headers asunder, and when it cannot do so it will spring them sidewise.

TO ESTIMATE THE AMOUNT OF HEATING SURFACE NECESSARY TO MAINTAIN THE HEAT OF THE AIR OF INCLOSED SPACE IN BUILDINGS TO THE DESIRED TEMPERATURE.

The ordinary rule-of-thumb way of the average pipe fitter is to multiply the length by the breadth of a room and the result by the height, then cut off two figures from the right hand side, and call the remainder square feet of heating surface, with an addition of from 15 to 30 per cent for exposed or corner rooms.

In the computing of heating surfaces there is much more to be considered, and it is evident the amount of surface necessary for a good and well constructed building will not be enough for a cheap and poorly put up one.

The cubical contents of a room occupies only an inferior place when estimating for large rooms and halls, and no place at all in figuring for small or ordinary office rooms or residences, which are heated from day to day throughout the winter.

Suppose a small room on the second floor of a three story building with only one outside wall, with no windows, but the whole furred, lathed, and plastered, with all the other rooms of the building heated and maintained to 70° Fah.; now place a portable heater in this room and keep it there until the room is heated to 70° also, then remove it. How long will it take to cool 10°? Answer, perhaps three hours. Now make a window without blinds, and you find it cools 10° in less than half the time. Why? Because the glass of the window being a good transmitter of heat, it is able to cool more air than the whole outside wall. You may now say: What about the inside walls and floor? Why, they actually help to maintain the heat in the room by conduction, etc., from the other rooms.

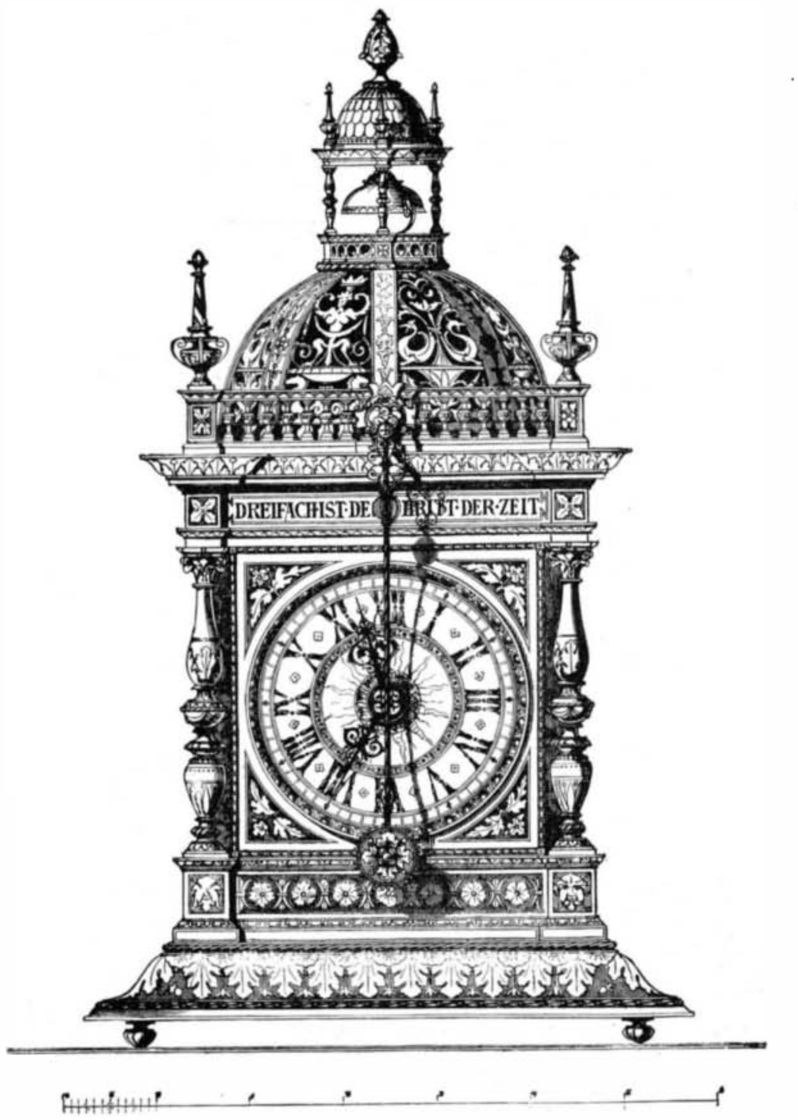
Thus the windows are the first and most considerable item. Secondly, the outside walls, how they are plastered—whether on the hard walls or on lath and furring. Thirdly, the prospect—whether exposed or sheltered. Fourthly, is the whole house to be heated, or only part of it? and, lastly, what the building is to be used for.

TABLE OF POWER OF TRANSMITTING HEAT OF VARIOUS BUILDING SUBSTANCES, COMPARED WITH EACH OTHER.

Window glass	1,000
Oak and walnut	66
White pine	80
Pitch pine	100
Lath and plaster	75 to 100
Common brick (rough)	120 to 130
Common brick (whitewashed)	125
Granite or slate	150
Sheet iron	1,030 to 1,110

In figuring wall surface, etc., multiply the superficial area of the wall in square feet by the number opposite the substance in the table, and divide by 1,000 (the value of glass), the product is the equivalent of so many square feet of glass in cooling power, and may be added to the window surface and treated the same.

The following method has given good results and is not wholly empirical. The writer has used it for many years in preference to any other:



CLOCK OF AUSTRIAN DESIGN.

Divide the difference in temperature between that at which the room is to be kept and the coldest outside atmosphere, by the difference between the temperature of the steam pipes and that at which you wish to keep the room, and the product will be the square feet or fraction thereof, of plate or pipe surface to each square foot of glass or its equivalent in wall surface.

Thus: Temperature of room, 70°; less temperature outside, 0°; difference, 70°. Again: Temperature of steam pipe, 212°; less temperature of room, 70°, difference, 142°. Thus: 142+70=0·493, or about one half a square foot of glass-heating surface to each square foot of glass or its equivalent. For each additional mile and a half in the average velocity of the wind above fifteen miles per hour add ten per cent to the heating surface.

In isolated buildings exposed to prevailing north or west winds there should be a generous addition of the heating surfaces of the rooms on the exposed sides, and it would be well to have it in an auxiliary heater, to prevent over-heating in moderate weather.

In windy weather it is well known to the observant that the air presses in through every crack and crevice on the windward side of the house; and should they take a candle and go to the other side of the house they will find that the flame of the candle will press out through some of the openings. Thus the air in a house blows in the same general direction as the wind outside, and forces the warmed air to the leeward side of the house; this is why the sheltered side of a house is often warmer in windy weather.

Conditions which tend to the warmth of a house in windy and cold weather without stopping the leakage of air under doors or around windows are: 1st, blinds on the windows inside; 2d, blinds on the windows outside; 3d, window shades and curtains; and, last, papered walls. The leakages are really blessings in disguise in houses which are not systematically ventilated.

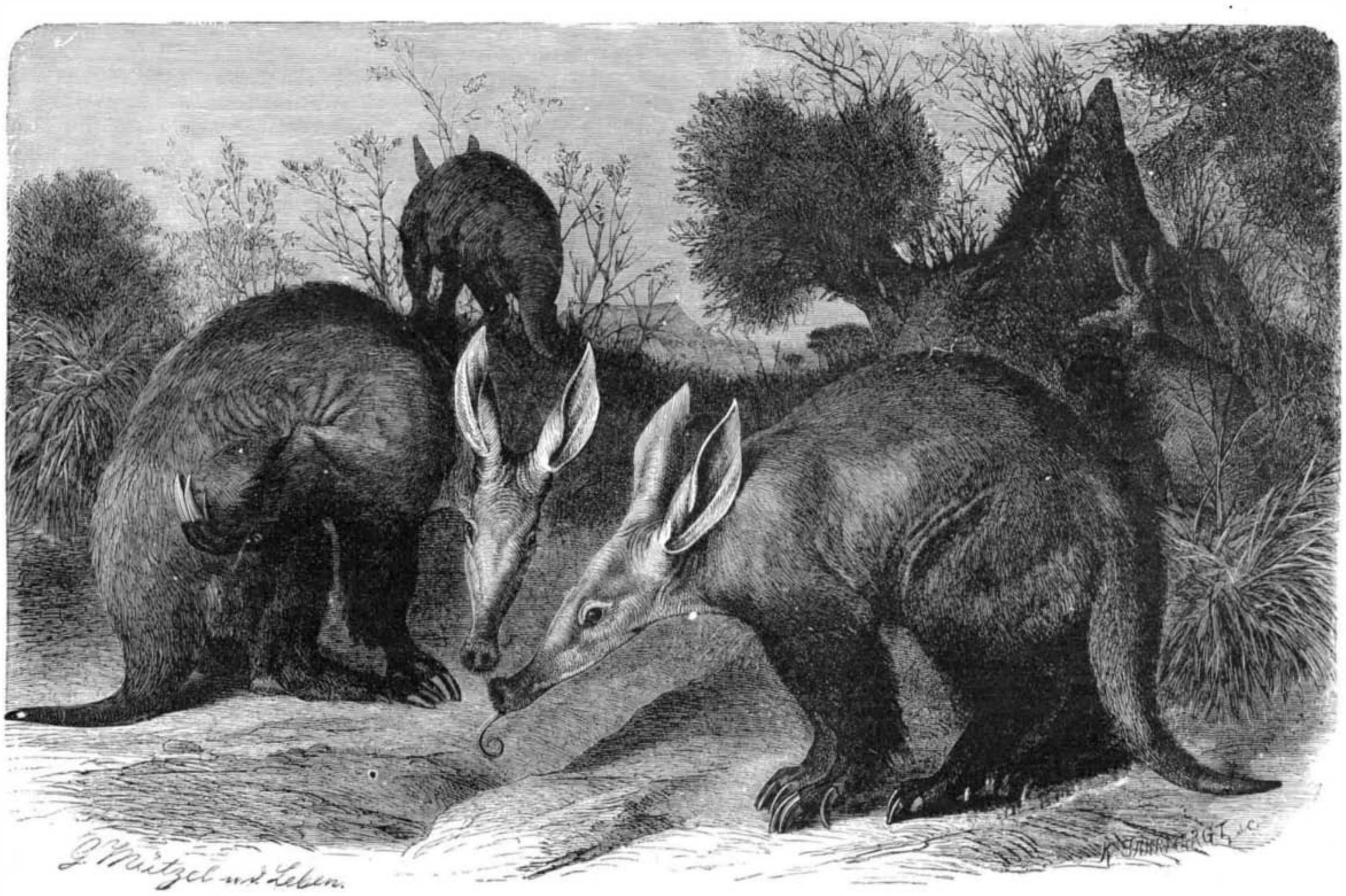
Lead or zinc paint should not be used on heaters; several coats of lead paint may destroy their heating power from fifteen to twenty per cent. Ocher and oil, or varnishes mixed with color, are the least harmful.

A NOVEL CLOCK.

On this page we illustrate a handsome clock of Austrian manufacture, which makes no pretense of being anything other than what it is, and in which the design and ornament are studied with due reference to the use for which it is intended. The simplicity of the design is offset by elaborateness in the detail of the decoration, which is rich and well conceived. In the panels of the dome is some very fine work. Above the dome is an open belfry, containing a bell and hammer. With this arrangement the vibration of the metal, when the hours are struck, is not muffled, but rings out clearly and with distinctness. Another feature, companionable or distracting, according to one's mood, is the pendulum swinging across the face of the dial, attracting the eye by its mute motion to the ever-advancing hands and to the significant legend inscribed above them.

THE AARD VARK.

The aard vark, or earth hog, is a native of Southern Africa, and is a very curious animal. The skin of the aard vark is not protected by scales or plates like those of the



AARD VARK.—*Orycteropus Capensis.*

mals and the armadillo, but rather thinly covered with coarse bristly hair. Its length is about five feet, the tail being twenty inches long, and it is a very powerful creature, especially in the fore limbs, which are adapted for digging, and are furnished with strong hoof-like claws at their extremities. These claws can be used with marvelous rapidity and force, and are employed for the purpose of destroying the dwellings of the ants on which the aard vark feeds, as well as for digging a burrow for its own habitation.

The burrows are not very deep, but are of tolerably large dimensions, and are often used, when deserted, as extempore tombs, to save the friends of the deceased from the trouble of digging a grave fortheir departed comrade. The creature makes its burrows with marvelous rapidity, and can generally dig faster with its claws than a man with a spade.

The aard vark is a nocturnal animal, and can very seldom be seen during the day time. At night it issues from its burrow, and making its way toward the ant hills begins its work of destruction. Laying its fore feet upon the stone-like walls of these edifices, the aard vark speedily tears them down, and as the terrified insects run about in the bewilderment caused by the sudden destruction of their tenements, it sweeps them into its mouth with rapid movements of its long and extensile tongue. This member is covered with a tenacious glutinous secretion, to which the ants adhere, and which prevents them from making their escape during the short period of time that elapses between the moment when they are first touched and that in which they are drawn into the mouth.

Trapping Rats.

A Wisconsin correspondent of the New York *Tribune* gives the following mode which he has successfully adopted:

Having lured to destruction many old Solomons among rats, I will detail my plan: Take a pan nearly full of bran, set a small steel trap without any bait, put a light wad of tow or cotton under the pan of the trap, which press down so it is just ready to spring; put the trap in the bran, making a place with the hand, so that it may be below the surface when level; lastly, scatter a few kernels of corn on the bran (pumpkin seeds are better), and you are ready for your victim. I hardly ever fail to fool some of the ringleaders in this way, while younger ones are easily caught. If "P." cannot thus circumvent that shy and cunning old specimen, I will give him my plan with strychnine, which is as swift with rats as with dogs.

So much for the Wisconsin rats. We cannot but think that the "old Solomons" out there are not half so wise or cunning as some we have encountered at the East. Some years ago the rats made bad havoc in our cellar, and we resolved to try the efficacy of the steel trap. It was set in a large flat vessel, and well covered and hidden with bran. We were more cautious than the writer above, for we used a large spoon to move the bran, fearing the rats might smell the touch of fingers and keep away. Small bits of cheese were then dropped over all parts of the bran and over the covered trap. The next morning there were tracks of rats all over the surface, *except where the trap was buried;* and the cheese was all taken, except directly *over the trap.* We were compelled to resort to a more effectual trap, which proved quite successful—in the shape of a fine old tom cat.—*Country Gentleman.*

New Fossil Reptiles from the West.

The Yale Museum has recently received numerous remains of reptiles from the Jurassic deposits of the Rocky Mountains, and some of the more interesting dinosaurs are briefly described and figured by Prof. O. C. Marsh, in the current number of the *American Journal of Science and Arts.* These reptilian remains pertain to several distinct groups, and are interesting from the fact that they throw considerable light on the forms which have already been described from the same horizon.

Most of the animals described in the present communication belong to genera hitherto unknown. Of these new genera, the first (nearly allied to *Laosaurus*), which is called by Prof. Marsh *Camptonotus*, contains, as far as known, two species. *C. dispar* appears to have been a reptile about 8 or 10 feet in length, and herbivorous in habit. The fore limbs of the animal were much reduced in size; the massive portion was not in front, but behind, the ischium being larger than the pubis. All the specimens discovered are from the Atlantosaurus beds of the Upper Jurassic. The other species of this genus, *C. amplus*, was about three times as large as the one just mentioned, and is represented in the collection by various remains, among which is a left hind foot nearly entire.

Brontosaurus excelsus (new genus and new species), one of the largest reptiles yet discovered, has been recently brought to light, and a portion of its remains are now in the Yale collection. This monster, which was probably 70 or 80 feet in length, apparently belongs among the *Sauropoda*, but differs from any of the known genera in several important respects. The sacrum of the animal was 4 feet 2 inches in length, but had the striking peculiarity of being comparatively light, owing to the extensive cavities in the vertebræ, the walls of which were very thin. The remains of this gigantic reptile were discovered in the Atlantosaurus beds of Wyoming. Additional specimens of *Stegonosaurus*, including a new species (*S. ungulatus*) have been recently secured, and much new information in regard to the group has thus been obtained. These reptiles belong to the dinosaurs, but differ widely from any of the known sub-orders. The most striking character, to which the name refers, is the huge dermal plates which served to protect the animal. A number of these, from 2 to 3 feet in diameter, and others of smaller size, were found with the remains of the present species. The skull is very small, and more lacertilian than in the typical dinosaurs, and the brain cavity is remarkably small. The vertebræ known are all solid, and the fore limbs of the animal are shorter than those behind.

Cœlurus fragilis (new genus and new species) was a very small reptile, apparently a dinosaur, which left its remains in the same locality with *Camptonotus dispar.* The most characteristic specimens that have been obtained are vertebræ. Judging from what is known of the remains of this species, the animal appears to have been about as large as a wolf, and probably carnivorous in habit.

Human and Canine Blood Corpuscles.

The question whether it is possible to distinguish between dog's blood and man's blood by microscopic measurements of their respective corpuscles was pretty strongly negatived by the evidence given in a noted murder trial by Dr. Woodward, of the Army Medical Museum at Washington. Dr. Treadwell, of Boston, had previously testified, in the same case, that he had identified certain blood stains on a pocket-knife as human blood by means of such measurements. Dr. Woodward, on the other hand, contended that such identification was impossible.

The corpuscles of the blood of man and dog vary within very wide limits, and corpuscles vary according to the health of the individual; a French investigator had discovered some in persons afflicted with anæmia as large as 1-551 of an inch; another 1-500; however the witness had never found one so large, his experiments giving measurements from 1-2500 to 1-4500; the corpuscles of dog's blood vary little from those of man's, but the largest or smallest sizes are not always to be found in any single drop from any animal; it has been claimed that there was no difference in the corpuscles of young or old; but Perrier, of Bordeaux, wrote in 1877 that the two extremes of size disappear as age advances and the corpuscles become uniform. Dr. Woodward had investigated this theory so far as it applied to man and the dog, and believed it correct; this applies to age; the variations caused by disease are yet an open question. Between the extremes all measurable sizes exist, varying even to millionths of an inch, the corpuscles in a drop of blood varying as much in size as different men do in a throng. Therefore when you try to get an average from four corpuscles or fifteen corpuscles you cannot do it any more than you can get the average size of men in a throng by measuring a few of them. Therefore it has happened that scientific men in their investigations do not get results comparing with each other; a noted investigator, Mr. Gulliver, in 1848 stated that the average size of man's corpuscles was 1-3200 of an inch, but Pellus and Franie, French investigators, found them slightly larger, and other Frenchmen found them smaller; what varies in nature must, of course, vary in the results placed upon paper, continued the witness, who admitted that he had never been able to get the same results from measurements of the corpuscles in two different drops.

At this point the witness referred to a paper written by him in 1875 for the *American Journal of Science*, and giving thirteen sets of measurements of human corpuscles; those of each set of 50 were averaged, he said, and the average of the aggregate was 1-3500 of an inch. These figures he had since criticised in print as being not absolutely correct, yet many European authorities still agree with them. Continuing, he remarked that as a drop of blood contains between five and six million corpuscles, in endeavoring to identify blood one must think of how many drops there are in a human body, and consequently how many millions of corpuscles. Hence we see how impossible it is to identify blood by measuring fifty corpuscles.

In reply to a question as to the relative sizes of dog's blood and human blood, Dr. Woodward detailed some recent experiments. One with forty corpuscles of the blood of one of his assistants in the Medical Museum in Washington, showed an average of about 1-3058 of an inch. Fifty corpuscles of dog's blood averaged only one millionth of an inch from the average of the forty of human blood above described. Upon the subject of restoring to their normal size for measurement the corpuscles of dried blood, Dr. Woodword said that there were numerous difficulties which tended to prevent accurate work. When restored they are generally smaller than their normal size, and would therefore appear to come within the ranges of the corpuscles of other species; the best restorative is that nearest approaching the serum of the blood, and that is the embryotic fluid surrounding the fœtal calf; glycerine with water gives good results in careful hands.

In reply to the question whether other diseases than anæmia affected the size of blood corpuscles, Dr. Woodward said: A statement is going the rounds of medical literature that all fevers do; however, one of my colleagues has examined the blood of a person who died of yellow fever and found no difference. The fifteen corpuscles discovered by Dr. Treadwell and testified to in the case under trial were within the range of human blood corpuscles, but they were also within the range of dog's blood.

Said the counsel: "You don't agree absolutely, doctor, with any of the line of eminent experts of Europe or America who were mentioned this morning?" A. "No, sir, for my own averages of measurements can never be made to agree."

"Why?"

"Because of the differences of the things measured—the corpuscles."

The Most Northern Point of the United States.

BY WILLIAM A. MOWRY.

If the question were asked, Which is the most northern part of the United States, excepting Alaska? perhaps many would say, The line of 49° from the Lake of the Woods to the Strait of De Fuca. But that answer would be incorrect. There is a point where the United States reaches 49° 23′ 54″ north latitude. It is in longitude 95° 14′ 38″ west from Greenwich.

In other words, at the Lake of the Woods, in Minnesota, our territory includes a small area reaching beyond 49° more than 25 miles. This little excrescence, jutting out into British America, is recently put down upon some of our maps, but I have not seen it on many of them. It is indicated, though roughly, upon Case's large map of the United States and upon the large map published by the Government and issued by the Land Office. I observe it also in Warren's School Geographies.

The map which shows it most accurately is perhaps the Map of the State of Minnesota, published by the St. Paul Book and Stationery Company, at St. Paul. On most of the maps the Lake of the Woods is by no means correct, or even approximately so.

After learning the fact that our country does hold this little jutting piece of both land and water, the question arises, How did it happen that the boundary should take this circuitous direction? The answer is as follows: In the definitive treaty of Paris, signed (September 3, 1783) by John Adams, David Hartley, Benjamin Franklin, and John Jay, Article II. defines the boundaries of this country. In this article we find that from Lake Superior westward the boundary is given as follows:

"Thence through the middle of Long Lake and the water communication between it and the Lake of the Woods to the said Lake of the Woods; thence *through the said lake to the most northwestern point thereof,* and from thence in a due west course to the river Mississippi."

Evidently it was then supposed that the source of the Mississippi was to the north and west of this point. When, however, it was subsequently ascertained that the headwaters of this river were to the southward, the line was made to run from this "most northwestern point of said Lake" due south to latitude 49°.

We next find allusion to the matter in the treaty of "Amity, Commerce, and Navigation," signed at London (November 19, 1794) by Grenville and John Jay. The 4th Article proposes that, "Whereas it is uncertain whether the river Mississippi extends so far to the northward as to be intersected by a line to be drawn due west from the Lake of the Woods," measures shall be taken "to make a joint survey," and "the two parties will thereupon proceed to amicable negotiation to regulate the boundary line in that quarter."

By the 7th Article of the treaty of Ghent it was agreed to refer to commissioners "the boundary line from Lake Superior to the Lake of the Woods." In 1827 the commissioners made their final report, with maps of actual survey from Lake Huron to the Lake of the Woods. In this report they say:

"The extreme northwestern point of the Lake of the Woods is declared to be at lat. N. 49° 23′ 54″ and lon. W. 95° 14′ 38″; so that in conformity with the treaty this point, having been ascertained to be north of parallel 49°, a line is drawn due south from it to parallel 49°, on which parallel it is to be continued to the Rocky Mountains. No means have yet been taken to delineate the boundary westward from the Lake of the Woods."

The commissioners were Peter B. Porter and Anthony Barclay. No change was made from these agreements by the "Webster Ashburton Treaty" of 1842.

It is to be hoped that all future school geographies and larger maps will show this boundary.—*N. E. Journal of Education.*

The Red Spot on Jupiter.

Recent communications to the *Astronomische Nachrichten* give further interesting details of the large, oblong red spot which may at present be seen so conspicuously on the southern portion of Jupiter's disk. According to Th. Bredechin, of Moscow, it is 16 seconds of arc long and 4 seconds broad, and lies about 9 seconds south of Jupiter's equator. It is surrounded with very brilliant white faculæ, which are especially conspicuous on its southern border.

According to Dr. Lohse, who has observed the spot since last June, it appears to lose in a considerable degree its intensity and color when near the planet's limb. He also sees the faculæ, spoken of above, and remarks at the preceding end of the spot a sort of grayish continuation, resembling in form an inverted comma.

This spot has not apparently diminished in intensity or size during many months—a fact which indicates considerable stability. As there is considerable probability that it will be visible another season, Dr. Lohse suggests that observations of its position will afford very valuable data for an accurate determination of Jupiter's rotation period. The sharpness of outline and regularity of form of the spot admirably adapt it for this purpose. The position of the spot should be fixed by estimation, its distance from the planet's limb being expressed in parts of the parallel of latitude passing through the spot, that is, in parts of the chord of the planet's disk drawn through the spot parallel to Jupiter's equator. Either end of the spot may be used for this purpose. The estimation made when the spot is near the center of the disk will be manifestly the most certain.

This is an opportunity that amateurs should not neglect, since the observations can be made with moderate telescopes and without a micrometer.—*Science Observer.*

Fast Railway Speeds.

The speed of railroad trains in France, Germany, and the United States is still below that of several lines in England. The "lightning train" on the Paris-Marseilles line makes the distance of 539 miles between these two cities in 15 hours and 21 minutes, the average speed, including stoppages, being 35 miles an hour The express train on the Lehrter Railway runs from Berlin to Cologne at the rate of 37½ miles an hour, including stops, making the entire distance of 364 miles in 9 hours and 26 minutes. The Scottish mail leaves Euston Square at 8 .50 in the evening and reaches Edinburgh at 6:45 the next morning. The distance is 401 miles, the time 9 hours and 55 minutes, the rate of speed, including stops, 41¼ miles an hour. The express from King's Cross runs to Edinburgh, a distance of 397 miles, in 9½ hours, or at the rate of 42 miles an hour, including stops. The fast train from Paddington to Plymouth, and the Irish mail from London to Holyhead, average between 41 and 42 miles an hour, or about the same as the Scottish trains. The fastest short-distance trains in Germany are that which runs from Spandau to Stendal, 57½ miles, without stopping, in 1 hour and 17 minutes, or at the rate of 45 miles an hour, and the express, which makes the distance of 88¾ miles, between Berlin and Magdeburg, in 2 hours and 7 minutes, or at the rate of 42 miles an hour, including two stops. In England a much higher rate of speed is attained on short distances. The Great Western trains run through from London to Swindon at the rate of 53 miles an hour, making the entire distance of 77¼ miles in 1 hour and 27 minutes, while nearly 50 miles an hour is made by the special express, which runs from London to Wantham, 105 miles, in 2 hours and 5 minutes. This is doubtless a much higher rate of speed than the usual schedule time on roads in the United States. The Washington limited express leaves New York at 10 A.M. and reaches Washington at 4 P.M. The distance, 230 miles, is made in 6 hours, or at the rate of 38 1-3 miles an hour, including stops. Between New York and Philadelphia but two stops are made, the rate of speed is 40 miles an hour. The Boston express, which leaves New York at 11 A.M., runs to Boston, 233 miles, in 7 hours and 11 minutes, which is about 32 miles an hour, including the six stops that are made. The special mail and express train on the New York Central and Hudson River road makes the distance at night between New York and Albany, 143 miles, in 4 hours and 5 minutes, or nearly 36 miles an hour. Only one stop is made. The Cincinnati express on the Pennsylvania Railroad leaves New York at 6 in the evening and reaches Pittsburg, a distance of 444 miles, at 8:30 on the following morning, and Cincinnati, 757 miles, at 8 P.M. of the same day. The rate of speed, including stops, is about 30 miles an hour between New York and Pittsburg, and 29 miles an hour between New York and Cincinnati. The distance between Harrisburg and Pittsburg, 249 miles, is run in 7 hours and 35 minutes, with three stops, or about 33 miles an hour. The fast line to Chicago by way of the Pennsylvana Road leaves New York at 9 A.M., and reaches Chicago at 7:20 on the following evening. The distance is 912 miles, the time 34 hours and 20 minutes, the rate of speed less than 27 miles an hour.

Silk Woven Pictures.

It would almost seem that silk weaving has attained perfection in the marvelous pictures woven in silk by Mr. Thomas Stevens, of Coventry. Elegant designs in Coventry ribbons are familiar to all, many beautiful examples having won general admiration, but none excel the dainty silken pictures woven by Mr. Stevens' process These pictures are comparatively small, and the subjects chosen are popular. Specimens may be seen in the shops of many stationers, and they form not only pretty but most unique and interesting wall decorations. Four subjects we have noticed illustrate the old stage coach, with horses, driver, guard, passengers, and luggage complete, and, in contradistinction to the primitive mode of traveling, there is the original locomotive engine, or "Puffing Billy," which laid up the old stage coach as a public conveyance, and terminated the "good old coaching days." A race for the blue ribbon of the Turf is vividly portrayed in silk, as is also "Dick Turpin's Ride to York." The specimens shown us were woven in the machinery department of the Fine Art and Industrial Exhibition held at York. These silk pictures are made in the largest known loom of its kind in the world—an admirable machine, which has taken medals at every exhibition wherein it has been shown, including the Philadelphia Centennial Exhibition, where, among thirty others (of all nationalities), it secured first prize. This extraordinary mechanical contrivance contains 160 shuttles, and will weave patterns in from eight to sixteen colors. The four subjects above mentioned contained ten and twelve colors, and it may be interesting to know that the pattern takes 5,000 perforated cards and 600 threads. As the loom makes twenty pictures at a time there are no fewer than 12,000 threads at work. A knowledge of these facts tends to make the Stevensgraph still more interesting, and demonstrates the vast amount of thought and labor entailed in the productions of pretty silk pictures, sets of which are very suitable for Christmas presents and New Year's gifts.—*British Trade Journal.*

Stereoscopic Pictures.

Professor Steinhauser, of Vienna, has recently pointed out that there exists a determinate relation between the size and relative position of the two views of a stereoscopic picture, the lenses of the camera with which it is taken, and the optical arrangements of the stereoscope in which it is to be viewed. If these relations are observed rightly, the effect of relief will be much more perfectly attained for all parts of the picture than if they are neglected. The eye pieces of the stereoscope above the plane of the photographic pictures ought to be made as nearly as may be equal to the focal length of the objective of the photographer's camera, and this again should be about equal to the mean distance of easy vision, or, from ten to twelve inches. Herr Steinhauser, after developing the theory of the instrument in relation to this point, throws out three very definite and simple suggestions for the photographers. First, that all stereoscopic pictures should be taken with lenses of equal focal length, say five inches; secondly, that all should be made of equal breadth, or about three inches; thirdly, that the distances between the centers of the objective lenses should always be kept constant.

The Okinawa Islands.

These islands have recently become a regular province or *ken* of the Japanese Empire, but are still a subject of serious controversy between Japan and China. Their ancient name was Liu Kiu, which has been corrupted by modern navigators into Loo-Choo, Lew Chew, and Lieou Kieou, and by the present natives into Doo-Choo, but the more musical name of Okinawa was given to them by the inhabitants themselves centuries ago, and the meaning of it is "the cord lying upon the sea." The entire group consists of thirty-seven islands, the largest of which is eighty-five miles long, by from three to twenty-three in width, and has a circumference of one hundred and fourteen *ri*, or about two hundred and seventy-eight miles.

During the whole of the eighteenth century the islands of Okinawa would seem to have remained in a state of perfect tranquillity. They continued to pay a double tribute to Japan and China, and having faithfully done so they felt that they had a right to bring in from abroad any new ideas that they might fancy. Hence they imported the paper mulberry from Japan, and began to manufacture paper; and from China they obtained the secret of making India ink, and also as an article of food when young, and for the beauty of its wood, they imported and cultivated the famous *moso* bamboo. They also adopted a code of criminal laws and of laws for reward, and not only established a national school, but many local schools in the various districts.

The peculiarities of the inhabitants of Okinawa may be summed up as follows: They are noted for their natural intelligence, though the majority have few opportunities for acquiring the knowledge contained in books; their language is closely allied to that of the Japanese; their occupations are chiefly agricultural, the leading productions being rice, wheat, sugar, millet, sweet potatoes, beans, peas, radishes, turnips, tobacco, cotton, indigo, and flax; their manufactures are limited to cloths made from cotton and grass, to porcelain and lacquered goods, and such other things as are needed for a simple rural population; the men are generally stout, well formed, and fond of wearing beards; the women are small, and kept in a low social position; all classes are industrious and neat in their persons and habitations; their style of dressing is Oriental, and suited to the climate; their homes are comfortable and picturesque; the table and household customs are similar to those of the Japanese; in religion they are generally Buddhists, although some of their rites are peculiar to these islands.

They know not what it is to have an army, nor any such offspring of civilization as a political demagogue; their policy is to carry on their public affairs in a spirit of courtesy and kindness. When they have deemed it necessary to carry guns on their little vessels, they have borrowed them from Satsuma. They use the Japanese alphabet, and write after the manner of their neighbors and protectors; and in speaking of their language they claim that six-tenths of the words are Japanese, three-tenths a local dialect, and one-tenth Chinese. When any public business is to be transacted, the people are called together in their several districts, and the men in authority accomplish the purposes of the government by kindly admonitions.—*International Review.*

Production of Phosphorescent Powders.

The patentees of this process (Prince Sagan, W. F. McCarty, and E. Peiffer) employ a mixture of 100 parts carbonate and phosphate of lime (obtained by the ignition of shells, especially *Tridama* and *Sepia*) with 100 parts quicklime, 25 parts of calcined salt, and 25 to 50 per cent of the whole mass of sulphur; 6 to 7 per cent of a coloring matter —a sulphide of calcium, strontium, barium, magnesium, aluminum, etc.—must then be added. This powder serves to render barometers, compasses, etc., luminous, and is particularly phosphorescent under the influence of an electric current.

Artificial Indigo.

At a recent meeting of the Chemical Society, London, a paper was read "On Alizarin Blue," by G. Auerbach. About eighteen months since a blue coloring matter was brought into the market as a substitute for indigo; it is now disused on account of its high price and its unstable nature when exposed to sunlight. The researches contained in this paper were finished in May, 1878. The author gives a *résumé* of previous work on the subject, and recommends the following method of preparation: 1 part of dry mononitroalizarin, 5 parts of concentrated sulphuric acid, and 1½ parts of glycerine, sp. gr. 1·262, are mixed and heated gently. Reaction commences at 107° C. and becomes violent, the temperature rising to 200° C.; much frothing takes place, with evolution of sulphurous acid and acrolein. The whole mass, when frothing has subsided, is poured into water, boiled up, and filtered, the residue being boiled out three or four times with dilute sulphuric acid. The mixed filtrates are allowed to cool, and the blue separates in brown crystals. These are purified, by mixing with water, and adding borax till the solution becomes brownish violet; the blue with the boric acid forming an insoluble compound. This residue is washed, decomposed with an acid, and the pure blue obtained as a violet silky paste. If required perfectly pure, it must be crystallized successively from its various solvents, high-boiling naphtha, amylic alcohol, and glacial acetic acid When pure it forms brown shining needles, melting at 268–270°; it has the formula $C_{17}H_{11}NO_4$; salts were prepared and analyzed, but the results were not satisfactory, as it was difficult to obtain them quite pure; bromine derivatives were also prepared and examined. The action of chlorine, zinc dust, acetic anhydride, etc., have also been studied. The author discusses the constitution of the blue, and thinks it must be closely related to the aldehydines discovered by Ladenburg, which are formed when aromatic orthodiamides act upon aldehydes.

Mineral Tanned Leather.

An account of a new process of mineral tanning, patented in Germany by Dr. Chr. Heinzerling, of Frankfort-on-the-Main, was described in the last volume of the SCIENTIFIC AMERICAN, page 234.

Referring to that article, Messrs. Wirth & Co., of Frankfort, write that there are now eight tanneries using this process in Germany, their leather everywhere meeting with approval. The leather is impervious to water, and its durability is said to be much greater than that of leather as ordinarily tanned. For example, a pair of shoes were made, the right with a mineral tanned sole, the left bark tanned. These shoes were subjected to natural wear, and when the left was worn out the right sole was uninjured. Trials made by the spinning mill of Jüngst & Co., of Biederkopf, within the past year, showed that belts of mineral tanned leather were not only better, but 30 per cent cheaper, than others. It is worthy of note that this method of Dr. Heinzerling is radically different from Prof. Knapp's method of iron tanning, and presents none of the objections which make the latter unsatisfactory.

Fur on the Tongue.

One of the marked symptoms of certain diseases is a thick coating or "fur" on the tongue. In a recent paper before the British Royal Society, Mr. H. T. Butlin, F.R.C.S., described this fur as consisting chiefly of (1) *Débris* of food and bubbles of mucus and saliva; (2) Epithelium; (3) Masses which appear at first to consist of granular matter, but which are the glœa of certain forms of schistomycetes. That the last named of these three is the essential constituent is proved by the fact that the quantity of the glœa corresponds roughly with the quantity of fur present, and that its position upon the tongue corresponds exactly with that of the fur, both covering the tops of the filiform papillæ, but not usually lying between them. In order to ascertain the true nature of the glœa, and to obtain it in a purer form, it was cultivated upon a warm stage. Several fungi were discovered, but only two of these were present in every instance, *Micrococcus* and *Bacillus subtilis;* and, as the glœa produced artificially was similar to that existing naturally in the tongue fur, it is believed that fur is composed essentially of these two fungi. *Micrococcus* developed freely and abundantly, forming large masses of yellow or brownish yellow color. *Bacillus* did not develop, but existed in greater or less abundance in all the cases examined. Its development was probably prevented by the presence of other developing organisms, from which it was found impossible to separate it. It appeared to be identical with the *Leptothrix buccalis* of Robin. Although it did not develop under artificial conditions, it is probable that development takes place freely upon the surface of the tongue Its habitual occurrence there and the presence of spore bearing filaments favor this view. Besides these fungi there were present, more or less constantly, *Bacterium termo, Sarcini ventriculi, Spirochæta plicatilis,* and a larger form of *Spirillum* (or rather *Vibrio*). *Sarcini ventriculi* was frequently present, and generally developed quickly, forming large masses of a yellow or yellowish brown color. *Spirochæta plicatilis* occurred only in two or three of the specimens examined. *Bacterium termo* existed in some of the furs, and twice developed with such rapidity that the whole of the fluid was crowded with these organisms. The slime between and around the teeth was found to consist of the same fungi as the tongue fur, but the rods of Bacillus were longer, probably owing to the disturbing causes being fewer.

Contagion.

Contagion consists physically of minute solid particles. The process of contagion consists in the passage of these from the bodies of the sick into the surrounding atmosphere, and in the inhalation of one or more of them by those in the immediate neighborhood. If contagion were a gaseous or vapory emanation, it would be equally diffused through the sick room, and all who entered it would, if susceptible, suffer alike and inevitably. But such is not the case; for many people are exposed for weeks and months without suffering. Of two persons situated in exactly the same circumstances, and exposed in exactly the same degree to a given contagion, one may suffer and the other escape. The explanation of this is that the little particles of contagion are irregularly scattered about in the atmosphere, so that the inhalation of one or more of them is purely a matter of chance, such chance bearing a direct relation to the number of particles which exist in a given cubic space. Suppose that a hundred germs are floating about in a room containing two thousand cubic feet of air. There is one germ for every twenty cubic feet. Naturally the germs will be most numerous in the immediate neighborhood of their source, the person of the sufferer; but, excepting this one place, they may be pretty equally distributed through the room, or they may be very unequally distributed. A draught across the bed may carry them now to one side, now to the other. The mass of them may be near the ceiling, or near the floor. In a given twenty cubic feet there may be a dozen germs, or there may be none at all. One who enters the room may inhale a germ before he has been in it ten minutes, or he may remain there for an hour without doing so. Double the number of germs and you double the danger. Diminish the size of the room by one half, and you do the same. Keep the windows shut, and you keep the germs in; open them, and they pass out with the changing air. Hence the importance of free ventilation; and hence one reason why fever should be treated, if possible, in large airy rooms. Not only is free ventilation good for the sufferer, but it diminishes the risk to the attendants.—*Nineteenth Century.*

New Process of Gilding Glass.

We translate from a late issue of the Dresden *Glasshutte*, says the *Pottery and Glassware Reporter*, the following concerning a new chemical process for gilding glass discovered by Mr. Mayan, which will be of interest to our manufacturers of ornamental glassware. The glass, it will be observed, is gilded by bringing it in contact with a bath containing a solution of gold, the composition of this bath conditioning several reactions in order that the gold may settle upon and become firmly attached to the glass. The bath consists of—

1. A solution of gold.
2. A solution of caustic soda.
3. A reagent.

The first of these is obtained by dissolving chemically pure gold in muriatic acid. This solution is then evaporated until a perfect crystallization is secured. The gold crystals thus obtained are dissolved in water in the ratio of six or seven grammes to one liter of distilled water, and filtered until perfectly pure.

For the second solution forty grammes of caustic soda are treated with alcohol or lime, dissolved in one liter of distilled water, so that the solution shows seven or eight degrees of caustic soda. Although a greater or less portion of gold or alkali does not affect the operation materially, the proportions given are those which have proven themselves practically the most economical both in regard to the ingredients and rapidity of the process.

Four fifths of the gold solution and one fifth of the caustic solution are then mixed, and to one liter of this mixture is added one of the reagents in the following proportions:

1. Three cubic centimeters of concentrated and chemically pure glycerine, mixed with the same quantity of distilled water, with the above mentioned caustic solution, form the most energetic reagent.

2. Five cubic centimeters of 90 per cent alcohol mixed with equal parts of glucose solution, the latter being prepared by taking twenty grammes of glucose to 100 grammes of distilled water, and boiling the mixture down to about fifty grammes. This reagent gives the gilding a reddish color.

3. Thirty cubic centimeters of a mixture of 90 per cent alcohol and the following solution of sugar: Dissolve twelve grammes of white sugar in 100 grammes of distilled water, add two grammes of nitric acid of 1·34 specific gravity, and let the whole boil for fifteen minutes. Of this and the alcohol equal weights are mixed.

4. Forty cubic centimeters of aromatic alcohol—butyl, propyl, or amyl-alcohol answers the purpose best. This reagent gives the gilding a peculiar brilliancy.

5. Forty cubic centimeters of brandy made of fruit juice or sugar cane.

Although the quantity of the reagent to be added need not correspond exactly with the proportions given above, it is to be understood that certain limits are not to be overstepped. One would, for instance, fail in the operation if, instead of three centimeters of glycerine, twenty grammes should be taken.

The reaction or gilding begins as soon as the different elements of the bath are united. The setting of the gold occurs in every direction, but it can only be used when it acts upward; therefore the article to be gilded must be placed in such a position that the gold will touch the parts to be gilded in the direction mentioned. A glass plate to be gilded, for instance, must be allowed to swim on the bath. No deviation from this rule will be followed by success. As soon as the gilding is sufficiently strong, the article is taken from the bath, rinsed with pure water, thoroughly dried, and coated with varnish. In order to make the gilding more durable, use a varnish made of a glass enamel easily vitrified, or of enamel colors, afterward burning it in a muffle.

A Novel Experiment.

A pretty illustration of the extent to which practical demonstration is sometimes carried in popular scientific lectures was given in the crowded hall of the Cooper Institute, in this city a few evenings since. It was nothing less than the measurement of the velocity of a rifle ball fired across the stage, in the course of a lecture on projectiles by Professor Robert Spice, of Brooklyn.

The distance measured on the platform was only thirty-three feet, the ordinary distance used in determining this question being about 200 feet. The co-operation of Lieutenant E. L. Merriam, of the Brooklyn 13th regiment, had been secured for the experiment. There was provided a mahogany base, 12 inches by 15 inches, on which were placed two levers which carried bent wires to make marks on a piece of smoked glass underneath the points. One of these wires was connected with a pendulum attached to an Atwood machine, vibrating seconds. By means of electric currents the lever connected with the pendulum came down on the glass precisely at the beginning of each second, making a series of lines separated by spaces somewhat similar to the old Morse alphabet. Consequently the distance from the beginning of one line to the beginning of the next represented a second of time.

The second lever, exactly opposite, had a spring attached to one end, which kept the point off the glass. It also had two electro-magnets, one at each end, which had electric currents passed through of different strength—the weaker current tending to pull the lever down on the glass; the stronger current tending to keep it elevated. In addition to this, the current from the stronger magnet passed through a loose wire resting on two globules of mercury, and immediately in front of this wire was to rest the muzzle of the rifle. The weaker current passed through a precisely similar loose wire, also on two globules of mercury, which wire was placed thirty-three feet distant from the first wire. Lieutenant Merriam's part was to shoot away the wires on the mercury. He used a regular Creedmoor rifle, 45 caliber, 34 inch barrel, loaded with 45 grains of powder (a light charge) and a 450 grain ball. The pendulum was set in motion. On its striking the fifth second the plate of smoked glass was drawn along by the descent of a weight on the top of a column of sand which ran out of a tube. On the sixth second, Lieutenant Merriam pulled the trigger and both wires vanished. On the first wire being broken the point of the corresponding lever descended on the glass, but immediately arose again by the action of a spring, when the bullet broke the second wire. The consequence of this was that the point connected with this lever scraped a very short line on the smoked glass; while the other point, being kept down during the swing of the pendulum, scraped a longer space.

Then the glass was withdrawn and placed in the stereopticon, projecting a magnified image of the lines on the screen. The relative lengths of these lines were ascertained, thus obviating any source of error in measuring the minute lines on the smoked glass. This method of measuring the lengths was claimed to be original by the professor.

The longer line was found to have the length of 110 inches; the shorter 5 inches; making the duration of the flight of the ball 5-110 or 1-22 of a second. Hence its rate of motion was $33 \times 22 = 726$ feet a second.

Corn Malt.

In consequence of the great scarcity of good malting barleys, fresh attention is sure to be directed to the manufacture of maize malt, and we see no reason why a really good brewing material should not be obtained from this grain. One of the principal practical difficulties in the way of malting maize is due to the fact that its husk is so thin, and therefore the grain is very liable to be damaged on the floor. The application of the pneumatic system would probably surmount this difficulty, and we should be glad to hear of some attempts to malt maize in a malting built on the new system. The husk of maize contains a peculiar yellow oily body which is liable to impart an unpleasant flavor to beer, but this may be counteracted to a great extent by repeatedly changing the steep liquor. Maize costs now about 30*s.* per quarter, which price compares favorably with that of good barley, and only a few practical difficulties require to be surmounted to produce a good malt from this grain; we therefore anticipate it will come more and more in use for this purpose.—*Brewer's Guardian.*

Long Distance Walking.

The six days' walking match which ended in this city Dec. 27 was remarkable, not only for the long distance covered by the winner, but for the number of competitors who covered or exceeded 500 miles. The winner, Hart, made 540 miles; the other distances were 534, 531, 527, 520, 520, 502, 500 miles; eight other competitors equaled or exceeded 450 miles.

Geology of the Rocky Mountains.

Since his return to Edinburgh, Prof. A. Geikie has given to his classes in the university of that city an account of his last summer's observations and studies in connection with Rocky Mountain geology.

He had three objects in the expedition: (1.) To study the effects of atmospheric agencies and of erosion generally upon the surface of the land; and there was no region where those lessons could be learned with more powerful impressiveness than in those great plateaus and table lands. (2.) To study the relation which the structure of the rocks underneath bore to the form of the surface. In this country and in Europe generally one was continually brought face to face with evidence of dislocations, protrusion of igneous rocks, faults, and so on, which greatly complicated the geological structure, and made it sometimes by no means easy to tell how far the present irregularities of the surface were due to unequal waste of surface, and how far to the direct effects of underground causes. The western regions of America, which retained to this day for thousands of square miles the horizontality which they had originally, presented wonderful facilities for the discussion of this subject. (3.) To watch with his own eyes some of the last phases of volcanic action. He had been familiar with this as displayed in Italy and in the Lipari isles; but he was anxious to see some of those marvelous evidences of the gradual wearing and decay of a vast volcanic area which were so well seen in the famous region of the Yellowstone.

CHARACTERISTICS OF THE ROCKY MOUNTAINS.

The professor went on to give a brief account of his journey, mentioning that in crossing the prairies toward the Rocky Mountains, he noted, in a few sections that occurred, soft, gray clays and marls, evidently cretaceous, and sometimes tertiary rocks. Getting down at some of the stations, and looking at the ant hills and burrows of the prairie dog, he found that the surface of the prairie was veneered with a thin coating of pinkish, fine grained sand, sometimes approaching to gravel, its color being due to the presence of a great many small pieces of fresh feldspar. It was clear that this mineral, as well as the quartz and fragments of topaz which he saw, did not belong to the strata in which they lay. In going west, the grains of sand began to get coarser, and assume the form of distinct pebbles, till, when he reached the mountains, these became huge blocks and bowlders, evidently derived from the hills in their neighborhood. After submitting that the phrase "Rocky Mountains" was a very unfortunate one, as applied to the great number of independent ridges comparable to waves that covered this part of America, the professor said that he halted for a little while on the flanks of the first great mountain ranges—those that formed the colossal bulwarks of Colorado. As seen from the prairies they form a very picturesque line of peaks. They had been pushed as a great wedge through the rocks forming the prairies, and had carried those rocks up with them. Crystalline masses formed the central core and crest of the range, and this feature was combined with some very interesting facts connected with the surface erosion of the district. He found then where all the pink feldspar and gravel had come from; it had been borne down from this region, where great masses of pink granite, gray gneiss, and other crystalline rocks formed the core of the mountains. He found that the mountains themselves had been covered with glaciers, which had gone out into the plains and shed their huge horseshoe-shaped moraines where now everything was parched and barren. Having crossed the watershed of the Rocky Mountains, he struck westward into the Uintah, one of the few ranges in that region that had an east and west direction. The central portion of this range consisted, not of crystalline rocks wedged through the older rocks, but of carboniferous rocks that had been upraised as a great flat dome, and had been above water for a very long time. This carboniferous center was particularly interesting from the fact of its presenting the strata perfectly horizontal. They could be seen, terrace after terrace, for miles, and it could be noted whether or not they had been cut through, by faults, to what extent they had been twisted, and to what extent eroded by atmospheric influences. Getting on the tops of these great mountains, he could see that the strata were almost entirely horizontal for miles, and that the valleys had been trenched out of them, not by means of faults at all, but actually by erosion of the surface. He found also that the numerous lakes were true remains of erosion, that they had not been formed by any subterranean movements, but actually gouged out by the ice that once covered those mountains. Striking into one of the valleys, he found beautiful horseshoe moraines. These had gone across the valley and formed a succession of lakes; while the beavers had made a great many more lakes in places not reached by the moraines. In most of these valleys there were hundreds of acres of bog land, entirely due to the damming of the waters by the beavers. The plains in the neighborhood of the Uintah Mountains were called "bad lands," because they were crumbling down under the action of the weather, and nothing would grow upon them. A skeleton found in a hill of that district was brought to Professor Marsh, and turned out to be the bones of an extinct and undescribed reptile.

VOLCANIC REMAINS IN THE YELLOWSTONE COUNTRY.

From the Uintah Mountains Professor Geikie found his way north into the Yellowstone country, and examined the fading traces of volcanic action. The volcanoes seemed in that region to have confined themselves very much to the valleys. The heights on either hand consisted of crystalline rocks; the bottom of the valley had been literally deluged with sheets of lava. These were examined with considerable care. In the course of the examination, huge mounds of gravel and stones were met with, which, at the first glance, were evidently moraines. The first was marked by a huge block of rock, an erratic of coarse granite, different from the rocks round about. Such blocks he found to increase in number as he went up the valley; and on entering the second cañon, or gorge, he found the sides exquisitely glaciated. It was clear, therefore, that not only was this second cañon old; it was older than the glacial period; it supplied a channel for the glacier that ground its way out from those mountains. Endeavoring to estimate the minimum thickness of the ice, he traced striæ up to 1,000 feet, and they evidently went higher than that. But in going farther up the valley, he found that the erratic blocks of granite and gneiss dropped by the glacier as it melted went far above the 1,000 foot limit; he got them on the shoulder of one of the great hills overlooking the valley 1,600 or 1,700 feet above the bottom of the valley; the ice, therefore, must have been 1,600 or 1,700 feet thick. It thus appeared that not only did those mountains possess glaciers, but some of these were of such thickness as to deserve the name of ice sheets, covering the whole surrounding region. As to the volcanic phenomena of the district, he saw evidence of a long series of eruptions, one after another, separated by prolonged intervals, during which the river was at work cutting out the older lavas, the newer lavas filling up the hollows eroded by the river. In the grand cañon of the Yellowstone he saw the most marvelous piece of mineral color anywhere to be seen in the world. It was cut out of tuffs of lavas, showing sulphur yellow, green, vermilion, crimson, and orange tints, so marvelous that it was impossible to transfer them to paper.

THE GEYSERS.

Leaving the Yellowstone Valley, he struck southwestward into the famous geyser regions, where a number of geysers had been made known of late years more wonderful than those of Iceland. He tried hard here to get a pool to wash in, but could find nothing below 212°, and the only chance of getting a bath was to get into some hole where the water had had time to cool after flowing out of the hot crater. The whole ground was honeycombed with holes, every one of which was filled with gurgling, boiling water. Some went off with wonderful regularity, others were more capricious; and the chief geyser, which threw up an enormous body of water and steam, was very uncertain in its movements. In one part of the district he came upon a marvelous mud spring, the center of it boiling like a great porridge pot full of white and very pasty porridge. Steam rose through this, and, after forming great bubbles, burst, the mud thrown out forming a sort of rim round the crater. After describing a meeting with Indians on their way to a great council, the professor said his road after that lay across what he supposed was one of the most wonderful lava fields in the world—hundreds and thousands of square miles of country—a sort of rough plain—having been absolutely deluged with lava. How this lava was poured out he at present could hardly tell; it seemed to have risen through long fissures, and spread out so as to fill a vast area. Here and there along the margin of it were distinct volcanic mounds, apparently formed during later stages of its volcanic history.

THE VICINITY OF SALT LAKE.

Coming at length to the Salt Lake territory, one of the first geological features that struck him was the evidence for the former vast expansion of the Salt Lake. He found traces of a terrace well marked along the sides of the mountains, about 1,000 feet above the present level, and so succeeded in discovering what was the relation between the extended lake, which must have been a great many times larger than the present one, and 1,000 feet deeper, and the glaciers which at one time covered the Wahsatch and the Yellowstone Mountains. Striking into some of the cañons descending from the Wahsatch into the Salt Lake basin, he found evidence of wonderful glaciation. The rocks were smoothed and polished and striated by the glaciers that had come down from the heights, and these glaciers had carried with them great quantities of moraine matter. Huge mounds of rubbish blocked up the valleys here and there, and these mounds came down to the level of the highest terrace. That was to say, that, when the Salt Lake extended far beyond its present area, and was over 1,000 feet deeper than now, the glaciers from the Wahsatch Mountains came down to its edge and shed their bergs over its waters. On his return journey the professor resumed the examination of the prairies. Coming out of the Colorado Mountains, he noted, in connection with the gravel formerly observed, great quantities of a peculiar gray clay. This clay was interstratified with the gravel, and here and there contained a small lacustrine, or terrestrial shell. It was, therefore, a fresh water deposit, a deposit swept by the waters coming down from the mountains over the prairie; and marked an interval in the period during which the gravel and sand were being thrown down. He traced the gravel mounds over an extensive tract, and he found the gravel had been deposited irregularly, just as would have been the case from the action of water escaping from the melting ends of the ice. A great current would traverse the plain in one direction, then the ice mass would send water in another, so that the whole prairie must have been flooded with water derived from the melting ends of the vast sheets of ice. It was those excessive floods that brought down the gravel and sand; and during that time there were intervals when nothing but the finest mud was coming down, just as was seen in the valley of the Rhine and Danube.

The Geodetic Survey of the Great Lakes.

A great deal of curiosity having been excited in the eastern part of Illinois with regard to certain pyramidal structures in that region, the meaning of which the average citizen could not make out, Professor J. O. Barker, of the State University, rises to explain. They are observatories built by the United States lake survey, and are a part of a chain of such stations extending from near Chicago to the Ohio and Mississippi Railroad near Olney, Ill. For many years past the War Department has been engaged in making a very accurate survey of the shores of the great lakes. The method is that known among engineers as a trigonometrical or triangulation survey. This consists in measuring very carefully a line five or six miles long, called a base. From the extremities of this line angles are measured to distant signals erected for the purpose. Then, having measured one side and the angles by trigonometry, they calculate the distance from the base to the distant signals and also the distance between the signals. From these latter stations they measure angles to still other stations, and so continue until they have spanned the whole section to be surveyed with a network of triangles, whose sides are ten, twenty, thirty, and sometimes as much as a hundred miles long. When a map is desired, numerous smaller triangles are measured inside of the larger ones, thus determining the position of a great many points very accurately. Near the close of the work another base line is measured to test the accuracy of the intervening operations. These bases are measured with apparatus constructed expressly for the purpose, and the degree of accuracy is most wonderful, the error often being no more than the sixteenth of an inch in a mile. This system of surveying is the most accurate known. In one instance the lake survey triangulated about three hundred miles with no greater error than four inches, and this is not an exceptional case.

In the beginning the object was a survey of the great lakes for the aid of navigation, and for this purpose the system of triangles was carried around the shores. In the prosecution of this work a line of triangles was extended from the north of Lake Superior to a few miles south of Chicago.

The lake survey having about completed the work for which it was organized, it was suggested by scientific men that the chain of triangles already referred to be extended south from Chicago for the purpose of measuring an arc of the earth's meridian. Astronomers and engineers determined the size and form of the earth by measuring a portion of the circumference. In scientific circles there has always been a great interest connected with the size and figure of the earth, and just now there is increased interest on account of the transit of Venus, which was so much written about in the papers a few years ago. Astronomers use the radius of the earth as the foot rule with which they measure the distance and sizes of the heavenly bodies.

Then, to get back where we started from, the work which the lake survey is now doing in our midst is the measurement of an arc of a meridian from which can be determined the radius of the earth. The structures which have caused so much inquiry among our farmer friends are the observatories built by the lake survey for the purpose of elevating their instruments and signals so as to get a better view of the distant targets.

Nearly all civilized countries have been engaged more or less in the determination of the figure of the earth. The methods and means used by the American coast and land survey are equal, if not superior, to any ever before used, and hence the scientific world waits with great interest for the results of our geodetic surveys. The United States has an enviable international reputation for the liberality and the skill with which our surveys have been conducted. Every American should feel proud of the distinction his country has thus attained.

People frequently ask of what practical benefit is all this. We reply that the principal object of the survey is as above indicated, that is, the advancement of pure science and to add to the sum total of human knowledge. It has nothing to do, as some seem to think, with the land survey. However, it could be utilized in this respect if Illinois should choose to make a trigonometrical survey of this State as has been done in several Eastern States. To some it may seem that the engineers are not very industrious, but such is not the case, since they can only do first-class work under the most favorable circumstances. It was the hope and intention to finish the field work last fall. The computations will take perhaps a year longer.

New Kinds of Plated Sheet Iron.

In Iserlohn, Westphalia, thin sheet iron is plated with alloys of nickel or cobalt and manganese. A half of one per cent of manganese makes cobalt and nickel very malleable, fluid when melted, and ductile. The plates, which are already in the market, are beautifully white and brilliant.—*Metallarbeiter.*

New Jersey's Silk Industry.

Statistics gathered for the forthcoming annual report of the New Jersey Labor Bureau include reports from sixty-seven silk mills, mostly in Paterson. The Paterson mills alone employ 10,000 hands, besides from 2,000 to 3,000 employed in their own homes. The annual production of these mills reaches the total of $14,000,000.

MISCELLANEOUS INVENTIONS.

An improved instrument for mending harness and other articles, patented by Mr. Charles P. Adams, of Stockbridge, Mass., consists in a handle made of such a shape and size as to serve as a receptacle for various tools. It is made with a large central cavity, which is surrounded with a number of smaller cavities of suitable shape and size to serve as receptacles for a knife blade, a needle, a hook for removing stones from horses' feet, and other suitable tools.

Mr. Walter F. Jenkins, of Fithian, Ill., has invented an improved clothes pounder having a hollow stem made with an enlarged upper part and provided with a set of valves and partitions, so that the obstruction of one valve will not interfere with the working of the other.

Mr. Emery M. Hamilton, of New York city, has patented a T-square for use in making perspective drawings, whereby the mechanical difficulties connected with such work may be readily overcome. Heretofore in making such drawings, to avoid the tedious process of working by diagonals or by elaborate scales, whereby only an accurate perspective could be obtained, the draughtsman has usually made the vanishing point too close, so as to bring it within reach, or has selected a point of view with reference to the angle that will effect the same object, the result in either case being to cramp or distort the drawing. This invention consists in a T-square, fitted with a swinging blade, adapted for giving perspective lines vanishing either to the right or left at any distance. The blade is moved by an adjustable slide piece, that is attached upon the drawing board, so that by it a true and accurate perspective drawing may be made with facility.

Mr. Otto Ernst, of South Amboy, N. J., has patented an improved building for cremation purposes. The object of the invention is to associate the process of cremation with the usual practices at funerals; and the invention relates to the peculiar arrangement and construction of cremation furnaces, in connection with a building or temple.

All horses, when in motion, necessarily move the head independently of the body, which causes a jerk or pull on the driver's or rider's hand, and, the mouth of the horse being very sensitive, the effect is unpleasant to both driver (or rider) and the horse. This result is due to the want of elasticity of the reins, or what are in some localities denominated "lines." To remove the difficulty, Mr. Benjamin A. Davis, of Petersburg, Va., has patented lines provided with an attachment which renders them elastic within certain limits, or up to a certain degree of tension, but has no effect when such limit or degree is exceeded.

Messrs. William M. Smeaton and John Smeaton, of Newcastle Street, Strand, County of Middlesex, England, have patented an improved water closet valve mechanism adapted to be brought into operation by a pull or handle for the purpose of regulating the amount and preventing the waste of the water supplied to the bowl of a water-closet, to flush and cleanse it during or subsequent to use.

Messrs. Mortimer H. Bachman and Sebastian S. Peckinpaugh, of Stanton, Mich., have recently patented an improved process of photo-negative engraving, which consists in placing a mask over, but not in contact with, the negative previously developed by the usual process of photography, for the purpose of preserving intact any portion of the object upon the negative, while the remainder not wanted is obliterated by exposure to the light, and the negative subsequently finished in the usual manner and engraved by means of a sharp steel instrument, which cuts through the varnish and exposes the glass, so that whatever design is engraved will be printed along with the photograph.

An improvement in buckles has been patented by Mr. George G. Bugbee, of Gonzales, Texas. The invention relates to buckles for harness or other purposes, adapted for connection to a strap or billet without sewing; and the invention consists in a buckle having a rigid crossbar, that is formed with a loop or crank-shaped tongue, over which the billet or strap is placed to secure the buckle, and on which the swinging tongue of the buckle is secured, this construction rendering the buckle more compact and of better appearance than double tongue buckles as heretofore made, and giving a wider range of use for the buckle.

Mr. Henry Gottlieb, of New York city, has patented an improved billiard cue cutter, which consists of a cylindrical box, four or five inches long, or thereabout, bored throughout its length for the admission of the end of the cue. The box is divided longitudinally into halves that are hinged together at the lower end by an annular hinge, and are prevented from separating too far at the top by a slotted circular plate that is fastened on the top of one half and engages with staples on the other, and under this plate is secured a blade that projects horizontally part-way over the bore.

An improved Wagon Cover, patented by Mr. Thomas Danahey, of Council Bluffs, Iowa, consists in making a bow of two straight springs of equal length, and connecting them by a top hinge, while on the other side, opposite to the wings of hinge, are arranged two stops that abut together and limit the inward movement of the hinge ends of the spring toward each other.

Mr. Edward Clark, of Jersey City, N. J., has patented an improved composition for fire kindlers, composed of resin, lard, washing soda, flour paste, and sawdust.

An improved railway rail has been patented by Mr. Silas Nicholls, of Westminster, England. It consists in a rail, constructed of parallel lengths or half rails, of channeled iron or steel of] shaped section, bolted or riveted together, with their channeled sides outward, and with cast iron spacing blocks between.