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.

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