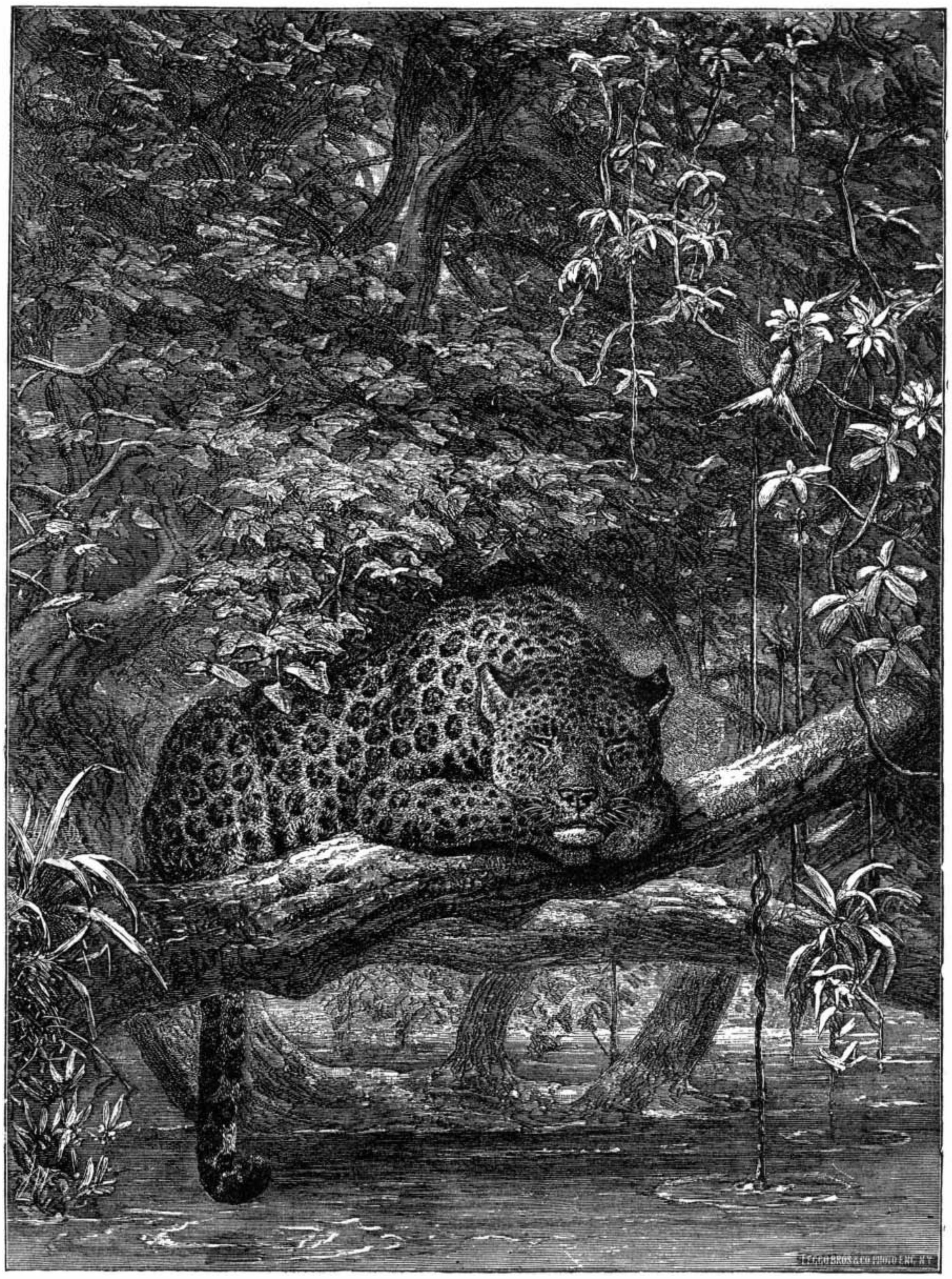
THE JAGUAR OR SOUTH AMERICAN TIGER.

Among the many handsome and formidable creatures which are natives of the western hemisphere the jaguar is entitled to the first place for beauty, strength, and ferocity. In these particulars it rivals the royal tiger of Bengal, resembling it also in subtlety. It is occasionally seen in North America as far north as Louisiana; but the southern continent is its home. The natural history of this animal was given in detail on page 39 of our volume XXXIV.; and we herewith publish an admirable engraving, showing a fine specimen of the race, enjoying the coolness of the shade and the river in one of the tropical forests. The picture was drawn by Mr. Joseph Wolf, and engraved by the brothers Whymper; and it first appeared in "The Life and Habits of Wild Animals," published by Messrs. Macmillan & Co., of New York and London.

The artist has well succeeded in portraying the ferocious beast in an attitude of perfect repose. But for the blinking eyes and the curl on the tip of the tail (which has evidently just touched the surface of the water) the animal gives no sign of life; and its watchfulness, even when at rest, is the only indication of its remarkable cunning, which never allows it to be surprised. In this state of rest, we can admire the immense muscles of the shoulders and neck, and the great size of the thighs and legs, as well as the exceeding beauty of the coat and the configuration of its spots. Of all the larger specimens of the tribe *felis*, the jaguar most resembles in countenance the domestic cat; and the likeness is very apparent in our engraving, the *pose* of the monster increasing the similarity.

A terrible tragedy took place some time since, in a monastery in Santa Fé, New Mexico, in which the strength and courage of the jaguar were forcibly shown. One of the brothers entered the sacristy, and found himself face to face with a large jaguar. The beast clutched him at once, and dragged him into a corner. The screams of the victim brought another monk to the room, whom the jaguar also despatched with promptitude; and another comer met a similar fate. A gentleman named Irondo attempted to approach the sacristy by another door, but unfortunately the jaguar had left the room through this door, and before Mr. Irondo could reach the spot he was saluted by the cries of a fourth victim. The doors were, however, finally shut upon the jaguar, and he was shot through a hole bored in one of them.



THE SIESTA.

It seems to be a merciful dispensation of Nature that the most terrible quadrupeds are not gregarious, but hunt alone or in couples. If lions, tigers, and jaguars herded like wolves, whole provinces would be depopulated by their ravages, and man would hardly be able to hold them in any subjection. But by destroying them in detail, their numbers can be kept within bounds, and their depredations confined to their native forests and jungles.

Facts and Simple Formulæ for Mechanics, Farmers, and Engineers.

Velocity of circular saws at periphery, 6,000 to 7,000 feet per minute. Rate of feed for circular saws, 15 to 60 feet per minute. Velocity of band saws, 3,500 feet per minute. Velocity of gang saws, 20 inch stroke, 120 strokes per minute. Velocity of scroll saws, 600 to 800 strokes per minute, Velocity of planing machine cutters at periphery, 4,000 to 6,000 feet per minute. Travel of work under planing machine, $\frac{1}{20}$ of an inch for each cut. Travel of molding machine cutters, 3,500 to 4,000 feet per minute. Travel of squaring up machine cutters, 7,000 to 8,000 feet per minute. Speed of wood carving drills, 5,000 revolutions per minute. Speed of machine augers, 1¼ inches diameter, 900 revolutions per minute. Speed of machine augers, ¾ inch diameter, 1,200 revolutions per minute. Gang saws require, for 45 superficial feet of pine per hour, 1 horse power indicated. Circular saws, for 75 superficial feet of pine per hour, 1 horse power indicated. In oak or hard wood, ¾ of the above quantities require 1 horse power indicated.

The area of a safety valve should be ·006 times the area of the fire grate.

On railway car axles, 20 pints of oil lubricate 8 journals of cars for 5,000 miles, or 1 pint for 250 miles.

The following is the effective horse power for different water motors, theoretical power being 1: Undershot water wheels, 0·35; Poncelet's undershot water wheel, 0·60; breast wheel, 0·55; high breast, 0·60; overshot wheel, 0·68; turbine, 0·70; hydraulic ram raising water, 0·60; water pressure engine, 0·80.

The following are the ordinary dimensions of windmill sails: Length of whip, 30 feet; breadth at base, 12 inches; depth at base, 9 inches; breadth at tip, 6 inches; depth at tip, 4½ inches. The effective horse power is found by dividing the product of the total area of sails in square feet and the cube of the velocity in feet per second of the wind by 1,080,000.

Rule for speed of screws: Velocity in miles per hour = pitch of screw in feet multiplied by the number of revolutions per minute, and divided by 88.

With hydrogen gas, having a buoyancy of about 13·3 feet to 1 lb., the diameter of balloons = the cube root of 25·5 times the weight to be raised, including that of the balloon itself, or the weight = 0·0392 times the cube of the diameter.

The unit of heat is the quantity required to raise the temperature of 1 grain of water at its maximum density 1° Fah. The absolute mechanical equivalent thereof is 772 foot grains, and the thermal equivalent of the absolute unit of work = 0·000040224.

The proper proportion for the width or hoist of the American ensign is $\frac{10}{19}$ its length. The thirteen horizontal stripes should be of equal breadth and begin with the red. The blue field is 0·4 of the length of the striped portion, and is 7 stripes in depth. The 37 stars are ranged in equidistant horizontal and vertical lines.

The actual horse power of pumping engines = quantity of water raised per minute in cubic feet multiplied by hight elevated in feet, multiplied by 0·0023. The indicated horse power of engines is found by dividing twice the product of the area of the piston in square inches × the average pressure of steam in lbs. per square inch in cylinder × the number of revolutions per second × the length of the stroke in feet by 550.

Useful numbers for pumps: The square of the diameter multiplied by the stroke, multiplied by 0·7854, gives capacity of the pump cylinder in cubic inches; by 0·002833, in gallons; by 0·0004545 in cubic feet; by 0·02833, in lbs. fresh water.

Resistance in lbs. per tun on different roads, exclusive of gravity: Stone tramway, 20; paved roads, 33; macadamized roads, 44 to 67; gravel, 150; soft sandy and gravelly ground, 210.

Climbing a Standpipe.

Some reparations having become necessary upon the standpipe at Spring Garden Station of the Philadelphia Water Works, among which the scraping and painting of the exterior, which had become weather-worn and rusted, was the most considerable task, the first step to be taken was obviously to construct a scaffold for the workmen; and as no means had been provided for the attachment at the top of the pipe of the blocks and falls from which a scaffold should be suspended, the climbing of the pipe for this purpose was an undertaking which preceded all others. This climbing was accomplished by Mr. George Robinson (a working rigger of this city) in the following way: The standpipe itself is 127 feet of wrought iron shaft, above a square stone plinth, the shaft being about 6 feet in diameter at the bottom, and 4½ feet in diameter at the top (under the cap or head ornament, which projects 12 or 16 inches all round). At the foot of the plinth, a light ladder, 30 feet long, was set up, with the top to rest against the shaft. Climbing the ladder to the top, carrying a bow or ring of half an inch round iron rod, which was made to surround the shaft loosely, with the ends about 16 inches long, turned downwards, these ends were lashed fast to each side of the ladder. Next, a piece of rope (3 inches, equal 1 inch diameter) with an eye in one end, was passed also round the shaft, and was lifted to the top of the ladder, below the ring of iron, when the plain end of the rope was drawn through the eye and made fast, so that the rope formed a lashing, and the end of the fall, passed down between the ladder and the shaft, was made fast to the lower round of the ladder, and the ladder itself then hauled up to the lashing; and with its upper end steadied by the ring of iron, was placed vertically against the side of the shaft. Another ring of half inch iron was placed around the shaft at the bottom of the ladder, which ring was also lashed to the sides of the ladder, and steadied at the bottom whenever it was attempted to lift by the lower round. The ladder being elevated as described, and held in place by making the hauling side of the fall fast to something below, another lashing like the first one was taken to the top of the ladder (in point of fact, Robinson stood upon the top of the ladder each time it was hauled up, and took with him this second rope); and this rope was then converted into a second lashing like the first one only 25 feet higher up on the shaft. A second block was hooked into this second lashing, and the end of a fall from it was taken down behind the ladder to the lower round, and made fast, while the other end was hauled tight to relieve fall number one. Lashing number one was now cast off, and taken to the top of the ladder; and by means of the second fall, the ladder, with Robinson upon it, was lifted to the second lashing. At this point the operation merely repeated itself, except that, from the reduced diameter of the shaft, it was necessary to to bring the head of the ladder up to the lashing and make new ends; to the top bow of iron (which could be bent cold), twice in the whole climbing. The bottom ring it was not found necessary to reduce in dimension. Five fleats brought Robinson to the top of the shaft; and as the top of the ladder was then hung far enough from it, he was able to pass at once over the projection of the cap, and mount upon the plates which covered the projection (a low ornamental railing surrounds the cap). Having reached the top, the other attachments became easy. The man Robinson, and another rigger to handle the rope, aided by one or two men, when a pull was requ:1ed, performed alone all the labors of the task. They came to the Spring Garden Works at about 10 A. M.; and in less than two hours (before 12 M.) the column had been climbed, and the ladder was sent down.—*Journal of the Franklin Institute.*

NEW YORK ACADEMY OF SCIENCES.

At a recent regular weekly meeting of this society, held at 64 Madison avenue, the following papers were read:

ON DETERMINATIONS OF SPECIFIC GRAVITY BY THE ARABIANS IN THE XII CENTURY,

by Professor H. C. Bolton, Ph. D. In this very interesting paper, the author gave various extracts from a book written by Al-Kharzini, about the year 1121. This remarkable book, called "The Book of the Balance of Wisdom," was first translated, in part, by the Russian minister, Khanikoff, into French, and afterwords translated into English and edited by the American Oriental Society. The perfect familiarity of these ancients with the methods of determining specific gravities, and the accuracy of their results, as shown by tables given in the work, and which Dr. Bolton copied on the board, are quite surprising. Al-Kharzini tells the story of Archimedes and the crown (see page 351, volume XXXIV, SCIENTIFIC AMERICAN), with some slight errors and discrepancies. Dr. Bolton quoted from Vitruvius the correct version of this well known but usually distorted anecdote. It seems beyond question that Archimedes solved the problem by filling a vase to the brim with water, immersing a ball of gold, one of silver, and the crown, successively, measuring each time the quantity of water displaced, or necessary to fill the vessel after the ball was removed.

The accompanying engravings are reproduced from Al-Kharzini's book. Fig. 1 he calls the conical vessel of Abu-r-Raihan; it differs but little from the specific gravity bottle of today. Fig. 2 shows the graduations on the hydrometer of Pappus, a Greek who lived in the fourth century. It resembles a Gay-Lussac hydrometer. Fig. 3 he calles the balance of Archimedes. It has two pans, *a* for gold, *b* for silver, and *c*, the counterpoise. Fig. 4 represents the "balance of wisdom." It has five scale pans, two aerial and one aquatic; *a* is the means of suspension, *c* tongue, *d* two checks, *f* and *g* air bowls, *i* winged bowl, *m* ring to suspend the bowls, *h* aquatic bowl, *l* counterpoise. The use and design of the ladder-like piece at the center is unknown. He seems to have known that the air had weight, and care was taken to measure density at a standard temperature, after careful purification. Not only does Al-Kharzini give the density of metals, alloys, and liquids, but also of soluble bodies, like tabie salt, with great accuracy. He also gives the density of mercury, but remarks that it is not a metal, but the mother of metals, as sulphur is their father. Al-Kharzini also describes a balance for leveling land, and another for weighing time, and it is probable that temperature was likewise determined by the balance.

Professor B. N. Martin made some remarks on

A CHANGE OF THE EARTH'S AXIS AT THE CLOSE OF THE TERTIARY,

referring to Mr. C. B. Warring's paper on this subject and expressing his favorable opinion of that gentleman's view of the cause of the great climatic changes in that time. Dr. Newberry dissented from Mr. Warren's opinion, and gave his reasons for so doing, also referring to the fact that there were probably glaciers in the Permian and other periods.

On the Manufacture of Black Ink.

By the term ink, we understand a liquid mixture with which we can write and draw upon paper. The qualities demanded of a good ink are that it shall flow well but not too freely from the pen, shall fix itself properly to the paper, without, however, blotting or spreading, and preserve its own color permanently.

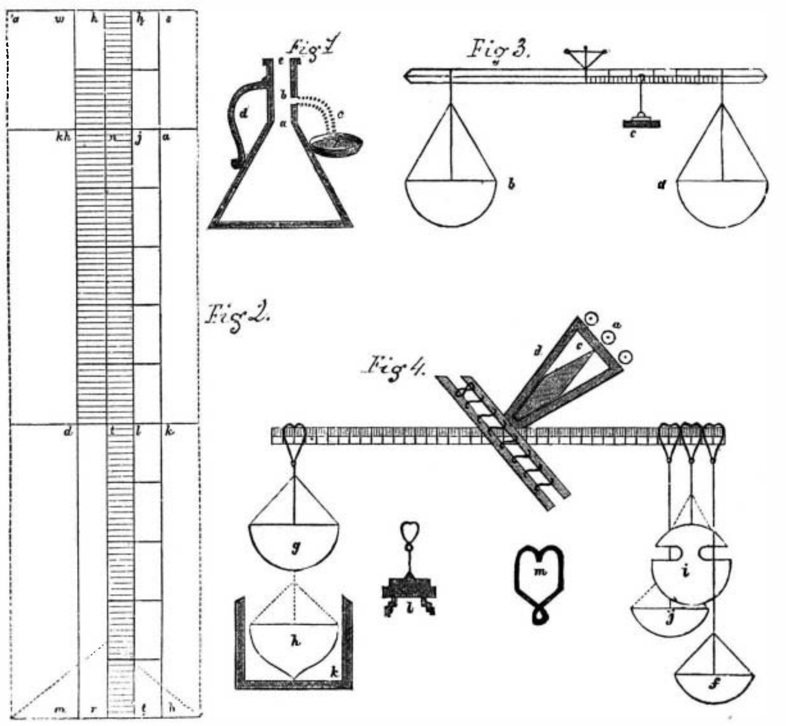
There are in existence at the present time an innumerable quantity of recipes for the manufacture of black inks, and yet we hear the general complaint either that the ink is too pale when written, and therefore injures the eyes when used continuously, or that when the writing gets old it fades or turns brown. James Stark, a Scottish chemist, has prepared about 230 kinds of black ink, and found, as he expresses it, only one to be recommended, namely, an ink made from myrobalanen.

The cause of black writing turning pale, and disappearing entirely when it gets old, is to be found in the iron it contains, in so far as the iron is changed to a higher oxide and is precipitated. Ink made with nutgalls is a special case of this kind; it is in a continual state of decomposition; when this process is ended, the ink in a short time becomes useless. Free sulphuric acid retards this rapid and complete destruction, hence sulphate of indigo is added.

A decoction of gall nuts contains tannic acid; this combines with protoxide of iron to form a tannate (proto-tannate of iron), which is colorless, but very greedy for oxygen, and strives to change itself into the sesquioxide salt. Finally the tannic acid changes into gallic acid, and a black proto-gallate of iron is formed. At last, when all the tannic acid in the proto-tannate of iron is converted into gallic acid, it continues to absorb oxygen and forms the tannate of the proto-sesquioxide of iron, which separates as a shiny precipitate. The sediment in the ink is continually growing thicker, and of course it can no longer be used.

In the manufacture of ink, any substance containing tannin may be used in connection with the iron salts, such as galls, tannin, divi divi, myrobalanen, extract of nut shells, etc. Black inks are also made of logwood and iron salts on the one hand. and neutral chromate of potash on the other. Alizarine ink consists of protoxide of iron and indigo solution; it generally has a bluish green color, and afterwards darkens beautifully; the more acid the ink contains, the slower this takes place. Slightly acid inks scarcely perceptibly attack steel pens, but spoil sooner, with the formation of a blue-black precipitate. They are usually and best prepared with madder, gall nuts, indigo carmine, and acetate or pyrolignate of iron.

It did not lie in the province of the above few lines to present a selection of the best ink recipes, but only to explain the phenomena which appear in the use of black inks. If such a recipe is introduced in the following description of its method of preparation, we only do it under the conviction that we meet the wishes of many of our readers by giving one that has been tested by years of experience, and which involves the least cost.



ARABIAN PHYSICAL APPARATUS, A. D. 1121.

When black ink is made in large quantities, it is well to let it become clean in large barrels and afterwards put it into bottles and inkstands. It is believed that in this way an article is obtained which is less exposed to mold. To avoid this unpleasant feature, a small quantity of corrosive sublimate, or a few drops of carbolic acid, or some broken cloves, may be put into the ink.

Numerous experiments have shown that no salt of iron and no iron preparation equals the proto-sulphate of iron (the green vitriol of commerce) in the manufacture of ink, and also that the admixture of a salt of the sesquioxide, for instance the nitrate or chlorides, although it improves the color of the ink at first, renders it less durable. The most permanent of the common inks are those made of gall nuts, with green vitriol and gum arabic. The proper proportions of these constituents for the production of such a durable black ink are the following: Two lbs. bruised Aleppo gall nuts are digested in 2 quarts alcohol at a temperature of 104° to 140° Fah.; when about half of the spirits has evaporated, 3 quarts water are added; it is well stirred and strained through linen cloth. To the clear solution are added 8 ozs. glycerin and 8 ozs. of gum arabic with 1 lb. sulphate of iron dissolved in water. This mixture is thoroughly stirred from time to time for a few days, allowed to settle, and then put into well stoppered bottles for preservation.

Care should be taken to avoid the addition of too much sulphate of iron, as otherwise the ink soon turns yellow.

An ink prepared according to these directions will resist the action of light and air at least 12 months without suffering the slightest change of color. If this ink could be completely protected against precipitation of gallate of iron, we should have a perfectly permanent ink, retaining its beauty. The addition of sugar as well as of logwood decreases these properties.—*Victor Soclet, in Polytechnisches Notizblatt.*

Formation of Anthracite Coal.

A correspondent writes: The Supplement to the SCIENTIFIC AMERICAN, No. 17, April 12, contains an article from the *Shenandoah Herald*, giving an account of the formation of anthracite coal from apparently pure spring water in a pipe used for draining the Indian ridge shaft of the Philadelphia and Reading Coal and Iron Company. It appears this coal forms in about four months by exposure to the air, thus scattering to the winds all the geological theories that coal takes thousands of years and heavy pressure to form it. We recommend this discovery to the notice of the authors of "The Recent Origin of Man," and "Light as a Motive Power."—*London Mining Journal.*

How the Wind goes through Brick Walls.

Mr. A. Cluss, in a letter to the *American Architect and Building News*, gives a description of Professor Pettenkofer's experiment on the porosity of brick walls, as published with the "Records of the Royal Academy in Munich."

Pettenkofer caused to be erected, upon a cast iron plate, a section of wall two feet high, two and a half feet long, and twelve inches thick (the bricks he used were twelve inches long). It was put up with bricks carefully laid in lime mortar. After the brickwork was thoroughly seasoned, the two faces of the walls, containing five square feet each, were plastered with a floated brown finishing coat. This being well dried, the edges were pargetted with plaster of Paris. Time was again given for evaporation, when the plaster of Paris was overlaid with a coating of wax, oil, and resin. Next, metal plates with flanges turned over the edges were cemented to both faces of the wall, firmly clamped, and screwed tight. In this manner the rims and margins of the metal plates were fitted and secured to the wall, the whole being airtight, while there remained thin layers of the air inside the margins, between the faces of the wall and the metal plates. Both metal plates had holes in their centers, of one third of an inch in diameter, and to these short tubes were soldered. If air was impelled through the tube attached to one metal plate, it had to penetrate the wall before it could be discharged through the tube of the opposite metal plate. The neat area of each metal plate, facing the air cushion between it and the wall, was three and a half square feet. A lighted candle was placed directly in front of the open tube on one side, and, by blowing in the open tube on the opposite side, the air would pass through the wall, and extinguish the light, without any trouble whatever. The current of air had, of course, much more velocity in the tubes than in the wall, since the exposed area of the wall was 2,860 times larger than the area of the tubes. Assuming that a light wind of ten feet velocity per second had acted on the open tube, this velocity, though much diminished within the porous wall, would regain its original speed when passing through the other tube, and no doubt suffice to extinguish the light. Supposing the solid particles of bricks and mortar occupied three fourths, and the pores one fourth part of the exposed surface, the air would have moved $\frac{2860}{4}$ or 715 times slower in the wall than in the tube, and a velocity of ten feet would have been redneed to about $\frac{14}{100}$ of a foot. Now, our nerves being insensible to a motion in the air of one foot and over, it is clear that a motion of seventy times less speed will go on without our being aware of it.

It will be very easy for the institutes of technology or others to repeat this, and make similar experiments with various facing materials, and observe these phenomena, of supreme importance for a clear understanding of hygienic problems met by the practising architect.

South Pass Jetties.

Captain J. B. Eads, who is building the jetties at the mouth of the Mississippi, has become involved in an unfortunate and unnecessary dispute with Major Howell of the United States Engineers, who was, with General Humphreys, one of the advocates of the Fort St. Philip Canal. The grant obtained by Captain Eads from the government (one of the least objectionable that ever passed through Congress) stipulates that nothing is to be paid him unless he succeeds in securing twenty feet of water through the South Pass to the Gulf within the specified time. Now, Captain Eads declares that the work is going on in the most encouraging manner, that he has already got sixteen feet, so that the largest coasting steamers have been sent to sea over the bar, on which scarcely eight feet of water could be found last year. Major Howell, on the other hand, declares in a published letter that there are only twelve feet of water at the South Pass, that the nucleus of a new bar exists in front of the jetties, that a shoal is making out to this nucleus, and in short the jetties are doing no good. Against all this Captain Eads brings certificates from his engineers that Major Howell's statements are unfounded, and he protests against his enterprise being embarrassed by officers having no immediate connection with the work, and has written a letter to the Secretary of War, begging that any further interference on the part of such officers be prevented, and that instructions be issued, to the inspecting officer authorized by the Jetty Act, to furnish him directly with any information as to the result of the work he may need, and that he be ordered to report to the Secretary of War instead of to the Chief of Engineers. Whether this is desirable or not we do not know; but it is certainly a great mistake to allow engineer officers in the employment of General Humphreys, who is known to have no faith in the jetty system, to write letters to the newspapers ridiculing the experiment when the department of the service to which they belong stands in a judicial attitude to the undertaking. This, at any rate, ought to be stopped.—*The Nation.*

HARD GLASS.—We shall never, we fear, hear an end of new methods for hardening glass. R. Mensel, of Geiersthal, uses as a tempering bath a weak solution of glycerin and mucilaginous or gummy substances, such as a decoction of linseed. The glass is tempered while still on the pipe, and is then put into a moderately heated oven. The inventor puts great stress on the properties of the tempering bath.