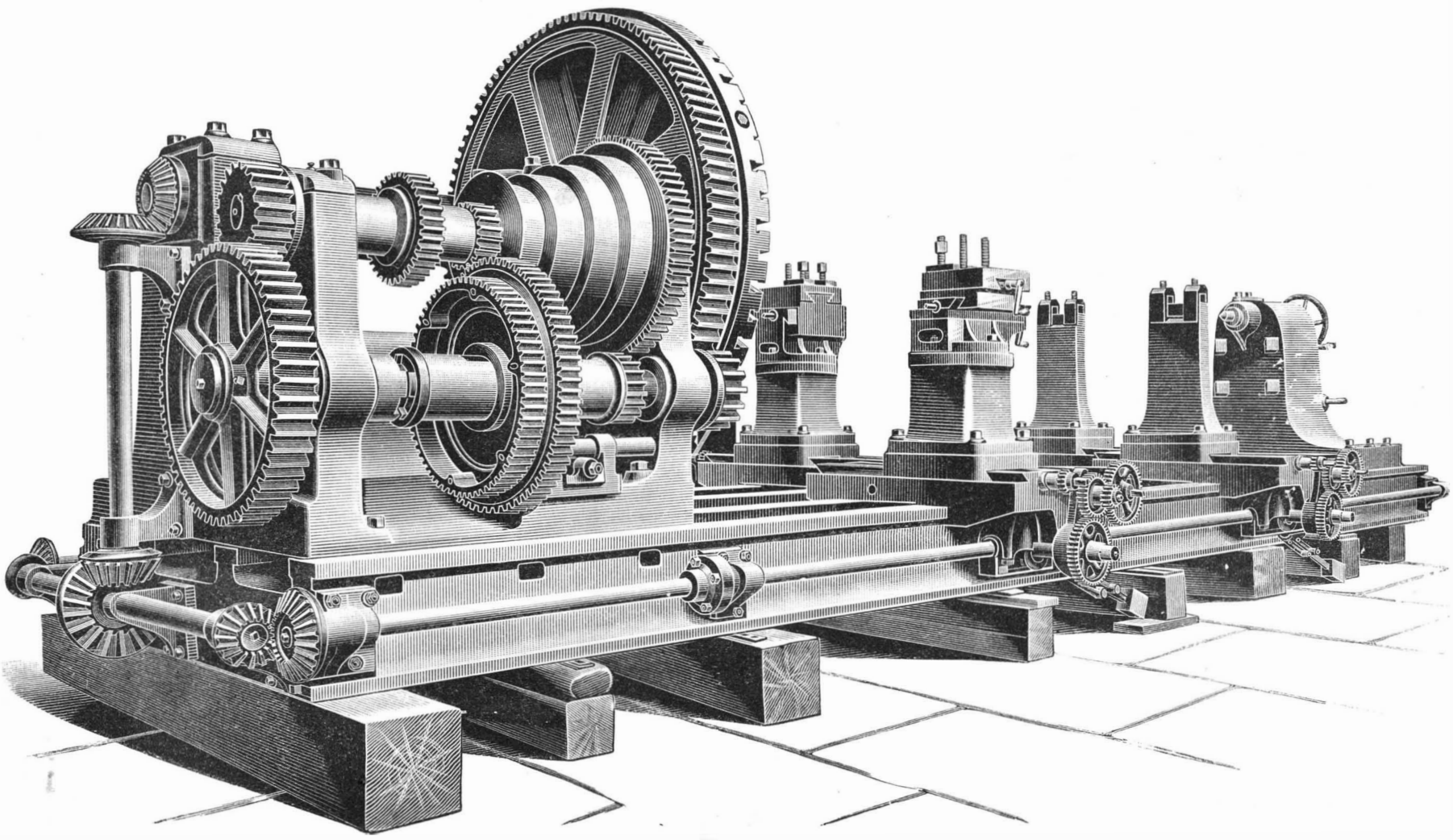
In saddles for velocipedes, unicycles, etc., it is sometimes desirable to permit the swaying of the body of



HARPER'S VELOCIPEDE SADDLE.

the rider from one side to the other, to shift the center of gravity, and thus enable the machine to be more readily turned and steered. By the use of the saddle-supporting stem shown in the illustration, which may be conveniently applied to any saddle and to any machine, this object is readily attained. The improvement has been patented by Mr. Lewis W. Harper, of New York Mills, Minn. The stem is of spring material, so that it may sway or swing laterally, as indicated by the dotted lines, although it has sufficient stiffness to hold it normally in vertical position. At its lower end it is adjustably held in a socket by means of a set screw, whereby the height of the saddle may be regulated, and on its upper end is a horizontally slotted head to receive the saddle spring, which is secured to the head by a set screw. The bending of the stem is effected by the rider throwing his weight to one side or by pulling himself to one side by his grip on the handles of the machine.

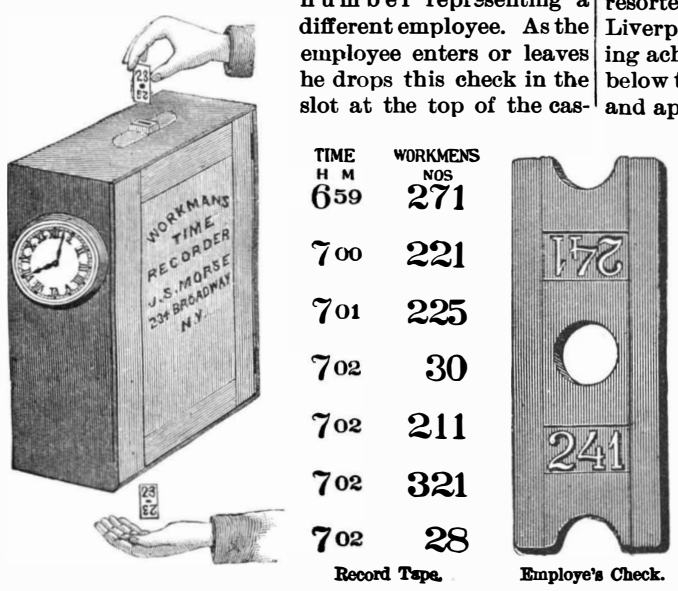
OF the 3,559 vessels using the Suez Canal in 1892, 2,581 were British. France fell from second to third place in the list, with 174. Germany follows England, and only 292 ships of that nation passed through the canal. Two American vessels used it.



DUPLEX LATHE FOR MARINE CRANKSHAFTS.

RECORDING TIME OF EMPLOYEES.

A time recorder for registering the exact time of arrival and departure of employees is now offered by the American Watchman's Time Detector Co., J. S. Morse, treasurer, No. 234 Broadway, New York City, and is herewith illustrated. The instrument is placed in some convenient position near the common entrance, and each employee is provided with a small check having a raised type figure on the side, as shown, each separate number representing a different employee. As the employee enters or leaves he drops this check in the slot at the top of the casing, and the passage of the check through the machine trips a hammer which causes an impression to be made on a tape of the number and the exact hour and minute, the employee almost at the same time receiving the check as it drops out of the machine. The machine is automatic and the checks may be passed through it at the rate of over a hundred a minute, so that the operation causes practically no delay to the workmen passing in or out. The device is adapted for use in large offices and salesrooms, as well as in factories and establishments of all kinds, the record tape affording such evidence of the time of arrival and departure of employees as to preclude all dispute. The machine has been in successful operation for about three years.

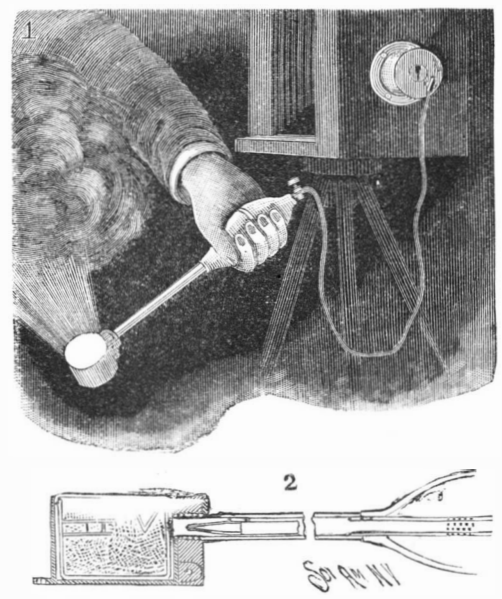


Record Tape. Employe's Check.

EMPLOYEE'S TIME RECORDER.

A PHOTOGRAPHIC FLASH LIGHT APPARATUS.

An instantaneously operated flash light apparatus, so connected with a pneumatic camera shutter that the latter may be timed relative to the flash to expose a plate only during the time of the explosion, is shown in the illustration. It has been patented by Mr. Albert F. Mallick, of Jamestown, North Dakota. Fig. 1 represents the operation of the apparatus and Fig. 2 is a sectional view of the flash light device. A rigid tube with perforations covered by an elastic hand bulb has at one end a stop cock and a flexible tubing connection with a pneumatic shutter, there being on the other end of the rigid tube a collar to which is hinged a flash light powder box holder. In the holder is fitted a removable powder box containing an anvil for receiving a percussion cap, as shown in the sectional view, there being in the side of the box radial slits converging to a center opposite the center of the anvil. In the tube is a tubular pneumatic hammer, pointed on the end next the powder box, and with its conical end apertured. On the under side of the cover of the powder box is a bent piece of metal, against which the hammer strikes in its forward movement, forcing the cover from the box before its contents are exploded. The stop cock regulating the flexible tubing connection with the pneumatic shutter may be so nicely adjusted as to cause the shutter to open by the compressed air the instant the hammer moves forward to discharge the flash light powder, this being effected by the compression of the bulb. The air forced through the hammer itself intensifies the illumination and assists in consuming the smoke. After the flash light is discharged, the powder box may be removed and replaced by another.



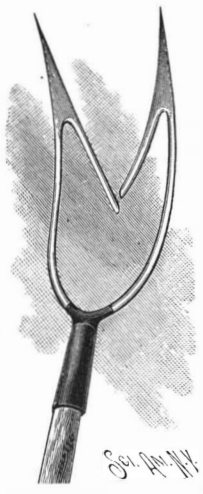
MALLICK'S FLASH LIGHT APPARATUS.

Tunnel Ventilation.

In the important matter of ventilation, the method resorted to in the tunnel beneath the Mersey at Liverpool is claimed to present one of the most striking achievements. Extending as does this tunnel deep below the bed of the Mersey to the solid red sandstone, and approached at either end by elevators of seventy and ninety feet lift, it was foreseen that ventilation was a necessity of the gravest character. The tunnel is large enough to avoid the piston action, its cross section being several times that of the trains, and at and near the middle of the tunnel are openings to a smaller side drift or tunnel running alongside of the main tunnel to the shore end, where is fixed a large fan, the result being that air constantly enters at the stations, which are thus swept clear of all foul air. A train starting in pure air at the station follows the air traveling in the tunnel up to the center, and any change of air between train and tunnel is thus less than it would be if the air in the tunnel were not moving. Past the tunnel center the train begins to travel against the moving air, by which time the air in the train will be more or less fouled by the passengers, and the ventilation due to train motion then begins to increase. The first air entering from the tunnel to the train is perhaps as good at that time as the air in the train, and, as the train proceeds, it meets purer air at every foot forward, and when it reaches the station is in air of surface quality again.—*New York Sun.*

A COMBINED PITCHFORK AND BAND CUTTER.

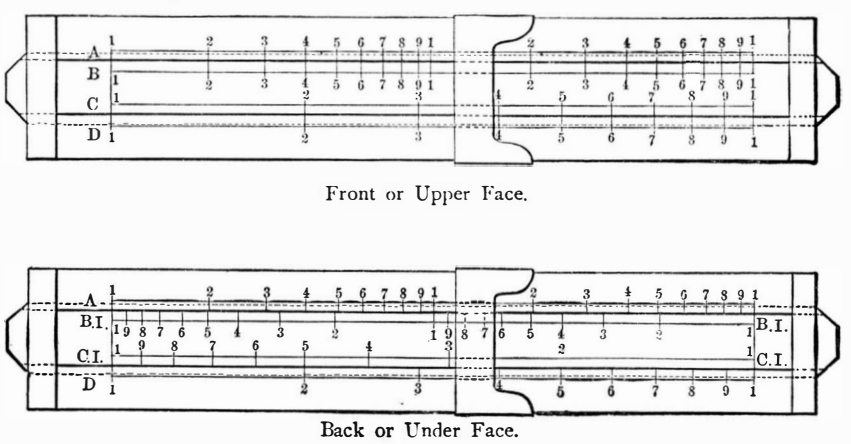
The implement shown in the picture may be conveniently used for pitching a sheaf of grain to the feed table of a thrashing or other machine, and then to cut the band on withdrawing the fork. The improvement has been patented by Mr. Francis Duggan, of Odessa, Delaware. Extending inwardly from the fork are curved knives, whose ends do not quite meet, but form a passageway for the twine or band, the front edges of the knives being smooth, while the rear edges are their cutting edges. When the operator takes up a sheaf with the fork, the twine passes through the passageway to the rear of the knives, and in withdrawing the fork either of the knives may be used to cut the band, the fork being then used in the usual way to spread the grain as it is fed to the machine.



THE "DUPLEX" SLIDE RULE.

A rule in many respects similar to the Mannheim slide rule is shown in the illustration. It is the invention of Mr. William Cox, and is manufactured by Messrs. Keuffel & Esser, of New York City. A distinguishing feature is that the slide itself is of the same thickness as the rule, and has its two faces flush with those of the rule. The rule and slide are fully graduated on both sides, scales, A and D, being alike on each side of the rule, whereas scales, B and C, on the slide are graduated on the upper face in the usual way, like A and D, but on the under face in *reversed order*, the initial indices being on the right hand, and the scales progressing toward the left, as shown in the figures.

The indices of the scales of one face coincide with those of the other side, and a metallic runner, encircling the whole rule, enables coinciding points on any scale of either face to be at once found. This improvement simplifies considerably the working out of many complex calculations, besides allowing of such computations as $a \times b \times c = x$, $\sqrt{a^3} = x$, etc., to be performed with *one single* setting of the slide. In a descriptive manual the inventor gives fuller particulars, as well as the practical solution of many formulæ and problems, the working of which is greatly facilitated by the use of the rule.



Front or Upper Face.

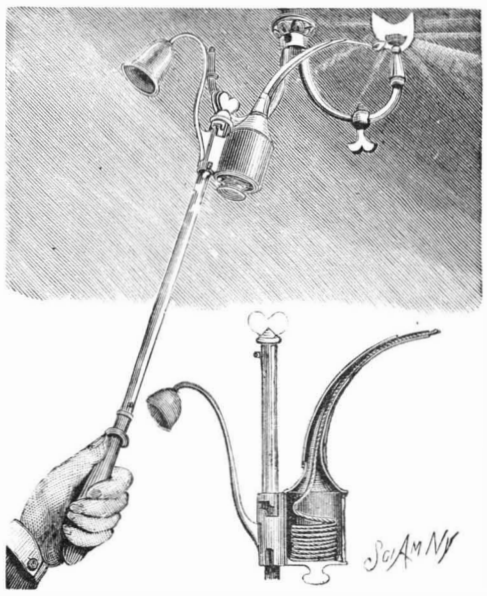
Back or Under Face.

THE "DUPLEX" SLIDE RULE.

THE Croton aqueduct in New York surpasses all modern engineering efforts of this kind.

A GAS LIGHTER OR EXTINGUISHER.

This light, simple and durable device, patented by Mr. Rudolph Geissler, of Nos. 52 and 54 Lafayette Place, New York City, affords a ready means of manipulating the key of a gas fixture. The lighter slides upon a standard having at its lower end a handle and at the upper end a key to turn the key of the gas fixture, and comprises a receptacle adapted to hold oil, alcohol, etc., from which extends upward a curved wick tube, as shown in the sectional view. An oppositely extending curved arm carries a bell-shaped extinguisher, especially adapted for extinguishing the flame of a candle. When it is desired to use a wax taper for lighting purposes, the bottom of the receptacle may be screwed upon the body to permit of its ready removal for the introduction of the taper. The lighter and extinguisher may be moved up and down on the standard and has a locking connection therewith near the top and bottom, a pin in the standard fitting in a bayonet slot of the sliding sleeve to hold the lighter and extinguisher in the desired position.


GEISSLER'S GAS LIGHTER OR EXTINGUISHER.

Blacking for Sheet Iron.

The simplest method to blacken iron is to heat it with oil, especially linseed oil. The objects are first rubbed or painted with oil and then heated to such an extent that the oil is burned off. The surface produced in this manner is coal black and gives the objects a black coloring which will withstand the highest temperature. After the application is thoroughly dried, the objects can be rubbed with benzine or with a solution of soda.

In order to procure a black asphalt lac for iron, melt 8 pounds of asphalt in an iron kettle, gradually adding 12 pints of cooked linseed oil, 1 pound of litharge, and ½ pound of sulphate of zinc. The whole mixture should be allowed to boil for three hours. Finally, 1½ pounds of black amber is to be added and the mixture carefully boiled for two hours longer. It is advisable previous to using this mixture to thin it somewhat by the addition of oil of turpentine.

THE torsion braided wire spring mattresses manufactured by the Weston & Wells Manufacturing Co., 1110 to 1116 Noble Street, Philadelphia, are well calculated to promote healthful and comfortable sleep, not only in hot summer weather, but throughout the year. This mattress is softer and more comfortable than one made of hair, as it conforms to the slightest movement of the body, and it cannot become heated, as each movement of the body changes the air beneath. It is made in two styles, No. 1 being a series of torsion springs which will not break down or get out of order, covered with a slip case of ticking and a quilted covering of fine curled hair, while No. 2 is made of a single layer of torsion springs upholstered in fine hair and alike on both sides. The mattress is, in each case, complete in itself.

WORLD'S FAIR NOTES.

(*Continued from page 99.*)

Jackson Park, the Javanese are the greatest favorites with the people of this country.

Lady Aberdeen's Irish village, which nestles at the foot of Blarney Castle, has been so successful that the Midway Plaisance has been beautified by the erection of a new gateway, which is a reproduction of the famous gateway at Clonmel. There is an intense rivalry between two Irish villages, Lady Aberdeen's Blarney Castle and Mrs. Hart's Donegal Castle. Both were erected to obtain funds to be used for charitable purposes in the "Emerald Isle." A model of the memorial church now being erected to the memory of Daniel O'Connell, at Cahirciveen, County Kerry, Ireland, will shortly be unveiled in the Donegal Castle inclosure.

A new ambulance has been put in commission; it is exhibited by the St. John's Ambulance Association, of London, of which the Prince of Wales is president. The new ambulance is called the Prince of Wales, and is most complete. The wagon is lit by electric light, is well ventilated, and has two or three stretchers, which are prevented from being jostled by rubber pads, while the wheels have rubber tires to relieve the patient from jolting.

Half of the Fair will be closed after six P. M. for economic reasons. At six all the buildings will be closed with the exception of the Electricity and Administration buildings, Machinery Hall and one other building which will be selected in turn from the Exposition buildings. This closing will save large sums of money and will doubtless not put the public to very great inconvenience.

An interesting party of excursionists arrived July 31 on the Berlin. The party was composed of forty members of the Society of Arts, London. This society was established in 1754 "for the encouragement of arts, manufactures and commerce." In Great Britain the Society exerted its influence in favor of the Chicago Exposition.

Karl Kahler, who exhibits a canvas in the German section of the Art Gallery, became dissatisfied, and slashed his $20,000 painting, "In my Studio." It is said that he slashed his picture because he was offered $12,500 for it, and lest he should be tempted to part with it for less than its value, he cut it. The cut has certainly reduced its value, although it is shrewdly suggested that the cut can be remedied with a little white lead paint and a hot iron.

Mr. J. G. Pangborn voiced the woes of exhibitors before the World's Columbian Commission on July 29. His criticisms were just and stinging. He intimated that the Exposition was an architectural exposition, but not a fair. He said, among other things, that the present was not the only "White City" that had been built, hinting that Jackson Park, like a number of beautiful cemeteries, might become the burial ground of the hopes of the managers of the Fair. Mr. Pangborn, who is president of the Associated American Exhibitors, complains of the galleries, the ventilation and the total inadequacy of transportation in the grounds. The exhibitors wish carettes run from the gates to the entrances of the various buildings. In regard to the Plaisance, Mr. Pangborn said: "The nations which have spent $100,000,000 in bringing their exhibits to the Fair are forced to compete for attention with the attractions of the Midway Plaisance. England is compelled to compete for attention against the Street in Cairo, and France vies with dancing girls, the scum of the Orient." Director-General Davis made an attempt to answer Mr. Pangborn, but the exhibitors had rather the best of the argument.

The prettiest effect in illumination that has yet been seen at the Exposition was provided on Monday evening, July 31. Hundreds of paper Japanese lanterns were stretched over the winding walks of the Wooded Island and miniature glass globes in which were small candles were scattered about the flower beds. Altogether there were 25,000 or more candles ablaze at the same time. The bright colors of the Japanese lanterns was a fine color effect seen through the trees and from the promenades surrounding the lagoon and opposite the island, while the flower beds seemed to be covered with myriads of fire-flies of many colors and of unusual size. Considerable colored fire was burned, and the illumination closed with a fine display of fireworks. During the holding of this illumination the Columbus chorus rendered quite a programme of well known airs.

Our valued correspondent, Mr. J. E. Emerson, sends us the following:

AT THE COLUMBIAN EXPOSITION—AMONG THE SAW MILLS.

To me the saw mill department is most interesting. As I took the elevated railroad and rode through the park, turning and twisting around the many short curves, getting a most splendid view of the exterior structures and magnificent and massive buildings, passing the caves and mounds, in good imitation of the relics of some prehistoric races of ancient diggers of caverns and builders of mud huts, which I have seen as they now exist, and the low, straw-covered roofs of the poor man's house, with Mother Earth for a floor, such as I saw in Ireland, in 1869, the mind wonders at the grand achievements of art and science of a high advancement of civilization and scientific developments.

Professor Tyndall says that, in all probability, there was a period when prehistoric man, naked, wandered along our seashores, eating the raw oyster as he went, never dreaming that the tree under which he took shelter from the raging storm contained elements that would warm his shivering frame; and also says that human skeletons are found in rock caverns beside that of some wild beast, where both were probably slain in combat for the possession of the cavern for a dwelling.

Before the saw mill came the mud hut and mound and nature's caves. But the saw mill came, and the ax and saw leveled the forests and converted them into comfortable and finally beautiful houses, and with the use of rocks and logs, massive buildings beautifully decorated. And here in this grand display one has it all, from the first locomotive of 12 miles an hour to that of 60 and even 70 miles per hour. I remember 60 years ago, when I worked in an old flutter wheel saw mill run by water, when it took five minutes to gig back the carriage of a long log, to the lightning saw mill of to-day, that will and has with a single circular saw cut 19 boards 16 feet in length inside of one minute. And here now in the saw mill department is the 12 inch band saw mill, such as I saw at Humboldt Bay cut redwood boards 10 feet wide, an achievement that I am indeed proud of.

Here in this saw mill department is to be seen the scroll band saw of ⅛ inch wide to that of 12 inches in width, dividing up timber of the hardest black ebony and harder South American logs into quarters and the gnarled white oaks and Western white pine, and the monster sled loads of logs, just as they are hauled in the logging regions to mills or river banks for floating to the great mills on the Saginaw and other rivers. And here is the logging camp, such as I worked in when a young man in the logging camp of old Maine, my birthplace. The astonishing wonder is how so much has been done in so short a time as can be seen here. Probably no one living to-day will ever see the like again. It may come in one hundred years from now, for civilization will never forget the great discovery of 1492. In place of America, for Americus Vespucius, our country should have been named Columbia. I have a great liking for art, design, structure, and architecture, but a greater love of useful inventions, which add to common comforts of life. And prominent among these is the saw mill.

J. E. EMERSON.

Impressions of the World's Fair.

BY T. C. CLARKE.

This is the greatest architectural display that the world has ever seen. Not the hill of the Acropolis of Athens, when covered with marble temples, nor the Roman forum in the days of Augustus, ever showed such an artistic grouping of columns, arches and long lines of facade. People who, from indifference, do not come here while this fleeting pageant lasts, will regret it, for it will never be repeated in our generation. We cross the ocean to see Venice, but here is a greater Venice at our doors.

This is my first impression; the second is of wonder that the genius which could create such marvels should be so lacking in common sense as to carry the buildings up to the outer edge of the park, and leave no neutral zone to protect them in case of fire breaking out in the nests of wooden boxes which surround them on three sides. Given a heavy wind from the south, north or west, and a fire breaking out just outside the line of the grounds, it would take a much better organized fire department than that which contended with the fire in the cold storage building the other day to save the whole Exposition from being wiped out. Therefore, my advice is to everybody to come. See it before this possible catastrophe takes place.

The wonderful architectural display of the Columbian Exposition would not make it a success, unless the buildings were also well contrived and arranged in the display of exhibits. I have seen all the world's fairs, except the fine one in London and that at Vienna, and I am sure I am right in saying that these buildings, considered as merely for the display of exhibits, far surpass any of their predecessors. They are well and fully lighted, without that glare which in former expositions has been found to be so painful. Their great height and good ventilation makes them cooler in a hot, still day than any place out of doors. Tired and hot people appreciate this. The classification is admirable; by which I mean that it is easy to find anything you want, and to see it when you do find it, unless its great popularity draws such a crowd that you cannot get near it. In these three most important respects the Chicago Exposition is far and away the best. There are so many buildings that the great divisions of Art, Manufactures, Machinery, Mining, Fisheries, etc., can be easily kept separate. By visiting those on separate days the visitor does not have that confused feeling in his mind which smaller expositions give him.

In each world's fair there has been some exhibit which has played a great part in human affairs. At the English Exhibition it was the sewing machine; at the Philadelphia Exhibition it was the telephone; and, unless I greatly mistake, at this Exhibition it is the electric elevated system called "Intramural." Rapid transit in cities and suburban towns is among the most important questions of the day, and any invention or plan which promises to assist in its solution is of vital importance.

Compare the Intramural Electric with the Southside Elevated (locomotive) system. The electric line runs trains of four cars, seating 384 persons, with no standing room. The train weighs, with motor on forward car, about forty tons. On a line properly constructed for speed, and without the sharp curves, the same speed could be attained between stations as with locomotive service, although now it is less. The electric motor can accelerate its trains quicker than the locomotive, so that on similar tracks it would make better speed, including stops.

The Southside locomotive train consists of five cars. To compare with the electric line, we assume four, or we might have increased that of the electric train to five cars. These four-car trains seat 192 persons, and, by dint of cramming in standing passengers, could carry the same number as the electric, or 384. Train and engine weigh more than double the other, or about eighty-eight tons. It averages fifteen miles an hour, including three stops per mile. On an equally good track the electric trains could beat this, on account of quicker acceleration.

For drawing long, heavy trains, with few stops, nothing yet devised can beat the steam locomotive. In rapid transit and suburban service, the greatest carrying capacity comes from small trains running very frequently and stopping very often. Other things being equal, that line which gives its passengers seats will take the traffic away from that one which makes half of them stand up.

The locomotive train has to suffer a loss of energy due to stopping and starting over eighty tons every third of a mile, or one and one-third minutes apart. The light electric train can afford to stop and start its forty tons every sixth of a mile, or once in forty seconds at no greater cost. The electric line costs a little more than the locomotive line for power and equipment, but this is more than made up by the low fixed charges on a lighter and less expensive structure. The dead weight per passenger of the locomotive train is about 400 pounds, that of the electric train about 175 pounds. Will not this difference tell in running expenses?

The whole question may be summed up as follows:

The use of the present style of cars and the economy of running as many cars in a train as the locomotive can start induce the managers of locomotive lines to run heavy trains at longer intervals apart, both for suburban and intramural traffic. Consequently, we see wherever the surface electric trolley car, with its one-minute intervals and no time table, competes with a steam locomotive line, with trains even twenty minutes apart, it always draws away the traffic from it. The elevated electric line should not have more than four cars, nor intervals greater than one minute in the heart of a city or five minutes in suburban traffic. Give people this service and seats instead of standing room, and it will take all the traffic.

The Illinois Central Railroad runs eight-car express trains, seats ninety-six people each, on cross seats, with doors at the sides, from Van Buren Street to the Fair grounds by locomotives. This is better than an electric service would be, because there are no stops. If, after the Fair is over, they would run four-car trains every five minutes on their suburban lines, either by electric motors or locomotives, they would build up a business in a few years equal to that of one of the Manhattan lines.

It has been often disputed whether it is better to use an electric locomotive or put motors on the cars. For city and suburban traffic we have said that frequent and light trains are the best; consequently, it follows that if a motor on the car like that on the Intramural line can haul the light train satisfactorily, that is the cheapest; but where grades are heavy a second motor on another car, connected electrically and mechanically with the five, would be necessary. Locomotives for long trains and electric motors on cars for light trains is the best practice.—*Railroad Gazette.*

A RUBBER compound especially adapted for use in valves where a high temperature is necessary has been perfected by Messrs. Jenkins Brothers, valve and packing manufacturers, New York City. This compound has been thoroughly tested in practical use for nearly two years, with results which are said to have been in every way entirely satisfactory. A new manner of holding the disk holder in place in these well known valves has also been adopted, the thickness of the flanges and the number of bolts in the valve bonnets being increased.

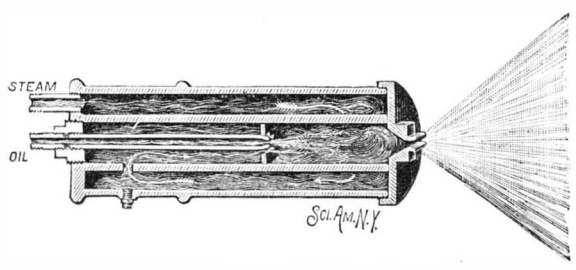
THE WORLD'S COLUMBIAN EXPOSITION—THE BABCOCK & WILCOX BOILER PLANT.

(*Continued from first page.*)

inclined position and connected with each other and with a horizontal steam and water drum by vertical passages at each end, while a mud drum connects the tubes at the rear and lowest point in the boiler.

In their latest work of the highest grade the company are now making all parts of the boiler of wrought steel. The end connections are in one piece for each vertical row of tubes, the tubes being "staggered," or so placed that each horizontal row comes over the spaces in the previous row. The holes are accurately sized, made tapering, and the tubes fixed in place by an expander. The sections thus formed are connected with the drum, and the mud drum also, by short tubes, also expanded into bored holes, doing away with all bolts and leaving a clear passageway between the several parts. Cleaning openings opposite the end of each tube are closed by perfectly jointed hand-hole plates, held in place by clamps and bolts, tested and made tight under a hydrostatic pressure of 300 pounds to the inch, iron to iron, without rubber packing or other perishable substances. The steam and water drums are made of flange iron or steel of extra thickness, double riveted, made for any desired working pressure, but always tested up to at least 150 pounds per square inch. In erecting the boiler it is suspended entirely independent of the brickwork from wrought iron girders resting on iron columns, thus avoiding any straining from unequal expansion between it and its inclosing walls.

The fire is made under the front and higher ends of the tubes, and the products of combustion pass up between the tubes into a combustion chamber under the steam and water drum, thence down between the tubes and once more up through the spaces between the tubes to the chimney. The water inside the tubes, as it is heated, tends to rise toward the higher end, and as it is converted into steam rises through the vertical passages into the drum, above the tubes, where the steam separates from the water, and the latter flows back to the rear and down again through the tubes in a continuous circulation. As the passages are



THE LARKIN OIL BURNER.

all large and free this circulation is very rapid, sweeping away the steam as fast as formed and supplying its space with water, absorbing the heat to the best advantage, causing a thorough commingling of the water throughout the boiler and a consequent equal temperature. The steam is taken from the top of the steam drum near the back end of the boiler.

A handsome octavo book, with numerous illustrations, entitled "Steam," is published by the Babcock & Wilcox Co., New York, for the information of intending users of steam who desire complete data respecting this make of boilers. This book has now reached its twenty-seventh edition, and contains a great amount of most valuable information, not the least important of which is to be found in extracts given from lectures delivered by Mr. Geo. H. Babcock at Cornell University and before the American Society of Mechanical Engineers.

The correctness of the scientific principles on which the Babcock & Wilcox boilers are based, and the superior mechanical skill employed in their construction and setting, are attested by the fact that these boilers have now been in use for over a quarter of a century, during which period they have constantly grown in engineering favor, until now they are used in all parts of the world, and the measure of the horse power they daily generate is figured by millions.

THE FITZNER EXHIBIT OF WELDED TUBES.

The conspicuous and at the same time most interesting display of tubes, tube bending, tube welding, etc., shown in one of the views is the exhibit of Mr. W. Fitzner, of Laurahuette, Upper Silesia, Germany. This exhibit is in the center of the Mining building, and attracts deserved attention among engineers and mechanicians generally. Their steam boiler and bridge building works and welded sheet metal establishment at Laurahuette cover several acres of ground, and the immense plant is furnished with every modern convenience for undertaking large contracts on advantageous terms. Welded tubes and every kind of iron welding is a specialty with them, and they have an improved system of lighting railway carriages by oil gas. They also make gas-light buoys. Among the leading articles in which they have developed a large business are coolers and brewers' coppers; wooden boilers with welded interiors of iron for various chemical industries and specially for the manufacture of cellulose; also tubes of every diameter, thickness and length, with all possible threads and flange connection; welding boilers for transportation of compressed gas, oxygen, etc.; gas receptacles for lighting vehicles; hollow shafts, retorts, crucibles, galvanizing basins, etc.

The most noticeable feature of this exhibit is a steam pipe with nozzles 65·5 feet long and thirty-one inches in diameter. The purpose in exhibiting this pipe was to show that iron manufacture was limited only by existing means of transportation. The thickness of this pipe is five-sixteenths of an inch, and it weighs three and one half tons. Tubes and pipes of various thickness are also shown. Not infrequently pipes of extraordinary thickness are made to serve as hollow shafts. One such specimen is shown which is sixteen feet long, with an exterior diameter of twelve inches and a thickness of an inch and a quarter. Hydraulic engine pipes for shaft pumps are shown. One of these pipes is twenty-eight inches in diameter and has a thickness of three-fourths of an inch, being designed to stand great pressure. Another pipe is shown designed for use as a well casing in artesian well use. This is made only three-sixteenths of an inch in thickness and is provided with stronger heads, which are welded upon the pipes and into which the threads are cut for purpose of making joints. Among the many other interesting features of this exhibit is a welded and turned centrifugal drum which is so constructed as to be impossible to explode. Other specimens of welding and tube making are shown which are well worth the careful study of users of these articles. Electric railway men will be interested in poles shown which are models of the poles used on electric roads at Breslau and Chemnitz. Detailed information regarding this exhibit may be had by applying at the office of the German Machinery Commission, in the Palace of Mechanic Arts.

CHEMICAL AND PHARMACEUTICAL PRODUCTS.

Another of the first page views represents the exhibit of the Roessler & Hasslacher Chemical Co., New York, the exhibit being in the Manufactures building, near north main entrance. It is one of the most conspicuous and handsomest in the American group of chemical and pharmaceutical products. It is particularly attractive and instructive, by showing not only a number of chemicals but also their application. The works of the company are at Perth Amboy, N. J., and they have a fully paid up capital of $250,000. The showcase is in the form of an oblong of large proportions, the steps leading to it and its foundation proper being covered with tiles of delicate tints, showing the application of a number of their ceramic materials. At the four corners the roof is surmounted by four large bronze eagles, each holding in its bill the concern's trademark, and the roof is supported by pilasters again partly covered with tile work and showing on their faces handsome signs gilded with their fire gold and mentioning the products of the firm. One of these signs is conspicuous in the picture. The tilework is the product of the Maywood Art Tile Co., Maywood, N. J., of which Mr. E. Bilhuber is general manager.

Specialties of the company's manufacture are cyanide of potassium, chloroform, acetone and ceramic colors, of all of which they are large manufacturers. Big glass cylinders show cyanide of potassium in large white crystalline lumps of 98–99 per cent. purity, a product extensively used for electroplating, mining and other purposes. Chloroform and acetone are exhibited both in large globes and in bottles showing the style of original packing. The ceramic colors are exhibited in their original form of powders and also supplied on china, glass and iron work. Two beautiful big vases show a rich effect in gilding with their liquid bright gold. The maroons, blues, rose colors, etc., shown on decorated plates, etc., are of a delicacy of tint and richness of color not inferior to any English, French or German products.

A novelty among the products shown is peroxygene, an article in powder form made from peroxide of sodium and excelling the latter in bleaching capacity and facility of application. Peroxide of sodium has before been mentioned in our columns. Up to within two years being merely a laboratory product, it has in a short time found extensive use in Europe with dyers and bleachers of wool, silk and mixed goods, bone, bristles, feathers, hair and other material requiring a bleaching agent combining efficiency with harmlessness. It is fast gaining ground in this country, and we are informed that some of the largest concerns in Philadelphia and elsewhere have been regularly using it in quantities for some time. Like all new products, it requires a careful study for a short time by practitioners to familiarize them with its properties, and, as usual, the trouble is amply repaid to its first users by the start gained over competitors. In the Mining and Electricity buildings the R. & H. Chemical Co. has smaller exhibits, showing products more particularly belonging there.

Journalism in China.

Were it true, as has been said, that it is necessary to count the journals of a country in order to have its rank in the scale of civilization, it would be necessary to make an exception in the case of China, which, eleven or twelve centuries ago, ignored the journal, although as compared with Europe it had at that epoch reached a high degree of civilization and was already in possession of xylography, or impression upon plates of wood.

On the contrary, the Chinese government conceived the official journal at an early date, and, while our *Moniteur Universel*, founded about 1789, did not become official until the 1st of Nivose, year VIII., the *Pekin Gazette* (*Tsing-Pao*, "news of the capital"), organ of the government, was already in existence more than 740 years before our era. Primitively printed by the aid of engraved wooden plates, it is at present printed by means of movable wooden characters—a process again in which the Chinese anticipated us. There are, moreover, three editions of the *Pekin Gazette*, and it is the official edition alone that is printed in this manner. The second is printed by means of tablets of wax, upon which are engraved the characters, which, traced in haste, are consequently not very legible. The third is manuscript.

The official edition, according to data furnished to the Geographical Society by Mr. Imbault Huart, French consul at Pekin, consists of from ten to twelve double sheets (printed upon one side only, because of their thinness), 7 inches in length by 4 in width, divided into seven columns by violet ink, each column comprising fourteen ordinary characters. It appears every morning.

The edition written by hand (*Sie-peun*) is 6 inches in length by 5 in width, and appears several days before the official edition. The price of it is $6 per month, while the official edition costs only about 25 cents; at least that is the price to the Chinese, for foreigners pay more for it. It is the latter, also, who especially constitute the subscribers to the manuscript edition.

The reading of this *Gazette* is very instructive. It is a true panorama, not only of the official, but of the social life of the Chinese. The reader finds in it, among other official documents, the date at which the Emperor has decided that the summer hat should replace the winter one. Moreover, we see therein that six candidates for license were more than ninety years old and thirteen more than eighty, and this establishes the absence of age limit for examinations in China.

This *Pekin Gazette* has been the only journal published in China up to the last twenty years, which have seen spring up at Shanghai, Tien-Tsin, and Canton five journals, founded especially by the initiative of the English with the aid of Chinese *literati*. Again, two of these journals have been recently suppressed, one of them by order of the English consul for having treated the foreigners as "barbarians."

Since 1885, the *Chen-Pao* ("news of Shanghai") has published a weekly illustrated edition of eight double sheets, with a red cover, and costing 5 cents. The engravings are line drawings in the Chinese style. The last Franco-Chinese conflict has its history largely represented therein, and we see in it Commander Fournier in the costume of an English admiral.

All these journals together, exclusive of the *Pekin Gazette*, print scarcely more than 15,000 copies—a small number for a population of four hundred million souls.

Two interesting details are noted by Mr. Huart: First, that misplaced characters are unknown in the *Pekin Gazette*, at least in the prose edited within the confines of the palace, and that the displacing of them might well cost the loss of one or more heads; and second, the singular phonetic transcription into Chinese of various French words culled from journals, ultimatum becoming *ou-ti-ma-toung*, statu quo *sseu-ta-touko*, telephone *to-li-foun*, etc.—*Revue Scientifique.*

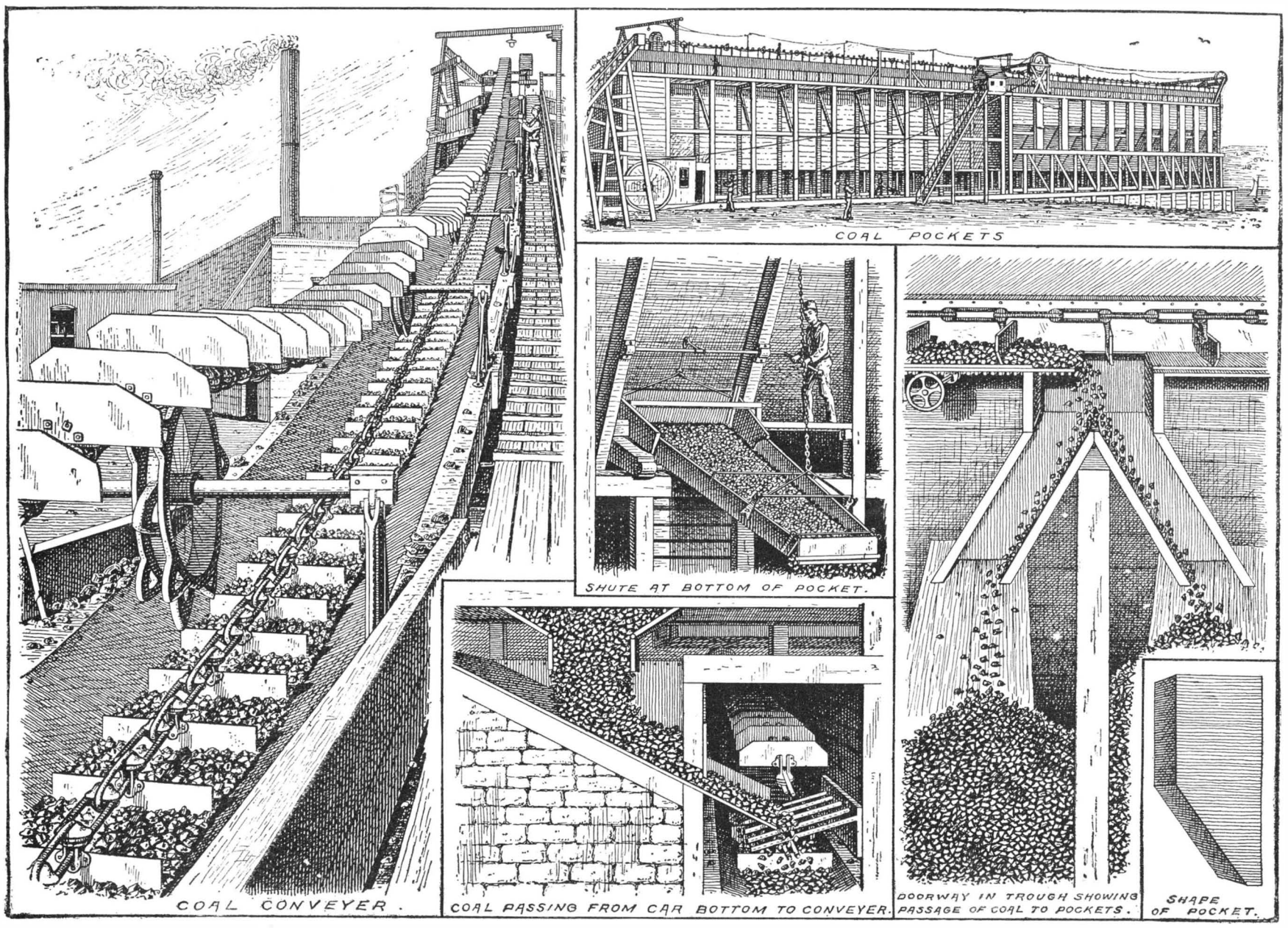
A More Effective Street Car Brake Wanted.

Many of the serious accidents which now frequently occur might be averted if a more effective brake could be invented. Something should be devised to prevent the sliding of the wheels when the track is slippery. On the general subject the *Electrical Review* says:

"A brake is essentially an apparatus or device which serves the purpose of retarding the motion of a car or other vehicle. In other words, the brake is simply used for gradually preventing the inertia of the moving car from acting. Friction upon the periphery of the car wheel has been the means employed, and, as a matter of fact, this seems the only feasible manner of diminishing the acquired speed. But the brake now in use cannot immediately stop the car; a minimum distance, when a car is traveling at about eight or ten miles per hour, in which all motion is arrested, is about fifteen feet, or nearly half the length of the car. This is satisfactory for ordinary use, but when danger is imminent, we want something better than this. Not an immediate stop, of course, for that is almost impossible, and the effects would be little better than a collision, but a brake whose action is automatic, rapid, and safe."

COAL CONVEYER AT WEEHAWKEN, N. J.

The present illustrations were taken from the coal pockets of the New York, Ontario & Western Railroad Company, at Weehawken, N. J. The coal-conveying apparatus consists of a number of steel scoops connected to a chain, which passes along the bottom of a trough to the top of the dock, where the coal is drawn over and dropped into the pockets. The dock containing the pockets is about 500 feet in length and about 50 feet in height. The pockets, which are 60 in number, are made of heavy yellow pine timber. They are 12 feet square and run from 15 to 20 feet in depth. They are lined with sheet iron and hold from 40 to 80 tons each. The conveyer or Dodge chain is 1,750 feet in length and travels over a space of 875 feet. Connected to this chain, about 16 inches apart, are 1,000 steel scoops, 20 inches in length and 8 inches in depth. From the end of dock to the starting point are a number of sprocket and idler wheels placed about 18 feet apart. These wheels, when chain is in motion, are formed so as to pass through the central link between the scoops, keeping them in place and also driving them ahead. The trough over which the coal passes is made of 8 foot lengths of sheet steel. It is three feet in width across the top and about 18 inches in depth and tapers down to 1 foot at the bottom. The bottoms of the scoops are made the same shape as the trough, so that no coal can escape when in motion. The coal first passes through the car bottom down into a steel hopper, where by means of a small door or gate it is passed into the conveyer as fast as required. Each scoop as it passes by the hopper takes up about 50 pounds of coal and travels at the rate of 175 feet per minute. About every 25 feet in the trough over the pockets are movable doorways, which can be opened and closed by means of gearing wheels connected to slotted bars attached to the bottom of the doors. As the coal is drawn forward along the trough to an open door it falls down into a double wooden chute, each leading to a separate pocket. When the pockets are filled the door is closed and the stream of coal is drawn along and dropped into other pockets. At the bottom of each pocket is a door or gate from which the coal can be passed to canal boats and barges by means of 22 foot steel chutes. These chutes work on hinges and can be raised and lowered to any elevation. A canal boat carrying about 250 tons can be filled in about two hours. The gate is raised and lowered by means of a lever or crank. The conveyer is driven by a wire cable connected to two 8 foot and two 6 foot drive wheels. The wire cable is ½ inch in diameter and is 1,140 feet in length. The engine is 100 horse power, carrying 80 pounds of steam. The conveyer has taken up and dropped into the pockets 69 car loads of coal in 10 hours.



THE NEW YORK, ONTARIO AND WESTERN RAILROAD COMPANY'S COAL CONVEYER, WEEHAWKEN, N. J.

Antiquity of the Lens.

Monsieur Edouard Fourdrignier has an article in the *Photo Club de Paris*, entitled "A Few Words on the Knowledge of Optics Possessed by the Ancients," in which he says: "Looking back at the works written by the ancients, we may discover very many ideas and germs which we, in the present century, presumptuously imagine that we have been the first to discover. With regard to photography, it is certain that the application of the dark chamber and the lens and also the sensibility of certain substances to light was well known."

With regard to the antiquity of the lens the author says: "If we are to believe C. P. Gaubil, quoted by M. De Paravey in his 'Chronologie Chinois,' the Emperor Chan, who reigned 2283 B. C., used enlarging lenses in the form of a telescope in order to be able to get a better view of the planets."

The use of lenses has also been traced to the Chinese moralist Confucius, 748 B. C. A glass case in the Assyrian section of the British Museum contains a piece of rock crystal formed into the shape of a plano-convex lens 1½ inches in diameter and $\frac{3}{10}$ inch thick. This was discovered in the ruin called Nimroud. It gives a focus of 4½ inches. According to Sir David Brewster, this lens has been designed for magnifying purposes. The date is about 700 B. C.

Plutarch speaks of instruments used by Archimedes "to manifest to the eye the largeness of the sun." Euclid's treatise on "Optics" appeared about 280 B.C. Other notices of lenses may be found scattered through the pages of antiquity, until the revival of science and learning in the twelfth century, when Alhazen is credited with having written on the refraction of rays and the magnifying power of lenses. Vitellus, a Pole, also wrote a treatise on lenses about 1270. The invention of spectacles has, however, been credited to Roger Bacon (1250), but Pliny mentions that Nero, who was myopic, used glasses when he watched the fights of the gladiators.

To prove the knowledge of the lens and dark chamber possessed by the ancients, M. Fourdrignier quotes two extracts from Aristophanes' comedy of Nuées, in which, during a conversation between Socrates and Strepsiades, an allusion is made to similar contrivances.

The first lenses of which it is possible to discover any reliable record are those invented by the Florentine Salvine degli Armati, who died 1317.

Baptista Porta (1560), the inventor of the camera obscura, states: "If you know how to combine a convex and a concave glass, one of each sort, you will see far and near objects larger and clearer."

It was not, however, says the *Photographic Times*, until the time of John Dollond (born 1706, died 1761) that perfect lenses were found, for he it was who discovered the method of achromatizing them by combining glasses of different dispersive power.

Value of Water Meters.

The value of meters in preventing the waste of water is shown in a recent report by Mr. G. Hillyer, the president of the Atlanta Water Works. In March, 1885, the city contracted for a supply of coal for the succeeding year; the quantity being estimated from the amount burned during the preceding twelve months. The city was then pumping 6,000,000 gallons of water a day, and nobody had enough. A number of serious fires broke out, at which the firemen were seriously hampered by lack of water. Consequently, as a matter of absolute necessity, meters were put on. The consumption at once fell off to 1,500,000 gallons, and everybody had sufficient. Moreover, the coal bought in March, 1885, lasted through the remainder of the year, all 1886, and until July, 1887. In 1885, before the meters were applied, and while there were only 1,500 services, the consumption of water was 6,000,000 gallons daily. Now, with 4,533 services, all metered, the consumption is only 2,530,000 gallons a day, or only about three-sevenths as much. The superintendent (Mr. W. G. Richards) states that the meters are the property of the landlord; the city keeping them in repair so far as the labor is concerned—the new material being charged to the owner. The water department commenced this system of repairs in November, 1892; and in the first six months they repaired 265 and condemned 26 meters. Mr. Richards believes that the principal cause of meters getting out of order is that they are often too small for their duty; the five-eighths inch meter being the size generally put in to measure the average domestic supply. The proportion of larger meters that get out of order in Atlanta is very small.

The Maxim Machine Gun.

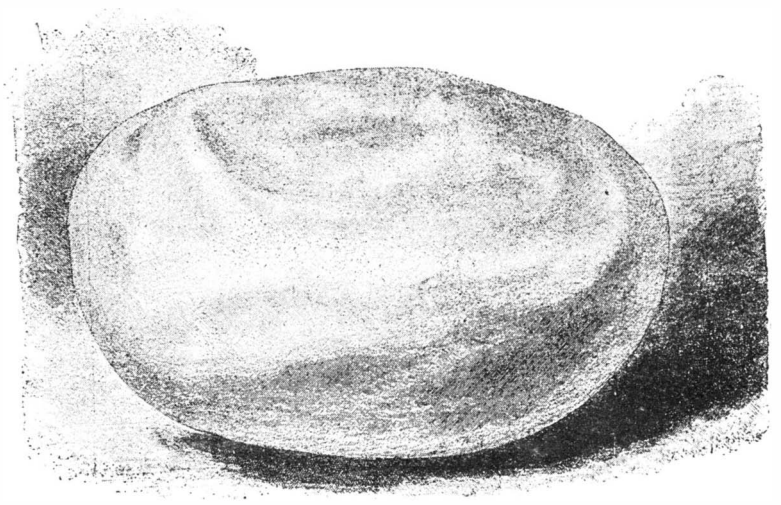
The long and close competition between rival machine guns has resulted in favor of the Maxim. It has been decided that hereafter, in the offensive equipment of British war vessels, the Maxim gun shall take the place of the five-barrel Nordenfelt and Gardner guns. The first to carry the new guns will be the cruiser Bonaventure, and she is to have four of them in her armament.

BROODING SNAKES.

The love of parents, especially mothers, for their offspring is a common and deep-seated characteristic of animal nature, and this love is necessary for the preservation of the species, for without it the progeny would not survive.

Creatures as low on the scale of animal life as the sea snails or worms guard their eggs. When danger threatens, even the common ear-wig sits over its tender young as an old hen does over its chickens, and many spiders place themselves as protectors over the balls in which they have concealed their eggs. Others carry their sacs of eggs. All of these creatures are spoken of as hatching their eggs; but the term is not correctly applied, for the word "hatch" implies the use of artificial heat, and we know that heat is not used in these lower animals. With birds it is different, for they are warm-blooded creatures, whose temperature is unaffected or only slightly affected by the influence of the surrounding air or water. On the other hand, reptiles are cold-blooded, and the temperature of their blood is affected by the temperature of the surrounding medium; therefore they are not in a position to impart warmth to their eggs and hatch them out. Most of the reptiles that lay eggs put them in protected places, in cracks or holes in the ground, in vegetable matter, or bury them in sand.

But in nature, as in everything else, there are exceptions to all rules, and in this case the exception is the python, a native of tropical Africa and Asia. While the young of its nearest relative, the boa of South America, are born alive, it lays eggs and hatches them by developing a high degree of heat, as has been proved in the case of the Indian and African species. The first careful investigations of this subject were made in 1841 by the renowned naturalist Achille Valenciennes, in the Jardin des Plantes, Paris. A python there laid fifty eggs within three hours, which at first were oval, but pointed toward the poles, the shells were soft and of a gray color; they soon changed to a perfect egg-shape and became white, and the shells hardened somewhat, although they remained pliable, like leather, and were lusterless and rather rough. Their length varied from 2½ to 4½ inches. After laying the eggs the snake gathered them together in a heap under the cover she had in her box, wound the rear part of her body around the base of this heap and then formed a cone-shaped spiral of the rest of her body around the whole, her head closing the top. Not a single egg was visible. After fifty-six days the first young ones crawled out. They were about 2 inches long. The temperature in the center of the heap of eggs was 105° F., while that of the box was only 72·5° F.

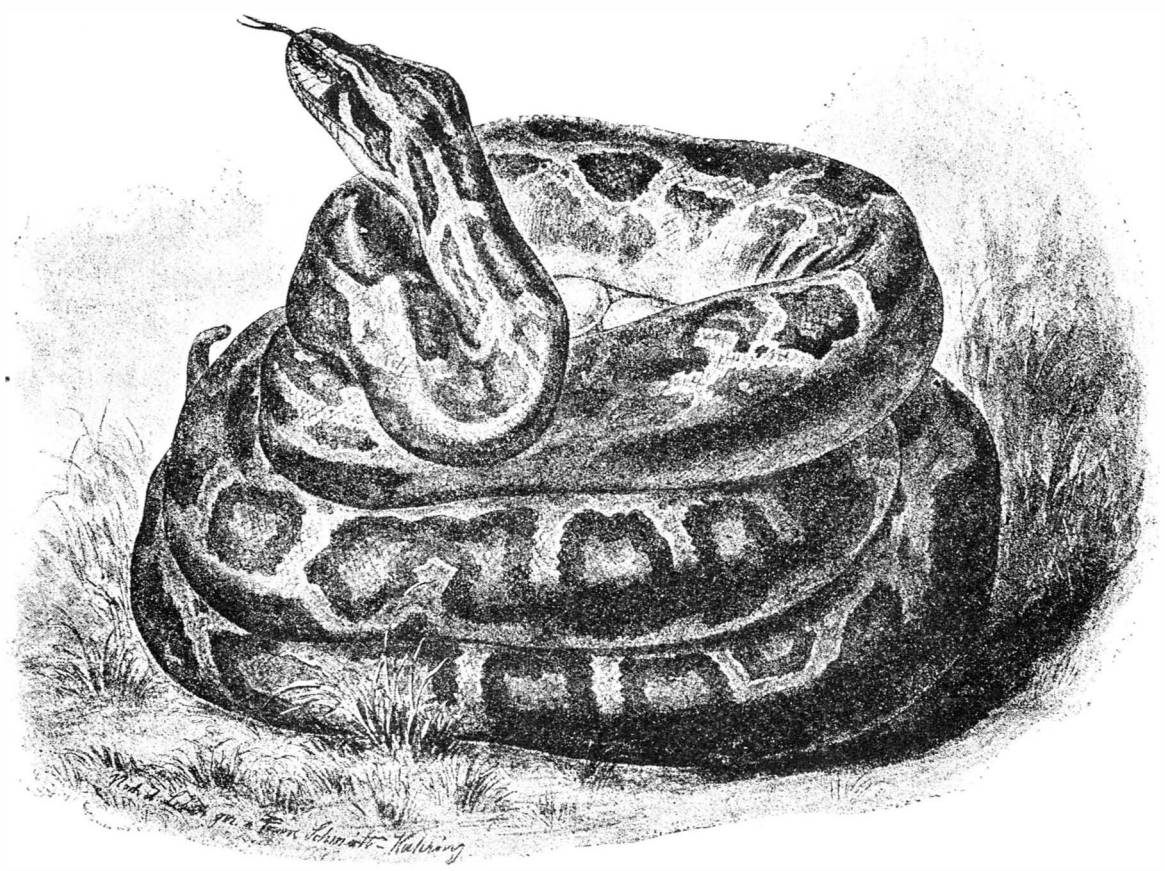


EGG OF A PYTHON—NATURAL SIZE.

DRAWN BY FRANZ SCHMIDT-KAHRING.

Two other pythons tried to hatch their eggs in the London Zoological Garden, one in 1862 and the other in 1881. In these cases the difference between the temperature inside of the heap of eggs and the outside air was much less; but the eggs were spoiled and no young were hatched.

In the zoological garden of Mr. Pinkert, in Leipzig, two brooding snakes (*Python molurus*) can be seen, each one rolled around its pile of eggs in the manner described by Valenciennes. Careful measurements taken on June 21, between 8 and 9 o'clock in the morning, showed the temperature within the rings of the snake to be 82° F., while that of the box was 67·5° F. The thermometer could not be placed in the bottom of the heap, where the heat was considerably greater; but it was left 20 minutes inside of the rings. It was impossible to experiment much with the creatures without causing injury to them and their young. —*From an article by Wm. Marschall in Illustrirte Zeitung.*



A BROODING PYTHON IN THE ZOOLOGICAL GARDEN, LEIPZIG.

DRAWN BY FRANZ SCHMIDT-KAHRING.

EYEGLASSES are worn by fifty-four members of Yale's senior class, twenty-five of whom have been forced to adopt them since entering college. Their favorite glass, the seniors in their annual class-book admit, is the beer glass.

Alloys of Aluminum.

Aluminum when alloyed with titanium, especially in certain proportions, gives a product which, in addition to the many useful properties of aluminum which render it capable of varied application in the arts, possesses other beneficial properties in which aluminum is deficient. Thus, although pure aluminum is somewhat soft and only slightly elastic, even after hammering or rolling, if it is alloyed with 10 per cent of titanium or less, a product is obtained intrinsically harder than aluminum, approximately as incorrodible, and capable of acquiring by hammering or rolling a degree of elasticity and hardness comparable to spring brass.

This alloy is fusible at a temperature below the melting point of steel, and its fusing point and specific gravity increase with the proportion of titanium which it contains. When the proportion of titanium is less than 5 per cent, the alloy is nearly as malleable as pure aluminum, and its malleability decreases and its hardness increases as the proportion of titanium in the alloy is increased. The best material for commercial uses, where elasticity combined with easy malleability is required, is an alloy containg titanium from one-half of 1 per cent (more or less) to 2 per cent.

By substituting for the titanic oxide or salt the oxides or salts of other metals more electro-negative than aluminum, the metallic bases of such oxides or salts may be alloyed with aluminum in like manner. Metals which can be alloyed thus with aluminum are bismuth, cadmium, cæsium, cerium, chromium, cobalt, copper, gold, iron, lead, manganese, molybdenum, nickel, osmium, palladium, platinum, silver, tin, titanium, tungsten, uranium, and zinc.

This alloy is made as follows: A bath of fluorides of aluminum and sodium or of fluoride of sodium, or of fluorides of aluminum, sodium, and calcium, or generally a fluoride or fluorides of a metal or metals more electro-positive than aluminum, is made by fusion. There may be added to these fluorides chlorides of the alkalies or alkaline earths; but these are unnecessary.

Cryolite of commerce may be used as the fluoride constituent of the bath, but it is in some respects disadvantageous because of its iron, which in the alloying process is reduced, and by mingling with the alloy impairs its quality. For this reason the fluoride is employed in as pure a state as possible. Either before or after the fusion of this fluoride bath there is added to it a reducible oxide or salt of the rare metal to be alloyed. In making an alloy of aluminum and titanium, titanic oxide is preferably used, and after thorough admixture of these substances, the oxide or salt being dissolved by the fluoride, the aluminum is introduced either in a molten state or in a solid state. When introduced in a solid state it is fused by the heat of the bath, and when fused a reaction between the aluminum and the oxide or salt at once takes place, the oxide or salt is reduced, its oxygen or acid radical combines with a part of the aluminum and the freed metallic base immediately alloys with the remainder of the aluminum. In practice, the fluorides of aluminum and sodium, which may be employed in amount ranging from 100 to 400 per cent of the weight of the aluminum intended to be added, are preferred. This bath is melted in a carbon crucible and the oxide or salt of the metal to be alloyed is added thereto.

When the whole mass is incorporated and as nearly fluid as possible, metallic alluminum is charged into the crucible, the relative proportions of the aluminum and oxide or salt being such that the percentage of oxide or salt shall be about twice the percentage in which its metallic base is desired to be present in the alloy. Immediately on the introduction of the aluminum the reaction noted takes place between the aluminum and the oxide or salt, and is accompanied by a rapid elevation of temperature in the bath. After waiting until further reaction ceases, which is indicated by the cessation of rise of the temperature, the contents of the crucible are poured into a suitable receptacle, and after cooling somewhat the melted fluoride can be separated as a supernatant slag from the metallic alloy at the bottom of the vessel. The alloy is then collected and is preferably remelted to cleanse it thoroughly from slag and otherwise to improve its properties.

It is important that the reduction of the oxide or salt of titanium and its alloying with the aluminum should be conducted in a non-silicious crucible (preferably a carbon crucible), since if the vessel be silicious in its composition a considerable portion of silicon will be alloyed with the aluminum and titanium, producing a compound of inferior quality.

The addition of chromium to the alloy of aluminum and titanium is of advantage in increasing the stiffness of the alloy. It is desirable that the chromium should be less than 15 per cent, preferably less than 5 per cent. As the chromium is increased, there is a corresponding increase of hardness. The difference between the alloy of aluminum and titanium and the alloy of aluminum, titanium, and chromium is that the chromium confers greater rigidity than the titanium; but if more than 5 per cent of chromium is used there is a greater loss of ductility.

Marking Soap Cakes.

The manufacture of cakes of soap that show the name or other designation used until the last of the cake is used has been exploited for some time in this and other countries, but so far as we are aware none of the plans so far adopted to this end resembles the following, which has just been patented in Germany. According to this latter invention, cakes of any ordinary soap are pressed in such a manner that the center on one side is depressed to half the thickness of the cake. Upon the bottom of this depression is placed a printed slip of paper, bearing the name, etc., of the soap, and the hollow is then filled out by inserting a piece of transparent soap. As a special advantage it is mentioned that the manufacturer, in adopting this plan, can dispense with the use of special dies for customers who require their names on the soap.—*Amer. Soap Jour.*

A TUNNEL under the Thames was proposed in 1799; the first tunnel was finished in 1843.

Correspondence.

The Gray Cat and the Yellow Hen.

To the Editor of the Scientific American:

Occasionally we see newspaper accounts of unusual cases of friendship existing between animals. One of these friendships has recently come under my observation, and I send you a short account of it, since such things are of some scientific interest.

This friendship is between a gray cat and a yellow hen, at the home of the Widow Eads, near Gap Mills, Monroe Co., W. Va. Mrs. Eads is now nearly ninety-five, was born a year before the death of Washington, and says that this friendship between the cat and the hen is the only one of the unusual kind she has ever seen.

The friendship probably sprang up some time during the past severe winter. At any rate, it was first noticed at that time, and since the cat was never allowed to stay in the house, one might suppose it started as a matter of mutual defense against the cold.

They are often seen in the yard together, the cat walking quietly and contentedly beside the beloved yellow hen. From time to time the cat, being of an affectionate disposition, desires fondling, and stops the hen from picking in the grass, and rubs herself several times back and forth on the chicken's breast, all the time with her eyes half shut and softly purring.

The cat is a little shy, and I could not coax her to come to me, but I soon succeeded in getting the hen to feed from my hand.

At the risk of making this appear still more incredible, I will add the further fact that the hen has one normal eye, rather dark, with large pupil, while the other is quite light and has an exceedingly small pupil. Some experiments lead me to believe vision to be imperfect in the light eye. W. J. HUMPHREYS,

Professor of Physics.

The Miller Manual Labor School of Albemarle,
Crozet, Va., July 21, 1893.

Water Power Electricity at Tampa.

To the Editor of the Scientific American:

The industrial utilization of water power is well illustrated here in Tampa, by the completion of the dam across the Hillsborough river, six miles above this place. This dam gives a 14 foot head of water, which is used to propel six Leffel turbine wheels, varying from 175 to 250 horse power each. They can develop about 1,100 horse power.

Only two or three of the turbines are now being used. One is running a Thomson-Houston generator, which is supplying a 2,000 volt lighting circuit on which they use Thomson-Houston transformers, from 2,000 to 50 volts.

A second is used on a Thomson-Houston generator which supplies a 500 volt street railway and power circuit. These turbines are governed by Woodward's automatic governors. The company is known as the Consumers' Electric Light and Street Railway Company.

They have about five miles of track laid in the city, and are operating four motor cars and one double-decker.

They have four trailers, which can be attached to the motors when desired.

The current runs from the power house to Tampa, a distance of six miles.

Bare copper wires are used to conduct the current this distance.

We have a small fan motor propelled by this current, and on suspending a needle beneath the wire I discover that the current comes in on the ground wire and goes out on the trolley.

They have received two strokes of lightning, burning out an armature each time.

They are building their track to Port Tampa City, nine miles southwest; then the track is to run six miles northeast of here to the power house, making a fifteen mile air line.

The water power is almost inexhaustible, and has backed up the river fourteen miles.

The company have about 900 acres of excellent cypress timber, which this back water enables them to float down to their mill site, which is situated opposite the power house across the river.

This mill will receive its power from the turbines through a traction cable.

It is generally understood that Mrs. Chapin (the wife of the millionaire) is the largest shareholder.

Tampa, Fla., July 20, 1893. H. BOMFORD.

Notable Aurora.

To the Editor of the Scientific American:

On the evening of July 15 there appeared at Elkhart, Ind., a most wonderful and extraordinary exhibition of northern lights. It began shortly after sundown and lasted until past midnight. The northern sky to a distance of fifteen degrees above the horizon was occupied by a massive white haze or glow, apparently in a quiescent state. Very few upward shooting beams of light were observable, and these only in the beginning of the display. Between 9:30 and 10:30 o'clock appeared a wholly novel and striking phenomenon. Three-fourths of the distance to the zenith, in the northeast sky, would suddenly spring into being long beams of white light that, as soon as organized, would begin a lateral motion toward the northwest, moving over an arc of sixty degrees in ten seconds. These beams followed one another at regular and brief intervals, so that there would be twenty or more in sight and in motion at once. During their swift lateral motion they preserved their integrity and a uniform, undiminished brightness. There was a perfectly clear and starlit interval between these moving beams, and the white mass resting on the horizon, of several degrees.

When the beams in motion reached a point in the northwest sky they appeared to encounter some obstacle to their further progress, and would there successively merge into one another and constitute a continuous body of light, reaching to the horizon. The moving beams lasted with great constancy for twenty-five minutes, the rate of motion at no time varying. They suddenly ceased, and the sky over which they had traveled thereafter remained clear. At the point in the northwest sky where the lateral motion had terminated, the light now became condensed in one broad or sometimes two sheets of light of great brilliancy, that shone for several minutes continuously, with but little change of form. These sheets of light were much longer than the traveling beams had been, but were not sufficiently extended below to make connection with the white mass on the horizon. They lasted in great beauty for twenty minutes. When they suddenly vanished, the horizon light for the first time appeared to become active, increased greatly in brilliancy, and rose *en masse* above the horizon, from which it was soon disconnected and showed a lower edge constituting the arc of a circle that was strongly serrated, like the crest of an inverted mountain range. This, with slight variations, terminated the display. I have made a particular study of auroras for the last forty years, but I have never before seen or heard of any in which this spectacle of lateral motion occurred.

Elkhart, Indiana. C. H. MURRAY.

[The lateral motion of the auroral streamers has been observed during strong displays on several occasions in the Eastern States, always ranging parallel with the magnetic meridian, and may be due to electric translation across the lines of magnetic polarity.—EDITOR.]

Notes on Eggs.

BY P. L. SIMMONDS, F.L.S.

The majority of the vertebrata are oviparous animals producing perfect eggs, which contain all the material necessary for the development of the embryo. Of the five classes, the first four are oviparous, namely, Pisces, Batrachia, Reptilia, and Aves.

The eggs of fishes is too wide a subject to enter upon, but they are much utilized even as food for the human race, in cod and other roes, and in caviare.

Professor Peters has lately described the mode of deposit of its eggs by a tree frog (*Polypedates*) from tropical Western Africa. This species deposits its eggs, as is usual among Batrachians, in a mass of albuminous jelly; but instead of placing this in the water, it attaches it to the leaves of trees which border the shore and overhang a water-hole or pond. Here the albumen speedily dries, forming a horny or glazed coating of the leaf, inclosing the unimpregnated eggs in a strong envelope. Upon the advent of the rainy season, the albumen is softened, and with the eggs is washed into the pool below, now filled with water. Here the male frog finds the masses, and occupies himself with their impregnation.

Frogs and toads lay numbers of small eggs. They are dropped in the water like fish spawn, in long clusters or strings. The Surinam toad (*Pipa*) carries her eggs soldered together like a honeycomb on her back. The *Aliphes* carries them between its legs, rolled up in a bunch.

Among reptiles the eggs exhibit great variety. The eggs of alligators are elongated and almost cylindrical, evenly rounded at both ends, and about the size of an ordinary duck's egg. The eggs of the sea turtle are as large as a small apple, rounded, and have a flexible shell. Those of the snapping turtle (*Chelydra serpentina*) are much smaller, but also rounded. Those of the terrapins (*Clemmys*, and other genera) are oblong, as also are those of lizards. In the common black and yellow dotted American fresh water terrapins, and in the painted terrapin, the eggs require four years of growth before they are laid. Take a seven-year-old turtle of this kind; it will contain only very small eggs, all of uniform size. An eight-year-old tortoise of the same kind will have two sets of eggs, one larger and one smaller. One of nine years will have three sets, the oldest set being the size of a small pea. A tortoise of ten years will have four sets of eggs, and in that year she will lay for the first time, and give birth to the most mature set.

The scaly reptiles—that is, turtles, lizards, and serpents—bring forth eggs similar to those of birds. They arise in the ovary in a similar way, and produce by successive growth yolks of a similar bulk, as do the birds. While, however, all these eggs are surrounded with a shell after fecundation, the egg is not necessarily laid, as in birds, in order to bring forth the new being. The bird brings forth its young by incubation, sitting upon the eggs, and transmitting to them by its own warmth the temperature needed for their final development. For the egg of the reptile, that temperature is usually derived from surrounding conditions. It is true that a few kinds of reptiles, the python for instance, sit upon their eggs and transmit to them a higher temperature from their body; but this is not usually the case.

The eggs of the Australian lace lizard (*Hydrosaurus varius*) are large, covered with a tough, leathery membrane. They deposit some ten or fifteen. The carpet snake of Australia (*Morelia variegata*) produces a large number of eggs, from twenty to thirty. The diamond snake (*Morelia spilotes*) deposits thirty or more eggs. The ringed snake (*Natrix torquata*, Ray) produces fifteen or twenty eggs, which are covered with membrane resembling parchment, and they are agglutinated together in a chain-like necklace. Snakes' eggs are oblong and sometimes cylindrical in shape.

Brown, in his work on Guiana, speaking of the iguana, says: "One of these reptiles, captured at its burrow, when killed and cut up for cooking, was found to contain ten eggs, of an elliptical form, shell-less, and midway in size between a pigeon and a hen's egg. These are good eating, when boiled for about five minutes, and then allowed to get quite cold. They then require some manipulation. A hole is made in one end of the skin and the albuminous part, which never coagulates, is squeezed out. Then the skin is stripped off, and the semi-hardened yolk, of the consistency of butter, is eaten with salt."

In the Mollusca we find a great variety in form among the eggs. They are sometimes, as in the land snails, laid separately, each inclosed in a shell of variable consistence; but in most cases they are agglutinated together in a mass, which sometimes takes the form of a ribbon, attached by one of its edges to some submarine body. Those of the *Bulimus* might be taken for a humming-bird's egg. The eggs of the great *Achatina* exceed an inch in length, and have a calcareous shell. The tropical *Bulimi* cement leaves together, to protect and conceal their large, bird-like eggs. The slugs bury theirs in the ground; the oceanic snail (*Janthina*) attaches them to a floating raft, and the *Argonaut* carries them in her frail boat. In some marine species the eggs are inclosed in leathery capsules, which are often united in a large mass. Each capsule contains numerous eggs. The horny capsules of the whelk are clustered in groups, with spaces pervading the interior, for the passage of sea water. The nidamental ribbon of the *Doris* and *Eolis* is attached to a rock, or some solid surface, from which it will not be detached by the waves.

The periwinkle lays an immense mass of eggs, larger than its own shell. In bivalves the eggs are usually like spawn, and generally retained by the mother. The ovaries of the brunnion, a snail without shell, are eaten in Nice.

The eggs of the octopus, we are told, when first laid are small, oval, translucent granules, resembling little grains of rice, and not quite an eighth of an inch in length. They are attached to a common stalk, to which every egg is separately attached, as grapes form part of a bunch. Each of these clusters contains about one thousand eggs, and a large octopus will produce forty thousand to fifty thousand.

The *Pyrula* lays a long string of egg cases, each containing from fifteen to twenty eggs, or sometimes more.

The eggs of the king crabs (*Limulus gigas* and *L. moluccanus*), which are collected in large quantities, among other places on the north coast of Java, are considered a delicacy by the natives and are eaten both fresh and salted, as the spawn of the lobster is here.—*Science Gossip.*

Growth of Willow Trees.

Garden and Forest has received a photograph of a willow tree standing in Waterbury Center, Vt., the trunk of which measures twenty-four and a half feet in circumference, and whose symmetrical top shades an eighth of an acre of ground. A person who knows the early history of the willow testifies that in 1840 it was a tree about six inches in diameter, which had grown from a walking-stick driven into the ground a few years before by some children. In that year it was cut down deep into the ground in the hope of killing it, but it started a new growth, and has reached its present dimensions in fifty years. The rapid growth of the willow in favorable localities is well known, and Dr. Hoskins (from whom the photograph was received) writes of another near his home, which sprang from a cane carried by a returning soldier in 1866, and thrust into the soil in his dooryard. It is now more than four feet in diameter with an immense top, and bids fair, at an equal age, to reach the dimensions of the one spoken of.

THE RACE OF STILT WALKERS AT BORDEAUX.

Just about a year ago we gave our readers an account of a race of stiltsmen organized by the *Petite Gironde*, of Bordeaux.

This year, on Ascension Day, the same journal organized a contest which was a repetition of that of last year, adding to it this time a race of female stilt-walkers and *portanieres*.

We should not have spoken of the race of stilt walkers of this year, had not the considerations that we advanced last year been totally reversed. We said, in fact, that it was very probable that the Paris-Belfort walkers (the race was to take place in a few days) would have to do better, and show more speed than the stiltsmen, despite the concurrence of their stilts. The experiment showed that we were entirely right.

But to-day the *roles* are changed, and Aime Martin, the first stiltsman to arrive, has beaten not only the time of Ramoge, the conqueror of Paris-Belfort, at the same distance (440 kilometers), but also the foot record for twenty-four hours that belonged in this race to Duval. The latter made 159 kilometers in the first twenty-four hours, while Martin made the fine mean of 7 kilometers and 85 meters per hour.

Further, it must be remarked that Duval, exhausted by this effort, and his feet in very bad shape, almost immediately lost the first rank to arrive only the fortieth. It is, therefore, rather with Ramoge that he must be compared, and the following is a parallel that will permit of judging of the superiority of the stiltsman over the walker:

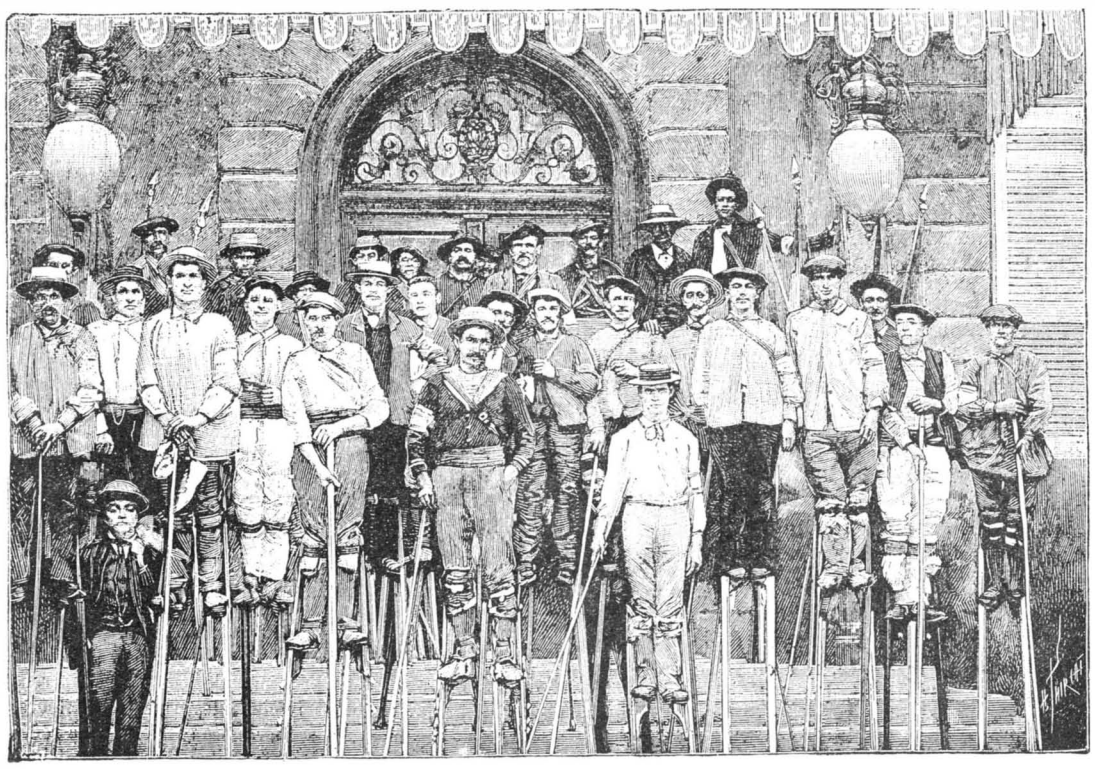
Ramoge reached Chalons-sur-Marne (161 kilometers) in 26 h. 40 m. Aime Martin reached Valence-d'Agen (170 kilometers) in 24 h. Ramoge reached Bar-le-Duc (244 kilometers) in 47 h. 36 m. Aime Martin reached Beaumont-de-Lomagne (252·5 kilometers) in 39 h. 22 m. Ramoge reached Chatenois (333 kilometers) in 64 h. 20 m. Aime Martin reached Chirac (326 kilometers) in 54 h. 50 m. Ramoge reached Mirecourt (358 kilometers) in 72 h. 20 m. Aime Martin reached Grignols (365 kilometers) in 60 h. 15 m.

It must be remarked, in the first place, in order to explain the change that has occurred since last year, that Martin had stilts of the unusual length of 1·7 meters. The mean, in fact, is scarcely more than 1·25 meters.

These long appendages, despite the great weight of four kilogrammes each, permitted him, even at the end of the race, to take steps of 1·1 meters in length. Another detail: Martin is only twenty years old, and such an age is but slightly in contradiction with the observations made upon the time of life most proper to resistance, which would be thirty years. During this long walk Martin experienced no inconvenience except a swelling of the feet, which were constantly bare upon the support of the stilts. His pulse alone exhibited great anomalies, even in comparison with that of the other runners. On the road, his pulsations were 138 per minute, and at the finish they were 120, while those of the second were but 68, and those of the third were 108.

The female stilt walkers had to make a journey of 70 kilometers, which is a long one for women. Yet the first one walked more than seven kilometers per hour.

The thing absolutely new this year was the race of the *portanieres*, which is the name in Bordeaux of women whose vocation it is to carry heavy burdens upon the head. The distance imposed was nine kilometers. Each competitor carried upon her head an osier basket, in which was placed a bag weighing twenty kilogrammes. Sixty *portanieres* took part in the race, and the first, Marguerite Pujol, thirty-six years of age, accomplished the journey, in running constantly, in the surprising time of one hour and five minutes. This last race, which took place in the presence of thirty thousand persons crowded along the way, was a genuine success, and, in conjunction with the other races of the *Petite Gironde*, shows that the human machine is capable of efforts much superior to those that have been attributed to it.—*La Nature.*



COMPETITORS IN A STILT RACE.

Two of our London contemporaries, *Iron* and *Industries*, have been united, and will be published under the title *Industries and Iron*. Each had a strong individuality. *Iron* had been published for seventy years. *Industries* was of more recent origin. We wish the publishers great success in their venture of combining the two publications.

The Ancient Eclipses of the Sun.*

BY F. TISSERAND.

Eclipse of Thales.—We read in Herodotus:

"After that the Lydians and Medes were at war for five consecutive years. In this war, the Medes were often conquerors of the Lydians, and the latter also often conquered the Medes. Once, even, they fought at night. Now, as the war was kept up with equal chances on each side, one day in the sixth year, while the armies were struggling with each other, it happened that, in the midst of the combat, day was suddenly changed into night. Thales of Miletus had predicted this phenomenon to the Ionians and had indicated precisely this same year in which it actually occurred. The Lydians and Medes, seeing that night suddenly succeeded day, put an end to the combat and thereafter occupied themselves only with the care of establishing peace between each other."

It is probable that the phenomenon mentioned by Herodotus was a total eclipse of the sun, but the place where it was observed is not indicated. We only know that it must have been situated in Asia Minor, or at least very near that country. The date is no better fixed. Pliny places it in the fourth year of the 48th Olympiad, and Clement of Alexandria toward the 50th Olympiad. The various authors who have spoken of it since make the date vary between the 1st of October 583 and the 3d of February 623 B.C. In the opinion of Baily, the eclipse occurred on the 30th of September of the year 610. Mr. Airy puts it at the 28th of May 584, in relying upon Damoiseau's Tables of the Moon. This date, moreover, agrees with that of Pliny, and seems to present serious guarantees of accuracy. Hansen is of the same opinion as Mr. Airy, remarking that in the year 610 Thales was but thirty years of age, and that it is difficult to concede that at such an age he could have been so expert in the calculation of eclipses. At the other date, on the contrary, he would have been fifty-four years old. Such proof, however, does not seem to be decisive. Mr. Newcomb has devoted himself to a very concise discussion of this eclipse, and finds that three points only are well established by Herodotus' narrative, viz., that a battle between the Lydians and Medes was terminated by a total obscuration, that on the 28th of May, 584 B.C., the shadow of the moon passed over Asia Minor, as results from calculations based upon the tables, and that Thales predicted an eclipse. But he does not consider as demonstrated that these three phenomena relate to one and the same event.

The Eclipse of Larissa.—We read in Xenophon:

"When the Persians succeeded the Medes in the empire, the King of the Persians, besieging this city (Larissa), was unable to take it by any means; but a cloud, in covering the sun, caused such a darkness that the men came out of the city, and it was thus that it was taken."

According to the details given by Xenophon, it appears certain that Larissa was the modern Nimrod. Hence the position of the place of observation is well known; but is it very certain that the phenomenon under consideration was an eclipse of the sun? The text merely says that it was a cloud (*νεφελη*) that covered the sun. Conceding that it was an eclipse, it is not proved that it was a total one of the sun. Mr. Airy concedes the totality, and, with Hansen's Tables of the Moon, examining all the eclipses of the sun that took place in an interval of forty years comprising the probable date of the fact reported by Xenophon, he finds that on the 19th of May of the year 557 B. C. there was at Nimrod a total eclipse of the sun whose zone of totality was very narrow.

The Eclipse of Xerxes.—This eclipse occurred during the march of Xerxes against the Greeks, in the very year of the battle of Salamis. Herodotus says that the army had left its winter quarters at the approach of spring and had just left Sardis, marching upon Abydos, when the sun ceased to be visible and night succeeded day, although there were no clouds and the sky was exceedingly clear. It was evidently a total eclipse of the sun, of which we know the year (that of the battle of Salamis), the season, and almost the hour (morning). Moreover, the position of the place where it was observed is well determined. Unfortunately, the tables show that there was no total eclipse of the sun visible at Sardis at this epoch. We see no means of reconciling these two discordant facts. Mr. Airy removes the difficulty by conceding that it is a question, not of an eclipse of the sun, but of the moon, that of the 14th of March of the year 479 B. C. But it does not seem easy to reconcile this substitution of the moon for the sun with the text of Herodotus.

The Eclipse of Agathocles.—Agathocles being blockaded by the Carthaginians in the port of Syracuse, profited by a momentary suspension of the blockade to escape from the port and sail toward Africa, which he reached at the end of six days. On the second day of his journey, he was witness of a total eclipse of the sun. Diodorus Siculus reports the occurrence as follows:

"As Agathocles was already surrounded by the enemy, night having supervened, he escaped contrary to all hope. On the following day, there was such an eclipse of the sun that it might have been thought that it was really night, for the stars appeared everywhere. So the soldiers of Agathocles, persuaded that the gods presaged some calamity, were in the liveliest inquietude as to the future."

Here, with the appearance of the stars in broad daylight, there is no doubt possible—it was indeed a total eclipse of the sun, and the only one, perhaps, of the chronological eclipses of which the totality is absolutely certain. Unfortunately, we are not certain as to the route taken by Agathocles on his departure from Syracuse. We do not know whether he went directly toward the coast of Africa, or whether he sailed around Sicily in steering to the north thereof. In either hypothesis, at what distance from his starting point was he at the moment of the eclipse? This is what cannot be established with precision. There is an agreement as to the date, which is fixed at the 15th of August of the year 510 B. C. By a singular fatality, says Mr. Newcomb, the limits admissible in the position of Agathocles correspond almost exactly to those between which we may make vary the secular acceleration. One of the possible passages gives 12 minutes and the other 7 minutes or 8 minutes for the acceleration.

The Eclipse of Stiklastad.—This eclipse happened during a battle that the Christian warriors under the leadership of Olaf the saint, King of Norway, were waging against an army of pagan peasants in revolt. The following is what Snorre Sturlæson has to say about it:

"The weather was fine and the sun was shining, but after the battle had begun, a reddish tint spread over the sky and sun, and, before the fight had finished, the darkness became as great as during the night." The position of the field of battle where the eclipse was observed has been determined with certainty, and this has permitted of fixing the date of the phenomenon, and consequently that of the battle, say August 31st, 1030. Now a recent work, which appears to be worthy of confidence, establishes, from historic documents, that the battle took place July 29th, 1030. If this is really the case, the eclipse must have happened more than a month after the battle, and we no longer know anything as to the position of the place of observation.

Summing up what precedes, it may be said that the chronological eclipses are not reported with sufficient precision to render it possible to conclude therefrom such or such a value for the secular acceleration of the moon. It seems that it is better to make use of them solely to throw a light upon chronology.

* From an article upon the moon and its secular acceleration, recently published in the *Annuaire du Bureau des Longitudes*.

RECENTLY PATENTED INVENTIONS.

Engineering.

AIR BRAKE.—Lucien A. Pinkston, Corsicana, Texas. This improvement provides for the use of a direct air brake system in combination with an automatic system, there being, with other novel features, an automatic and a direct reservoir and connections, the pump discharging into the direct reservoir, and the pump governor and mechanism being operated by the reduction of pressure in the direct system to hold the pressure in the automatic system to standard pressure during the application of the direct pressure. In descending long grades the direct pressure can be applied at the start, and the automatic brake used on top of it when desired, or one can be used while pressure on the other is being restored.

HYDRAULIC ELEVATOR LIFTING DEVICE.—Henry R. Koch, St. Joseph, Mo. This is a variable lifting device designed to economize in the use of water, carrying the full load to any given point and then automatically changing for a light lift. The invention consists of a lazy tongs pivoted at one end to a fixed support or casing and pivotally connected with the lifting rod, and adapted to be engaged at one of its pivots by the piston beam or slide. When a partial load only is to be carried, the piston rod is thus assisted to move the traveling sheaves their full distance while the pistons travel only part of the distance, thus effecting a saving in the consumption of water.

Railway Appliances.

CAR COUPLING.—Constant Cousy, New York City. In this coupling the drawhead and drawbar are pivoted on a common pivot to swing horizontally beneath a car, there being a vertically movable coupling pin, at one side of which is arranged a spring, while the drawbar has a hook at its front end to engage the pin of an opposing coupling. The coupling is automatically effected, and the cars may be readily uncoupled from the side or top, there being no liability to accidental uncoupling, while the coupling readily accommodates itself to the movement of cars around a curve.

CAR COUPLING.—Morse P. Scott, Woodville, Miss. This coupler has an arrow head capable of limited lateral and vertical movement, a hinged bar above the arrow head having inclined front and rear faces, while the arrow head carries a spring-controlled locking bar adapted for engagement with a gravity latch bar, and a shifting lever is connected with the locking bar. The drawhead may be readily removed from the car when desired, and is capable of coupling with an opposing drawhead of greater or less height, the locking engagement between opposing couplers being positive and firm. The uncoupling is readily effected without exposing the train men to danger.

CAR AXLE BEARING.—Olaus B. Jacobs, Fremont, Washington. This improvement is more especially applicable in railway and street cars, reducing friction to a minimum, and eliminating it from lateral and transverse thrusts, while giving the required strength within a small space. The invention consists of a series of rollers traveling on the axle and passing between it and the brass, the rollers being mounted on ball-bearing spindles held in rings. An end thrust plate is also held on the brass or box, and a ball bearing interposed between the plate and the end of the car axle.

GRIP OPENER.—William P. Courtney, Oakland, Cal. This is an improvement in automatic grip openers in which the grip is released by means of a tripping bar arranged to engage a suitably placed abutment or bearing. The keepers or guides of the grip are arranged to hold a safety bar formed with a shank and a ring or loop extending rearwardly from the lower end of the shank, where it is formed with reversely curved or inclined tripping surfaces.

STOCK CAR.—George C. Faville, Baltimore, Md. A movable slatted floor for cattle cars, so designed that it may be readily applied to any cattle car now in use, has been provided by this inventor. The floor serves as a foot lock to prevent cattle slipping during transit, and can be readily moved out of the way to permit easy cleaning of the cars without injury to the slats. The floor is of inexpensive construction and can be quickly attached to or detached from a car.

Electrical.

PURIFYING WATER.—Henry Roeske, Philadelphia, Pa. A method of and apparatus for purifying water on a large scale, designed by this inventor, consists in passing the water through a body of comminuted iron which is simultaneously agitated and subjected to the action of an electric current, when the oxide disengaged mingles with the water and precipitates the larger portion of its impurities, the remainder being removed by filtration. The filtered water is aerated before entering the distributing reservoir, and the entire plant may be set up and operated at a small cost.

Mechanical.

TAPER GAUGE.—Frank Peterson, Chicago, Ill. For conveniently and rapidly measuring tapers on work suspended in lathes or other machines this inventor has contrived a gauge composed of a U-shaped frame having aligned bearings at its ends, a table fixed on one arm of the frame, at an angle to which is arranged an opposite straight edge, a bar sliding in the other bearing carrying a pivoted straight edge. There is a graduated segment, secured in different adjustments or angles by a clamp screw, and also nearer to or farther from the table. A taper can be readily duplicated by applying the gauge to the sample and then to the work in the lathe.

SAW HAMMERING MACHINE.—Thomas H. Dillon, Beaumont, Texas. This machine has a sliding anvil adapted to be adjusted to come opposite the various parts of the saw, which can be carried by the machine in such a way as to be held at any desired angle, and an adjustable hammer may be brought opposite the anvil, whereby a blow may be made to expand both sides of the saw equally. The machine is especially adapted for use in hammering circular saws, facilitating quick and good work.

GANG SAW MILL.—William T. Mackey, Vancouver, Canada. Combined with a vertically reciprocating saw frame is a second frame reciprocating between parallel guide bars adjustable to a vertical or oblique position to change the pitch of the second frame. The invention also presents other novel features designed to afford a cheap and simple mill adapted to operate two gangs of saws in such a way as to saw an entire bolt into shingles or other stuff at one operation, there being means for adjusting the independent gangs of saws in relation to each other so that the desired pitch or bevel may be given to the stuff sawed.

Agricultural.

CHURN.—Downing H. King, Farmersville, Ill. This is a very simple churn adapted to use as a cream pot an ordinary stone jar, placed in the base of an upright frame, there being convenient means for fastening the cover to the jar. The rods of two dashers extend up through apertures in the cover, and the dashers are reciprocated by a simple crank mechanism, a fly wheel affording convenient means for adjusting the stroke of the dashers, and steadying the movement during the operation of churning.

CHURN.—John S. Thomson, Melbourne, Victoria. This churn aerates as well as agitates, and consists of a vertical cylindrical vessel to the bottom of which extends a central tubular spindle having at its lower end tubular and perforated radial arms, the outermost parts of which are bent up and stand parallel with the side of the vessel, to act as beaters and scrapers. The central shaft is connected with operating gear, and there are cocks for admitting either air or liquid to a pump also connected with the shaft, and an outlet for the air. The churn may be used for heating or Pasteurizing milk, by passing into it heated air followed by cool air, and when air and water can be had at the desired pressure no pump is required. The improvement may also be employed as a mixing machine, and for other purposes.

INCUBATOR.—Henry M. Sheer, Quincy, Ill. The casing of this incubator has double sides, top, and bottom, and the egg crates rests on transverse cleats within, a central heat flue being surrounded by an air supply pipe, both connected with each other at the bottom. Into the heat flue extends the chimney of a lamp, and in a hot air distributing flue is a thermostatic regulator, permitting the hot air to pass off when the temperature becomes too high. A hot water tank is supported in the casing above the egg crates, and is connected with evaporating pans, whereby the necessary amount of moisture will be disseminated through the casing.

Miscellaneous.

STOVE ASH SIFTER.—Albert E. Trentowsky, St. John, Canada. This is an attachment for base-burning heating stoves or cooking ranges, adapted for a quick engagement and ready removal of the ash receptacle, and affording convenient means for the thorough separation of ashes from partly burned fragments of coal, permitting the latter to be again readily placed in the fire box. The device comprises a pan on which is a rocking prop bar with a leg engaging the floor and a handle, in connection with means for securing the pan below a hole in the base wall of the stove, and a sifting grate pivoted to receive rotatable motion on the cross bar.

KITCHEN BOILER SUPPORT.—William Rowlinson, Englewood, Ill. L-shaped brackets are secured with their vertical members to the kitchen wall, a seat having a circular depression for the reception of the boiler being fitted on to the horizontal members of the brackets, while transverse members on the under side of the seat fit the outer sides of the horizontal members of the brackets. The device is of simple and durable construction and adapted to be readily fastened in place to securely hold the boiler in position.

FIRE ESCAPE.—Robert G. Dalphin, Malone, N. Y. This device, which the inventor styles the "Columbian" fire escape, is of an extremely simple and practical character, and comprises a peculiarly formed suspensible friction block, frictionally engaged by a pendent rope hung by one end from the house wall near a window, a flexible seat being suspended from the block. A spring clamping plate, vibrating in a recess of the block, presses the rope in one of the cross grooves, the friction, and consequently the speed of descent of the person in the seat, being regulated by the turning of a winged nut, bringing pressure upon the clamping plate. The device affords a safe, convenient and expeditious means of escape from a burning building.

ACCORDION.—Wilhelm R. Muhlmann, Klingenthal, Germany. This accordion is provided with a handle made hollow and adapted to be attached to one side of the bellows, a melody reed board held in the hollow handle containing the reeds, and the reed board dividing the hollow handle into two compartments, of which one is connected with the interior of the bellows, there being key valves for opening and closing the apertures leading to the sounding chambers of the other compartment. Ready access may thus be had to the melody reeds without disturbing the bellows, and the instrument is of simple and durable construction.

FRET FOR MUSICAL INSTRUMENTS.—John F. Stratton, Brooklyn, N. Y. This fret has in its shank recesses or grooves, adapted to be filled by the wood expanding after the fret is driven in place, there being then no danger of the fret coming loose on the shrinking of the wood into which the fret is driven.

DENTAL ARTICULATOR.—George W. Simpson, Santa Barbara, Cal. This is an improvement in devices for holding casts of artificial teeth in position to have the teeth perfectly articulated. It has no small parts to be detached and lost, is designed to afford substantially the movement of a human jaw, to be quickly and easily adjusted to bring the cast-holding jaws the correct distance apart, to permit the movable jaw to be arranged to correspond with a jaw or mouth of any peculiar shape, and may be conveniently used for either single or double sets of teeth.

ROWLOCK.—Lewis Minerley, Kingston, N. Y. This invention consists of a ring provided with a pintle, and an interior recess adapted to be engaged by the projecting ends of a pin held on the oar stem passing through the ring. It affords a swivel rowlock adapted to enable the boatman to easily and properly feather the oar without danger of displacing it.

SPRING GUN.—William H. Cram, Penawawa, Washington. A suitably supported breech-loading barrel has a pivoted hammer connected by a spring with a swinging trigger, and the latter is connected with a lever from which extends a bait rod, whereby bait may be so held in front of the barrel that the disturbance of the bait will cause the discharge of the gun. The improvement affords an extremely cheap and simple substitute for traps for killing all kinds of wild animals, and it may be safely carried and easily loaded and unloaded.

SLICING MACHINE.—Pierce Ford, Chicago, Ill. This machine comprises a wheel carrying sets of knives, each set containing a gauge plate and a knife blade, and a feed tube is engaged at its discharge end by the knives to cut the material passed through into slices. A screw adjusts the wheel to hold the knives against the tube, and a feed screw in the tube feeds the material to be cut. The machine is more especially designed for slicing or cutting grain after it has been steamed or cooked and hulled for preparing a food product.

Designs.

PHONETIC PRINTING TYPE.—Robert S. Avery, Washington, D. C. This design is for a font of phonetic script, complementary to a font of phonetic printing type heretofore patented by the same inventor, the printing being in imitation of handwriting.

ORNAMENTAL METAL SHEET.—Leopold Kahn, New York City. This design comprises curved fern fronds with intervening meshed work, there being an ornamental marginal band at the base, near which are arched fern fronds.

BRUSH BACK, ETC.—Charles Osborne, New York City. This design consists of a wreath-like border formed of raised connected scrolls, with leafy rosettes at intervals in the border.

BUCKLE AND SNAP HOOK.—George L. Frederick, Ebensburg, Pa. The lines of this buckle are longitudinally in the form of a compound curve, the cross bar lying out of the plane of the curved body. The lines of the snap depart from one end of the buckle about centrally, and are narrowed a short distance from the buckle.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

A STANDARD DICTIONARY OF THE ENGLISH LANGUAGE. 1893. New York: Funk & Wagnalls Co. Prospectus and sample pages, 4to. Pp. 34, colored plates. Price 25 cents.

The definers are working in the letter T, so that we may expect the completed work possibly next December. The Standard Dictionary will be a remarkable work. It will embody many new principles in lexicography. It will contain 2,200 pages of 4to size, over 4,000 illustrations, made expressly for the work, and 280,000 words. The editors number two hundred and $500,000 will represent the cost of the dictionary. It is indorsed by Professor Skeat, of Cambridge, and Dr. Murray and Professor Sayce, of Oxford, Professor R. Ogden Doremus, Dr. G. Brown Goode, and many others. Advance subscribers are treated in a liberal manner, as they receive the book for $8, while $12 is to be the retail price. We recommend all who are interested either in teaching or in a good common sense dictionary to send for the prospectus.

METAL PLATE WORK. Its patterns and their geometry. By C. T. Mills. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1893. Pp. xi, 377. Price $3.50.

This very excellent work is devoted largely to the development of surfaces for the laying out and cutting sheet metal for different articles made of tin plate. It is very fully illustrated, the problems being treated by practical methods based on descriptive geometry. Although an English technical manual, it is refreshing to find it written without reference to some specific examination, so that the author is not limited to the requirements of the London University. It will be found quite applicable to the American.

A PRACTICAL TREATISE ON FOUNDATIONS. Explaining fully the principles involved. By W. M. Patton. First edition. New York: John Wiley & Sons. 1893. Pp. xix, 402. Price $5.

A work upon foundations alone seems particularly timely at the present day. The demands made upon the earth in the way of supporting weight are so much greater than formerly, owing to the increase in height of buildings and of sizes of structures generally, that so elaborate a treatise as the present is particularly valuable. The author has drawn on the principle that theories and formulæ are of little value in this class of work, so that the book is written entirely from a thoroughly practical standpoint. As in all books published by this firm, an excellent index is given.

THE SOIL IN RELATION TO HEALTH. By H. A. Miers and R. Crosskey. With illustrations. New York and London: Macmillan & Co. 1893. Pp. xvi, 185. Price $1.10.

This little work purports to be based on the principles of geology, as far as they concern sanitary science. It begins with the subject of rocks and soils, microorganisms of the soil, the distribution of water, constituents of water derived from the soil, the soil in its relation to air, and the geological distribution of diseases. The work contains an excellent index, and the examples of danger from cesspools and surface pollution are excellently selected and mentioned. It is to be wished that more attention was given to this subject by sanitarians.

LECTURE NOTES ON THEORETICAL CHEMISTRY. By Ferdinand G. Wiechmann. First edition. New York: John Wiley & Sons. 1893. Pp. xiv, 225. Price $1.50.

This little work by Dr. Wiechmann is warmly to be recommended to the chemist as being up to date, and as in that sense supplying some of the deficiencies inevitable to the larger works. It appears adapted to form an admirable supplement to the larger works, and would seem to be a peculiarly useful laboratory handbook. It possesses the quality of individuality in the place which it fills and in the information which it contains—a thing which gives a book a special interest.

LECTURES ON SANITARY LAW. By A. Wynter Blyth. London and New York: Macmillan & Co. 1893. Pp. xi, 287. Price $2.50.

Although devoted to English law, this book possesses a character of general interest in being written by a fellow of the Institute of Chemistry, who is also a barrister at law and a professor of hygiene, for these three positions are occupied by Professor Blyth. The blending together of the information incident to these different occupations makes the book peculiarly good, the knowledge of the lawyer being supplemented by the technical acquirements of the chemist.

THE CARAVELS OF COLUMBUS. Compiled from original documents by Nestor Ponce de Leon. New York: N. Ponce de Leon. Pp. 41. Price 50 cents.

In this book of Mr. De Leon's are given the original sources of information on which the designing of the famous caravels was based. The story of the building of the caravels from a technical aspect is told in this monograph. It then goes into more minute particulars of their equipment. It even describes the instruments used by Columbus. The flags, lights, galleys, pumps, and religious observations on board, with other details, are all very fully treated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5249) H. M. W. says: A friend of mine, a practicing physician, carries a tie weight in the front of his buggy and it continually winds up the strap. The movement is from right to left or against the sine. It does not seem to matter how the buggy is loaded. Can you explain the phenomenon? A. The turning is probably due to jarring of the vehicle and slight projections on the bottom of the weight.

(5250) W. V. S. asks: Will water boil in a pot set in another pot of boiling water? If so, how? A. No; not unless you put salt in the water of the outer kettle. Brine boils at a higher temperature than water.

(5251) J. McG. asks how to make brewer's yeast. A. Brewer's yeast is prepared as follows: 72 pounds unkilned malt and a handful of hops are gradually stirred in a clean tub containing 7 gallons of water of 170° Fah., and to this 5½ gallons of water of 200° are added. The tub is then covered tightly and left quiet. After some time it is cooled rapidly. This is accomplished by setting in cans filled with cold water. When the temperature of the mash has reached 70°, the tub is covered again and allowed to stand for some twelve hours longer, when 1½ gallons fresh beer yeast are to be stirred in. After another twelve hours have elapsed, pierce a hole in the layer formed by the husks of the malt and dip 3½ gallons of the liquor beneath, then stir the whole up and dip 1¾ gallons from it (husks and liquor). This is the mother leaven, from which yeast can be generated all the year round by using it in the way described instead of the ordinary beer leaven. To the remainder in the tub add 5 gallons wort of 90° and make use of it within two hours. The mother yeast also must be used the same day for fermenting another portion.

(5252) A. E. L asks how to make skeleton leaves. A. A quick method is as follows: Four ounces sal soda are dissolved in 1 quart hot water, 2 ounces quicklime are added, and the whole boiled for twenty minutes. The solution is cooled and strained. The leaves are then boiled in this for one hour, or until the pulp is easily removed, when it is washed off as already mentioned. The fibers remain, leaving a perfect skeleton or framework of the leaf. This is bleached by exposure to a solution of 1 tablespoonful of chloride of lime in 1 quart water, strained clear from sediment. The skeletons are placed in a dish, covered with this solution and kept in a dark closet for two days, watching in the meantime that the fibers are not softened too much and thus injured. After bleaching, the leaves are steeped in clear soft water for a day and then floated off upon a card and placed between soft napkins until dry. They are then ready to be finally pressed, bent, curled, or arranged in bouquets or groups.

(5253) C. H. J. asks: 1. Will you inform me if the first charging forms the storage cell described in SCIENTIFIC AMERICAN of March 4, 1893, page 134, or is a more complicated process necessary, and what is the process? A. To form a storage cell it is necessary to charge it and discharge it several times, each time reversing the charging current. After it is formed it should always be charged with the current passing in the same direction, and that should be the same as last used in forming. 2. Is it necessary to form them with a bichromate cell, or can it be accomplished with the gravity? A. You can form them more rapidly with a bichromate cell or dynamo than with gravity cells. 3. Should the gravity be connected in series, and how should the storage be connected when charging and discharging? A. The cells should be connected in series, four gravity cells to each cell of storage battery. 4. Is it possible to charge two sets of secondary cells separately and then to discharge them connected together in series, etc., and would the time of charging of the two or more sets have to be exactly the same? A. The batteries can be charged in this way, but they should be charged to the same voltage. 5. How long would it take 16 gravity to charge 4 storage, and would the 16 gravity charge any more than 4 storage at a time? A. It would take from 8 to 10 hours to charge the storage cell. You could not make a more advantageous combination with 16 cells.

(5254) A. G. G. asks (1) why the water of a whirlpool always flows in a direction contrary to the hands of a clock? A. A whirlpool may have either direction of rotation. 2. Is there any method of nickel plating without the aid of batteries? If so, how? A. On some bases a coating may be produced without a battery, but it will not be a satisfactory one. 3. What are eye stones? Are they supposed to possess life? A. They are the opercula (closing or door shells) of certain shell fish (*turbinidæ*). Their action on the eye is mechanical. They are devoid of life.

(5255) W. S. asks: How is phthalic acid (anhydrous) made? A. By acting on naphthalene, alizarin or purpurin with nitric acid, phthalic acid ($C_8H_6O_4$) is produced. By heating this to a temperature exceeding 365° Fah., phthalic anhydride ($C_8H_4O_3$) is produced.

(5256) W. H. J. asks: 1. Is the term horse power, used as a unit of power, in estimating the efficiency of a steam engine, equivalent to the horse power of 746 watts used by electric engineers? A. Yes. 2. Can a steam engine of say 10 horse power drive an electric generator and produce more than 10 horse power of electric energy? What per cent gain or loss of power would occur? A. A loss of from ten to twenty-five per cent may be anticipated.

(5257) E. C. J. writes: I am making an electrical machine consisting of a glass wheel and rubbers. I should like to know in what way I could fasten the wheel to a brass axle so that the wheel could bear a great strain when turned. I thought of getting a flange to screw up tight to the glass on either side, but I fear it will break the glass. Could a cement of some kind be put between the flange and the glass? If so, please state what kind and its preparation? A. You can clamp your glass disks between collars on the shaft as you propose without danger of breaking the glass, provided the glass is flat. We would suggest a cement of plaster of Paris put between the flanges and the glass.

(5258) H. J. S. asks: Which will take the most force, the pipe running up outside and running the water in at the top or with the pipe screwed in the bottom of the tank? A. It requires the most power to pump the water over the top, by the difference in pressure between the level of the water in the tank and the inlet pipe added to the friction of the additional pipe to carry the water to the top. This amounts to 0·43 of a pound pressure for every foot of height between the level of the water in the cistern and the mouth of the pipe at the top. The friction of a few feet of pipe is small, but still a factor of lost power in a discussion.

(5259) Richmond says: If you take a tub of water weighing 50 pounds (tub and water), the tub being half full of water, and put a 5 pound live fish in the tub of water, none of the water being forced out, will the tub of water weigh any more with the live fish in it than it will without it? If so, how much, and how do you account for it? A. The tub, water, and fish will weigh exactly 55 pounds. This old yarn has been answered many times in this journal and many more directly. We are in hopes that some of our readers will eventually get out of this class of ruts, take to the physical facts of nature, and come to the conclusion that nothing comes from nothing and that one and one makes two every time. Everything that has weight when added to a weight increases the weight, whether animate or inanimate, fluid, air or gas.

(5260) J. H. R. writes: I have an electric bell from tank to house that rings when tank is full; the connection is made under water by a float pulling a brass wire against a copper wire above it. The copper wire will corrode in a few hours, so that a connection will not be made. Will you kindly help me out? A. We think you cannot expect good results from your electric circuits until you place the contacts outside of the tank. This you can readily do by connecting a rod with the float.

(5261) E. L. writes: 1. I saw in your last SUPPLEMENT to SCIENTIFIC AMERICAN a very good description of how to make a cheap and simple electric motor. Now I ask is it possible to make likewise a dynamo of such simple pattern, for running one or two Edison standard lamps? A. We have no description of a very small dynamo that will light one or two Edison standard lamps, but you will find in SUPPLEMENT, No. 844, a detailed description of an Edison dynamo for nine lamps. 2. I have got a small electro-magnet, used for medical purposes; the magnet does not work properly. How or where can I get it charged again? A. You can have your permanent magnet recharged by any electrician, or it can be recharged at any electric light station.

(5262) J. B. asks: Is there any way to harden steel castings, can they be tempered? A. Steel castings can be case-hardened by the same process as for iron.

(5263) J. H. S. asks: What amount of horse power can I get from an underflow wheel in a stream with a current 4½ miles an hour, 100 feet wide, 3 feet deep, the wheel to be 20 feet diameter, 24 feet wide, paddles 2×24 feet, with a cable wheel 10 feet diameter, to convey power 150 feet distant? Also how fast will the wheel run when power is on? A. Wheel should run at a peripheral speed of one-half the water velocity, or 6½ revolutions per minute, and should transmit 8 horse power through the cable.

(5264) B. A. M. asks: How can canvas be made mildew-proof at a small expense? A. Immerse the canvas in clear tan bark liquor, of about the strength of 1 pound oak bark to 4 gallons water, boiled settled and decanted, for a few hours, then rinse and dry. This will give the canvas a slight color. A wash of alum water 1 pound to 4 gallons water answers a good purpose and does not change the color.

(5265) H. S. asks for a receipt for that kind of brass that is commonly known as gun metal. It is used for the hubs of bicycle wheels. These castings are done at a very low price (about eighteen cents per pound). I would like to know how it can be done. A. The best gun metal is an alloy of 9 parts copper, 1 part tin, by weight.

(5266) L. C. D. asks: 1. Is there any satisfactory explanation of why a ball can be made to curve being delivered from the hand of a pitcher? A. The throwing of a curved ball is illustrated and explained on scientific principles in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 402, 410, 423, 10 cents mailed. 2. Peculiar freaks in electricity are often seen in the shape of luminous balls which move comparatively slow, and if they strike a wooden surface, will bound off. They are, I think, called St. Elmo balls. Can you explain the phenomenon? A. St. Elmo's fire is a peculiar condition of low electric intensity in the atmosphere, such as often occurs in fair weather, when by supposed induction and insulation, pointed objects projecting above surrounding objects become surcharged with the electric fluid and a brush discharge takes place, without audible noise, but with a feeble luminous glow. It has been observed on spires, on the masts and spars of ships. 3. Does electricity stream on as well as off a point? If it does not, does a lightning bolt go from the cloud or *vice versa*? A. Electricity passes in the brush form of discharge from generating surfaces to conducting surfaces when of low intensity, and both ways between conductors. The lightning bolt occasionally passes upward by the reverse atmospheric conditions as to polarity.

(5267) C. S. asks: In regard to deep wells, which water would be the most healthy, that out the black iron casing pipe or out of the galvanized casing? A. Water that is constantly flowing from a deep well pipe is equally healthy from both black and galvanized pipe. If the water is checked for a time without flow, the water from the black pipe may become charged with iron and will not be palatable, although healthy, while water standing in the galvanized pipe becomes charged with zinc oxide, which is poisonous. If then, the contents of the pipe is drawn off, the following water will be good.

Replies to Enquiries.

The following replies relate to enquiries published in the SCIENTIFIC AMERICAN, and to the numbers therein given.

(5186) Referring to SCIENTIFIC AMERICAN of July 15, page 45, paragraph 5186, will you please say to G. L. F. that if he will plant tansy about the trunks of his plum trees, a good thick growth of it, the fruit will not be stung. As the plums ripen, the skin will be coated with a sort of frosting or bloom bitter to the taste, but easily rubbed off. Fifty-odd years ago I noticed this in my father's garden, about a wild plum transplanted from the woods. I think it never failed to yield an abundant crop, the fruit increasing in size and quality. The tansy was supposed to spread several feet from the tree trunk. If, upon trial, G. L. F. is pleased with result, he will oblige the public, and I hope Professor Riley especially, who has done so much for the cultivators of fruit and grain, flowers, etc., by asking the SCIENTIFIC AMERICAN to acquaint the world with this simple remedy.—G. W. DEVIN, Ottumwa, Iowa, July 15, 1893.

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