SCIENTIFIC AMERICAN

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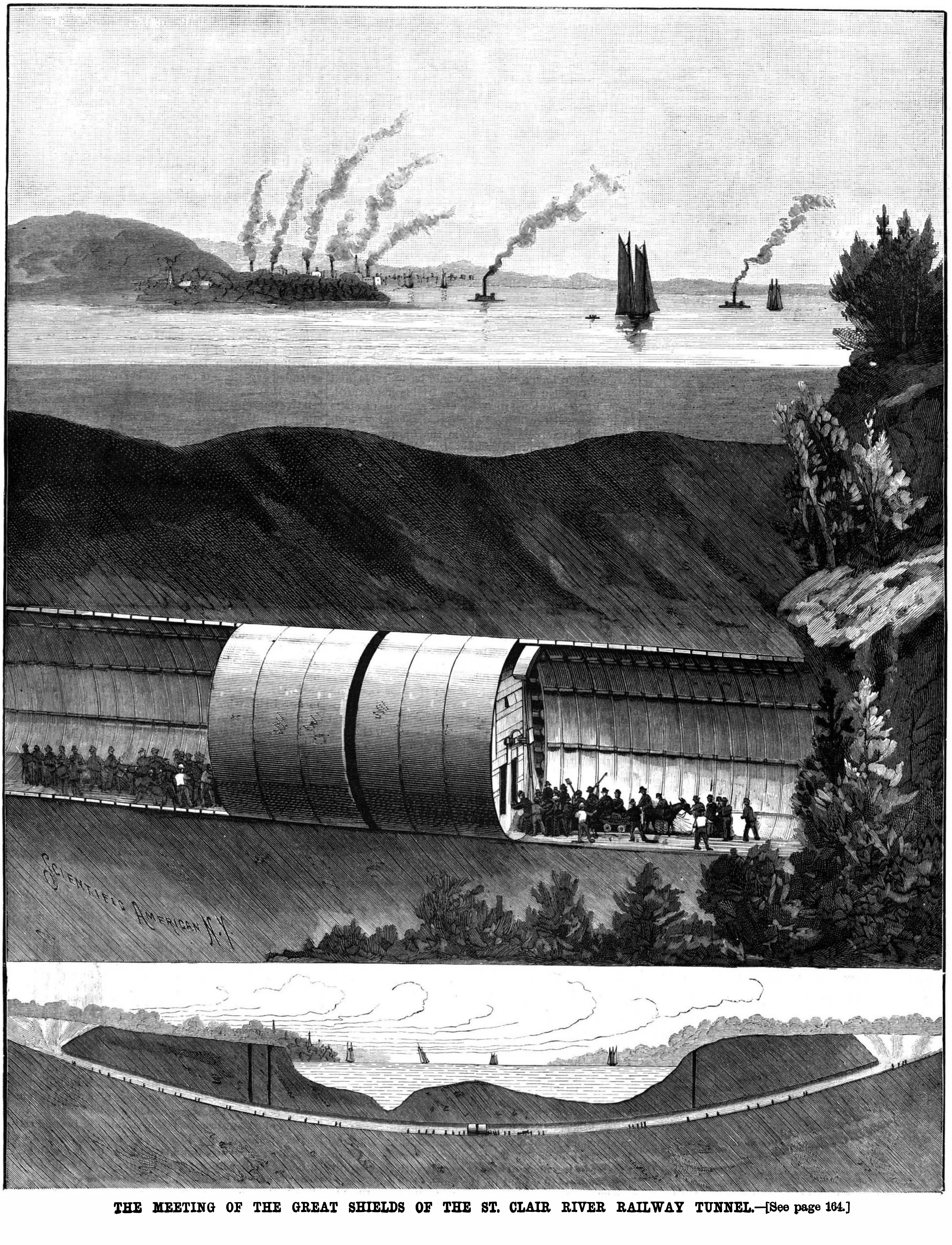

THE MEETING OF THE GREAT SHIELDS OF THE ST. CLAIR RIVER RAILWAY TUNNEL.—[See page 164.]

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Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 767.

For the Week Ending September 13, 1890.

Price 10 cents. For sale by all newsdealers.

IMPORTANT TESTS TO BE MADE OF HEAVY ARMOR PLATING.

Neither in the new vessels thus far constructed or designed for our navy, nor in any of the plans adopted for the harbor defense of the principal cities, has it been contemplated to put into immediate use such very heavy steel and compound plate defensive armor as may be found already in place on the largest English and Italian ironclads. We can only be said to be taking steps gradually in this line, and with the care and circumspection that should characterize any effort in a direction where the cost will necessarily be very great, and the results by no means certain to be satisfactory in an actual war experience. One such step was taken in the ordering from leading European manufacturers, about a year ago, of some heavy armor plates for a competitive test on the naval proving grounds at Annapolis. These plates, which were expected some months ago, have just arrived. They are all-steel plates and nickel-steel plates made by the famous French firm of Schneider & Co., at their Le Creusot works, and compound plates made by Cammell & Co., of Sheffield, England, both firms of considerable experience in making armor plates for the Italian, French, and English governments. The huge butts required for their trial have been already erected, and it is now expected that these most interesting and important tests will be made during the present month.

To prepare for this trial, a six-inch rifled breech-loader of unusual proportions has been manufactured at the Washington ordnance factory, having been made thirty inches longer than a service gun of the same caliber, to secure increased muzzle velocity, by allowing the charge to act longer against the projectile. Some criticism has been based upon the use of special ordnance instead of the standard gun for these tests, and it might be well founded were the ordnance as well as the armor under trial. Perhaps on some accounts it would be better to obtain the double result of testing not only the plates, but exactly what may be expected from the actual six-inch guns now carried in our new steel cruisers. For the same reason, a shot with an eight-inch service gun would be desirable, and this test the board conducting the trial is empowered, under its instructions, to order after a couple of shots from the smaller caliber. As to this special six-inch gun, which was completed from the forgings within the short space of fifty-two days, it will find its regular work aboard one of the new vessels. In the mean time it will be a powerful weapon of its size to use against the plates.

The plates, which are 8 feet high by 6 feet broad and $10\frac{1}{2}$ inches thick, will be bolted to 3 feet of oak backing, as armor is secured on war ships. They will then be divided into square feet by horizontal and vertical lines painted on them, the parallel lines being 1 foot apart. From the 6-inch gun, 100-pound Holtzer chrome steel, armor-piercing, ogival-headed projectiles are to be fired against the plates, with a striking velocity probably somewhere between 2,075 and 2,115 feet per second. The point of impact for the first shot is to be the intersection of the second vertical with the second horizontal line, counting the vertical lines from the right and the horizontal from the bottom. The point for the second shot is the intersection of the fourth vertical and the sixth horizontal lines; that for the point for the third is the intersection of the second vertical with the sixth horizontal, and so on for the fourth and fifth shots. But there are provisions by which changes in the point of impact may be ordered or agreed upon, after the first or second shot, since the condition of the plate may warrant such a variation. The board may also substitute an 8-inch gun, with Frith projectiles more than twice as heavy, but having a lower initial velocity, firing one shot with it instead of the last three with the 6-inch gun.

It is a pity that provision has not been made for a trial at the same time of some of our best American steel plates, and that the foreign plates are not also to be subjected to tests with armor-piercing projectiles of American manufacture.

About Lead Pencils.

"What does it cost to make a lead pencil?" said the manufacturer in reply to a New York *Sun* reporter's inquiry. "First, let me tell you how we make a pencil.

"See this fine black powder? That's graphite. It costs twenty-five cents a pound. This white substance is German clay. It comes across the ocean as ballast in sailing vessels, and all it costs us is freight. We mix this clay with this powder together and grind them in a mill, adding moisture during the process, until the two are thoroughly mixed and are reduced to a paste about the consistency of putty.

"This paste we press into these dies, each one of which is the size of a pencil lead except in length. There are four leads in one of these. After they are pressed we cut them into proper lengths and bake them in an oven kept at a very high temperature. Then we have the lead made. Its hardness is regulated by the greater or less amount of clay we mix with the graphite—the more clay we put in, the harder the lead.

"The cedar we use comes principally from Florida, and is obtained entirely from fallen trees that lie there. The wood is delivered to us in blocks sawed to pencil lengths, some of them thick, to receive the lead, and some thin, for the piece that is to be glued over the lead. The blocks are sawed for four pencils each. They are grooved by a saw the entire length, the groove being the place where the lead is to lie. The leads are kept in hot glue, and are placed in the grooves as the blocks are ready. When that is done, the thin piece is glued fast to the thick one. When dry, the blocks are run through a machine that cuts the pencils apart. Another machine shapes them, making them octagonal, or round, or flat, or three-cornered, as the case may be. The pencils are burnished by machinery, and are then ready to be tied in bunches, boxed, and put out.

"The different grades in value of a lead pencil are made by finer manipulation of the graphite and the use of better material. The average pencil in every day use costs about one-quarter of a cent to make. We are content with one hundred per cent profit on it when we sell it to the dealer. What his profit is you may figure out for yourself if you have one of the pencils about you that you paid five cents for. Of this grade of pencil an operator will turn out 2,500 in a day.

"The most valuable lead pencil that I know of is owned by a lawyer in this city.

"It is a cheap-looking affair, but I don't think it could be bought for $100. The wood in this pencil came from a cedar tree that was probably centuries old before any cedar tree now standing began to grow. It was taken from the bottom of a marl bed in Orange County, at a depth of nearly one hundred feet below the surface. Near it was found the remains of a mastodon. The knob of the end of the pencil was made from a piece of the mastodon's tooth. The pencil has never been sharpened, and probably never will be."

Bee Stings for Rheumatism.

Dr. Al. Laboulbene, at the meeting of the French Entomological Society, held on March 13, 1889, gave a short abstract of a paper published in 1888 by an Austrian physician, Dr. Terc, who seems to have made extended experiments for a number of years. Dr. Terc asserts that a person stung by bees acquires thereby a relative immunity from the consequences of subsequent stings; in other words, that the virus of the bee sting acts like a vaccinal inoculation against its own poison. The immunity lasts six months, sometimes less, probably according to the number of stings inflicted on a person. Persons suffering from acute rheumatism require a larger number of bee stings to feel the usual effect of the poison, but as soon as by inoculation of a sufficient amount of virus they have acquired immunity against its effect, they will—as long as this immunity lasts—be free from rheumatic attacks. Dr. Laboulbene suggests that, in the interest of medical science, it would be well to thoroughly test these assertions.—*Insect Life.*

Rolling Cold Steel.

The particles of any metal in cooling are supposed to make a definite crystallized arrangement. Heat, in a certain sense at least, is as to the atoms a distintegrating or repellent power, and, under great force or pressure, crystallizations may be compelled to rearrange themselves on new lines, or submit to a change in form. In drawing wire, for example, the force applied is in the direction assumed by the fiber, as softened by heat, and its strength is supposed to depend upon this arrangement of particles, compacted more or less by the die through which it was drawn. Now, rolled wire is a reversed process, as the compression of molecules both changes their form of arrangement and form of crystallization. Up to a recent period heat was always supposed to be a prime factor in the process, and that without it no alteration in what may be styled granulation was possible. Now a Chicago paper announces a change in manipulation that completely explodes the old theory. Bars of cold steel are as easily rolled into wire as if the metal were hot, and not only that, but the process nearly doubles the tensile strength. That of hot-drawn steel wire is 56,460 pounds to the square inch, while cold-rolled is 105,800 pounds.

What is the nature of the changed arrangement of particles that produces such results? It must be compression that forces the atoms into new forms, or compacts them more closely together, and yet one effect of compression is to evolve heat. The fact of added strength is abundantly vouched for, but the reason of it remains to be explained. Manifestly, if wire can be rolled from cold bars with such results, why may not steel plates for ships or other purposes? yea, why not even railroad bars? If these things are possible, with strength doubled and cost diminished, this manufacturing industry is certainly on the eve of a total revolution. Science, too, has added to its domain the wealth of a new discovery whose value is beyond estimate. Gains on any line of advancement, as all experience proves, are but a prelude to greater gains on other or similar lines. The ending of a beginning in what is new now is beyond the ken of the wisest.—*Iron Trade Review.*

Men of Science at Indianapolis.

BY H. C. HOVEY

In a former article I described the massive and costly State house, and gave an epitome of the opening addresses of the president and sectional vice-presidents of the American Association for the Advancement of Science. Before mentioning some of the scientific papers read from day to day, let me remark that, valuable as these are, they can hardly be of greater practical service than those less formal but equally earnest conversations in corners of the capitol, in parlors of the hotels and on the street cars and railways, and which are seldom noticed by the press. When five or six hundred learned men gather from all parts of America, they have a great many things to talk about. You see that dapper little gentleman cornered with a tall veteran whose snowy beard reaches his waist. One is a chemist from California and the other a Hoosier geologist, and their jovial talk is about the continuity of the natural gas supply and its conditions. Grouped around a table are a scholarly recluse, a pioneer in homespun, a trim business man and a foreign dude, familiarly chatting about the flow and friction of fluids in open channels; and shortly their topic changes to a cheerful discussion of some of the conditions that underlie chemical reactions. A hundred illustrations might be given, proving that these annual conventions answer as a sort of scientific clearing house, and not a mere cluster of sections, where papers are read bristling with technicalities. And these private confabs, as well as the more public systematic discussions, are all "for the advancement of science."

But it is in order to attempt at least a hurried report of the scientific papers, of which more than 250 were offered, and of which only a bird's eye view can be given. The reader wishing more full information can have it in due time in the official publications of the *Salem Press.* All now undertaken is to say what we might find were we to flit from room to room and catch a few ideas as to the work of each section.

Here is a set of anthropologists to whom Prof. Mason is speaking of the Indian origin of maple sugar—not as weighty a subject as some others, but very suggestive. It is said that 36,000,000 pounds of maple sugar were made last year, besides more than 1,000,000 gallons of sirup; and for this sweet art we are indebted to the aborigines. Relics of Indian sugar troughs, and various implements that have hitherto puzzled archæologists, confirm the statement. The Indians tapped the silver maple and ash-leaved maple, as well as the common sugar tree. They were well acquainted with sugar manufacture, it entered largely into their food supply, and many curious customs and religious ceremonies were associated with the annual gathering of sap and production of maple sugar.

Prof. B. G. Wilder, who is always original, exhibited and discussed diagrams prepared with great skill, showing comparatively the brains of man and the chimpanzee, and they looked altogether too much alike. Prof. F. W. Putnam, the faithful and long-time secretary of the association, and whose interest in and purchase of the famous serpent mound of Ohio is well known, described a singular earthwork near Foster's and also an ancient hearth found in the Little Miami Valley. Prof. C. C. Abbott exhibited a bone image from Livingston County, N. Y., and gold beads of Indian manufacture from New Jersey and Florida.

Dr. Jastrow, of Madison, Wis., gave results of his preliminary studies in the line of "Mental Statistics." Among his conclusions was the fact that a marked difference exists between the mind of man and of woman. Dr. Minot, of Boston, spoke of his own psychological investigations, and he, as well as others who followed him, thought that more thorough investigation should be made than had yet been made of the phenomena of mind reading and all that.

An important paper in the biological section was by Prof. Stanley Coulter on "The Forest Trees of Indiana." Of these there are 106 species, embraced in 24 orders. Indiana stands fifth in lumber interests in the United States. The maple is the most uniformly distributed tree, being known to exist in every county in the State. Indiana, once heavily wooded, is now reduced to about two million acres of forest, equal to about one-tenth of its whole area. In this connection attention may be called to a black walnut grove described by Prof. John Collett, and which he planted some forty years ago. Its trunks are now suitable for saw logs, and the owner regards his grove as a most profitable investment, "quite as good as bank stock."

In a paper on the blood corpuscles, Dr. Minot held that there are four stages in corpuscular development; the original nucleated red corpuscle, the granular stage, the embryonic or amphibian form, and the final mature, non-nucleated red corpuscle; the white cells appearing between the second and third stages.

The chemists began by considering a paper on hog cholera germs, read by Dr. Schweinitz, of the agricultural department of Washington, D. C., who had undertaken experiments for the purpose of isolating and identifying the poisonous ptomaines produced by these germs by splitting up certain substances in the body. Prof. W. E. Stone, of Purdue University, read three papers representing the result of a year's work of original research among the pentaglucosides. These are allied to the sugars, but are of a different composition. Two were specially discussed, namely, xylose and arabinose, which have been extracted from bran, gum arabic, sawdust, jute, etc. They do not ferment, but give rise to furfurol when distilled with strong acids. They give the same reaction as ordinary glucose with the copper test, and form an important constituent of food substances.

Other papers in this section showed the composition of Osage orange leaves, which it has been discovered may be used as substitute for mulberry leaves in raising silk worms; the food value of Lycoperdon (the common puff ball) as proved by analysis, it containing a large amount of nitrogenous substances, and its ash being mainly phosphate of potassium; and the governmental experiments for simplifying the methods for extracting sugar from sorghum, and thus promoting its culture. The committee on pronunciation and spelling of chemical terms reported progress, and were asked to condense results, agree on a standard and report next year. The committee on founding a national chemical society (carried over from a former year) reported favorably, and the indications are that such an organization will be formed during the coming year; although, in the opinion of many, the time is not yet ripe for the movement.

Here it may be announced that the ornithologists have been taking a step in advance. Their field is so wide and unique, and on a plane so different from that occupied by any other department of zoology, as to justify their organizing a permanent society of their own. About 941 species are now recognized as belonging to the avi-fauna of North America, of which only 82 are stragglers from other countries. In other words, we have about 859 kinds of birds that make this continent their home. There are 225 varieties in the vicinity of Indianapolis, of which perhaps no more than 25 or 30 are permanent residents of the county, while all the rest are more or less migratory. One of the rising ornithologists is Prof. W. S. Blatchley, of Terre Haute, whose numerous writings on bird life have tended in a marked degree to popularize science. Others in this department of natural history are Professors Steere, Widmann, Jenkins, Jones, Evermann and Butler. Prof. Butler is also the efficient secretary of the Indiana Academy of Science, whose indefatigable efforts have so largely contributed to the success of this meeting of A. A. A. S.

Many practical matters were discussed in the section of mechanical science and engineering, *e. g.*, as to experiments in the resistance of metals to cutting; torsional stiffness and methods of testing it; a standard formula for the efficiency of steam engines; element of waste in machine shops; value of the solid emery wheel; results of tests of 75 ton ammonia compression refrigerating machines; vortex automatic lubricators for high speed shafts.

A strikingly interesting communication was by Prof. T. C. Mendenhall, on standard metric weights and measures. They came sealed from France, and were not opened until in the presence of the President of the United States. They are incased in such a way as not to be injured by moisture or changes of temperature. There are three sets of them kept in different places, so that if one set should be destroyed, it could be restored from the others. Models of the meter and kilogramme were exhibited. Two of the latter had been shown at Washington, and it was observed that when placed side by side they weighed a little more than when placed one on top of the other. This difference amounted to one sixty-millionth of a kilogramme, and was accounted for by the fact that in the latter position, the upper one was removed further from the center of the earth than when it stood beside its fellow! He also told of the materials of which the standards were made, and explained the method of manufacture.

If I have said nothing about the geological section, it is simply because there is so much to be said that I hope to make it the subject of a separate article. The same is true of the Botanical Club and of the Agricultural Society, each of which holds a separate meeting in connection with the A. A. A. S.

Delightful excursions were made to the Rose Polytechnic School, at Terre Haute; a romantic locality near Waveland, known by the gloomy title of the "Shades of Death;" the knobs of New Albany, Mammoth Cave, Ky., and Wyandot and Marengo caves in Indiana, and the famous natural gas region. The latter interested me to such a degree that I shall revisit it for further exploration.

At the closing meeting on Tuesday evening, August 26, Prof. Putnam reported that 89 fellows and 219 members had been elected, of whom 84 were from Indiana. Of the 364 members present besides, 64 were from Indiana, 38 from Ohio, 29 from New York, 27 from the District of Columbia, 26 from Illinois, 22 from Michigan, 19 from Massachusetts, and so on from nearly every State and Territory. The next annual meeting will be held in August, 1891, in Washington, D. C.

Devices for the Fruit Garden.

At this moment I have four fine Mazzard cherry trees covered with mosquito netting to keep off the birds. When only a few cherry trees are grown, as is now the case in central New York, robins, cedar birds, and cat birds will take every cherry within five days of their coloring. But this fruit is not only very delicious to me, but invaluable as a health preservative. In my judgment the sour cherries when fully ripe are the most wholesome of all fruits. Generally I cover not only Mazzards, but Early Richmonds and Late Montgomery. Of course the cost of covering will be more than the value of the fruit as a market product; but the same cover will last for two years. Thus protected, one can gather delicious cherries from July 5 down to the end of September. The fruit does not decay badly before September, but ripens and then gets riper and riper till the fruit is good enough for Asgard. This device is valuable when one cannot induce his neighbors to plant cherry trees by the thousand, and so have enough for birds and planters. When we grew a few raspberries, it was just the same—the birds took the bulk of the crop; but now the cat birds and robins are welcome to help themselves and pay for the privilege with music. We do not miss what is taken, because we harvest a hundred bushels and are glad to pay a percentage to an orchestra. The cherry tree ought to be planted again in this State as freely as it was fifty years ago. The black knot has entirely left off troubling them here, and, therefore, even the lazy can grow them.

My remedy for currant worms is to plant gooseberries about the currant gardens, and on these the worms first appear. If thoroughly dusted then, the attack is far less severe on the currants. They prefer the gooseberry just as they prefer the white currant to the red. Of course, such preferences are not discoverable when very little care is taken of the bushes, and worms multiply beyond all measure. The currant ranks next to the cherry as a matter of wholesome diet. It is to be preferred far above all other berries.

I have quinces again bearing like the old-fashioned quince bushes of my father's day. Thirty years ago I found it difficult to get crops, and till now have only had an occasional peck of quinces. Two years ago I drew the limbs together in November with stout twine, then wound on straw or hay. The result has been heavy crops of fruit. The quince needs only slight protection here. It is best to plant on a south or southeast slope, and have an evergreen hedge or tight board fence to the north.

I had great trouble with my berry gardens, owing to the lopping down and tangling of the bushes. To remedy this I set stakes about twenty feet apart in the row, and fasten to these one wire, about four feet high. To this wire I tie the new canes in September with strong twine, two to four in a bunch. Then I leave the canes standing six feet high to bear. They are never broken down in winter, and never in the way in summer. The cost is a trifle.—*E. P. Powell, in Garden and Forest.*

The Debts of the Counties.

According to the returns of the new census for 1890, the existing gross indebtedness of the several counties of the various States of the Union is $145,693,840, toward which the amounts held in sinking funds, cash, and other resources are $30,468,955, leaving $115,224,885 as the actual debts not provided for. The annual interest charge is $7,318,374.

The following is the county indebtedness by States:

Alabama	$1,392,020	Maine	$449,878	South Dakota	$2,690,484
Arkansas	1,592,582	Maryland	872,131	Ohio	7,856,810
California	5,607,450	Massachusetts	4,008,660	Oregon	782,015
Colorado	3,190,258	Michigan	1,615,028	Pennsylvania	8,654,943
Connecticut	44,713	Minnesota	3,275,387	Rhode Island	
Delaware	618,400	Mississippi	1,238,124	S. Carolina	1,141,550
Florida	390,616	Missouri	9,974,734	Tennessee	2,237,659
Georgia	465.060	Montana	1,937,150	Texas	6,678,563
Idaho	1,320,795	Nebraska	5,302,091	Vermont	5,151
Illinois	11,760,596	Nevada	857,278	Virginia	1,691,434
Indiana	6,827,674	N. Hampshire	495,175	Washington	1,170,637
Iowa	3,643,814	New Jersey	5,159,339	W. Virginia	1,023,887
Kansas	14,817,780	New York	10,064,372	Wisconsin	1,681,256
Kentucky	5,741,636	N. Carolina	1,521,086	Wyoming	1,081,482
Louisiana	156,915	North Dakota	1,382,583		

TERRITORIES.

Arizona	$1,549,697	New Mexico	$1,650,837	Utah	$74,110

Total.......................................$145,693,840

Canadian Natural Gas.

The Toronto *Mail*, speaking of the Provincial Natural Gas Co., in Humberstone and Bertie townships, publishes a description of the ten completed wells and their output of 22,000,000′ of gas per day. Two more wells are approaching completion and another is about to be commenced. The company has seventy-five square miles of land under lease. Of the ten wells which have been drilled on these lands, eight are good producers. The operations have been carried on in the center of this territory. The wells are about one mile apart. The center of the group is 11 miles from Buffalo, 13 miles from Niagara Falls, 19 miles from St. Catharines, 45 miles from Hamilton, and about 60 miles in a straight line from Toronto. The cost of piping is about $7,000 a mile. An important factor in conducting gas great distances is the pressure it has at the well. So far the gauge has shown a rock pressure of over 500′ to the inch.

Cold Water without Ice.

The following method of obtaining a constant supply of cool water at all times is described by the *Railroad and Engineering Journal* as being in general use in Hanover, York County, Pa.

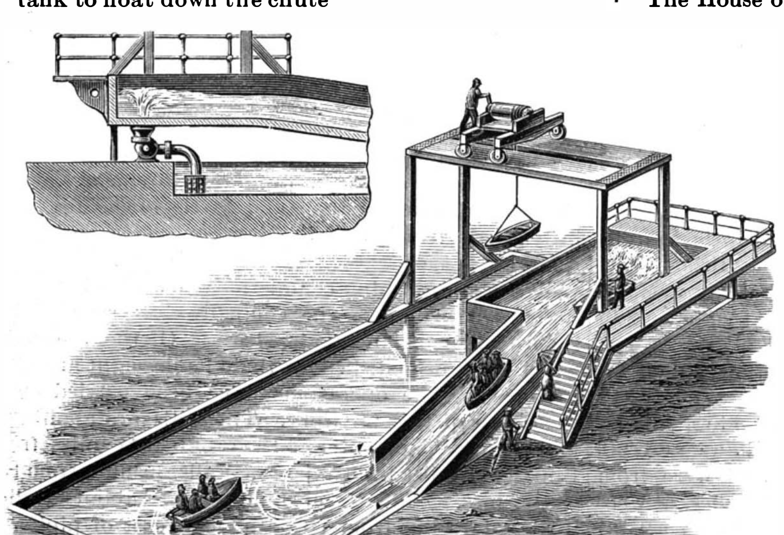
The town, says the *Journal*, is closely built up and without any system of drainage, so that the water from the wells is unfit to drink. Some years ago these reasons led to the introduction into the town of a supply of very excellent water from a large spring about three miles distant. This water is brought through iron pipes, and when it reaches the consumer in summer is warm, while the water in the wells is cool. For this reason many of the inhabitants drink the well water, and, as a consequence, typhoid fever is a prevalent disease in that community. In order to obtain pure cool water, not impregnated with lime, some of the inhabitants of the place have adopted a plan which is so simple and gives such excellent results that it is worthy of general adoption wherever there is a water supply other than wells or springs.

The plan is as follows: A cylindrical galvanized sheet iron tank, 12 inches in diameter and 4 feet or 5 feet long, is placed in the bottom of a well. This tank is then connected by a galvanized iron pipe with the water supply pipes, and another pipe is carried from the tank to the surface of the ground, or to any convenient point for drawing water, and has a cock at the upper end. The tank is consequently always filled with water from the water supply, and being in the bottom of the well, the water is cooled off and acquires the temperature of the well; so that that which is drawn from the tank is as cool as well water, and is without any of the impurities with which the latter is contaminated. The water drawn from the tank in one of the wells in the place named had a temperature of 56° when the thermometer in the atmosphere above stood at 76°

This method gives an abundant supply of cool water during the whole summer, and can be adopted in all cities, towns, or in the country. If a well is available, it can be used; if not, by simply digging a hole in the ground, deep enough so as not to be affected by the surface temperature, and burying the tank, it will answer equally well. This hole might be dug in a cellar or outside the building. If the water has any impurities in suspension, such as mud, the tank should be made accessible, so that it can be cleaned occasionally.

AN ARTIFICIAL LAKE AND WATER SLIDE.

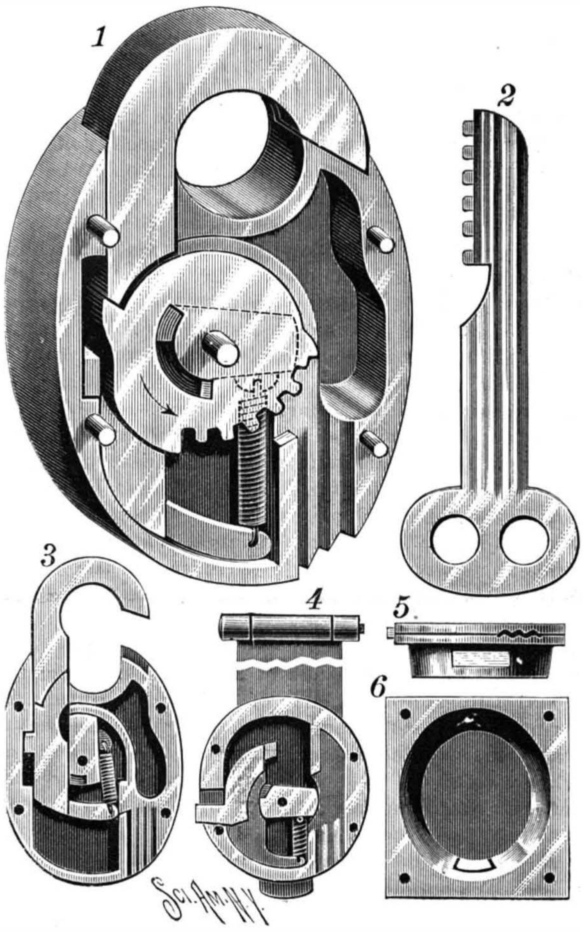
The illustration represents a water slide intended for amusement and recreation, which has been patented by Mr. James Inglis, of No. 8 Custom House Square, Montreal, Canada. The primary object of the inventor has been to provide a form of amusement for the people which might be utilized in connection with the Chicago World's Exposition, as well as at minor shows or at popular summer resorts. From a suitably constructed tank a chute extends downward to an artificial lake or reservoir, the latter also extending to one side under the tank. The part of the reservoir which extends under the chute is connected with pumping machinery, as shown in the small view, for raising the water back into the tank, thus providing for a constant flow down the chute into the lake. The slope or incline of the chute may be varied as desired, but is intended to be such as to cause a current that will carry boats or floats with sufficient speed to produce an exhilarating effect upon the passengers. At the lower end of the chute is a pivoted apron, floating freely and horizontally in the water, to prevent boats coming down from diving too deep into the water at the end of the descent. Above the tank, and over the back part of the channel, is a frame supporting a guideway on which travels a carriage with a hoisting apparatus adapted to lift the boats above the level of the tank. After they have been thus lifted the carriage may be moved transversely and the boats lowered into the tank to float down the chute



INGLIS' ARTIFICIAL WATER SLIDE FOR PLEASURE RESORTS.

AN IMPROVEMENT IN LOCKS AND KEYS.

The accompanying illustration represents a lock of novel construction recently patented by Andrew S. Fisher, Bedford, Bedford County, Pa. This device has all the advantages of other locks, with the additional merits of durability, security, and simplicity, and consequent cheapness of manufacture. Fig. 1 represents a perspective view of the padlock with the lid of casing removed. Fig. 3 is a top plan view thereof, with top of case and tumbler removed. Fig. 2 is a detailed view of the key. Figs. 4, 5, and 6 represent the same principle applied to a trunk or hasp lock, of which Fig. 4 is a top plan view with top of case and tumbler removed; and Fig. 5 a bottom edge elevation thereof, entire. Fig. 6 is a top plan view of the socket plate to receive hasp, said socket having a suitable opening in its circumference to receive the bolt of the lock, when the hasp is in position. In locking the bolt is pushed to place by means of a projection at the side of lock, as shown in Fig. 4, and can be released only by using the key. The construction and operation of locks for other purposes on this principle is substantially the same as those shown herewith. Numerous combinations are made by varying the number, size, and shape of teeth in the tumbler and key. In operating, the meshing of the teeth of the key and tumbler revolves said tumbler, and with it the dog from its engagement



FISHER'S LOCK AND KEY.

with the shackle, at the same time drawing on the spiral spring connection between said dog and shackle. When the shackle is finally released, the retractile power of the spring throws it forward, and the lock is then open. In closing, the spring draws the dog into its locking position, when the shackle is pushed to place. This invention was patented March 5, 1890, No. 422,759. Any information regarding its manufacture or sale will be given by addressing the patentee, or John O. Smith, Bedford, Pa.

Condition of Workers Here and Abroad.

The House of Representatives has recently passed a bill ordaining that eight hours shall be considered a day's work for all laborers, workmen, and mechanics, now or hereafter to be employed by the government.

In the course of the debate on this bill, the Hon. J. O'Donnell, of Michigan, made an eloquent speech, in the course of which he gave the following:

Eight hours for labor, eight hours for sleep, eight hours for improvement and recreation, will make the days gladsome for those who toil. Mr. Speaker, the workingman is better off in this country than in any other. It will be seen that the nation and its inhabitants have not suffered by the lightening of the hours of toil; the country is the most prosperous in the world. Our people are accumulating wealth; there are some sharp contrasts in the social conditions, but the general average of wealth and comfort is rising all the time. I know the number of millionaires is increasing, but it is gratifying to realize that the number of citizens worth four, two, and one thousand dollars is increasing wonderfully faster. The aggregate wealth is large, and the distribution is as nearly equal as will ever be reached under any government.

We are in the forenoon of our national existence, but what a change in the condition of all in the last century, and for the better—improvement and progress. This is the genius of our people and is inwoven in the fiber of our free institutions. This, compared with the "good old times" we hear of, is an era of luxury in all strata of society. The statistics show that in the savings banks of this country (six States not reported) there are 4,021,523 depositors, with $1,425,239,349 to their credit, an average of $354.40 for each depositor. In my own State of Michigan there are 99,245 depositors in savings banks, who have $24,015,207 on deposit. If you compute the millions deposited in building and loan associations, to secure homes for themselves and families, you will find our artisans and laboring population are in the sunshine of prosperity.

One of the enterprising papers of Michigan two years since sent fifty workingmen to Europe to see the condition of their fellow laborers abroad. They visited many points in Great Britain, France, and Germany, and, after due observation, they were of opinion, without exception, that "the American workmen are better housed, better fed, better paid, better clothed, and generally better off than their European fellows." This pleasing picture of American contentment is supplemented by the report of the statistician of the Agricultural Department, who states that labor here secures a larger share of reward than in other countries; there is one pauper here to twenty-two in Great Britain; our people consume double the amount of meat here over those of Great Britain, and nearly four times the meat the inhabitants of other lands have; our consumption of cereals is three times as great as that of Europe, in proportion to population nearly the same gratifying ratio of bread, while our inhabitants have the same excess of clothing and other comforts.

An Imprisoned Fish.

The following was related to the Chattanooga *News* by one of its correspondents residing near that city:

"My cousin owns a watermill, and in removing some obstructions found an immense log embedded in the stream which must have been submerged for a number of years. The log had to be cut in two to remove it, and much to our surprise we found it hollow, although it had every appearance of being solid. One of the negroes while examining the log looked into the hollow and thought he saw something moving. He began using his ax, and soon had the log cut into in another place.

"Imagine our amazement when we discovered a live catfish which had grown to an enormous size and length, and was so completely wedged in the hollow as to be unable to move except to open its mouth and wiggle its tail. The fish was very lively and apparently in the enjoyment of excellent health.

"The question is how did the fish get into the log, as the only means of ingress or egress we could discover was a small round hole not more than two inches in diameter. We surmised that he must have entered the little opening when no larger than a minnow, and grown great in his solitary confinement."

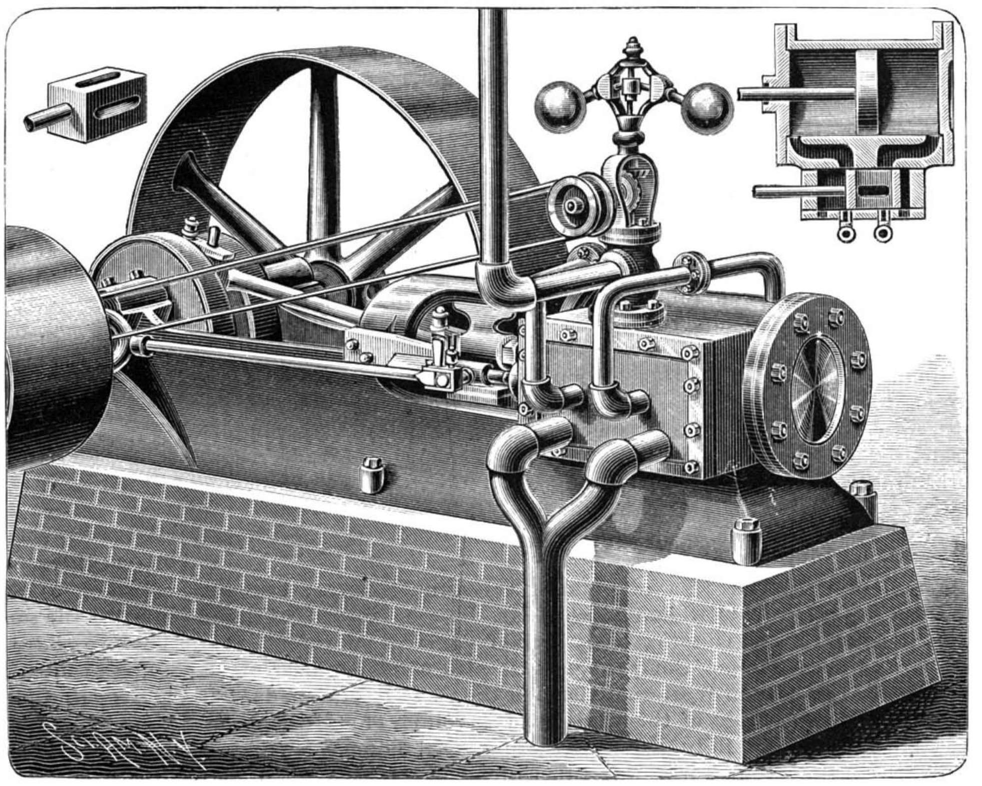
A CONVENIENT SPONGE FOR CLEANING SLATES.

The illustration shows a device especially intended to facilitate the wiping of school-slates, or the erasing of certain portions only of what may be inscribed thereon. It has been patented by Mrs. Emma C. Hudson, of No. 327 Arch Street, Seattle, Washington. It consists of a flexible casing having meshes or perforations, and adapted to hold a small piece of sponge, the casing being preferably a rubber net-work, and formed with a neck adapted to be engaged by the end of a pencil. The sponge is thus always at hand when needed, and can be readily wet sufficiently for the use designed, while it is retained in shape by its casing.

HUDSON'S SLATE-SPONGE.

AN IMPROVED SLIDE VALVE FOR ENGINES.

The illustration represents the application of a simply constructed slide valve for engines, provided with intersecting slots, and designed to be perfectly counterbalanced, so as to reduce the wear to a minimum. One of the small figures presents a sectional plan view thereof, the other showing the valve in perspective. It has been patented by Mr. Oscar L. Ward, of Eagle, Neb. From each end of the cylinder an inlet port connects with the steam chest, in which slides the valve, actuated by suitable means from the main driving shaft, the valve having a vertical slot connecting at all times with the steam inlet pipe. The valve also has a transverse slot intersecting the vertical one at right angles, and adapted to be connected alternately with the steam inlet ports leading to each end of the cylinder. The steam chest has exhaust ports near each end leading to the outside, and the ends of the cylinder are also connected with the exterior of the steam chest by pipes opening into the steam chest in line with ports connecting with the cylinder ends. In operation, live steam passing through the vertical slot of the valve exerts an equal pressure on its top and bottom, the steam passing through the transverse slot also exerting its pressure against the sides of the valve, so that it only rests by its own weight in the bottom of the steam chest, and the pressure against the valve is counterbalanced by the steam in the cylinder passing alternately through one of the pipes connecting the ends of the cylinder with the exterior of the steam chest, whereby the valve is at all times completely counterbalanced.



WARD'S SLIDE VALVE FOR ENGINES.

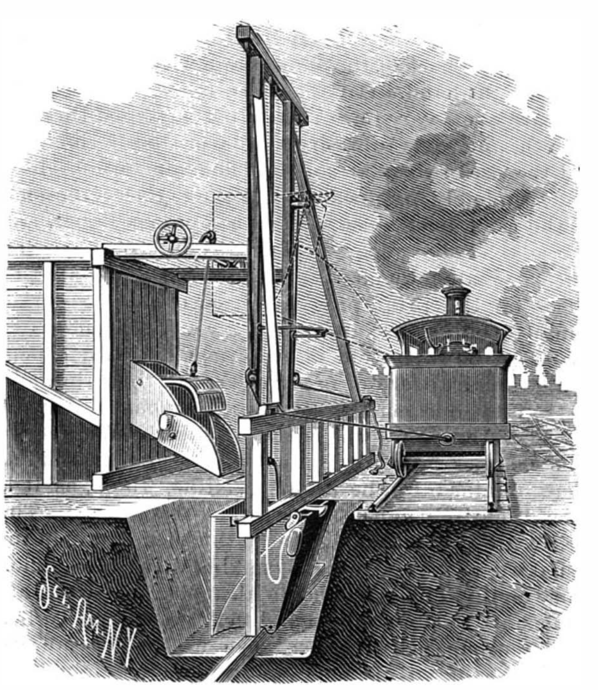
Exhaustion of Natural Gas.

Professor Orton, of Ohio, in a paper recently read before the American Association for the Advancement of Science, stated that there is not the faintest doubt that the natural gas supply in the Indiana and Ohio fields is not only exhaustible, but is rapidly and surely being exhausted. He said he was yet to find a man conversant with existing facts who does not entirely agree with him. The gas is stored in the rocks, where it has been for untold ages. It is not now being generated, and every foot that escapes to the surface leaves the quantity remaining for future use just so much smaller. The pressure of gas in the wells in the Ohio and Indiana fields is steadily diminishing, the decrease already having amounted to thirty or forty per cent. In view of this, Dr. Orton urges the imperative necessity for cities and States to take action restricting the lavish and wasteful use of gas. Even the strictest regulations cannot prevent the exhaustion of the supply of gas in a few years, but they may put off that exhaustion some time.

A COAL ELEVATOR FOR RAILWAY SERVICE.

An elevator designed to load coal from a bin into the tender of an engine, the bucket being raised by the engine and dumped at the proper moment into the tender as the latter is brought in front of it, is shown in the accompanying illustration. A coal-holding bin with inclined bottom faces the track, and in front of it is a pit, upon the bottom of which is the base beam of a frame having two standards united at the top by a cross-bar. The frame is stayed by braces, and between it and the track is a guard fence. In the frame slides a bucket with forwardly inclined bottom, the front of the bucket consisting of a door pivoted at its lower corners, while side guards extend rearwardly in contact with the outer sides of the bucket. To the upper sides of the body of the bucket, at the front, are attached guide lugs, limiting the rearward movement of the door, the latter also having a weight attached to its upper end on each side, the weights being connected with the body of the bucket by ropes or chains of sufficient length to allow the door to drop to a proper incline, as shown in dotted lines. From the bail of the bucket two ropes or chains extend upward over guide pulleys in the top cross-bar of the frame, and downward and outward at the sides over pulleys journaled on the guard fence, the extremities of the ropes having each a hook or other fastening device whereby they may be readily attached to a locomotive.

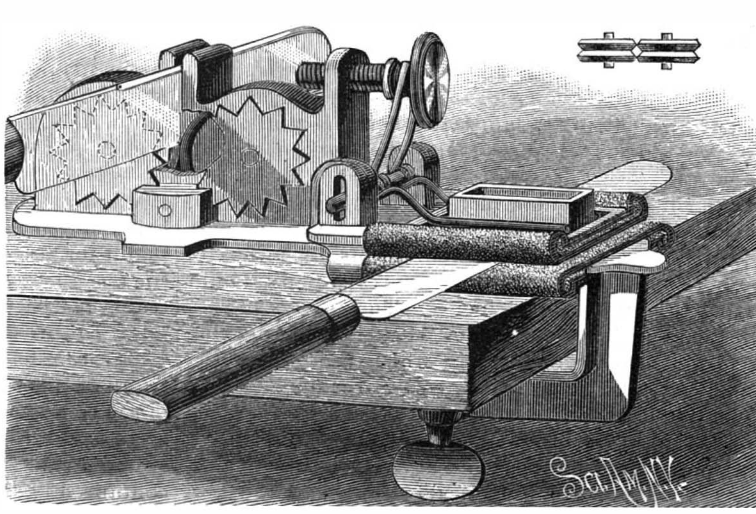
In the front upper portion of the body of the bucket is journaled a shaft, centrally upon which an outwardly extending latch is pivoted, and the shaft has at one end a crank arm adapted for engagement with a trip on one of the standards of the frame, the trip being so located, and the length of the ropes or chains so calculated, that, when either rope or chain is attached to an engine, and the tender arrives opposite the frame, the crank arm of the bucket shaft contacts with the trip to release the door of the bucket and deliver the coal to the tender, such position of the bucket being shown in dotted lines in the illustration. In the front of the bin is a downwardly inclined chute, to the lower extremity of which is pivoted an auxiliary chute, in such manner that it may be carried up to a vertical position, and within the main chute is pivoted a gate or cut-off, made preferably of a series of curved fingers united by suitable brace bars. This gate is raised to permit the coal to flow from the bin by a link connection with a cranked shaft journaled upon beams attaching the standards to the bin, the shaft being preferably manipulated by hand wheels at each end. By the lifting of the gate the auxiliary chute of the bin is thrown down for the delivery of coal into the bucket in the pit, the supply being cut off when the bucket is filled. With the drawing up of the bucket, the auxiliary chute is thrown upward to vertical position. When the tender has received its load, the engine is backed and the bucket thereby lowered, its open door, as it passes down, being closed by coming in contact with a yoke-like frame attached to the standards. The engine thus does the work of hoisting the coal, and the tender may be filled when approaching from either direction. This invention has been patented by Mr. A. H. McLean, No. 210 Mott Street, Saginaw, Mich.



McLEAN'S COAL ELEVATOR FOR RAILWAY ENGINES.

AN IMPROVED KNIFE SHARPENER AND POLISHER.

A simple and durable device designed to facilitate the quick and convenient sharpening and polishing of knives is shown in the illustration, and forms the subject of two patents which have been issued to Mr. John Vermeulen, of No. 300 East Seventy-fifth St., New York City. On one end of a suitably constructed bed plate adapted for attachment to a table or a bench is arranged a casing with a vertical slot, into the lower part of which extend the rims of two sharpening rollers turning in suitable bearings in the casing. Each of the rollers has V-shaped annular ridges on its periphery, as shown in the small figure, the outer edges of the ridges touching at the center of the slot, so that when a knife is drawn through, as shown, its edge comes in contact with the edges of the ridges of the rollers and is thereby sharpened. The shafts of the rollers each have on one outer end teeth adapted to be engaged by a plate arranged in proper position for such purpose, the plate being on one end of a transverse shaft sliding in the casing. The shaft has a head on which bears a spring to normally press the head outward and hold the plate in contact with the other side of the casing in engagement with the toothed wheels, and, when the sharpening rollers have become worn at their contact point, the operator presses on the head of the shaft to force it inward and disengage the plate from the notched wheels. The sharpening rollers can then be turned a distance of one or more teeth, so that new portions of their ridges may pass into the slot. The shafts of these rollers may also be held in longitudinally sliding bearings, adjustable by a set screw, when, as the rollers become worn on their peripheries, the bearings may be moved nearer to each other. The sharpening rollers are preferably made of solid steel or emery, or they may be made of a series of washers. On the other end of the bed plate is a polishing device, with a lower fixed polishing strap and an upper yieldingly mounted strap. The ends of the lower strap are held in place by a spring plate pressing the ends of the strap against inclined lugs or flanges on the under side of the bed plate, the strap being easily removed for renewal when worn out. The upper strap is passed under a plate having inclined lugs at its sides, and the ends of this strap are held in place by another spring plate. At the inner end of the plate to which the upper strap is attached are upwardly extending vertically slotted lugs, through which pass the ends of a pin held in lugs on the bed plate, the vertical slots in the lugs permitting the upper plate to swing upward when a wedge-shaped knife is inserted between the two straps, the pin forming a fulcrum. A spring is arranged to press on the top of the upper plate to hold its strap against the strap of the lower plate or against a knife blade drawn between the plates to be polished. In the middle of the upper plate is a hopper, opening downward through an aperture in the upper strap, whereby a polishing material placed in the hopper will be supplied to the polishing surfaces of the opposed straps.



VERMEULEN'S KNIFE SHARPENER AND POLISHER.

THERE are 413 species of trees to be found within the limits of the United States and Territories, 16 of which, when perfectly seasoned, will sink in water. The heaviest of these is the black ironwood (Condelia ferra), found only in Southern Florida, which is more than 30 per cent heavier than water. Of the other 15, the best known is the lignum vitæ (Guiacum sanctum) and the mangrove (Rhizophora mangle). Texas and New Mexico, lands full of queer creeping, crawling, walking and inanimate things, are the homes of a species of oak (Quercus grisea) which is about 1¼ times heavier than water, and which, when green, will sink almost as quick as a bar of iron. It grows only in mountain regions, and has been found westward as far as Colorado desert, where it grows at an elevation of 10,000 feet. All the species heavier than water belong to tropical Florida or in the arid West or Southwest.—*Commercial Advertiser.*

THE MEETING OF THE GREAT SHIELDS OF THE ST. CLAIR RIVER RAILWAY TUNNEL.

In the SCIENTIFIC AMERICAN of August 9 we gave illustrations showing the construction and mode of operation of the Beach hydraulic shields used for the excavation of the great railway tunnel now successfully executed underneath the St. Clair River between Port Huron, Mich., and Sarnia, Canada, by which the tracks of the Grand Trunk Railroad, of Canada, and the Chicago and Grand Trunk, Detroit, Grand Haven and Milwaukee, and the Toledo, Saginaw and Muskegon railroads, of the United States, are to be connected.

We have now to announce the successful completion of the under-river portion or tunnel section of the great work. This interesting event occurred at half past eleven o'clock on the night of August 30, when the two great 21 foot shields, by means of which the tunnel was excavated, were pushed together and made to meet edge to edge, exactly in line with each other, thus entirely finishing the work of excavation. The reader will, of course, understand that two headings were worked in the excavation of this tunnel, one heading being started from the American side of the river and one from the Canadian side. In each heading one of the great hydraulic shields was employed, by means of which the workmen were protected while the earth was being excavated and the iron plates composing the walls of the tunnel were put in place. As the work of construction proceeded, the two great shields were made to advance toward each other from opposite directions, until they finally met face to face, edge to edge, underneath the river torrent above them. This meeting of the great shields forms the subject of our first illustration. The second engraving shows the location of the tunnel as it extends from one bank of the river to the other.

The shield consists of a strong cylinder somewhat resembling a huge barrel with both ends removed. The front end of the cylinder is sharpened, so as to have a cutting edge to enter the earth. The rear end of the cylinder, for a length of two feet or so, is made quite thin, and is called the hood. Arranged around the main walls of the cylinder and longitudinally therewith are a series of hydraulic jacks, all operated from a common pump, each jack having cocks, whereby it may be cut off from the pump whenever desired.

Within the shield are vertical and horizontal braces and shelves. When at work, the iron plates or the masonry, of which the tunnel is composed, are first built up within the thin hood of the shield, the hydraulic jacks are then made to press against the end of the tunnel plates or masonry, which has the effect to push the shield ahead into the earth for a distance equal to the length of the pistons of the jacks, say two feet, or not quite the length of the hood, and, as the shield advances, men employed in the front of the shield dig out and carry back the earth through the shield. By the advance of the shield, the hood, within which the iron or masonry tunnel is built, is drawn partly off from and ahead of the constructed tunnel, thus leaving the hood empty. The pistons of the hydraulic jacks are then shoved back into their cylinders, and a new section of tunnel is built up within the hood as before described. The shield is then pushed ahead, and so on. The extreme end of the tunnel is always within and covered and protected by the hood. In this manner the earth is rapidly excavated or bored out, and the tunnel built, without disturbing the surface of the ground, the workmen being at all times protected by the shield from the caving in of the earth. This machine is the invention of Mr. Alfred E. Beach, one of the editors and proprietors of the SCIENTIFIC AMERICAN, and was first made and used by him in 1868–69, in constructing a railway tunnel under Broadway, New York. The invention was also used in London in 1886–89, in constructing the two subway tunnels, each three miles in length, from the Monument, passing under the Thames River, Kennington Park Road, etc., to Clapham. The cars in these tunnels are to be worked by electricity. The Beach hydraulic shield is also now being used in the Hudson River tunnel, in process of construction under the Hudson River between New York and Jersey City.

In the construction of the St. Clair River tunnel, two deep cuttings were made, one on each side of the river; that on the American side had a depth of 53 feet, and that on the Canadian side 58 feet deep. Upon the floor of each cutting, against the head thereof, one of the great shields was placed, and the work of tunneling began.

Each shield is circular, 21 feet 7 inches in diameter, 16 feet long, and is built of plate steel, one inch thick. It is divided into twelve compartments by means of two horizontal and three vertical stays, which are built up to a thickness of two inches. These stays have a knife edge in front and extend back ten feet, leaving six feet of clear cylinder into which the end of the tunnel extends. Ten of the compartments are permanently closed and brazings of angle iron placed across them. The other two are provided with heavy iron doors which can be closed at once in case of accident or danger. These doors are situated at the bottom in the center, and through them is passed all the excavated matter. Flush with this heading (with their cylinders extending forward into the compartments) are twenty-four hydraulic rams at equal distances around the shield. These rams are eight inches in diameter and have a stroke of 24 inches. By their means the shield is forced forward enough to admit of another section of castings, viz., 18 inches. Each of these rams can be worked separately, as may be seen by the sketch of the back view of the shield. The power supplied by a Worthington pump is capable of producing a pressure of 5,000 pounds per square inch, which will amount to 125 tons per ram, or 3,000 tons on the 24 rams. The greatest pressure used was 1,700 pounds per square inch, which is 40 tons per ram and 1,060 tons on the shield.

These shields weigh eighty tons each, and were built by the Tool Manufacturing Company, of Hamilton, Canada. They were brought to their destination in pieces, and erected at the tops of the great cuttings, on the north side in both cases, at which side are also the machines and workshops which have been erected. This immense machine when completed was rolled down the side of the cutting on a wooden track composed of four rails of wood, each one foot square, and placed about four feet apart. It was restrained in its downward course by means of six large ropes which were passed around it, fixed at one end to the upper end on the wooden track and coiled around piles, with a number of men to lower out when the order was given. From the time at which the machine first moved to the time it was resting on the cradle of wood (which was prepared for it) at the bottom was only one hour and twenty minutes. For complete illustrations see SCIENTIFIC AMERICAN of Aug. 9, 1890.

The tunnel is 6,050 ft. in length from cutting to cutting, and is divided as follows: From the American cutting to the river edge, 1,800 ft.; from the Canadian cutting to the river edge, 1,950 ft.; and distance across the St. Clair River, 2,300 ft.

The tunnel proper was commenced in August of 1889, and the shields met August 30, 1890, thus practically completing the tunnels within about one year from the time the shields were fairly set to work.

The expedition with which it has been completed so far (for its manner of construction renders it complete as the shield proceeds) has beaten all previous records of tunnel construction, and proved a success beyond expectations, inasmuch as it shows a fewer number of accidents than other types of tunnel, the most serious accident being a broken leg.

The idea of building this tunnel of cast iron segments originated with Mr. Joseph Hobson, of Hamilton, Ontario, who is chief engineer of the St. Clair Tunnel Company, and is also chief engineer of the Great Western division of the G. T. R. of Canada. The success of this work speaks volumes for Mr. Hobson's skill in tunnel construction. Mr. Thomas Murphy, of New York, was superintendent of excavation. Mr. Murphy is a man well versed in these matters, and is thoroughly competent, having been connected with the construction of several tunnels of note throughout the United States.

The cost of this tunnel was estimated at $3,000,000, but it is now thought that (notwithstanding the immense amount of money expended on the test and brick shafts) it will not reach that figure. Should another tunnel be put through, as now expected, we shall have a much fairer chance to compare the certain and marked advantages which the cast iron tunnel possesses over the old style brick and cement tunnels.

The Great Trees.

At a recent meeting of the California Academy of Sciences, Prof. Gustav Eisen, who has recently returned from a trip to the big tree forests of the Tule and Kaweah rivers, called the attention of the Academy to the magnificent groves of the *Sequoia gigantea* along these rivers, which are now being ruthlessly destroyed. On the Tule river are to be found the largest number of big trees to be found anywhere in the State. A very large portion of this marvelous timber has been purchased by private parties, who are now cutting down the trees as fast as possible. There are hundreds of these monarchs of the forest 20 and 30 feet in diameter which have been cut down and only a small portion of the lumber in them utilized; the rest has been left to rot on the ground.

Professor Eisen saw the stump of a tree near the Tule river, Tulare county, that had just been felled. It was about 33 feet in diameter and the height was not less than 250 feet. The man who cut the tree down sold it for $60. It was calculated that from the top of the tree 60,000 shakes would be made. A part of the trunk has been secured for exhibition at the world's fair. In this same region there was cut a monster tree 41½ feet in diameter and 250 feet high. A part of the trunk of this tree was sent to the Centennial. The rest of the tree was left to rot. Professor Eisen said it was a sad sight to see such great trees destroyed. The stump of the tree which was sent to the Centennial contains 6,126 rings, indicating in all probability that the tree was that many years old.

There are still many tracts of land covered with huge redwoods which the government still possesses, and there is now an effort being made to have these groves perpetually reserved from sale.

On motion of Professor Eisen the Academy instructed the president to appoint a committee of three to draught a memorial to the Secretary of the Interior requesting that official to do everything in his power to save the remnant of the fast disappearing big trees.

PHOTOGRAPHIC NOTES.

Removing Yellow Stains.—Every photographer is, no doubt, to his own sorrow, familiar with a yellow stain in the negative, caused by taking the plate from the fixing bath before it is thoroughly fixed. Mr. Belitski, the well known photo-chemist, made some experiments recently to remove this stain, and succeeded very well. A slight stain can often be removed by placing the negative in the following solution: 50 parts alum, 1,000 parts water, 10 parts bichromate of potassium, 20 parts muriatic acid. After several minutes the negative turns yellow all through. It is washed now very thoroughly, exposed to sunlight for several minutes, and developed or blackened with the ordinary iron developer. When the stain is very intense this remedy will not prove to be of any avail, and only by leaving it for twenty-four hours in the Lainer acid fixing bath (so often described in all journals recently) he succeeded in removing the stain, and saving valuable negatives. —*Deutsche Photographen Zeitung.*

Steeling Photogravure Plates.—Mr. Wilkinson gives the following instructions for the steeling of etched plates when large numbers of prints are required therefrom:

"When the plate has been proved, the next operation will be to steel-face it, for which purpose it is thoroughly cleaned with whiting moistened with turpentine and naphtha, polishing with a soft cloth; a small portion of the plate behind is scraped clean, and a piece of copper wire soldered to it. The steeling solution is placed in a wooden cell, the positive and negative poles from the battery (Leclanche) ending in copper rods the whole length of the cell. The solution is composed of:

Warm water	20 ounces.
Ammonium chloride	3 "
Sulphate of iron and ammonia	4 "

"When dissolved, filter, and let it stand in the cell twenty-four hours before use. When required for use, the copper plate is hung upon the rod connecting with the negative pole of battery, the positive pole being occupied by the anode (a plate of pure steel), which must be the same size or larger than the copper plate. The two plates being in position, the current is turned on by pushing in the rod of battery, and in from three to five minutes the operation is complete, the copper plate being covered by a very thin film of steel. The plate, when steel-faced, is thoroughly washed and dried, and then cleaned with whiting and turps and naphtha, the copper wire behind carefully unsoldered, and the back scraped flat. If the battery is not to be used again for some time the anode should be removed and wiped dry, the cell being carefully covered up."—*Photo. News.*

Enameling Photo. Prints.—Use very clean plates and rather larger than the prints to be enameled. Wipe them well, rub them with talc, and remove the excess with a soft brush passed lightly over the surface. In a dish, half filled with ordinary water, immerse the photographs and allow them to soak. This being done, coat one of the talcked plates with enameling collodion in the ordinary way, agitate to cause the ether to evaporate, and when the film has set—that is to say, in a few seconds—steep this plate, the collodionized surface up, in a second dish containing pure water. Now take one of the prints in the first dish and apply the printed side to the collodion, remove the plate from the dish, keeping the print in its place with the finger of the left hand, and remove the air bubbles by lightly rubbing the back of the photograph with the forefinger of the right hand. Care has been taken beforehand to prepare some very pure starch paste, passed through a cloth, and some thin cardboards, or simply thick paper the size of the plates used. The air bubbles having completely disappeared, and the perfect adherence of the print ascertained, dry with bibulous paper, and spread over the prepared cardboard on paper a coating of the collodion by means of a flat brush. Apply this sheet on the print, pass the finger over it to obtain complete adherence, and give it twenty-four hours to dry. At the expiration of this time, cut with a penknife the cardboard or paper even with the print, and detach by one corner. If the plate has been well cleaned, the print will come off itself. We get in this manner a very brilliant surface, and as solid as that obtained by the use of gelatine, which, as it is seen, is entirely done away with in this process. The prints are afterward mounted on thick cardboard in the usual way. It is possible, by mixing with the collodion some methyl blue dissolved in alcohol (a few drops are sufficient), to obtain moonlight effects, especially if a rather strong negative has been used. For sunsets, make use of an alcoholic solution in coccinine.—*F. Tarniquet, in Science en Famille.*

Correspondence.

Salt as a Preservative.

To the Editor of the Scientific American:

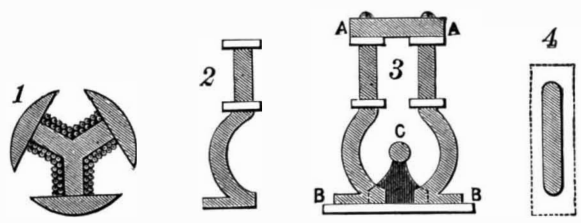
Thirty-four years since, I set four 4½ by 4½ inch oak hitching posts near my residence, 3½ feet deep in the earth, having first bored one 1 inch hole into same some 3 inches above, and another hole of like size some 4 inches below the earth's surface, and partly filling each hole with salt, and then plugging same with a dry oak plug. The posts are to-day sound and strong. Draw your own inference. WM. T. SMITH.

Oskaloosa, Iowa, Aug. 25, 1890.

WORK OF AMATEUR ELECTRICIANS.

To the Editor of the Scientific American:

I noticed in your valuable paper of July 19 an article entitled "Electrical Workers will Please Report," so I take the liberty, as a subscriber of your paper, to tell you of some attempts of mine to make electric motors and dynamos described in the SCIENTIFIC AMERICAN and SUPPLEMENT. I first made the small dynamo (SUPPLEMENT, No. 161), as directed in SUPPLEMENT; put a small grooved pulley on shaft, and run it as a dynamo from a sewing machine table, using the fly wheel to drive it by. Dynamo is coupled up as a shunt machine; have a small rheostat in field, with which I can regulate the current from nothing to full capacity of machine. I can run two 1 c. p. incandescent lamps with it easily. I made a small storage battery, and used to charge it with the dynamo. Later I made an armature out of cast iron, like sketch No. 1, having



three sections wound with No. 18 wire, and it runs nicely, especially as a motor, it having no dead center. I also made another dynamo same type, but half the size of dynamo No. 161. It will run a small fan very well on three Grenet cells. The fields are wound with No. 19, and armature No. 23, coupled in shunt.

I started to make the simple electric motor described in Hopkins' "Experimental Science;" made the armature, and made a commutator like the eight-light dynamo commutator. The field I made out of cast iron; got two pieces cast like sketch No. 2, wound them in a lathe, each leg having 12 layers No. 16 wire on it. On top of fields (see No. 3) I bolted a piece of wrought iron, A A; on the bottom, at B B, is screwed a brass plate; on this plate the two bearings, C, are screwed. The field (No. 2) bars are rounded at the edges (see Fig. 4), so as not to injure the wire in winding. I tested the machine on a six-ampere arc circuit as a series motor, and it runs splendidly. I should be pleased to give you the dimensions of the fields if you want them. I have not built the eight-light dynamo yet, but expect to do it this fall. If any of your readers have ever built a small motor (shunt-wound) for a 110 volt incandescent circuit, I would like to know size of magnets, armature, size of wire in field and armature, layers, etc., and resistance of shunt and armature, and what current it takes, type of field, etc. FRANK B. WIDMAYER.

Montclair, N. J., August 24, 1890.

Ingrowing Toe Nails—Their Treatment and Cure.

To the Editor of the Scientific American:

In a recent issue of SCIENTIFIC AMERICAN, "C. R. W." gives a "remedy" for ingrowing toe nails. The treatment is well enough for temporary relief, like almost all of the many forms of cutting the nail, but it is not a cure, and if followed up will certainly prove disastrous. Thinning the nail in any manner, or even pulling it off, as is sometimes done, makes the after growth thicker, harder and more inflexible, causing the nail to curve into the flesh more and more, making the ailment worse. The following treatment was prescribed to me thirty years ago by our family physician, and was a permanent *cure* in my case, and has been in that of several to whom I have recommended it:

1. Wear stockings that are at least one-half inch longer than the feet.

2. Wear broad-toed shoes or boots that will allow the toes to rest without lateral pressure when standing. If possible, have the boots or shoes made over a last which has an elevation—a "knob"—where the great toe comes, so as to stretch the uppers *up*, thus preventing pressure on the nails.

3. Cease cutting the nail in *any manner*, but allow it to grow until it is from one-half inch to three-quarters inch beyond the "quick," bearing the soreness and pain that will come while growing to that length, with as much patience as possible, but on *no consideration cutting any part of the nail.* Putting cloth or cotton under it will usually add to the pain, because increasing the pressure.

4. Three or four times a week (every night is not too often), before retiring, soak the feet for half an hour in soap suds as hot as can readily be borne, and with a small blunt knife blade carefully remove from under and around the nail any dirt or matter that may have accumulated. Soaking the feet will do much toward removing the soreness. After the nail has grown to the required length, it may be trimmed as occasion requires, but always in such a manner as to leave the end of the nail about the shape of the end of the toe, with the corners at least ¼ inch beyond the flesh, until the cure is effected; and even then the nail should *never* be cut back of the end of the toe.

Soaking the feet as often as once each week, and cleaning the nails as prescribed, will do much toward preventing a return of the malady.

I may add that frequent soaking the feet and scraping with a dull knife the callous places while moist, with easy-fitting shoes or boots, will remove and prevent corns and bunions.

I have not the space to give reasons for the above treatment, but they will become apparent to any who use it. C. R. J.

Norwich, N. Y.

Tyrotoxicon in Cheese and Milk.

During the years 1883 and 1884, there were about three hundred cases of cheese poisoning reported to the Michigan Board of Health. One physician reported the following symptoms: Every one who ate of the cheese was taken with vomiting; at first of a thin, watery, later a more consistent, reddish-colored substance, while at the same time the patient suffered from diarrhœa, and some complained of pain in the region of the stomach. At first the tongue was white, but later it became red and dry, the pulse was feeble and irregular. One small boy, whose condition seemed critical, was covered all over the body with bluish spots.

Samples of the cheese which proved poisonous in each of the three hundred cases were sent to Dr. Voughan for analysis, and he reported thereon as follows:

"At first I made an alcoholic extract of the cheese. After the alcohol was evaporated in vacuo at a low temper ture, a residue consisting mainly of fatty acids remained. I ate a small bit of the residue, and found that it produced dryness of the throat, nausea, vomiting, and diarrhœa. The mass of this extract consisted of fats and fatty acids, and for some weeks I endeavored to extract the poison from these fats; but all attempts were unsuccessful. I then made an aqueous extract of the cheese, filtered this, and drinking some of it, found that it also was poisonous. But after evaporating the aqueous extract to dryness on the water bath at 100°, the residue thus obtained was not poisonous. From this I ascertained that the poison was decomposed or volatilized at or below the boiling point of water. I then tried distillation at a low temperature, but by this the poison seemed to be decomposed. Finally, I made the clear filtered aqueous extract, which was highly acid, alkaline with sodium hydrate, agitated this with ether, removed the ether, and allowed it to evaporate spontaneously. The residue was highly poisonous. By resolution in water and extraction with ether, the poison was separated from foreign substances. As the ether took up some water, the residue consisted of an aqueous solution of the poison. After this was allowed to stand for some hours in vacuo over sulphuric acid, the poison separated in needle-shaped crystals. Ordinarily, the microscope was necessary to detect the crystalline shape. From sixteen kilogrammes of one cheese I obtained about 0·5 gramme of the poison, and in this case the individual crystals were plainly visible to the unaided eye." To this ptomaine Dr. Voughan has given the name tyrotoxicon, or cheese poison.

On August 7, 1886, twenty persons at one of the hotels at Long Branch were taken ill soon after supper, and at another house nineteen other persons were affected with the same form of sickness, the symptoms being similar to those which appear where there is poisoning from tyrotoxicon. While an investigation into the causes of their sickness was going on, thirty persons at another hotel were affected with precisely the same symptoms. A thorough examination of the cooking utensils was made, because unclean copper vessels have caused irritant poisoning. Lobsters, crabs, bluefish, and Spanish mackerel have, at times, and with certain persons, produced toxic symptoms, but no evidence of poisoning was found in any of these. It was finally ascertained that all who drank milk were taken ill, and those who had not partaken of it escaped, and it was decided that the milk had caused the trouble. It was found upon the further prosecution of the inquiry that one dealer supplied all the hotels where the sickness occurred, and a thorough investigation was then made of the cattle and the farms where they were fed, but everything, so far as the feeding and the condition of the animals was concerned, was found to be satisfactory, but it was also ascertained that the cows were milked at the unusual hours of noon and midnight.

The noon milking was placed in cans while it was still warm, and then carted eight miles during the warmest part of the day in a very hot month. Chemical treatment of a sample of the milk which had caused the sickness produced a mass of needle-shaped crystals. A portion of these crystals was mixed with milk and fed to a cat, when in course of half an hour the animal was seized with retching and vomiting, and was soon in a condition of collapse, from which, however, it recovered in a few hours. Drs. Newton and Wallace, who had charge of this investigation, in summing up the results of their investigations, said: "We are justified in assuming, after weighing well all the facts ascertained in the investigation, that the sickness at Long Branch was caused by poisonous milk, and that the toxic material was tyrotoxicon."

Another remarkable case of milk poisoning, which was traced directly to tyrotoxicon, was that of a farmer and his family living at Milan, Michigan. The head of the house, a man of about fifty years, was first affected with severe vomiting and other symptoms similar to those previously described. A few days after this the son, who was eighteen years of age, strong and vigorous, was taken down with the same symptoms, and then the mother and a daughter sixteen years of age were similarly affected, and these comprised the entire household. The mother and the son were taken on Thursday, and they both died on the following Monday. The daughter became sick on Friday and died the following Thursday.

Dr. Voughan personally visited the afflicted ones, and he and Dr. Novy investigated the cause of the poisoning. The family was neat and tidy in their habits, but the house in which they lived was old and very much decayed. They had been troubled now and then with nausea and vomiting, followed by prostration, but these symptoms had not been sufficiently severe to cause them to summon a physician. Before this family had moved to the farm, the house had been known among the neighbors as an unhealthy one, and there had been much sickness and a number of deaths among its former tenants. The house was frame, consisting of two rooms on the ground floor, with attic above. The frame rested upon four large logs lying directly on the ground, and these were thoroughly rotten. There was no cellar. The floor was of unjointed boards, and every time the floor was swept, the dirt sifted through upon the ground; and when it was scoured or mopped, the water and filth ran through the crevices, and thus the conditions most favorable to putrefaction were brought into existence and maintained. A corner of one of the rooms had been partitioned off as a buttery, and here the food was kept.

The original floor had rotted away, and a second layer of boards had been put down without removing the old ones. Between these two floors was found a mass of decomposing matter, which gave forth a peculiar nauseating odor, sufficient to cause nausea and vomiting in one of the persons engaged in the examination. The family lived very simply, and had eaten no canned foods for months. During the week in which the sickness occurred they had eaten bacon, and this was examined and found in perfect condition, and the drinking water was also found to be pure. The greater part of the milk produced on the farm was correctly treated to remove the animal heat. The milk which the family used, however, was kept in the buttery previously described, and the family were in the habit of drinking it between meals. The father stated that he frequently noticed that the taste of the milk was not pleasant. Dr. Voughan ordered some pure milk to be placed in this buttery over night and then examined it. In this milk he found tyrotoxicon, not only by the employment of chemical tests, but by poisoning a kitten with it.

The similarity shown in these cases scarcely needs to be pointed out, while the necessity of a more thorough understanding of the chemistry of putrefaction and of the liability which exists of poisons being generated in articles of food by decomposing matter, or by other unfavorable conditions, must be equally apparent.

Dynamic Power of the Sea.

From experiments at Bell Rock and Skerryvole lighthouse, on the coast of Scotland, it is found that while the force of the breakers on the side of the German Ocean may be taken at about a ton and a half to every square foot of exposed surface, the Atlantic side throws breakers with double that force, or three tons to the square foot; thus a surface of only two square yards sustains a blow from a heavy Atlantic breaker equal to fifty-four tons. In March of this year a heavy gale blew for three days and nights at Skerryvole, washing out blocks of limestone and granite of three and five tons weight as easily as if they had been empty egg shells. One block of limestone, estimated to be of fifteen tons weight, was moved over one hundred and fifty feet from a place in the surf where it had been firmly grounded since 1697, it having first been rolled in sight by the awful gale of the "windy Christmas" of that year. This is quite a high sea record for 1890, showing that the gale of March 3d was the worst known on the Scottish coast for 193 years.

A SWINGING HYDRAULIC CAPSTAN.

We have already described the electric capstan devised by the Railway Company of the North, for the maneuvering of locomotives and cars at stations. Its essential principle, which is the transmission of electric energy to a distance, merits attention and constitutes a genuine progress. It would, nevertheless, be absurd to consider it as a final solution of the question, for the moment at least, by very reason of the special expense that at present attends the production of electric energy. In many cases, when we have a natural hydraulic power at disposal, or when we have a mechanism at hand that permits of accumulating and storing an excess of power, we shall still have recourse, with advantage, to the use of the transmission of hydraulic energy, the well elaborated elements of which have, on their side, reached true perfection.

Armstrong was the first (as long ago as 1853) to point out the utility that the use of water under pressure might present for loading and unloading, and for industrial purposes; and he made an application of it which has remained classic. The improvements introduced into the three-cylinder Brotherhood engine greatly extended this principle; but it was soon found that there was one drawback to the use of it, and that was losses of head and leakages in the conduit that carried the liquid, and it is to this inconvenience that must be attributed the relative slowness with which so practical a means of action has been developed.

But this has been remedied, let us hasten to say, and in recent years, while waiting for electricity to have its final word, models of hydraulic apparatus of great perfection have been combined. We observed some interesting examples of these at the exposition of 1889, and, in order to complete the series of apparatus of this kind that we have already described, we shall give a short description of the swinging hydraulic capstan of Fives-Lille, which completely solves the hydraulic problem.

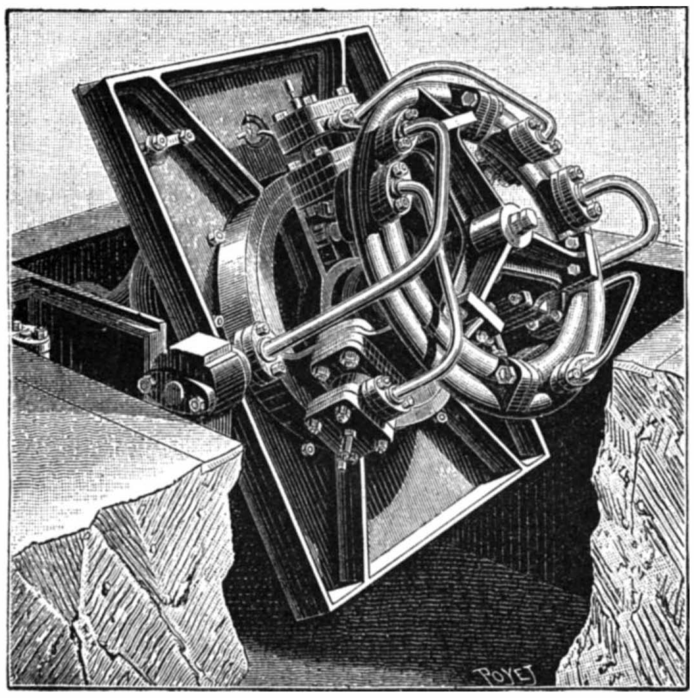
Our engraving will help to make it understood. This capstan, which was elaborated in 1884 by the Fives-Lille Company, in view of the application of hydraulic maneuvers to the apparatus of ports and railway stations, has received two important applications, one at the establishment of coaches at the Saint Lazare station, and the other for the service of the wharves of the port of Marseilles.

It is formed of two parts, which are distinct, but interdependent; one of them, above ground, constituting the drum around which the maneuvering rope winds, and the other, in a pit, containing all the mechanism and covered with a cast iron plate established flush with the surface and serving as a frame in common. The plate is capable of revolving on two journals through which the motive water enters and makes its exit, so that it may be made to turn upside down when it is desired to inspect the mechanism, or can even be used while it is thus reversed. In the old systems, on the contrary, the inspection of the mechanism placed in a pit underground and permanently fixed, was a most difficult matter. The motive cylinders in this apparatus are stationary and simple acting. They are situated in three different planes of action, and each is supported by a sort of vertical bracket cast in a piece with the central support of the driving shaft.

This arrangement presents the advantage of leaving between the cylinders free spaces, through which the mechanism can be easily got at. Moreover, the distributing valves of the water under pressure move flat, and each is balanced by a small compensating piston, which reduces the friction and diminishes the wear.

In order to set the capstan in operation, it suffices to press with the foot, a pedal that projects from the support, alongside of the drum. This pedal opens a valve which controls the entrance of the water under pressure, and the capstan is set in motion with the precision of a large piece of clockwork, of which, in reality, it has all the finish, despite its weight and power.

Hydraulic capstans will assuredly always remain one of the primordial loading and unloading apparatus of the wharves of our seaports; but for the service of railway stations we must expect to see the disappearance from them, in certain cases, of the external part around which winds the rope serving to give a rotary motion to locomotives and cars. It has been found, in fact, that it is no more difficult and that it is more practical to give turntables this rotary motion directly, as soon as the car or locomotive is placed upon them. This modification, or rather this simplification, is under study with several of our large companies. As for the maneuver by rope, that will be reserved for pulling single or coupled cars upon sections of track for the purpose of making up trains.—*La Nature.*



SWINGING HYDRAULIC CAPSTAN.

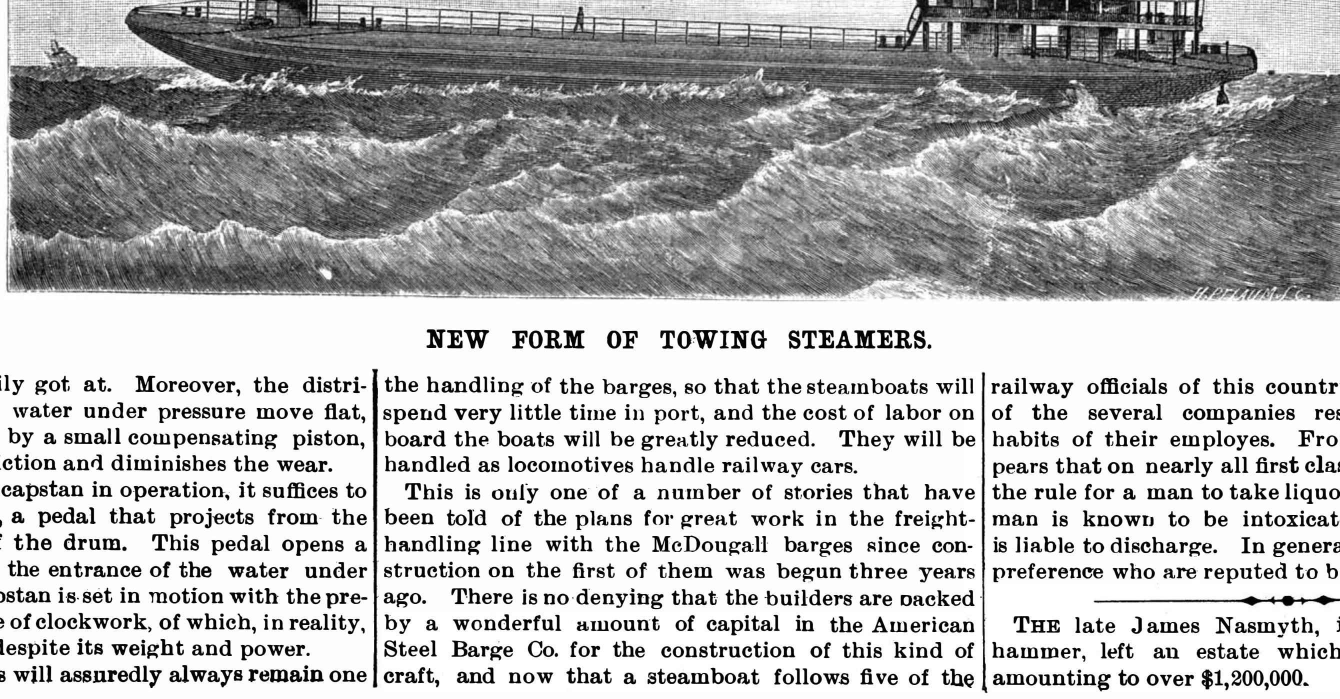
NEW FORM OF TOWING STEAMERS.

We illustrate herewith the first steamboat built by the American Steel Barge Co., of West Superior, after Capt. Alex. McDougall's model for whale-shaped freight carriers. It is with this class of steamboats—if all that has been said of the queer-shaped craft can be believed—that Capt. McDougall proposes to handle one hundred of the tow barges in the coal and iron trade. When one hundred, or even a smaller number, of the tow barges have been turned out of the West Superior ship yards, slips will be provided for them at both ends of the route. The steamboat coming down the lakes will bring a tow of the barges laden with ore, and, returning immediately, will use the same crews with another tow of the barges, light or loaded with coal, as occasion may require. The slips will facilitate the handling of the barges, so that the steamboats will spend very little time in port, and the cost of labor on board the boats will be greatly reduced. They will be handled as locomotives handle railway cars.

This is only one of a number of stories that have been told of the plans for great work in the freight-handling line with the McDougall barges since construction on the first of them was begun three years ago. There is no denying that the builders are backed by a wonderful amount of capital in the American Steel Barge Co. for the construction of this kind of craft, and now that a steamboat follows five of the tow barges already in commission, and making money for their owners, additional interest is attached to the strange fleet in the lake marine and the bearing it may have on the cost of carrying bulk freight. Not a few of the owners of the lake floating property are of the opinion that the barges will carry ore and coal with profit at low rates, on account of the cheapness of the construction, but the shipbuilders who go on building costly steel and wooden ships for iron mining companies and individual capitalists point to the care with which the few whale-shaped barges have been handled in mild weather, some of them declaring at the same time that they will build the new style of cheap boats for any one who may want them, when business in the old line gets slack, irrespective of any of the patents which Capt. McDougall claims. They say that there can be no patent on such a craft, and hint that the builders of them have taken their plans from the models of the general style of lake boats.

In the steamboat—Colgate Hoyt is her name—Capt. McDougall has, however, presented a craft that shows improvement over the tow barges. The *Marine Review*, to which we are indebted for the accompanying cut and description, sent a representative to Duluth, Mr. Sprague, to prepare the drawing of her which accompanies this paper, and it is the first in print. The principal changes will be noticed in the house arrangements above deck. The hull is the same as the tow barges, excepting in the run aft, which is more steamship-like. It is claimed for her that she will carry about 2,600 net tons on 15 feet of water, and that with this draught her cabin deck will be 15 feet above water. She is 280 feet over all, 36 feet beam, and 22 feet moulded depth, and has Hodge engines and aft compound engines, with cylinders 26 and 50 inches by 42 inch stroke. The boilers, built by the Lake Erie Boiler Works, of Buffalo, are 11½ feet long, allowed 150 pounds to the square inch.

The quarters for officers and crew are far better than might be expected, and are in many respects equal to anything on the lakes. The cabin rests on three turrets, supported on the sides by twelve ventilation pipes. Four of these ventilate the engine room, four perform the same duty for the fire hold, and four the cargo hold. The captain and officers will all have spacious quarters in the cabin above deck, which also contains a dining room. The different rooms are finished in oak and elegantly furnished. The wheelmen, firemen, and other members of the crew have quarters below deck, forward and aft, and the engine room is large and well lighted. In the turret forward is one of the American Ship Windlass Co.'s steam windlasses, with the capstan above. She has hand steering gear, with the shaft and hub of the steering wheel of brass, to avoid affecting the compass. On the port side of the cabin forward, just aft of the pilot house, there is also a chart room and office combined. Capt Ed. Morton, of the Wilson fleet, will accompany Capt. C. H. Beach, who will be in command of the new boat, for one or two trips, and both masters declare she will show a surprising speed. She will have a Hodge wheel of coarse lead. The Colgate Hoyt may be expected down the river in a few days.—*Iron Trade Review* (*Cleveland, O.*)



NEW FORM OF TOWING STEAMERS.

A RECENT number of the New York *Independent* contains letters from a large number of the most prominent railway officials of this country describing the rules of the several companies respecting the drinking habits of their employes. From these letters it appears that on nearly all first class railways it is against the rule for a man to take liquor while on duty. If a man is known to be intoxicated when off duty, he is liable to discharge. In general those men have the preference who are reputed to be non-drinkers.

THE late James Nasmyth, inventor of the steam hammer, left an estate which has been sworn as amounting to over $1,200,000.

THE KOLA NUT.

BY NICOLAS PIKE.

Mankind through all time has sought for stimulants, but what were used in earlier ages we know only from very meager records, outside of wine and fermented drinks. It is quite certain that the aborigines of all nations were aware of the medicinal and stimulant properties of most of the plants in their vicinity. It would make an interesting book to describe all the plants used thus by various nations. Though doubtless many would be rejected, some might benefit the present generation, and be simpler and more efficacious than the deadly drugs so constantly prescribed. Nature often provides us with remedies at our doors better than those we seek with so much trouble far and wide. The one I am about to write of is well known, probably has been for centuries to many colored nations, but not much outside of them, though, from the attention it is beginning to excite among medical scientists, it may possibly play a more important part in future among the white races of the earth.

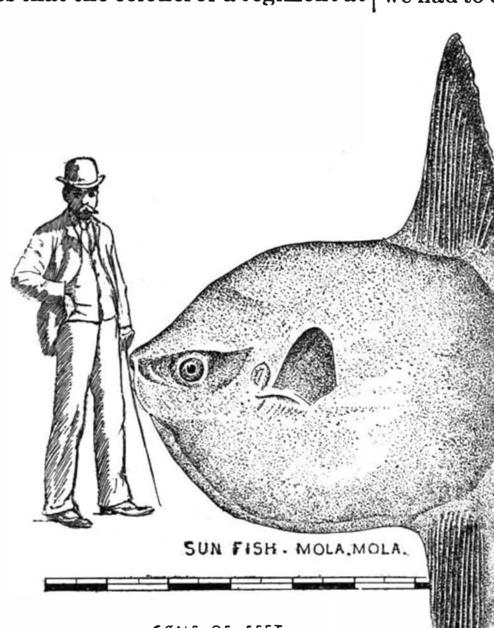
The kola or cola is a large tree, native principally of Guinea, the Soudan, Mozambique, Abyssinia, and various regions in India. It is a *Sterculia*, and the seeds of two species, the *acuminata* and *tomentosa*, go by the name of kola nuts. There are two trees in the Brazils with fruit of the same name, the *S. chica* and *S. lasiantha*. The Asiatic ones are of several species, but I only know of the *S. nobilis*.

The whole family of the *Sterculiads* contain much mucilage, and many of the trees and plants are very valuable, the leaves, bark, fruit, and seeds being used as medicinal agents in different parts of the world. All contain a fixed oil which can be burned in lamps. The fibers of some are made into cordage, and others serve in the weaving of cloth. There is only one I know of in North America, the *S. platanifolia*, introduced into the Southern States from China and Japan. In the Soudan the name kola changes to *jaru*.

The nuts are very extensively used and very highly valued by various African tribes, who chew them for their agreeable effect on the system, their peculiar properties in causing wakefulness and their general stimulating results. They are said to contain no tannin, and in this respect differ from caffeine. In form they are rounded, compressed, somewhat resembling the European chestnut, and of a bitter taste.

It is affirmed that the kola has the power of arousing persons from their maudlin and idiotic condition when suffering from intemperance, and is used by the natives of Mozambique to cure drunkenness. (Pity it could not be applied here for the same purpose.)

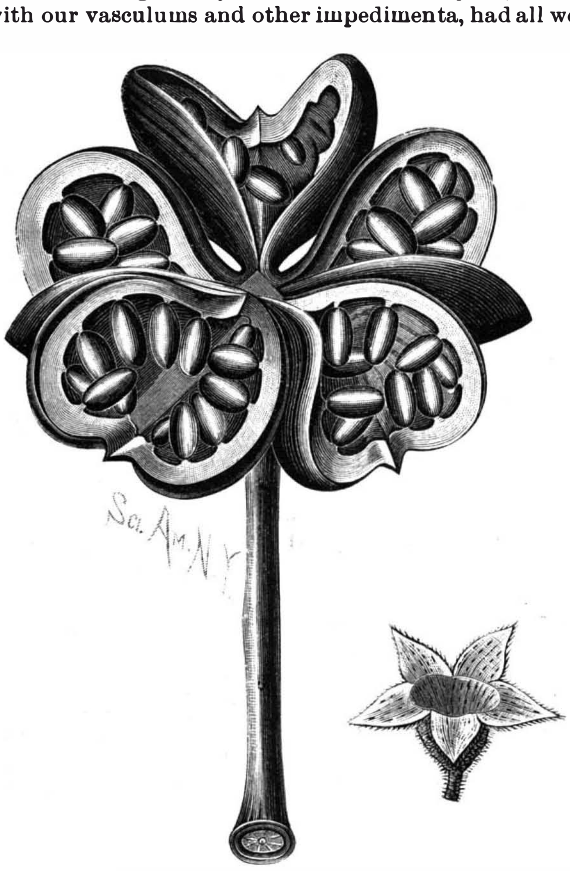
In many parts of Africa, where water is scarce and the supply is impure from any cause, the natives are said to purify it with kola. Some experiments have been made recently by scientists in the old world, and particularly by Professor Haeckel, of Marseilles, showing that the kola nut possesses extraordinary stimulating powers. He states that the colonel of a regiment at Perpignan dosed with kola made the ascent of the Canigou mountain, 9,137 feet, and felt quite fresh after his twelve hours' climb. He only halted once for twenty minutes, and ate nothing. The 124th French regiment, by means of kola, marched for fifteen and a half hours, from Laval to Rennes, a distance of forty-five miles, or at the rate of three and three-quarters of a mile an hour, and were fresh at the finish. Kola is said to have the same effect on horses.



Professor Haeckel urges the use of kola instead of caffeine for a muscle bracer. It is also stated that the members of a certain Alpine club who perform unusual mountaineering feats without experiencing any fatigue employ it in the preparation of their food. Possibly the members of all our athletic and baseball clubs might benefit by the use of the nut in their long and fatiguing sports. Many a good game has been lost from breaking down of the players when under unusual strain.

Surgeon Hamilton, R. N., appears to have found a use for the kola which, if it is really a fact, will prove a "boon and a blessing to man," and woman also. He says that he has tried it in cases of sea sickness, and in many instances there was complete relief from nausea in about 40 minutes from chewing 50 to 60 grains of kola seed, but it must be good and fresh. Is not this grand news for all those "who go down to the sea in ships," and who have to pay a severe penalty when they invade old Neptune's domains?

During my visit to the Seychelles Islands, when on an excursion to the Black Forest, in the island of Mahe, I had an opportunity of seeing the stimulating powers of kola tested. The Morne Blanc mountain is the highest in the island, and rises over 2,000 feet above sea level. This elevation is not great for a mountain climb, but the difficulties of the ascent made it equal to one of double the height. My Scotch friend and myself, laden with our vasculums and other impedimenta, had all we could do to surmount the obstacles in our way. It was steep and rugged for a good way up, but when we came to sheer masses of rock, often a hundred feet high, with only a foothold in the numerous interstices or up the crossed ropes of the great lianes that covered the bowlders, it was no easy matter. So many ferns and other rarities grew from every crevice, which we had to snatch at haphazard, and we were thoroughly exhausted when we reached the first plateau.



THE KOLA NUT.

Our three Mozambique men, each with a heavy load on his head, had still harder work than ours. Yet, strange to say, they climbed up like monkeys, and were not half so tired as we were. After leaving the tableland, we had to cut our way at every step through the jungle, with a tropical sun overhead, which made it terribly oppressive and fatiguing to us, but our men bore it well. We were so surprised that we questioned them about it. One of them spoke Portuguese fairly, so through him I could converse with all of them. They told us that the day before their departure they had prepared for the climb by having the whole body well rubbed with certain oils, and just before leaving had mixed kola seeds with their food. These men had been made slaves by the Arabs, and, after being put on board one of their dhows, they had been captured by a British man-of-war and landed at Mahe. They said the slave dealers gave the kola nuts to their prisoners on their long forced marches to the coast, as without them so many would succumb from cruel treatment and fatigue.

While making a tour round Mauritius with some friends, we encamped in a forest, at a distance of 16 miles from Port Louis. I had my photographic apparatus with me, which was carried on the head of an Indian servant. When I had finished with it I decided to send it back to Port Louis with other traps, before resuming our route. I packed the whole up as compactly as possible, but it weighed full 22 pounds. He took his rice and curry for supper, mixing a paste with it made from kola nuts, and started off at sunset with the package on his head and a stout staff in his hand. He arrived in Port Louis at midnight, after traversing a devious road of hill and dale and swampy land. He remained long enough in the city to procure a saddle and some other things for me, which took him about an hour, and he returned with them to our camp about five P. M., fresh and in good condition, and was quite willing to go back again if he got paid. He trotted most of the way, and the number of miles was not remarkable, but that it should have been traversed over rugged paths and with a heavy weight on the head.

The Brazilians eat the nuts of the chica, but if with the same results as from the kola nuts I do not know. The trees and fruit of the African and Asiatic sterculias greatly resemble the chica.*

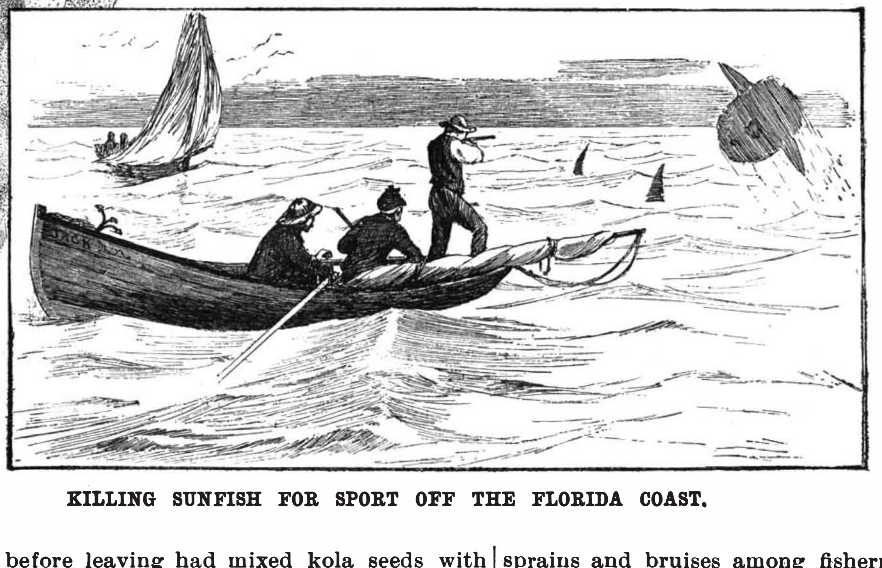
I will here say a few words on the areca nut, principally credited with being an intoxicant. The nuts are largely procured from the palm *Areca catechu*, and, when mixed with lime and enfolded in the leaves of the *Chavica betle or Piper betle*, are chewed by hundreds of thousands of both men and women. All the ingredients are said to be stomachic. They stimulate the salivary glands and digestive organs, and counteract the effect of the large amount of rice they eat. The Indians tell you it preserves the teeth and gums, though it is a disgusting sight when the chewing is going on, making the gums and lips appear to be bleeding. Physicians who have resided long in India say that in the damp, pestilent regions of that country, where the natives live on miserable food, the chewing is really conducive to health.

* The natives of Brazil call the nuts *balaughas*.

KILLING LARGE SUNFISH WITH FIREARMS.

Our illustration presents a spectacle sometimes seen at the present time along our southeastern seaboard. Since many parts of Florida and other sections of the South have become popular as resorts for pleasure seekers during the more inclement portions of the year, the fishing in the harbors and off the coast has received a degree of attention formerly unknown, tarpon fishing, particularly, having become quite an object with sportsmen. It is a long distance, however, from the virile and game tarpon, sometimes called the "silver king," and weighing up to nearly 150 pounds, to the sluggish, clumsy, and ungainly sunfish, shown herewith, notwithstanding the great size of the latter.

As represented, the sunfish has the appearance of being tailless, due to the extreme shortening of the tail, which is supported by only a few short vertebræ, and reduced to a broad fringe of the trunk. Directly in front of it rise dorsal and anal fins, high and broad, and nearly triangular in form. The head is completely merged in the trunk, the boundary between them being indicated only by a small and narrow gill opening and a comparatively small pectoral fin. The mouth is small, and the teeth adapted for bruising sea weeds and soft-bodied animals. The fish propagates its species in the open sea, and only occasionally approaches the coast, living at some depth in the stormy season, but in calm, bright weather rising and resting on the surface, with its dorsal fin high above the water. It is this habit which is said to have given the fish its name. It is sluggish in its motions, and is often seen asleep at the surface of the water.



KILLING SUNFISH FOR SPORT OFF THE FLORIDA COAST.

The usual size of the sunfish is from three to five feet in length, though many exceed seven feet long, with a weight of nearly a thousand pounds. The flesh is tough and very elastic, unfit for eating, while the liver is very fat, its oil being sometimes used for lubricating purposes on board ship, and for sprains and bruises among fishermen. In color, the fish is grayish above and whitish below, with a silvery luster when alive, and phosphorescent at night. In some seasons it is frequently seen in Massachusetts and New York bays. It is said there is probably no other fish more infected by parasites, internally and externally.

ENGINE POUNDING—WAYS OF STOPPING IT.

An engineer in charge of a smoothly running engine shows it with pride; but if, on the other hand, his engine *pounds*, he is humiliated and feels like apologizing for the disorder, when, perhaps, it has pestered him from the start. That monotonous thud is always in his ears. He goes to the crank, and it is there; and when at the cylinder, it is there. It can only be silenced by making the boxes so tight that they become heated. The remedy is worse than the disease; so they are slackened again, the pounding goes on, and at times becomes almost unbearable. It is known that such imperfections are caused either by poor work in the shop or by imperfect alignment, and sometimes both; in which case the trouble may be regarded as chronic, and an overhauling in the shop is required. The work involved in dismantling and lining up is such as to discourage this undertaking. There are tests which do not require much time or labor and serve well to detect imperfect alignment, as well as bad workmanship, and will show up imperfections that a line will not. A description of these may be of interest to some. The accuracy of the results will largely depend on the proper fitting of the connecting rod and correct boring of the boxes.

In Fig. 1 is shown a simple device for proving this work. A square block of wood is turned at one end to fit the wrist pin boxes. The other end is made to fit the crosshead, as shown at A. The square shoulders are to rest against these boxes. A strip of wood, B, is made to reach the point, C, when bolted to the block as shown. The point at C is brought within the thickness of paper of the side of the rod. The block is then withdrawn and introduced into the opposite side of box, care being taken not to derange the strip, B. When the block is thrust to its shoulder, the point, C', should be the same distance from the rod as at C, provided the flanges of box, O, are of equal thickness. Allowance must be made at C C' for any difference that may exist, as, for instance, if the point at C should stand off an eighth of an inch and the box flange at O be found as much thicker on this side, the boring of box, O, is evidently correct. The same process is employed to test the box, E. It will be seen that any deviation from a true right angle in the boring of these will be increased at the point, C, in the ratio that the width of box bears to the length of rod. Assuming the rod to be correct, it is connected with the crosshead and keyed some tighter than when in use. The engine being horizontal, the crank end of rod is brought to center of the main shaft and raised to the wrist pin at the upper half stroke. It should here be in position to go on the wrist without forcing laterally in either direction, and the same when lowered to the lower half-stroke position. If it should bear off in one direction above and in the other below, it is evident that either the shaft or crosshead wrist is not level. This correction may be made without reference to a level, judgment dictating where the change can best be made. If the wrist box should require forcing toward the main shaft, both above and below, it is plain the wrist of crosshead is not square with the slides, or the hub of crank is too short. A subsequent test will indicate which is wrong. The rod may now be supported in a horizontal position, and the crosshead with rod attached moved from one extreme of slides to the other, noting if the wrist boxes bear the same relation to the wrist of crank at the two dead centers. Any discrepancy here will indicate that the main shaft is not square, or not at a right angle with the slides. By adjustment of the shaft and repeated trials, a good degree of accuracy may be secured in this way; but care must be taken to see that the rod has no lateral movement.

The next and last test is to disconnect the rod from the crosshead and connect it to the wrist pin, keying so as to prevent lateral movement and yet allow the wrist pin to turn. Support the rod above the crosshead so it may be free to move horizontally. Revolve the crank slowly, at the same time keeping the crosshead wrist exactly under the rod box. If all is right, the box should be in position to freely drop on the wrist at any point. This verifies the accuracy of the previous test. But if continually on the crank side of crosshead, and requiring about the same amount of forcing to bring it to the wrist pin that it did at the other end in the former example, it is evident the hub of crank is too short, or in other words, the center of wrist in crank is too near the main shaft, and the wrist in crosshead is not out of square, as the former test might indicate. Should the end of rod vibrate from side to side as it moves from end to end of slides, it shows one of two things—either the shaft is not squarely placed, or the wrist pin in crank has been improperly set, thus causing the rod to wobble. This latter defect is a serious one, and invariably causes pounding if it exists to any considerable degree. It may be a matter of surprise to those making such tests, to find how seldom the machinist reaches perfection in such work.

The above methods are doubtless open to criticism, but at the same time they possess merit in being able to detect defects that cannot be reached with a line or level.

W. A. L. KIRK.

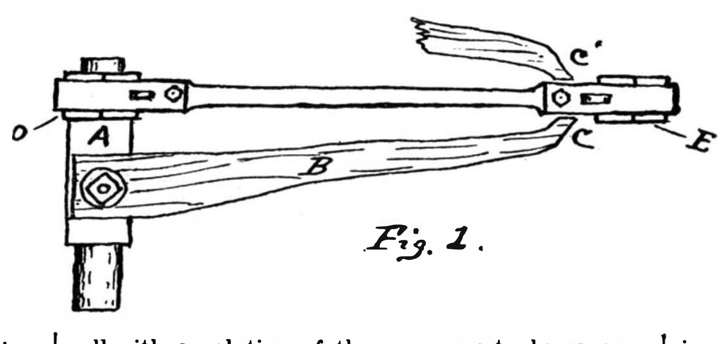


Fig. 1.

Photographing upon Wood.

The Magazinist, The Century, Harper's and other popular monthlies use "process" engravings more and more. Photography on wood is their mainstay, and has almost superseded the draughtsman on wood. A sketch, say a dozen times as large as the proposed engraving, is made, reduced by photography, and then put upon the wood.

Photographing on wood by the wet plate process is done thus: A slight modification of the collodion transfer will no doubt meet all requirements. First make a reversed collodion transparency in the camera from the negative. A tough and horny collodion should be used. Develop with—

Pyrogallic acid	100 grains.
Citric acid	60 "
Acetic acid	2 ounces.
Water	20 "

and fix in hyposulphite of soda. Coat the wood with the following hot solution of gelatine:

Gelatine	4 ounces.
Water	1 pint.

Dissolve the gelatine by placing in a vessel of warm water, and then add 4 grains of chrome alum and mix thoroughly. The wood, having been coated, is allowed to dry. The gelatine surface is then moistened with water for ten or fifteen minutes, and the transparency, still wet from the washing water, is laid down upon it and pressed lightly in contact, and allowed to dry under slight pressure. When dry, the collodion readily leaves the glass, and remains in contact with the block.

Here are some further points: The plate is cleaned as usual, and dusted with powdered talc and polished off. It is then coated with positive collodion, sensitized, and exposed as usual, fixed with cyanide of potassium, and placed in a dish of warm water. In the meantime, have your block blackened by rubbing drop black on it, or ordinary blacking, and coat and drain well with a solution of the commonest glue you can get, 1 ounce to 12 ounces of hot water. The common glues are the best, for they take a much longer time to set than better ones, and so you can get a much thinner coat with draining. Place your block in a vessel of water, having it immersed about three inches, then bring your photo. from the dish, place it over the block, and under the water. You will find by touching the edges of the film it will readily leave the glass. You can then turn it about any way under the water, and when in position raise your block gently out of the water, bringing the film with it; if it is puckered at all, it is owing to raising too roughly, and must be placed in the water again. If satisfactory, place at an angle to drain, and dry in warm, airy place. The whole operation, from focusing to getting the block ready for drying, will not take a practiced hand more than twenty minutes. The common glue will not block the tool at all if you drain the block well, and when cut all can be removed immediately with a sponge and warm water. I may add that a very good way to black the block is to hold it over a petroleum lamp with its chimney removed. The glue water will not come off it if applied in the same manner as applying varnish to a negative, and under no circumstances be induced to use a black varnish, for it is next to impossible to do a good job, for the graver slips as if it were cutting on glass.—*Wilson's Photographic Magazine.*

Lamp Accidents.

Some people have the notion that any coal oil lamp is safe, provided the best quality of oil is used. A very large proportion of our population must use kerosene lamps, and they must have cheap oil. It is among such people that lamp accidents are most common, and many a life is lost. Happily, humanity has little regard for station when life is concerned, and the government department of explosives exists for eminently humane reasons; hence the institution of an inquiry by Sir F. Abel and Mr. Boverton Redwood on the subject of accidents with mineral oil lamps, which has just been concluded, and upon which Colonel Majendie has submitted a report to the Home Secretary. This does not altogether substantiate the theory that cheap oil is to have all the blame.

The investigation is a continuation of one which the same chemists made in 1885, and which resulted in a number of suggestions that have benefited the public not a little. All lamp accidents are not due to explosions in the lamp; but those which are, comprise the largest number, and it was as to the cause of these that Sir F. Abel and Mr. Redwood directed their attention. Their experiments have resulted in the enumeration of several causes, which we give briefly:

1. Rapidly carrying or moving a lamp, so as to agitate the oil, causes a mixture of vapor and air to make its escape from the lamp in close proximity to the flame, and, by becoming ignited, determines the explosion of the mixture existing in the reservoir.

2. Existence of an imperfectly closed filling aperture in the lamp reservoir favors explosion, owing to a vapor and air mixture being formed.

3. A sudden cooling of the lamp, owing to exposure to a draught, may give rise to an inrush of air, whereby the air space in the reservoir is charged with a highly explosive mixture, and the flame of the lamp may at the same time be forced into the air space. Blowing down the chimney to extinguish the lamp has the same effect; and if the wick be lowered very much, or the flame is otherwise much reduced in size, the lamp may become much heated, and its susceptibility to the effects described will be increased. Explosion in these cases is favored by the air passages being obstructed by dirt or charred wick; by the wick not being long enough to reach the bottom of the oil reservoir, and if the lamp is allowed to burn until the surface of the oil is scarcely level with the end of the wick.

4. The accidental dropping of the burning wick into the oil reservoir is a fruitful source of explosions.

5. If the flashing point of the oil used be just near the legal minimum, vapor is given off comparatively freely, but the mixture of vapor and air in the reservoir will probably be feebly explosive in consequence of the presence of an excess of the vapor; but if the flashing point of the oil be comparatively high, the vapor will be less readily or copiously produced, and the vaporous mixture be more violently explosive. The effects are more violent if the quantity of oil in the lamp is small, and oil of high flashing point is more likely to cause heating of the lamp than one of low flashing point, in consequence of the higher temperature developed by the former and of the greater difficulty with which some oils of that description are conveyed to the flame by the wick. It therefore follows that safety in the use of mineral oil lamps is not to be secured simply by the employment of oils of high flashing point.

Sir F. Abel and Mr. Redwood state that a loosely plaited wick of long staple cotton draws up the oil freely and regularly, and is altogether better and safer than a tightly plaited wick, and their experiments lead them to the conclusion that a lamp explosion is not usually sufficiently violent to cause the fracture of an ordinary glass reservoir, although in several recorded cases it has had this effect. They give a table of particulars of the cases of accident which they have investigated, and a long statement of the principles of construction which should be adopted to prevent accidents.

Crocodile Nests and Eggs.

Some habits of crocodiles have been lately described by M. Voeltzkow. Traveling in Wituland, he obtained in January last 79 new-laid eggs of the animal, from a nest which was five or six paces from the bank of the Wagogona, a tributary of the Ooi. The spot had been cleared of plants in a circle of about six paces diameter, apparently by the crocodile having wheeled round several times. Here and there a few branches had been laid, but there was no nest building proper. The so-called nest lay almost quite open to the sun (only a couple of poor bushes at one part). The eggs lay in four pits, dug in the hard, dry ground, about two feet obliquely down. Including eggs broken in digging out, the total seems to have been 85 to 90. According to the natives, the crocodile, having selected and prepared a spot, makes a pit in it that day, and lays about 20 to 25 eggs in it, which it covers with earth. Next day it makes a second pit, and so on. From the commencement it remains in the nest, and it sleeps there till the hatching of the young, which appear in about two months, when the heavy rain period sets in. The egg laying occurs only once in the year, about the end of January or beginning of February. The animal which M. Voeltzkow disturbed, and saw drop into the water, seemed to be the *Crocodilus vulgaris*, so common in East Africa.

The Fastest Boat in the World.

The torpedo boat Adler, constructed in Germany for the Russian Black Sea fleet, is described by the Russian papers as the fastest war vessel afloat, having attained during its trial trip a speed of 26·55 knots. The boat is 150 feet long and 17 feet broad, with a displacement of 150 tons. Three gunboats, one of which—the Narghen—is finished, are being constructed in German shipyards for the Baltic fleet, and these will be almost as fast steamers as the Adler.

THE SCIENTIFIC USE OF COMMON THINGS.

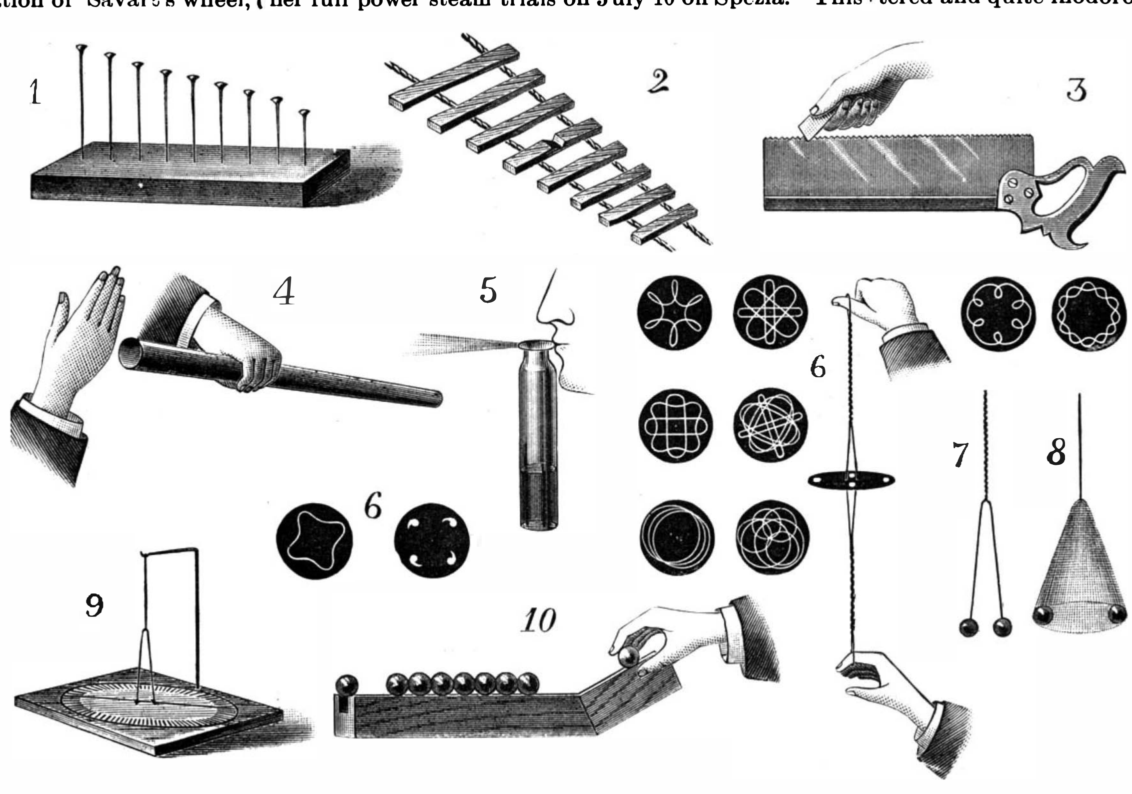
Some time since, the relationship of toys and science was treated in this journal. It is possible to go still further in the same direction. Scientific facts and principles may often be illustrated by means of common things, such as may be met with in everyday life.

Pins, needles, sticks, straws, bullets, bottles, hair pins, rubber bands, marbles, are among the things available for experimental purposes. Even a hand saw may be pressed into the service of scientific illustration.

The first figure of the engraving illustrates a piece of apparatus which is doubtless better known to the school boy than the professor. The writer's attention was first called to this instrument by a professor of physics who confiscated it from a student and used it in a lecture as an illustration. It consi sts of a board into which are driven eight common pins which are allowed to project different lengths, thus forming a musical instrument which may be played by plucking the heads of the pins. The instrument is tuned by driving the pins into the board more or less. In this experiment it is shown that there exists a certain relation between the length of the vibrating pin and the pitch of the sound it produces. In Fig. 2 is shown a zylophone, a musical instrument formed of bars of wood of different lengths and thicknesses. The particular instrument here illustrated was made of a piece of a pine box cover split up in a haphazard way and tuned by shortening to increase the pitch and reducing in thickness or notching at the center to lower its pitch. The bars are supported by a loosely twisted cord. The sound is produced by striking the bars at their mid-length with small mallets.

In Fig. 3 is shown a modification of Savart's wheel, which is in reality no wheel at all, but the effects secured are substantially the same. By drawing the edge of a card slowly along the cutting edge of a fine saw, regular taps are produced, which do not form a musical sound; but when the card is drawn along quickly, the taps are made with sufficient frequency to produce a sound, the pitch of which will vary, of course, with the rapidity of the movement of the card.

In Fig. 4 is illustrated an experiment with a paper tube, illustrating the closed and open organ pipe. When the end of the tube is struck smartly with the palm of the hand, if the hand is allowed to remain in contact with the end of the tube, the air in the tube will be set in vibration, and a tone will be produced which is due to a closed pipe of that length. If, however, the hand is instantly removed from the tube after the blow, two notes will be heard, one due to the closed pipe, the other to the open pipe, and the latter will be an octave higher than the first.



SCIENTIFIC USE OF COMMON THINGS.

In Fig. 5 is an experiment with a vial, which is made to answer as a closed pipe, the length of which is varied by pouring in water. By blowing across the mouth of the vial, a sound will be produced which varies in pitch with the length of the air space above the water. By closing the mouth of the vial more or less by the under lip, it is found that this also changes the pitch; the smaller the opening of the mouth of the vial, the lower the pitch.

In Fig. 6 is shown a toy which is interesting on account of the great variety of intricate figures it can produce. It consists of a disk of black cardboard, having two holes near and on opposite sides of the center, an elastic cord inserted in these holes, and four paper fasteners or bright brass nails inserted in the disk at four points equally distant from the center of the disk and from each other. This toy is used in the same manner as the well known buzz, by twisting the cord and drawing upon it, and while the disk revolves, first in one direction and then in the other, the cord is made to vibrate laterally. Some of the figures which may be produced in this way are shown in the engraving. These effects are due to persistence of vision.

In Figs. 7 and 8 is shown a simple device for illustrating centrifugal force. Two bullets split to the center are closed together upon the ends of an ordinary hairpin, and the latter is suspended by a small rubber band. The band is twisted and then allowed to untwist, thus imparting a rapid rotary motion to the hairpin, which causes the bullets to fly out by centrifugal force as shown in Fig. 8. The momentum acquired by the bullets during the untwisting of the rubber band twists the band in the opposite direction, so that when it untwists again, the apparatus will rotate in the opposite direction. This operation will continue for a considerable time.

In the apparatus shown in Fig. 9, hairpins are again pressed into service. One is opened out at a right angle, forming a standard; another is bent up at the ends, forming a double hook. The standard is inserted in a baseboard provided with a graduated circle. The double hook is suspended from the standard by a short piece of twisted catgut cord, and in the double hook is placed a small knitting needle to serve as an index. This forms a hygroscope, which is quite sensitive to atmospheric moisture. By substituting a filament of silk or a fine hair for the catgut cord, the double hook may be used for supporting a straw to show electrical attraction and repulsion, a stick of sealing wax or a glass rod being used to produce the electricity.

The apparatus illustrated by Fig. 10 shows the elasticity of solids. Two pieces of "matched stuff" are mitered together, as shown, to form an inclined plane and a guide for marbles or lead bullets. A number of marbles are placed in the groove in the horizontal guide and another marble is allowed to roll down the inclined plane. The blow thus imparted to the first of the series of marbles is transmitted through the entire series to the last, which is thrown forward. This action is due to the compression of the marbles by the blow and their restitution by their own elasticity to their original form. When lead bullets are substituted for the marbles, the force of the blow is expended in permanently changing their form.

The Andrea Dorea.

The new Italian battleship Andrea Dorea underwent her full power steam trials on July 10 off Spezia. This vessel, the Ruggiero di Lauria, and the Francesco Morosini form a group very similar in design to the Admiral class of the British navy. They are of 11,000 tons displacement, 328 feet long, and 65 feet 4 inches beam. Their engines, 10,000 horse power, were intended to give them a maximum speed of 16 knots. The armament exceeds anything we have hitherto attempted, or are likely to attempt, consisting as it does of four 110 ton Elswick guns, mounted in two barbettes, two 6 inch quick-firing guns, and twelve machine guns. The machinery of the Andrea Dorea and the Ruggiero di Lauria is by Messrs. Maudslay, Sons & Field, Lambeth, and is of the three-cylinder inverted with triple expansion type, working twin screws, and fitted with Joy's patent valve gear. Steam is supplied by eight large double-ended boilers, arranged in close stokeholds. The Andrea Dorea left the Gulf of Spezia at 10 A. M. Everything worked well, and an air pressure in the stokeholds of only three-fourths inch was found quite sufficient to maintain the power required. The result of the day's run was a mean horse power of 10,500, and an average speed of 16·1 knots. The coal was unpicked and the stokers were Italian.

Precautions against Consumption.

In a circular on precautions against consumption, published by the State Board of Health of Pennsylvania, the following advice is given: "The duster, and especially that potent distributer of germs, the feather duster, should never be used in a room habitually occupied by a consumptive. The floor, woodwork, and furniture should be wiped with a damp cloth. The patient's clothing should be kept by itself, and thorough ly boiled when washed. It need hardly be said that the room should be ventilated as thoroughly as is consistent with the maintenance of a proper temperature."

The Human Subject Forty Years under Water.

A very interesting report has just been issued by Dr. Konig, "Gerichtsarzt" (judicial physician) of Hermannstadt, on the state in which the human subject, after forty years' immersion in water, may be found by the physiologist. In the revolutionary upheaval of 1849, a company of Honveds, as the Hungarian militia are called, having fallen in the vicissitudes of war, were consigned to the waters of the Echoschacht, a pool of considerable depth not far from Hermannstadt. After some forty-one years their bodies have been brought up again to the light of day, and subjected to a careful and minute investigation from the physiologist's point of view. Dr. Konig found them in perfect preservation, without a single trace of any decomposing process. Externally they had the appearance of having been kept in spirit, like so many preparations in an anatomical museum. The epidermis was of a whitish gray color, the muscles rose red, feeling to the touch like freshly slaughtered butcher's meat. All the inward parts—the lungs, the heart, the liver, the spleen, the kidneys, the bladder, the stomach, the alimentary canal—were of the consistence of those in a newly deceased corpse, while the brain was hard, of a dirty gray color, as if preserved in spirit. Structurally, the organs retained their outline perfectly, and were so easily recognizable in tissue as well as configuration that, according to Dr. Konig, they might have been exhibited for "demonstration" in an anatomical lecture room.

After forty-one years under water this is indeed a remarkable phenomenon. The large intestine contained fæces of a yellowish brown color, quite unaltered and quite inodorous, while the bladder was partially filled with straw-colored urine. But perhaps the most significant feature disclosed by these corpses is the following: In their interior abundant chloride of sodium, crystallized in cubes, had been deposited and fixed on the several tissues and organs, and these salts had not penetrated, mechanically, into the dead bodies from without. In the completely closed and perfectly unimpaired pericardium of the corpses on the inner pericardial aspect, and also on the outer surface of the heart itself, salt crystals of the same kind, to a weight of five grammes, were found adherent. This, according to Dr. Konig, clearly shows that, in the water, particles held in solution may pass through the skin and the muscles, and find their way into the most deeply seated organs. Herein, he adds, we have confirmatory proof, if such were needed, that the specific virtues of mineral baths exercise in this way their salutary effect on the internal economy of the invalid bather. There is a notable difference, however, between the time spent in the bath by an ordinary bather at a "Curort" and the forty-one years during which the Honveds remained under water. The phenomenal stillness of the Echoschacht may also have been a material factor in this impregnation of the corpses with chloride of sodium. But, with every allowance for such considerations, Dr. Konig has furnished a striking illustration of the permeability of the immersed human subject to salts in solution, and we hope his painstaking researches will lead to others in the same important direction.—*The Lancet.*

British Wrecks.

The number and tonnage of British vessels respecting whose loss reports were received at the Board of Trade during the month of July, and the number of lives lost, are as follows: Sailing, 45; tonnage, 6,048; lives lost, 53. Steam, 8; tonnage, 10,864; lives lost, 205. One hundred and thirty-three lives were lost in the Quetta and seventy-two in the Gulf of Aden. The above is a record of "reports received," and not of wrecks which occurred during the month. Casualties not resulting in total loss of vessels and the lives lost by such casualties are not included.

A DAM, to develop 20,000 indicated horse power, is to be constructed across the Missouri River, near Helena, Mont. It will be a timber crib structure 47 ft. high and 800 ft. long, forming an impounding reservoir with an area of 429 miles. The water will be taken from above the dam to the turbines by a tunnel 15 ft. by 17 ft. cross section driven through a rock promontory. The total cost is estimated at $100,000. The power developed is to be transmitted electrically to Helena, thirteen miles distant.

The Cost of Running a Twin Screw Passenger Ship.

What does it cost to run a palatial twin screw racer across the Atlantic? That is the question which the *Sun*, for the enlightenment of many inquiring readers, recently put to the New York agents of several big steamship companies. The questioner was about to file the query away with a lot of other unsolved riddles of the sea, when he strolled into the office of the Hamburg-American line. There he obtained the information which had been withheld at every other office. Agent E. L. Boas dissipated, as well as he was able, the mystery that had enshrouded the little problem. A midsummer trip of the magnificent Normannia was the theme of his calculation. The Normannia is not quite as big as the twin screw boats of the White Star and Inman lines, but her expense account, owing to the greater length of her voyage, is just as formidable. The cost of running her from her dock in the Teutonic town of Hoboken to her dock in the town of Hamburg, no less Teutonic perhaps, is about the same as the cost of running the City of Paris from New York to Liverpool.

When the Normannia starts on an eastward voyage she carries nearly 3,000 tons of coal in her protected bunkers. Some of this is American and some foreign soft coal, and it costs about $3.50 a ton. The sooty stokers daily shovel into her roaring red furnaces between 250 and 300 tons. The expenditure for coal runs just short of $1,000 a day, or nearly $8,000 for the voyage. The cost of the gallons and gallons of oil used to keep her ponderous triple-expansion engines, her dynamos, her numerous smaller engines, her pumps, and so on, running smoothly, combined with the coal bill, is quite $8,500.

The salaries of the big ship's company are not an unimportant factor in the expense account. Among the 300 persons who look after the working of the racer and the comfort of her passengers, are, besides coolheaded Capt. Hebich, 8 officers, 1 surgeon, 25 engineers and machinists, 2 pursers, 5 boatswains, 28 seamen, 114 firemen, 65 waiters and waitresses, 22 cooks, bakers, and assistants, 2 carpenters, 1 barber, and 14 skilled musicians. The total wages of these for a trip of eight days is about $2,000, not counting perquisites.

Capt. Hebich receives the highest salary. It varies between $3,000 and $4,000 a year, and depends somewhat on the earnings of the ship, of which he receives a small percentage. This is the way the skippers of all the colossal racing craft are paid, and it is not likely that any of them are going to cease racing, or to be censured for it, as long as a fast trip means money in their pockets and in the coffers of their company. Every hour the captain of the City of New York saves means a saving in coal alone of $50.

Next in importance to the captain of an ocean speeder is the chief engineer. He is not as frequently visible to the cabin passengers as his gold-laced superior, and nobody makes much fuss over him, but he is, in the opinion of his employers, a very big man indeed. He is the man who makes the great ship "git up and git." He submits daily reports of how things are going on down below to the captain. He tells how many tons of coal he is using, how much indicated horse power he obtains, and the number of revolutions the ship's propellers make a minute. If he doesn't get as much speed out of the clanking twin giants as the captain thinks he ought to, the captain pats him on the back and tells him to whoop her up, like a good fellow. It is essential to the captain's interest that he should be friendly with the boss of the mighty machines. For his great work the chief engineer receives $160 a month and his board, which is equal to that of the cabin passengers. The chief officer receives $80 a month, which is more than the captains of many steamships of the second class get.

The food and drink consumed by passengers and crew during a recent trip of the Normannia cost about $16,000. This is the complete list of the things that were necessary to make life aboard the luxurious floating hotel something like a dream. Two thousand five hundred bottles of red wine, 2,000 bottles of Rhine wine, 2,000 bottles of champagne, 1,200 bottles of cordials, 15,000 bottles of beer, 80 kegs of beer, 400 bottles of ale and porter, 2,500 bottles of mineral water, 37,000 gallons of drinking water, 70,000 pounds of potatoes, 16,000 pounds of beans, peas, and so on, 2,500 cans of fruit, 1,500 pounds of jellies, tarts and biscuits, 45 baskets of vegetables, 7,000 pounds of butter, 1,200 pounds of cheese, 10,000 eggs, 3,500 pounds of sugar, 1,500 pounds of coffee, 1,000 pounds of tea, 250 pounds of chocolate, 150 gallons of milk, 10,000 apples, 1,200 oranges, 1,000 lemons, 400 glasses of preserved fruits, 120 barrels of flour, 65 gallons of ice cream, 17,000 pounds of beef, 12,000 pounds of mutton, 1,800 pounds of ham, smoked beef, and bolognas, 1,000 pounds of veal, 700 pounds of bacon, 600 pounds of pork, 600 pounds of game, 500 pounds of canned meat, 250 pounds of lamb, 30 barrels of preserved meat, 20 barrels of salt pork, 16,000 pounds of fish, 450 chickens, 180 ducks, 60 turkeys, 60 partridges, and 50 geese.

From the foregoing facts and figures it may be said that one trip of the Normannia costs the Hamburg-American line not less than $25,000. To offset this expenditure, which does not include the cost of insurance, the Normannia must carry many passengers and some freight. The number of her passengers varies, of course, according to the season. She carries in midsummer sometimes nearly 500 first and second cabin and about 300 steerage voyagers. The average price of a first cabin passage is about $110, and that of a second cabin about $60. The average price of steerage accommodations is $22. The receipts from all classes of passengers on a good midsummer trip are over $50,000. Usually the Normannia carries 800 tons of freight, which, at the transportation rate of about $10 a ton, amounts to $8,000. The cost of loading and unloading this freight is borne by the company. In the dull season, the big twin screw ships do not make much, but their receipts throughout the year are large enough to warrant the declaration that they are great successes financially, and that they are the passenger ships of the future.—*N. Y. Sun.*

Electricity in Insects.

M. Nicolas Wagner, by a series of experiments displayed before the Academy of Sciences, about the year 1865, showed that electricity produced variation in the color of butterflies. His experiments were performed on *Vanessa urtica.* He found that electric currents changed reds into orange, and blacks into reds, and with a constant battery, a weak current produced spots varying in shape with the strength of the current. He further demonstrated that the colors naturally existing in the butterfly's wings were due to currents in that organ, the most powerful of which passes from the attachment of the wing outward along the middle nervure to the outer edge. In these experiments he used a Bois-Reymond galvanometer of 20,000 coils. The following are the conclusions he arrived at: 1. The existence of fixed electric currents in the wings of insects. 2. The possibility by means of electric currents to provoke a change in the shade and disposition of the coloring matter. 3. And the possibility, by means of these currents, to produce a kind of atrophy and to change the shape of the wings. He concludes as follows: "With these facts as basis, I propose to pursue my research on this subject."—*Sci. Gossip.*

SPEAKING of the difficulties of ship building in this country, *Industries*, of London, says: "Usually, American labor costs 50 to 100 per cent more than the same description of labor in England."

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.

(2408) W. H. S. writes: Will you kindly state in your answers to correspondents which is the best vessel to mix bichromate soda solution in? I mix 6 gallons at a time; 1 gallon water, 2 pounds sulphuric acid, 1 pound bicarbonate soda. I first used a beer keg, but found the action of the acid on the wood weakened the solution. Next tried demijohn, but being impatient and in a hurry with my acid, I broke the demijohn. How would an earthenware glazed crock answer? How would it do to line it with sheet lead? Would the chromic acid affect the lead? What sort of a faucet would answer to put in the crock so as to be the least affected by the solution? A. Use a stoneware glazed vessel. If you wish a faucet, stoneware or glass faucets may be used. A siphon of one of the mechanically changing type may be used. Do not attempt to charge with the mouth by suction, as the acid may enter the mouth.

(2409) N. B. asks: 1. What is the candle power of a gas jet? A. From 12 to 36 candles. 2. What is the ratio of volts, amperes, and ohms? A. It is deduced from Ohm's law: amperes=volts divided by ohms. 3. How many ohms will a thirty-volt battery overcome? A. Any number. 4. What resistance has No. 9 copper wire? A. 0·824 ohm per 1,000 feet. 5. What size wire should be used with a 30 volt battery? What is the resistance? A. It depends on the internal resistance of the battery and on the length of wire and other factors. 6. What is the cost per hundred feet? A. It weighs 39½ pounds per 1,000 feet, and is worth about 20 cents per pound. 7. Can you recommend some work on the measurement of electrical force necessary for certain work? A. Munro & Jameson's Pocket Book of Electrical Rules and Tables, price $2.50. 8. Is there any method of taking ink stains from wood? A. Wash with oxalic acid. 9. What is the cost of Edison lights? A. 75 cents each for standard size. 10. Please give me the numbers of the SCIENTIFIC AMERICAN SUPPLEMENT containing descriptions of batteries? A. Nos. 157, 158, and 159, besides a great many others.

(2410) J. A. B. writes: 1. I wish to use a cement (resinous) of a heavier specific gravity than water, and melting at 212°. Could you give me a formula? A. A formula for exactly 212° cannot well be given, as resins vary in their melting points. We would suggest simple shellac or ordinary sealing wax. 2. How can ordinary resin be deodorized? A. No practical method can be given. 3. How many ounces bichromate of potash are required to render 16 fluid ounces of glue insoluble? A. Dissolve 5 to 10 parts white glue in 90 parts water. Dissolve 1 to 2 parts bichromate of potash in 10 parts water. Mix the two solutions; use at once or preserve in tin boxes. Expose to light after applying, to bring about insolubility.

(2411) H. M. writes: Can you tell me what causes sweat or emitting moisture on a looking glass when exposed to sudden change of atmosphere, likewise metal vessels? Do you know any preventives? A. The trouble you refer to is due to condensation of the moisture of the air. One preventive is to rub a little glycerine over the surface, and this is not permanent, and the remedy may be worse than the original trouble.

(2412) C. D. F. writes: Can you send me a paper giving a method of coating wood with copper by means of battery? I have tried coating with black lead and wax, and the current does not seem to run, although I connected the ends of the copper wire to the wood by black lead and wax. I also tried coating the wood with bronze powder and wax, and the current did not run over the wax. The battery was all right, as I plated other metallic substances at once with it. I used a sulphate of copper solution, and I also used a verdigris solution, and neither worked on wood. Can you tell me where the trouble is? A. In preparing wood for plating use no wax, but rub over well with plumbago. If this does not suffice, rub or sprinkle some fine iron dust over the plumbago-coated surface to start the deposition of the copper. Your trouble probably was in not using enough plumbago, and perhaps you did not use enough unmixed with wax upon the surface.

(2413) W. D. A. writes: Do you know of any simple and inexpensive method by which any one not an expert can find out whether or not cider vinegar is pure? A. Place some white sugar in a saucer, half fill with vinegar, and evaporate to dryness by placing on top of a boiling water kettle. If the sugar turns black, the vinegar contains an adulterating acid. This test is of course not universal, but is very simple and useful.

(2414) E. H. asks how chewing gum is made. A. The simplest is made from paraffine wax melted with a little olive oil and glycerine. The latter must vary in amount with the character of the wax.

(2415) D. W. G. asks how to cut burnt grease off an engine so it will be bright and show the steel as before. A. Try caustic soda solution. Otherwise clip it off with a sharp chisel, following with emery cloth.

(2416) W. S. asks for the process of frosting an incandescent lamp by hydrofluoric acid. A. The best method is to expose the lamp to the vapor of the acid. Cover all metal parts with wax, and suspend in a covered wooden or pasteboard box on whose bottom is placed a leaden tray containing powdered fluoride of calcium fluorspar mixed with oil of vitriol. Avoid getting any of the mixture on the hand. The etching should not be carried too far, or it will lose the "frosting" effect. A very small quantity of materials will suffice.

(2417) J. D. McC. writes: Will you give me the formula for water-marking paper? A. It is done in the factory by placing wire designs under the pulp when drying and setting.

(2418) F. W. F. asks (1) what the best method is for covering heavy muslin to make it waterproof for a tent. A. Use paraffine wax melted in with a hot iron. 2. How the starch is fixed that they use in laundries to get the right gloss. A. Principally by heavy polishing irons or their equivalent. A little paraffine wax may be added to the hot starch. 3. What are the best acids to use for engraving names on steel? A. Sulphuric or nitric acid diluted with three to five volumes of water.

(2419) W. O. asks for a solution for gold and copper plating without a battery. A. For mercury gilding see query 2365. An ethereal solution of perfectly neutral gold chloride is sometimes used for steel. The following is perhaps of more general use. Gold chloride 9 parts dissolved in 1,000 parts water, add 360 parts bicarbonate of potash and boil for two hours. The article to be gilded, if of copper, is immersed in the boiling fluid until gilded. If not of copper, a piece of copper is held against it in the fluid until it turns copper color. Then the copper is removed and the gilding is finished. For copper plating immerse the article in a solution of copper sulphate. If of iron, a few minutes will coat them. If not coated, then battery action is required. This may be brought about by placing a piece of iron in with the article held in contact with it.

(2420) E. B.—For an ice house the walls should have a thickness of twelve inches of well packed sawdust, floor and roof the same, so that the entire body of ice is inclosed and protected in twelve inches of saw dust. There should be a ventilator in the roof, and good drainage below the floor.

(2421) J. D.—In issue of August 9, 1890, in answer to H. V., No. 2367, I would say, in plaster of Paris, to prevent rapid setting or hardening, use dissolved glue, according to length of time wanted to harden.

(2422) A. asks: Does the muriatic acid and lead with which a hole in a tin pan is soldered injure the food which is cooked in it (the pan) afterward? A. Not if the pan is in constant use. If put away after soldering the acid may dissolve tin or may contain zinc in solution. In either case, cleaning before use would dispose of the trouble.

(2423) J. A. B. asks (1) how to make a good silicate of soda paint, such as backgrounds are painted with, and how the different shades are obtained. A. Dilute silicate of soda solution until it works well with the brush, and add dry coloring matter, such as will not be decomposed by the chemical. Ochers, Venetian red, smalts, umbers and siennas may be employed. 2. How to frost the glass in my skylight. A. Rub over with a little bag of muslin filled with fine sand, powdered glass, or grindstone grit and water. Some sand may be placed directly on the glass. 3. A good water and acid proof coating for wooden trays. A. 4 parts resin, 1 part gutta percha, and a little boiled oil melted together. 4. How to make a good liquid glue? A. To ordinary glue melted with as little water as possible add enough acetic acid to reduce to proper consistency.

(2424) H. E. R. asks: 1. Can the standard supporting the revolving disk be made of hard wood and can the ring of vulcanite which surrounds the glass disks be made of wood? A. The parts of the machine mentioned may be made of wood, provided it is very dry and well soaked in paraffine. 2. How are the clamps fastened to the glass of the tubular shaft? A. By means of a cement formed of equal parts of pitch, gutta percha, and shellac melted together. 3. Do the sector plates of brass rub on the glass of the other revolving disk which revolves alongside of it? A. The sector plates are upon the outer surfaces of the glass disks, consequently they cannot go into contact with each other. 4. What is the price of the Wimshurst, Holtz, and Toepler and Winters machines? Where can I get a catalogue of those machines? A. For this information, write dealers in electrical apparatus who advertise in our columns.

(2425) J. K., J. C. O., and others.—To tan or taw skins with the hair on for rugs and other uses, first thoroughly wash the skin and remove all fleshy matter from the inner surface, then clean the hair or wool with warm water and soft soap, and rinse well. Take ¼ pound each of common salt and ground alum, and ½ ounce borax, dissolve in hot water, and add sufficient rye meal to make a thick paste, which spread on the flesh side of the skin. Fold it lengthwise, the flesh side in, the skin being quite moist, and let it remain for ten days or two weeks in an airy and shady place, then shake out and remove the paste from the surface and wash and dry. For a heavy skin a second similar application of the salt and alum may be made. Afterward pull and stretch the skin with the hands or over a beam and work on the flesh side with a blunt knife.

Replies to Enquiries.

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

(2426) *How to Make a Small Emery Wheel.*—Your answer to S. A. A. (2385), 23d of August, How to make small emery wheels, is not good. The emery will peel off. Cover the wheel with heavy muslin, sewed or glued on, then glue and roll in emery, and you have a coat that will stay. I use wheels from ½ to 1½ inches in diameter made in this way and they work well.—J. S. Chandler.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

RAIL CHAIR AND CROSS TIE.—Marian M. Green, County Line, Tenn. This is a metal tie formed in H shaped sections, joined together, a pillow block being held in the upper socket of the tie and the chair resting upon the pillow block, with means for securing the block to the tie and the chair to the block, the construction being designed to give superior strength, efficiency and durability.

Electrical.

ALARM FOR CLOCKS. — William H. Deane, Brooklyn, N. Y. Combined with the hour hand arbor or other rotating part is a ring or apertured key adapted to receive a weight, a circuit-closing lever being connected with the weight by a chain, and a battery and electric bell, with electrical connections, for giving an alarm at a predetermined time.

INCANDESCENT LAMP HANGER.—Paul J. Chassagne, Akron, Ohio. This is an improvement in hangers in which the lamps are suspended from a rotatable spool, having suitable electric connections, so that the lamp may be raised or lowered at will without affecting the electrical current through its filament, the improvement consisting in the means for connecting the conductors with the lamp-suspending cord wound on the spool.

Agricultural.

CULTIVATOR. — Gideon M. Bowman, Springdale, Ark. This is a convertible cultivating apparatus, in which the beams may be swung half round to reverse them, and set with the front or rear shovels on the inside and adjacent to each other, the arrangement being such that one horse can be used to draw both beams and their attached shovels when desired, and do efficient work in peas, beans, and other small crops.

HAY FORK. — Morell W. Dickey, Big Timber, Montana. Combined with a head to which tines are pivoted is a recessed dog pivoted in the head, a bail pivoted to the tines and adapted to be engaged by the dog, and a sliding and spring-actuated latch engaging the dog, the implement being of simple, durable and inexpensive construction.

FRUIT CLIPPER. — John T. McMullen, Bay View, Fla. This is a device to be held in the hand by loops or stalls around the thumb and forefinger, so that by opening the hand the blades, one of which is serrated and the other smooth-edged, will be spread apart to cut the stem of the fruit, the clipper being conveniently operated without cramping the hand or affecting the natural movement of the joints.

FRUIT GATHERER. — John W. Cain, Rusk, West Va. The outer end of the handle of this fruit picker has a loop to which is secured a bag terminating in a spout connected with a receiving sack, and there is pivoted to the handle a spring-pressed jaw, with means for opening it, the jaw having a portion corresponding in size and shape with the loop, whereby a person may stand on the ground and pick fruit from the tops of the trees.

Miscellaneous.

SEWING MACHINE MOTOR.—George R. Smith, Benjamin F. Collins, and James W. Shook, Elizabethtown, Ky. A horizontal shaft is suitably mounted on the sewing machine table and adapted to be revolved by means of a spring, a worm wheel on the shaft having on its periphery a series of radially projecting anti-friction pins or rollers engaging with a vertical worm shaft connected by gearing with the revolving shaft of the sewing machine.

REFRIGERATOR. — Nancy A. Laman, Bertram, Texas. This refrigerator is designed for use without ice, the cooling effect being secured by the evaporation of water carried from trough to trough by cloths by capillary attraction, and the apparatus being formed by a suitable framing having its sides closed in with wire gauze to permit the free circulation of air and exclude insects, etc.

VOTING APPARATUS.—Peter Hoffman, Fort Branch, Ind. This invention covers novel constructions and combinations of parts to be easily put together and taken down, to afford means for keeping voters in line and secluding them while marking ballots, affording also desks for the judges, inspectors and clerks, and support for the ballot boxes, poll books, etc., while being adapted to fold compactly for transportation and storage.

POSTAL EXAMINATION CASE. — John Straughan, New Orleans, La. This is a case or cabinet having a series of pigeon holes, with a support hinged to the back of the case and a removable shelf extending across its front, and other novel features, to facilitate the examination of post office clerks and railway mail clerks as to their speed in and knowledge of distributing mail matter from memory cards representing post offices in suitably labeled pigeon holes of the case.

TRIPOD. — John R. Moeller, Grand Island, Neb. This is a device of simple construction, specially adapted when unfolded to conveniently support photographic cameras, while when folded together it is adapted for use as a walking stick, it being also designed for convenient use on uneven as well as on level ground.

COMPOUND PRESS.—Francis B. Deane, Lynchburg, Va. In this press the upper and lower platens are arranged to move simultaneously toward or from each other, the travel of the lever sweep being thereby diminished to one half the stroke of the press, the speed of which is proportionately accelerated to increase the amount of work done, the press being designed for use in baling cotton, hay, etc.

ADJUSTABLE CHAIR.—James P. Hindman, Olathe, Kansas. This is a chair which may have its back reversed, and also inclined at different angles, while it is provided with adjustable leg and foot supports independent of the back, the construction being more particularly designed for railway service.

FIRE ESCAPE.—Henry Vieregg, Grand Island, Neb. This invention is designed to provide a simple and durable construction which can be readily set up on the ground and extended to a window in the upper floor of a building to form a convenient exit therefrom, the invention covering novel parts and details and combinations thereof.

ACCIDENT CASE. — Ferdinand King, New York City. This is a case especially adapted for use on railway cars, to be attached to any convenient support and locked thereto in such manner that when needed any person may readily gain access to instruments, bandages, etc., designed to be contained in the case, the case itself being conveniently detachable.

BUCK FOR BEER COOLERS.—Frank T. Cladek, Rahway, N. J. This buck has pivoted hangers and a platform with slots in which the attachment of the platform to the hangers is placed, whereby the platform is adapted to have a swinging movement with the hangers and a longitudinal movement independent of them, facilitating the removal of empty barrels and reducing the labor of placing a full barrel in the buck.

HAME FASTENER.—Louis Wildhagen, Bailey's Harbor, Wis. This is an inexpensive device which may be made of malleable iron or low grade steel, the invention covering an improvement in the class of hame fasteners adapted for adjustment in length and for detachable connection with the hames.

BRIDLE BIT.—Oliver M. Sloat, Brooklyn, N. Y. This is an automatic curb bit having a fixed mouth bar and slotted cheek pieces, spring-actuated rein eyes sliding in the slotted cheek pieces, the power of the curb being regulated by the amount of force applied to the reins, increasing when the reins are subjected to great strain and diminishing when the strain is lessened.

GAME.—Alfred Van Brakle, New York City. This is an improvement in portable game apparatus adapted for temporary attachment to an ordinary table or other flat surface to enable it to be used as a billiard table, a rigid or semi-rigid frame being employed to which the other parts of the apparatus are attached.

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SEPTEMBER NUMBER.—(No. 59.)

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Rubba, gutta-percha, and other vulcanized gums, India, G. A. Alden & Co 18,373
Shirts, overalls, pantaloons, and working jackets, Gem Shirt Company 18,378
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