

in length including viaduct approaches, deck spans, and a channel span which in itself is 338 feet in length. The bridge and approaches cost in all about \$500,000. Near one of its terminal points the shape of the bank recently suffered from floods to such an extent that the railroad company found some plan of protection was necessary. After a careful examination the chief engineer determined upon a plan which has been carried out in several portions of the country by the government engineers, and the work was begun with the approval of the Missouri River Commission. The plan consisted of first grading the banks, then making an artificial foundation for the stonework by weaving what is known as a "mattress." This was "ballasted," and the revetment was completed by covering the shore end of the mattress with smaller stone in layers which reached a certain distance up the banks. In grading, the hydraulic system was used, a pump being installed which furnished a pressure of 100 pounds to the square inch, throwing the water through a 4-inch pipe fitted with a nozzle of $1\frac{1}{2}$ inches in diameter. This stream was found to be sufficient to cut away the top of the bank, throwing the surplus material into the river and leveling it to the desired grade. The force of the water was such that the bank beneath the water to be covered by the mattress was also graded. With a force of six men the engineers were able to grade 100 linear feet of bank in 10 hours.

In making the mattresses two barges, each 20 by 50 feet in size, were lashed end to end, and a platform and a set of ways constructed thereon. The weaving was done on the ways. When the top of the ways was reached, the mattress was held up by the men, and the mattress boat allowed to drop down stream until the work was again at the foot of the ways. The mattress is woven of brush, 1 to 2 inches in diameter at the butt, and 15 to 25 feet in length, the "stitch" being over and under. It is 12 inches thick and 86 feet wide, with a selvedge on both the inshore and outstream edges, and is strengthened and held in place by a system of cables. The line of the inshore edge of the mattress follows a contour line, 3 feet above low water. Galvanized wire cables were run longitudinally, one cable under the mattress and one on top, and a single cable was run in the inshore selvedge. Similar sets or pairs of cables were also run transversely, at intervals of 16 feet 8 inches, one cable under the mattress and one on top. The transverse cables were anchored to posts planted on the main bank, back from the top of the slope. These anchors are yellow pine timbers, 12 by 12 inches and 4 feet long. To prevent the finished mattress from sagging, it was straightened as fast as completed by pulling upon the cables with block and tackle.

In sinking the completed mattress, the mattress boat was floated down the stream with the current, the mattress itself being left to float on the surface. A barge loaded with bowlders weighing from 100 to 200 pounds each was then drifted upon the mattress, and the stones dropped upon it in such a way as to distribute their weight as equally as possible over all parts. The stone served as anchors to hold the submerged portion firmly in place on the bottom of the river.

One of the most difficult and interesting features of the revetment was the "paving," as it was termed, which extended from the top of the artificial grade to several feet beneath low water. The inshore edge of the mattress was covered with crushed stone from a point 3 feet below water to about 3 feet above, making a binding between it and the bank proper. Upon this was placed a layer of larger stone ranging from 8 inches to 12 inches in size, and extending as already stated to the top of the grade. It was wheeled in barrows to the graded banks and placed regularly in a sort of pavement. By following this plan much more resistance is offered to the action of the water than if the stone was merely thrown loosely upon the formation. A top dressing, however, was given the pavement, consisting of a layer of 2 inches of crushed stone, this filling the crevices and practically forming a solid embankment.

In spite of the apparently large amount of work required to carry out the various processes, the cost was less than \$7.50 a linear foot of revetment, including all expenses. The force of men required to weave the mattresses comprised but 33 in all, who completed 90 linear feet in 10 hours, while 30 men were employed to unload the stone barges and 32 men for paving and supplying the paving material. With the force of labor divided in this way, the various portions of the improvement kept pace with each other, so that while a section of the bank

was being graded, the mattress to cover it was being woven, etc.

The revetment which has been completed is 8,250 feet in length, and apparently will resist the action of the river even during the times of the highest water. It is considered superior to dikes and other formations for protection, for the reason that the submerged portions as well as the construction above the water are so bound together that the current can-



NOAH'S ARK OF THE HUICHOL INDIANS.

not work behind the bank where the improvement has been made—a frequent cause of injury to dikes, as indicated in the accompanying photograph. The plan followed in this instance leaves the formation of the shore at such an angle as to offer no direct resistance to the current, and it is believed will require little or no repairs for a period of years, although the formation of the shore at this point, as already intimated, is of loose material.

A change from steam to electric power on the



GOD HOUSES OF THE HUICHOL INDIANS.

Georgetown & Portsmouth Railroad has resulted in throwing upon the market a lot of second-hand rolling stock. It was first thought that this rather expensive equipment would be converted into junk, for the reason that the railroad is of narrow gage. A bargain has, however, been made with a large contracting company, interested in the construction and operation of roads in China, for the purchase of engines and cars, both passenger and freight. The rolling stock is to be shipped to China to be used on a road of similar gage now under construction.



THE GRANDMOTHER GROWTH OF THE HUICHOL INDIANS.

THE SYMBOLISM OF THE HUICHOL INDIANS.

BY WALTER L. BEASLEY.

Carl Lumholtz, the well-known Norwegian explorer, who has made three expeditions, occupying five years of research, among the natives of northwest Mexico, in the interest of the American Museum of Natural History, has brought back much valuable information and many strange and interesting ethnological objects. These have recently been installed in the new west wing of the institution, and form a most striking and comprehensive exhibit, illustrating the peculiar symbolism and culture of practically an unknown race of people, who are at present living in the same state of barbarism as when Cortez first put his foot on Mexican soil. Mr. Lumholtz is the first white man to visit and study the tribe. He succeeded in making friends with the leading shamans and tribal officials, from whom he obtained a great number of traditions and legends associated with the various symbolic and archeological objects collected. Of extraordinary interest among the specimens secured is the representation of an ark, together with the Huichol version of the same. There has been no Bible or priest among them for centuries, and they have forcibly resisted the intrusion of missionaries in recent years. Their old beliefs, customs and ceremonies all remain in their ancient vigor. Just how and when the Bible story found its way among the Huichols and became embodied in their mythology is unknown. Before explaining the ark and its symbolic significance, a brief outline of the Huichols is herewith given. The tribe number at present about 4,000, and they live in a rugged country, difficult of access, in the northwestern part of the State of Jalisco, among the Sierra Madre range. The territory is estimated to be about 40

miles long by 25 wide. All of their settlements—save one on a high mesa—lie on the east border of the Chapalagana River, which traverses their country from north to south. The Huichol are of medium height, with skin of light reddish brown. The dress of the men consists mainly of a shirt made of a cheap quality of cotton cloth. The women wear a skirt and short tunic of the same material, and cowhide sandals. The women weave tunics and girdles from wool, and are quite clever at embroidery, with which they adorn their dresses. They live in circular houses made of loose stones and mud, and covered with thatched roofs. They dwell in small ranches; only the officers of the tribe stay in the pueblos. The Huichols offer to their innumerable

gods many remarkable symbolical objects, being the embodiments of prayers. These votive images are found in the god houses and sacred caves. All ceremonial objects lose their potency after five years, after which time they are thrown out and renewed. The gods are implored naturally for material benefits only. The moving principle in their religion is a desire of producing rain, thereby enabling them to successfully raise corn, beans and squashes, their principal food. One of the most unique and remarkable of the symbolic objects obtained from the Huichols is an ark, which was kept in one of the god houses, and deposited occasionally upon the waters of a small lake as one of the extreme measures of getting rain. To the Huichol mind what has once been associated with an effect has the power of reproducing that effect, and therefore the Ark, once connected with water, is thought to have the power of causing the water to rise and descend again, or in other words to produce rain. The following is the myth of the Deluge and the Ark of the Huichols as related by a famous shaman to Mr. Lumholtz:

Once upon a time, long, long ago, before the white man (the Spaniards) came to the country, a Huichol was at work felling trees in the preparation of his field for planting, but each day he found that the trees he had cut down on the previous day had grown up again. He worried over this and grew tired of working, but still he came on the fifth day to try once more, bent upon finding out how it happened. Soon there arose from the ground in the middle of the clearing an old woman with a staff in her hand. The woman was Taka'tsi Nakawe. This name means our Grandmother Growth. She is the mother of the gods. All the earth belongs to her, and she lives in the under world. All vegetation is her product, and she is the special goddess of corn, squashes and beans. She pointed with her staff toward the south, north, east and west, and finally toward below, when all the trees which the young man had cut down immediately stood up. Then he understood how it was that his clearing was always covered with trees. She told him he was working in vain. "A great flood is coming," she said; "it is not more than five days

off. Make a box from the fig-tree as long as yourself, and fit it with a good cover. Take with you five grains of corn of each color, five beans of each color, take also the fire, and five squash stems to feed it with, and take with you a black female dog." The Indian did as Grandmother Growth had told him. On the fifth day he had the box ready, and placed in it the things he was told. Then he entered, taking with him the dog, and the old woman put the cover on. Then she seated herself on the top of the box with a macaw perched on her shoulder. The box or ark rode on the water, one year toward the south, next toward the north, the third toward the west, the fourth toward the east, and the fifth year it rose upward, and all the world was filled with water. The next year the water began to subside, and the box lodged on a mountain, where it may still be seen. The man took off the cover, and saw that all the country was still full of water, but the macaws and the parrots made valleys with their beaks, and the water commenced to subside. Then the land began to dry up, and trees and grass sprang forth, aided by Grandmother Growth. The man lived in a cave with his dog near by. In the daytime, while he was in the field, the dog remained behind. Every afternoon on coming back he found corn cakes ready for him. He was curious to know who made them for him. After five days had passed he hid among the bushes near the cave to watch, when suddenly he saw the dog take off her skin and hang it up, then he noticed that she was a woman, who knelt down to grind corn on the metate. He stealthily advanced toward her from behind, and quickly seized the skin and threw it into the fire, and from that time on she remained a woman. They were married, and the man had a large family, and his sons and daughters married, and the world became peopled and they lived in caves. The ark here pictured is made of a log of wood from a fig tree that has been hollowed out. The bark has been entirely removed and the surface smoothed. Both ends are closed by disk-shaped covers, made from the same kind of wood. A piece of carved wood glued into a groove on the top is intended to represent deer-horns, its purpose being to entangle the craft in the bushes when the water subsided, and thus stop it. The outside part, which was supposed to be above the water, was decorated with various designs which are symbolic of water and its effects. The cover nearest the horns is decorated in the center with two Mexican centavos and are fastened with beeswax as an offering. One of the objects inside of the Ark was a wooden image, representing the ancestor of the Huichols, who was saved from the deluge; another being a rudely carved figure of the dog, painted black, and also the five squash stems, with which the ancestor of the tribe kept his fire going; five grains of each of the seven colors of corn, and the pouch in which they were preserved; likewise five beans, of the five different colors, and five squash seeds. It might be interesting to state that the late Frank Cushing, after examining the Huichol material, was of the opinion that they were in the same state of culture that the Zuni Indians had reached in remote prehistoric times, while in the matter of their highly developed symbolic art, they even more nearly represented the Maya of two to three thousand years ago.

Transatlantic Wireless Telegraphy Achieved.

Mr. Marconi has confirmed the report that messages were received on board the "Carlo Alberto" in Sydney Harbor from the station at Poldhu, Cornwall. The terms of Marconi's agreement with the Italian government prevent him from giving out further information; for the Italian government has reserved to itself the right to make public the results of Marconi's experiments on board the warship. Mr. Marconi states that several improvements have been made both in the transmitting and receiving apparatus, and that he is now able to send at a rate of forty words a minute. A year ago the best speed attainable was sixteen or seventeen words per minute.

Bacon's Fifty-mile Balloon Trip.

On the afternoon of November 10, the Rev. J. M. Bacon, the well-known aeronaut, accompanied by naval and military officers, ascended in a balloon from Douglas, Isle of Man, with the object of crossing the Irish Sea to the coast of England. Mr. Bacon descended in Dumfriesshire, Scotland. The distance over the sea to the coast of Scotland, reached with a northeast wind, is about 25 miles; but in reaching Dumfriesshire, at the Solway Firth, he traveled between 40 and 50 miles.

Word is received from abroad that wireless telegraphic communication between Berlin and Venice is to be established. A station with a range of 800 kilometers will be built at Ober-Schoeneweide. Should this experimental station be successful, communication will be established with Calais, Stockholm and Lemberg. Since the station is to be built in Germany, it follows as a matter of course that the Slaby-Arco system will be used.



The Press on Col. Astor's Gift.

The letter from Col. J. J. Astor, which the SCIENTIFIC AMERICAN published, in which the Astor turbine patents are generously given to the public, has received no little attention both in the lay and the technical press. Most of the New York dailies commented upon Col. Astor's magnanimity in appreciative terms. The New York Sun discussed the gift editorially. Perhaps the most complimentary notice which has as yet appeared was published in the well-known Electrical Review. The notice, which is an editorial, reads as follows:

"Col. John Jacob Astor, in a letter to the SCIENTIFIC AMERICAN, dedicates all his patents on marine turbines to the public, in the hope that the development of this idea may bring the steam turbine to a high state of perfection.

"Col. Astor's turbine consists of a funnel-shaped outer shell or drum, having on its inner surface spirally arranged blades. Within this there is a solid axle carrying spiral blades set in the opposite direction. Both parts of the turbine revolve in opposite directions, and each drives a screw at the stern of the boat. By allowing the inner turbine and the outer case both to revolve, the speed necessary to insure efficiency is cut in half.

"The following advantages are claimed for this type of turbine: As both parts revolve, the weight for a given output is reduced; the steam efficiency is high and mechanical friction is much reduced. It is suggested that this type of turbine is suitable for central station work, as the armature and field of the alternator can be driven in opposite directions. This would improve the efficiency of the dynamo and decrease the weight.

"Col. Astor's activity in public affairs is too well known to need comment. In the Spanish-American war he not only gave freely of his means, but he risked his life as well in the service of his country.

"By surrendering his rights in this case, he not only gives further evidence of this liberal spirit, but by throwing the construction of steam turbines open to competition he thereby greatly stimulates developments in this important line of work. The gifts of the rich to the public are often belittled by the saying that they are merely giving back what they in the first place took away. It is worth noting that this ungenerous comment does not apply to the gift of this invention to the public."

Some Early Anticipations of Modern Inventions.

Of Rabelais' story concerning the "frozen words" which startled Pantagruel and his happy crew on the voyage to the oracle of the Holy Bottle the world has long been familiar. Students of the great humorist maintain that the narrative of the "frozen words" must be taken to imply that their author had something akin to a prophetic vision of the phonograph.

In another direction it now appears that Rabelais played the seer and still nearer approached to a recent invention of unique creation. This relates to the "moving platform," a leading attraction at the Paris Exhibition in 1900, by which a passenger stepped on to a traveling road, or path, and was carried to his destination without further effort. If some features of this may be traced, by anticipation, to the mind of the old sage who defined rivers as "roads that travel," the real precedent is discoverable in the fifth book of Rabelais' series of masterpieces.

Rabelais, in the exuberance of his imagination concerning the Isle of Odes, where the roads travel of themselves, depicts Pantagruel and his gay mariners voyaging to the oracle of the Dive Bouteille, on the island of Odes. The term "odes," in spite of its associations, has nothing to do with poetry. On this pleasant isle where the roads travel of themselves, and thus (according to Aristotle's definition), must be classed as animals of locomotion, the traveler had simply to inquire his way of the road which was going to his destination, to get upon it, and so be carried, without further trouble, to the place he desired, just as happens to those who take passage from Lyons down the Rhone to Avignon and Arles.

Who forgets that Mark Twain, some years back, amusingly propounded a similar fancy when he took passage (by slow freight) on a Swiss glacier?

At the present hour the traveling road or path is under experiment in the suburbs of Paris, and is possibly destined some day to supersede omnibuses and tramways.

In the light of these facts it seems hard that Friar Roger Bacon, the student of science before the scientific period, who predicted that one day carriages would move without horses, and ships cross the ocean without sails, should be laughed to scorn as an addle-

brained monk, whom much learning had made mad.—James Johnston, in Cassier's Magazine.

Brief Notes Concerning Patents.

It is said that over one hundred patents have been taken out by D. MacFarlan Moore, of New York, covering his system of electric lighting. The method, which has already been described in these columns, consists briefly of a series of tubes filled with a vapor which is made luminous by the passage of the electric current through it.

At the Western Standard Company, of Gas City, Ind., a test was made of a secret process of manufacturing paper from oat hulls. The inventor is said to have been working on the process for three years, the present being the third test which he has made. Although the two former tests were not very satisfactory, the last is reported to have been most successful.

The Board of Ordnance and Fortifications will probably ask for an increase in the annual appropriation from \$100,000 to \$200,000 for making experiments and trials of various kinds of ordnance and ordnance materials. This body is in constant receipt of inventions and suggestions which must be given some investigation.

In order fully to acquaint himself with the working of his new storage battery, Mr. Edison is building five automobiles which are to run five thousand miles each. It is expected to cover 100 miles with a single charging. A 62-mile run has already been made with a light runabout with 21 cells weighing 332 pounds; and after this trip, part of which was over steep grades, the carriage was still moving at 83 per cent of its normal speed.

C. J. Vernon, of Fresno, Cal., is the inventor of a peach-peeling machine which, it is said in a California paper, will prove invaluable to the canning industry. The machine has been subjected to a practical test at the San José plant of the California Fruit Cannery, and it has been pronounced a success. The capacity of the plant has been largely increased by the introduction of this machine. The work is done without waste and without marring the round surfaces of the fruit.

Since the general adoption of the upright piano, about twenty-five years ago, there has been no very material improvement made, but a novel feature has been recently introduced by F. J. Heppe, the junior member of the firm of C. J. Heppe & Son, of Philadelphia, who has added two sounding boards to the one which is already in general use. Patents on this idea are now pending. The superior advantage of this invention is in the fact that two of the sounding boards are placed forward of the other, the top and bottom panels being converted into sounding boards, thus attracting the tone to the front of the instrument where it properly belongs.

A dispatch from Rochester, N. Y., announces the death of Mrs. Bridget French, who died at her home in that city on August 7. This woman was the inventor of no less than thirty-six devices, some of which had brought her considerable money. Her first invention was the French burglar-proof lock, which was the first thing of the kind and which laid the foundation of the modern complicated safety locks now in general use in banking and safety institutions. She also invented a steam sterilizer which attained wide use. She also devised a stovepipe damper with vents in it to permit the passage of the objectionable gases. She also invented a car coupler, and her latest work was a fiber lamp chimney. Although over seventy years of age, she was at work on several inventions at the time of her death. Besides the genius for mechanical devices, she possessed the skill of a trained artisan in developing the ideas originated by her. She worked regularly in her own shop, and could handle tools like any man.

An entirely new thing in boat building is in the course of construction at one of the yards near St. Louis, Mo. It is a boat which is designed to meet all the requirements of traffic in both deep and shoal water. The craft is the design of Capt. George O. Rogers, who is well known in transportation circles in the South, having been identified with marine and railroad companies. His boat consists of two hulls, one within the other, each forming a perfect boat. The inner hull is of much greater draught than the outer one, and in shallow water service the inner one is raised by means of jacks, so that the greater part of its weight is sustained by the outer hull and the upper works are raised about ten feet above the deck of the outer hull. In this position the boat has a very light draught, calculated to be available for use on the shallow rivers of the South. For deep-water traffic the inner hull is lowered. This boat was especially designed for the trade between the Beaumont oil fields and St. Louis, but the inventor sees a much wider range of usefulness for it. He expects to demonstrate its value by the boat which is now being built and which will soon be ready for service. Capt. Rogers was at one time a member of the United States River Commission.