HOO-DEN, OR JAPANESE BUILDING.

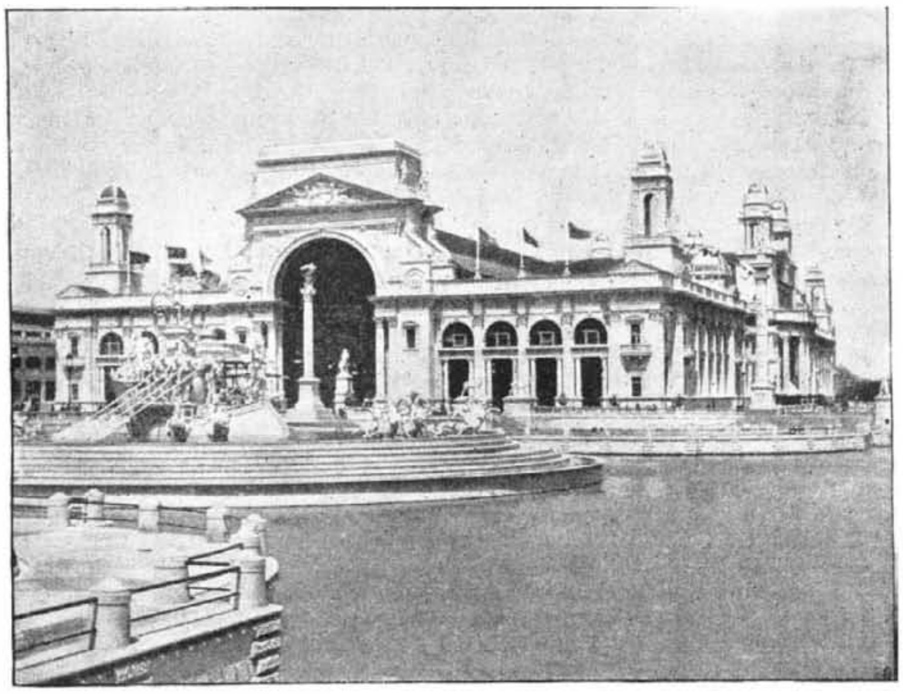
The Hoo-den, or Japanese building, on the Wooded Island is a very attractive building. The building is in three sections, the center one being a *fac-simile* of a room in the Nijo Castle, Kioto, built by Tokugawa Iyeyasu in 1601. No expense has been spared in the execution of these buildings and in the selection of their choice contents. Though the buildings are small still they are without doubt among the most expensive of the foreign buildings on the grounds. The entire series of buildings is presented to Chicago by his Highness the Emperor of Japan.

SOUTH SEA ISLAND VILLAGE.

The South Sea Islanders have an exhibit in the Midway Plaisance consisting of four Samoan houses constructed by natives. The largest of the houses stood for ten years in the village of King Mataafa and is made from the wood of the bread-fruit tree thatched by leaves of the wild sugar cane. There are about twenty-five villagers, natives of Samoa, Fiji Islands, etc.

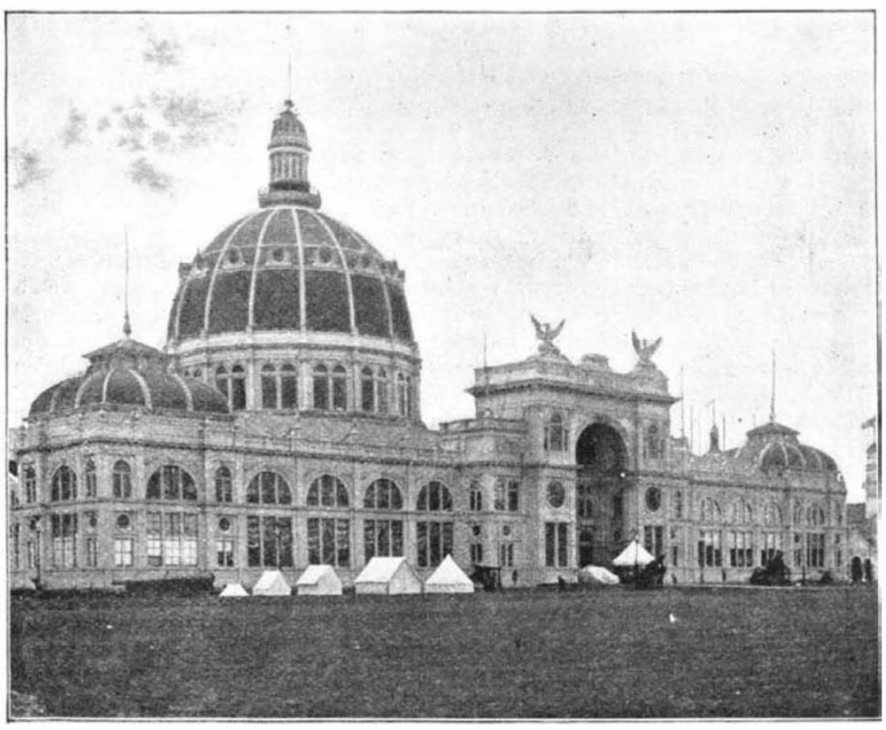
Aluminum Solder.

This is an alloy consisting of 9 parts of aluminum, 1 to 3 (or even 4) of silver, and 2 to 4 (or even 5) of copper. A silver-copper-zinc-aluminum alloy and a silver-brass-aluminum alloy are also described; moreover, the zinc may be replaced by cadmium or bismuth or a fusible alloy, such as "Wood's metal." A small proportion of gold may also be added. In making the alloys, the copper and silver are first melted together, molten aluminum added, and solid zinc then dropped in. To use the alloy it is broken up and spread between the surfaces of the articles to be soldered, previously heated. These are then pressed together with the soldering iron. No flux is required.

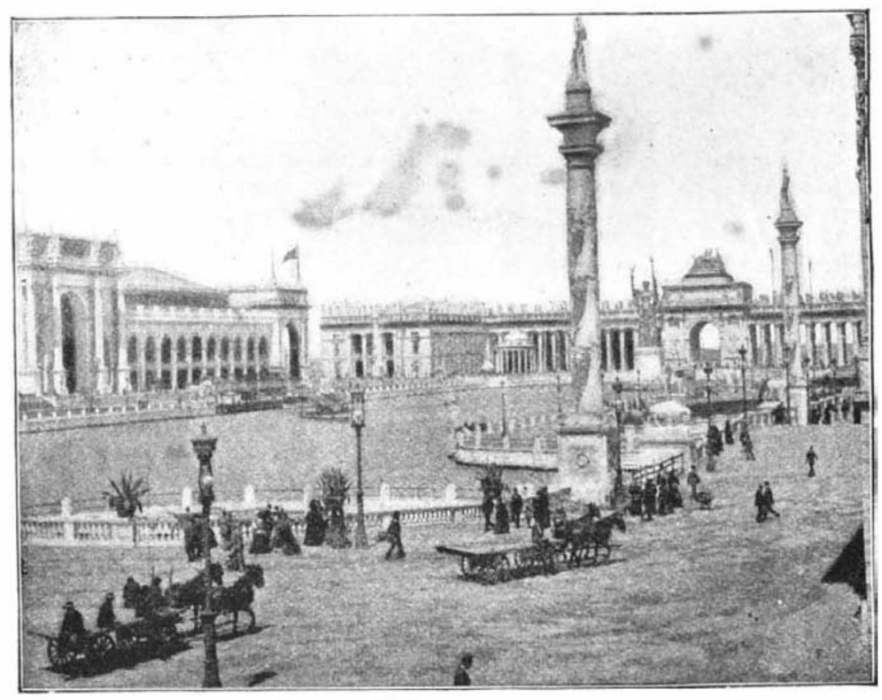


THE PALACE OF ELECTRICITY.

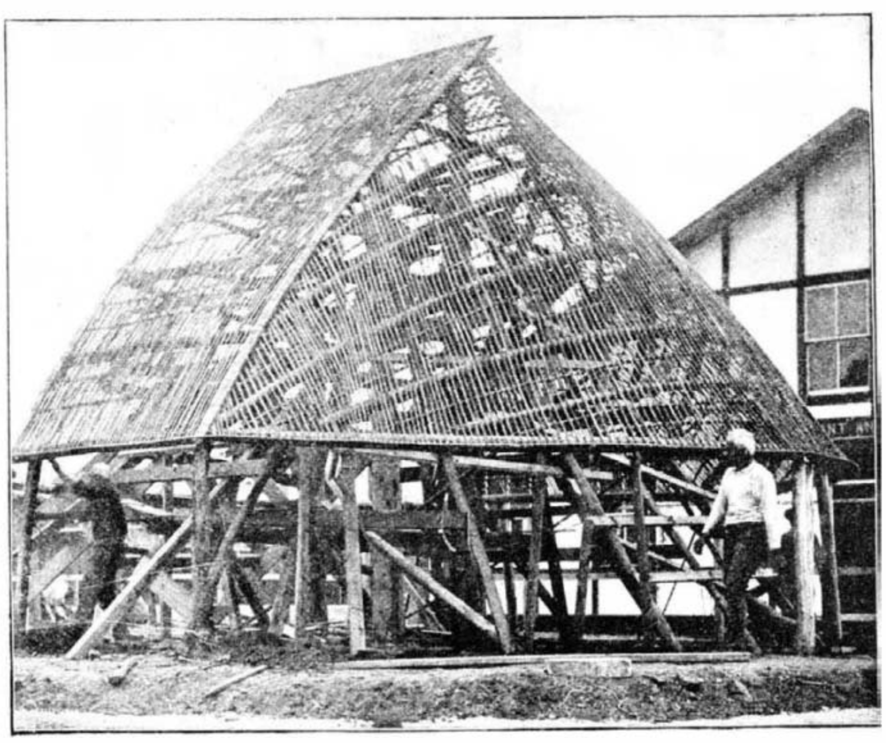
JAPANESE HOO-DEN—WOODED ISLAND.



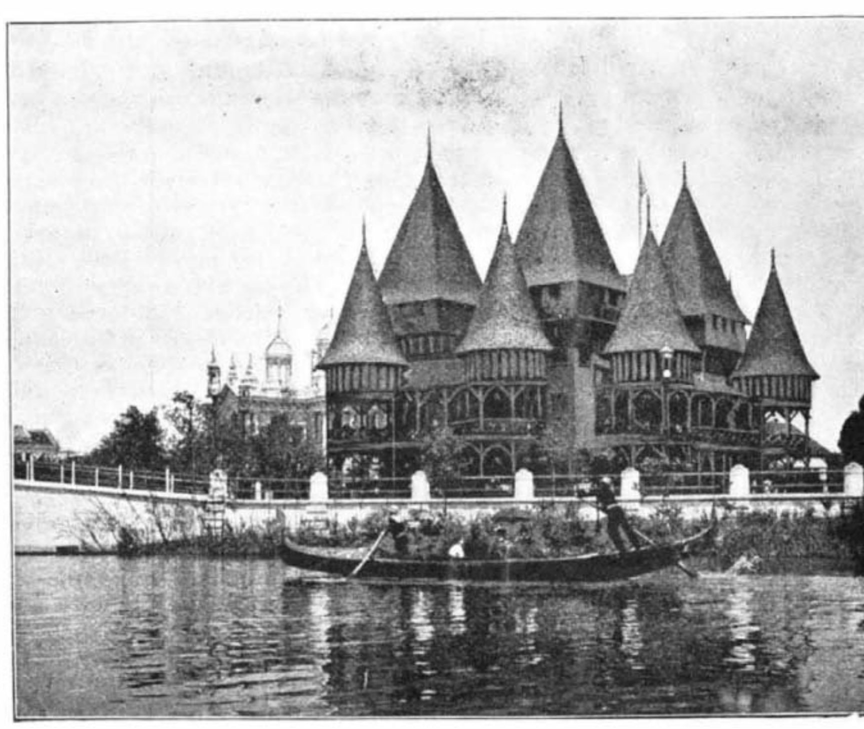
THE GOVERNMENT BUILDING.



VIEW ON THE LAGOON LOOKING NORTH—PALACE OF MANUFACTURES ON THE LEFT.



SOUTH SEA ISLAND HUT.



THE MARINE CASINO.

THE WORLD'S COLUMBIAN EXPOSITION—SOME NOTABLE BUILDINGS.

Some Extinct Lakes.

RALPH S. TARR.

The investigations of members of the United States Geological Survey have revealed to us many interesting episodes in the geological history of the country, and have thrown much light on the physical geography of the past. Two of these events in particular are of interest, for the reason that they tell of most interesting changes, not only of geography but of climate. I refer to the former existence of great lakes, one in the vicinity of Great Salt Lake, the other in the valley of the Red River of the North.

It was very early known (indeed, the early settlers could see it) that there had at one time been a great lake on the site of the present salt lake and desert in Utah. The early explorers noted the presence of terraces, flat-topped and often of remarkably uniform height, which they knew to be water-formed. There were bars, also, across the mouths of side streams, and spits, wave-cut cliffs at headlands, and, indeed, all the phenomena of lake shores along these terraces. Not only is there one terrace, but several which mark changes in the level of the lake.

Mr. G. K. Gilbert, of the United States Survey, undertook the task of unraveling the history of this region as shown by the terraces and gravels, and has published a most fascinating account of his results as a monograph of the United States Geological Survey, bearing the title of "Lake Bonneville," the name given to the extinct lake. What I have to say in this part of the article is merely a summary of his book, which every one interested in the subject should read.

Every tourist to Salt Lake City must have noticed the flat benches clinging to the mountain sides and have marked the flat desert tract in which the Great Salt Lake is situated, and, perhaps, have wondered what it means. They may have noticed the small mountain peaks rising from the desert like islands in the sea. These were once islands, and now they rise out of the lake sediments in which they are partly buried.

The mountain streams flow out upon the plain and disappear in the gravel. Here and there a shallow pool of saline water stretches over a depressed part of the plain, where some unusual rains give to the streams an excessive supply of water; but these soon evaporate and leave a dry mud, flat or marsh, perhaps glistening with salt or alkali. The term playa has been given to these patches, and when they are transformed into a lake they become playa lakes. Where the mountain streams are continuous and their current sufficient, the waters accumulate and remain throughout the year. But there is no escape for the water except through evaporation, and as evaporation takes only the pure water, and as all water carries salt and other substances in solution, obtained as it passes over the rocks, this is left behind, and each year the undrained lake becomes salter.

This is the present condition, and for many years the region has been in essentially this same condition; but a study of the terraces shows that at one time this great basin was filled with water and overflowed by way of Red Rock Pass into Marsh Creek and thence into the Columbia. This is shown not only by the high terraces, but also by the outlet itself. At present this outlet is a divide occupied by small vacillating streams and dry channel-ways, and by the crumbling of its steep walls it is being clogged. That it was once occupied by a mighty torrent might almost have been determined without the additional evidence of the associated shore lines. It has been cut to a depth of several hundred feet, with a width of a third of a mile.

When Lake Bonneville was full of water to overflowing, it had a surface of 19,750 square miles—a magnitude ranking it with the Great Lakes. Its maximum depth was 1,050 feet. Of it Mr. Gilbert says: "If the water were to rise again to its old mark, more than one hundred towns and villages would be submerged and 120,000 persons would be driven from their homes. The Mormon temple would stand in 850 feet of water," and 700 miles of railroad would be immersed.

The history of the lake is even more complicated than has been indicated. There is evidence that long before the existence of the overflowing lake the site was practically dry and arid. The water afterward rose, but not to its rim, and then another change in climate occurred and aridity again set in and the lake basin became nearly if not quite dry. A second rise occurred, and this time the lake overflowed to the ocean. Since that time the climate has been growing progressively more arid, and the author predicts that this may possibly continue until even the last remnant of the salt lake is evaporated. The evidence of these changes is conclusive, and will not be given here, but can be found in the monograph.

As to the duration of these periods, little can be said that is definite. The first period of aridity was probably much longer than any subsequent one, and the first rise of water appears to have lasted nearly five times as long as the second. The intervening dry period appears to have been of greater duration than the present period of aridity. There are no data at hand for an estimate of this period in years; but if, as seems probable, they were associated in point of time with the advances and retreats of the ice in glacial times, each episode must be represented in thousands, perhaps tens of thousands of years. On evidence, more or less reliable, it has been estimated that the close of the last glacial epoch was not far from 10,000 years ago, and it seems probable that at this time the last period of desiccation set in. We, therefore, have a rough basis for a calculation in years.

Just why these climatic changes have taken place no one can say with definiteness, although there is no lack of theory to account for it. The presence of a body of ice on northern America would amply account for an increase of precipitation; but here the difficulty is not lessened, for we must account for the ice. Some suppose that the land was higher in the north, and hence colder. Others suppose that astronomical causes must be sought for; and still others that a change in ocean currents accounts for the climatic variations. Many think that the real explanation is a combination of two or more of these causes. This much we know, that the present arid condition of the region is the result of the dryness of the air, which has been robbed of its moisture as it passes from the sea over the land and over the high mountains; but why this was not formerly the case, we cannot adequately explain.

Other interesting phenomena are revealed by this study. Before, during, and since the period of high water, the great basin has been the seat of considerable volcanic activity. At times the lava has flowed on the margin of the lake, again it has entered the waters, and volcanic eruptions have occurred even in the lake itself. At present, all volcanic activity seems to have ceased, though some of the lava has been erupted in very recent times.

Not only has the level of the water changed, but even the level of the land has suffered a change since the water sank below the terrace levels. Lake beaches are, of course, all formed in a horizontal position, and normally they should be at the same level in every part. But some of the terraces of Lake Bonneville are disturbed by faulting and folding, and are no longer level. These changes may possibly be associated with the volcanic eruptions.

It is not improbable that there are secular variations of climate, extending over great periods of time and changing so slowly as to have escaped our attention—great curves of variation, first of dryness, then of aridity, dependent upon some cause which we have not yet discovered. There even seems some reason to suppose that the world is at present in a condition of aridity. Arid basins are common in various parts of the world, and many of them seem to show signs of having been at one time occupied by water, as was the great basin of the West. There are many instances of this, and the ancestor of the Great Salt Lake is by no means the only one in the plateau region of the West. There are many such lake beds in New Mexico, Arizona, Nevada, and also in other parts of the world; but of foreign examples we know little, for their history has never been studied in detail.

LAKE AGASSIZ.

The second instance of a great lake, now extinct—that of the valley of the Red River of the North—is also associated in origin with the glacial invasion, and it has been appropriately named Lake Agassiz, in honor of the one who first proved that the northern part of the continent had been occupied by an ice sheet. This has been studied in much detail and reported upon admirably by Mr. Warren Upham in reports of the Minnesota State Geological Survey and in the publication of the Canadian Geological Survey. He is also preparing a monograph upon the subject for the United States Survey.

Here, as in Utah, the lake beaches, bars, terraces, and cliffs mark the history of the lake, and the broad, flat plains of the Red River Valley record the presence of a sheet of water. At present the Red River flows north through the plain; but when Lake Agassiz existed it was forced to flow southward, into the Mississippi. Here, too, the outlet was through a broad, deep valley, now partially clogged and occupied by shallow lakes and swamps, forming the divide between the drainage of the Arctic and the Gulf of Mexico.

The history of this lake is simpler and more easily understood than is that of Lake Bonneville. As the ice disappeared from the country, its front stood at successively different positions, gradually retreating northward. At one time it must have stood south of the divide between the Mississippi drainage and that of the Red River. Later, it stood on the divide, and, finally, north of the divide. It then formed a wall across a north-flowing stream and forced it to flow southward. Since the old preglacial valley existed with a northerly slope, a lake was formed with the two valley walls as east and west banks, the ice front as the northern boundary and the divide as the outlet, through which the mighty torrent, furnished by the melting ice, passed—a veritable Niagara in volume. When, finally, the glacier disappeared from the valley or permitted the natural northerly flow to begin, the lake dwindled down and finally disappeared, leaving only its lacustrine gravels and silts to indicate its presence; but this is sufficient, for the story is most plainly told by them. Like Lake Bonneville, its history was complicated, and at different times its surface was at different heights, since the outlet varied when the ice allowed its escape through some lower channel. Unlike Bonneville, there is one shore not now to be seen, and this is the shore line cut in the northern ice wall, and which disappeared when the ice went.

Mr. Upham estimates the area of Lake Agassiz, when it was at its highest stage, at about 110,000 square miles, and it then exceeded by more than 15,000 square miles the total area of the five Great Lakes combined. The area of the three great lakes, Manitoba, Winnepeg, and Winnipegasis, aggregate about 12,500 square miles, and they exist in the basin of extinct Lake Agassiz, being in a way descendants of that great lake, filling shallow depressions which were not filled with lake sediments. During the formation of the highest beach, the depth of Lake Agassiz was in many places as great as 500 or 600 feet. It was thus a colossal lake, greater than any now in existence on the earth.

The type of lake to which Lake Agassiz belongs is essentially extinct to-day, though it was very common on a smaller scale when the ice sheet was disappearing. Many of the north-flowing rivers of New England were thus dammed and their valleys transformed to lakes. The area of the Great Lakes was at times changed and enlarged, and their outflow was through different channels at different times. At present there are in regions of valley glaciers small lakes formed by an ice dam across a stream valley; but they are pygmies compared with Lake Agassiz, and are interesting chiefly as they show at present, on a small scale, what was formerly common on a much larger scale.

These two instances of great lakes now extinct are interesting, not only in themselves, but chiefly in showings that the present conditions of physical geography are but stages in a great and complicated history, and not, as we are too apt to think, fixed and permanent parts of the earth. Everything in nature is changing, geographical forms no less than others. These are, perhaps, exceptional cases, showing unusually great changes in a comparatively short time; but they are, nevertheless, instructive, and may be taken as indices of other great changes of a different character, acting more slowly but, nevertheless, surely.

A Youth's Prospects in the U. S. Navy.

Boys of good character, who have no physical defect, and who can read and write fairly well, are admitted into the navy between the ages of fourteen and eighteen years. Between fourteen and fifteen years a boy must measure 4 feet 9 inches in height, and weigh not less than 70 pounds; between fifteen and sixteen, 4 feet 11 inches, and 80 pounds; between sixteen and seventeen, 5 feet 1 inch, and 90 pounds; and between seventeen and eighteen, 5 feet 2 inches, and 100 pounds. They must serve till the age of twenty-one as boys and junior seamen and after that age they rank as seamen or petty officers. They are now allowed a sum of $45 for outfit, a fact which considerably enhances the value of the service. To discover the exact number of petty officers on board a fully equipped ship is by no means an easy task; but, at all events, the number of these minor prizes is encouragingly large, while still higher up, as the final goal of the common sailor's aspirations, are the substantial berths of the four warrant officers—held by the boatswain, the carpenter, the gunner and the sailmaker—whose pay and privileges are the same as those of the junior officers. And now as to rates of pay: The pay of boys enlisted as third-class apprentices is $9 a month; the next promotion, to second-class apprentice, brings $10; the next, to first-class apprentice, $11 a month. Further on we have second-class seamen apprentices with $19 a month, followed by first-class seamen apprentices with $24 a month, these two grades corresponding respectively to ordinary seamen and able seamen, or simply seamen, whose pay is also $19 and $24 a month.

It can thus be seen that a first-class seaman apprentice and an able seaman get each the respectable sum of $288 a year, which is $128 in excess of the highest sum paid to a first-class seaman in the British service, the only other navy in the world worth consideration on the score of pay and promotion. There is, besides, the daily ration of thirty cents, which runs through the ship from the apprentice to commander, for, strange as it may appear to some people, Uncle Sam distributes just the same fare to the officers as to the apprentice, and that, too, only when on sea duty. There are no other allowances whatsoever made to the officers; they have to furnish all their own mess equipments and everything else.
—*Harper's Young People.*

Motion of the Sun through Space.

Mr. A. D. Risteen, in a recently published paper in the *Astronomical Journal* on a new method for determining the direction of the sun's motion through space, concludes that he has obtained results which not only show the reality of such motion, but that its rate is 10·9 miles per second.

Mica.

Mica fills the interstices of modern progress. A few decades ago we were seeking practical use and market for the output of mica mines already found; now we are seeking new mines to supply the multifarious uses to which mica can be applied. Thus the law of necessity changes in its relation to all things.

Mica is now as essential to the various uses of electricity as this great force is necessary to human progress. In all appliances for electrical lighting and power the most important reciprocal agent entering into their machanism is mica. All armatures are built up with its insulation, whether for dynamos, motors, generators, or transformers. Without its use as an insulation the core of the armature would burn out with a flash. But by placing sheets of mica between the thin sheets of iron, which are secured to the shaft that runs through the drum of the armature, insulation becomes perfect. Thus armatures of even the largest generators can be run for twenty-four continuous hours without heating them more than 80° Fahrenheit above the temperature of the surrounding air. By this use of mica the lines of force are dissipated, but do not lose any of their electrical energy.

In all electrical safety appliances mica also performs an important part as an insulator. To its infusible and indestructible nature much of the success of the rheostat can be ascribed. This wonderful mechanism, which is applied as a motor starter, a governor of speed, a reversing switch, and an automatic safety switch, is absolutely fireproof, and can be subjected to a red heat without mechanical injury. This is rendered possible by making the resistance of thin plates of iron packed closely together, but separated by mica.

Thus the lines of force operate on the same principle as in the armature. Aside from these important uses of mica in electrical apparatus, it is also applied to a thousand minor ones, which make it the constant and willing servant of the greatest power that man has turned to intelligent subjugation.

Mica is also an important factor in many branches of manufacture and art. Owing to its peculiar elasticity and toughness, qualities in which it is not excelled by anything natural or artificial, it is used as an absorbent of nitroglycerine, and when so used explosions by percussion are rendered almost impossible, while at the same time nothing is taken from the energy of the nitro-glycerine when exploded by fulminates or similar device. For such purpose the plumose mica is used, or that in which the scales are arranged in feathery form.

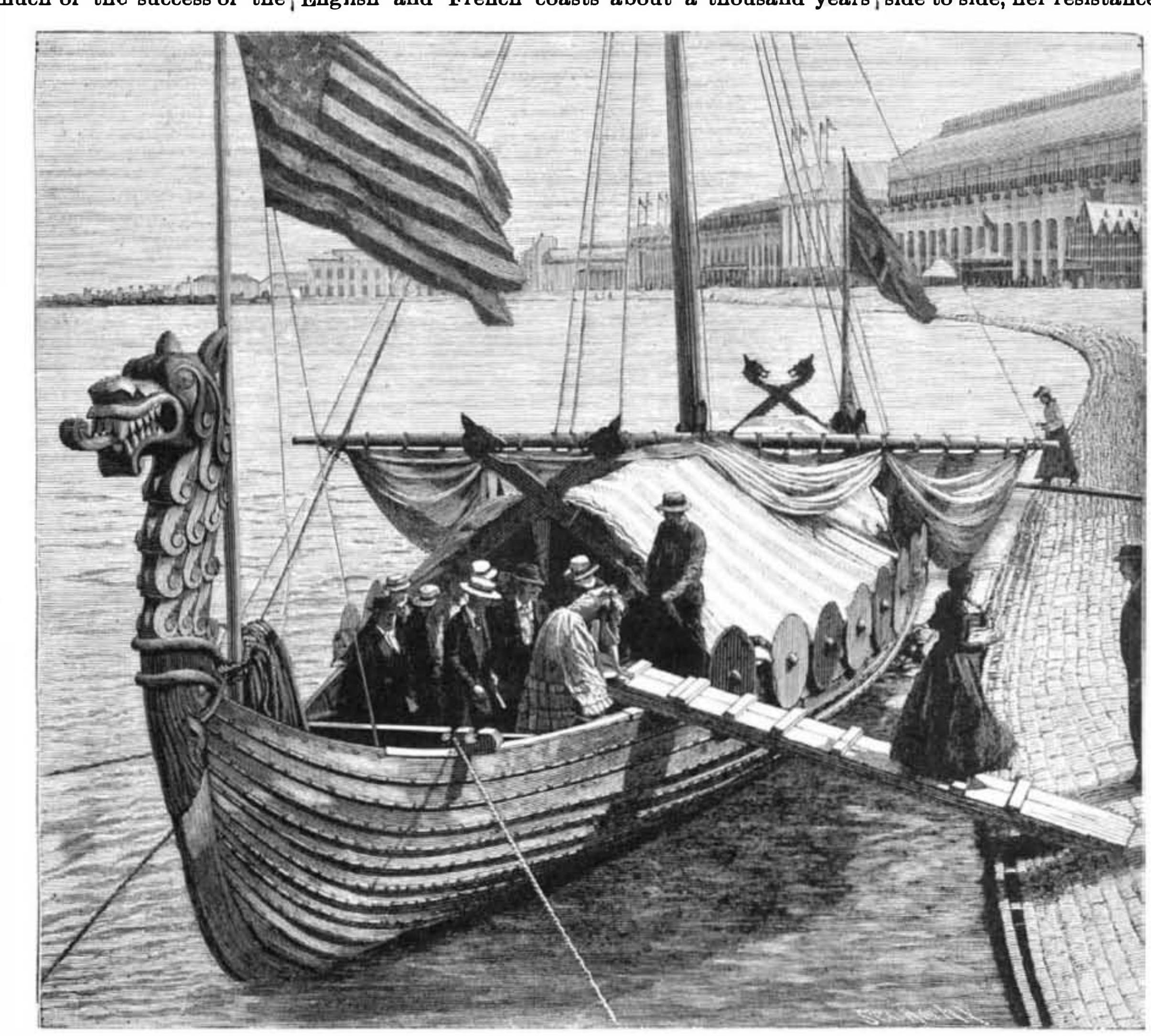
The prismatic or foliated mica is also used by passing it through a mill. This vastly increases the mica's bulk and forms masses of bran-like scales, translucent and beautiful. The French silver mouldings are also made with this ground mica. The unalterable nature of mica and the fact that it entirely resists the action of corrosive acids, smoke, and dust, make it a valuable material for edificial decoration. It can be readily colored or metalized, and its transparency preserves in all its pristine beauty anything to which it is applied. This ground mica is also used as a lubricant and axle grease, and for such purposes has no superior except plumbago. Coarsely pulverized, it is also used for roofing material and as a fireproofing for iron safes.

The cleavage of mica is so perfect it is estimated that it can be split or divided into leaves 250,000 to an inch. Much of its commercial value depends upon this wonderful property of lamination. The largest plates of mica with such foliacious structure are obtained from the Siberian mines, and they sometimes attain a diameter of five and seven feet. Crystals over two feet in diameter have been found in Pennsylvania, eighteen to twenty-four inches in New Mexico, and fourteen inches in North Carolina. Blocks of crystals weighing over one hundred pounds are frequently mined. The North Carolina mines are supposed to be very ancient.

Mica plates found in them when first discovered were trimmed to particular shapes, and it is supposed they were used for windows, mirrors, and ornaments. The number of the mines and the magnitude of these ancient operations excite wonder. Some of the mines are tunneled to a considerable length, and distinctly show marks of chisel-shaped tools. Mica in some form exists all over the earth, but not in quantities of any commercial value. It can be found in granite and quartz rubellite, green tourmaline, feldspar, lepidolite and other minerals, also in granular limestone, gneiss, and slate. It varies in color from white through green, yellowish, and brownish shades to black. Its chemical composition is silicite of alumina and potash, with a small amount of iron, magnesia and soda, and about five per cent water.—*Inter-Ocean.*

VISITING THE VIKING SHIP.

This now famous little Scandinavian vessel, only 74 feet long, which was sailed across the ocean from Norway in May last, is a constant attraction to large numbers of visitors at the Fair. She is an exceedingly well built little craft, but as to this it is said she in no way surpasses the original for which she serves as a model, and the interest in her, therefore, clearly lies entirely in the fact of her being an exact copy of one of the old Viking vessels, such as used to cruise along the English and French coasts about a thousand years ago. In this way the vessel affords one of the many valuable historical object lessons in which the Exposition abounds, and which amplify its far-reaching educational character.



THE WORLD'S COLUMBIAN EXPOSITION—THE VIKING SHIP FROM NORWAY.

Fast Ocean Steamers.

At the recent meeting of Naval Architects, London, Dr. Francis Elgar read a paper on this subject. The author sketched the history of the Great Eastern and compared her construction with that of the Campania, and then passed on to some of the general questions involved by the growing demand for increased speed at sea.

There are already several ships that can cross the Atlantic at an average speed of over 20 knots or 23 statute miles per hour. The Campania crossed from Sandy Hook to Queenstown, on her first voyage in May last, at an average of 21·3 knots, and during one day she averaged 22·3 knots. These speeds are a little over 24½ and 25½ statute miles per hour respectively. Among the conditions essential to high speed in all weathers are: (1) Great size of ship; (2) a form suitable for driving easily at high speeds over heavy seas without shipping heavy water, or lifting the propellers sufficiently to cause racing; (3) deep draught of water; (4) steadiness in a seaway; (5) great strength of structure and of machinery; (6) a large proportion of boiler power, so as to enable a full supply of steam for the engines to be easily kept; (7) a full and well regulated supply of air to the furnaces.

The speed of a ship at sea approximates more nearly to that obtained in still water, with the same propulsive power, the larger she is made. No doubt length is the principal element of size in this respect; but depth, or draught of water, is also very important. Whatever might be the speed obtained with a ship on trial in smooth water, the extent to which her average sea speed would afterward approach this would depend very greatly upon her size.

The full effect of form upon average speed at sea, over long voyages and in all weathers, cannot be measured by still-water trials.

One of the chief points in connection with the form best adapted for sea speed is that it should offer resistance to pitching. The fineness of ends that would give the best results in smooth water requires to be corrected by the fullness necessary to prevent undue pitching.

Deep draught of water is a most important element of speed at sea, and it is now strictly limited by the depth of water in the ports and docks used by the fast passenger steamers on both sides of the Atlantic. Twenty-seven feet is the extreme limit of depth to which a ship can load on either side. The Campania cannot load an inch deeper than the Umbria, although she is 100 feet longer.

Steadiness is important, not only as a very desirable element of comfort to passengers, but also as contributing to speed. When a vessel is rolling heavily from side to side, her resistance must be increased.

He concluded by saying that the improvements that would have the greatest effect in promoting the increase of speed at sea are: Increase of depth of water in harbors and docks, such as would admit of much greater draughts of water being obtained; and improvements in boilers, by which greater steam power could be developed out of the same space and weight. The Atlantic trade is increasing at such a rapid rate that larger and swifter ships are certain to be soon called for. The depth of water has lately been somewhat increased at Liverpool; but much deeper harbors and docks will be required if further great increases of speed at sea are to be obtained without excessive difficulty and cost.

The New York Aquarium.

The old historic fortress known as Castle Garden, situated on the extreme point of land at the south end of the city, where the waters of the Hudson and East Rivers unite, is now transformed into a free aquarium. The legislature appropriated $150,000 to pay for converting it, under the charge of the Park Department. The building has been remodeled by Mr. H. T. Woodman, a scientific aquarist. Round the walls and beneath a light circular gallery are two ranges of brick cells, which will form the tanks, and beneath the dome in the center of the building is a large central tank, which will in time become the home of a white whale or grampus; and six small tanks around the center tanks will be used for sharks, seals, etc. There are thirty-six side tanks in all, which will be lined with white tiles and faced with plate glass. In the gallery eighty-four small tanks will be placed. Great care is taken with the lighting, which is accomplished by means of skylights. Special tanks are provided for the blind fishes, and experiments will be carried on to see if the blind fishes will not, on favorable conditions, recover their sight. Abundant supplies of fresh and filtered salt water will be provided. The three great aquariums of the world are situated at Naples, Brighton, and Berlin. The present aquarium is much better equipped than the Berlin aquarium, and will doubtless in time rival the other two great aquariums. It is a valuable acquisition to the city.

Lead as a Coating for Iron and Other Metals.

To 100 pounds of lead are added 5 pounds of aluminum, 2 ounces salammoniac, ½ ounce arsenic, ½ ounce of borax or 1 pound of alum, and 1 pound of cryolite. The alloy of lead, aluminum, and arsenic gives a harder and more firmly adhering coat than is obtained in the ordinary process. The plates to be coated are cleaned and passed through the bath in the usual way.