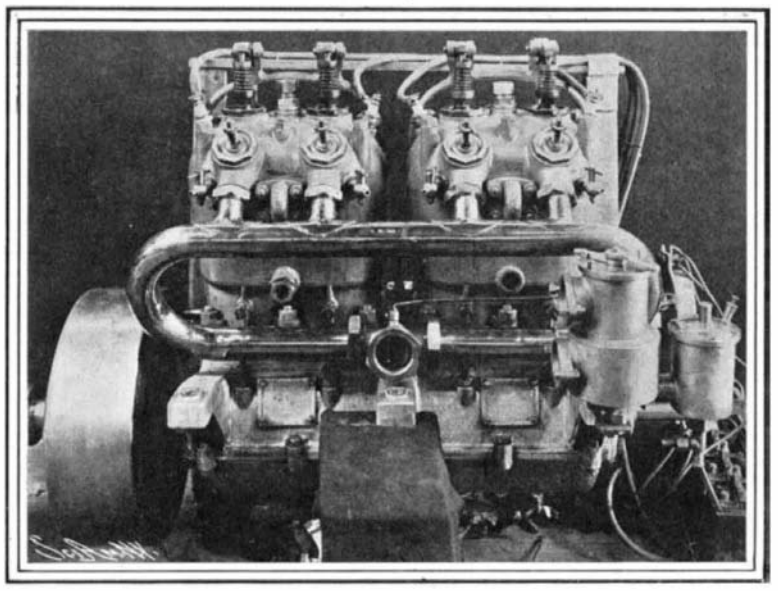
THE BARTON 150-HORSEPOWER AIRSHIP'S FORTHCOMING TRIAL TRIP.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

In the SCIENTIFIC AMERICAN for May 3, 1902, there was reproduced a photograph of a model of Dr. F. A. Barton's aeroplane airship. Since then the design has undergone many and radical modifications. It now consists of a cylindrical balloon large enough to support the car and its contents, with movable aeroplanes fixed on a frame between the balloon and the car. The inventor claims that this combination is quite original, and that by it he has overcome the fatal defect of all existing balloons, viz., the inability to rise or fall without discharging gas or ballast.

The balloon was made in the banqueting hall of the Alexandra Palace. It embodies several novel features, and is the largest in existence. It is 176 feet long, 43 feet in diameter, and has a capacity of 235,000 cubic feet, which gives it a lifting power, when filled with hydrogen, of 16,450 pounds. It is cylindrical in form, with an ogive nose and a nearly hemispherical stern. It is constructed of varnished silk, coated with linseed oil and baked after each coat. There is also an outer cover of pure unvarnished silk, strengthened with numerous webbing bands, from which are suspended the lines supporting the ship. By means of this outer covering and the bamboo arrangement (a series of bamboo strips bound round with fine cord and carried up to the nose of the balloon) greater strength and rigidity are imparted to the balloon, and no cord or metal can come in contact with the envelope. Dr. Barton claims that should a leakage of gas occur in the balloon, escape would be impeded, owing to this outer envelope, and that even if both balloon and outer covering were penetrated by shot, the two envelopes would, as the balloon grew smaller, slide over one another, and so cover the hole. The balloon is divided by partitions into three gas-tight compartments, one division being between the main body and the tail, and the other between the nose and the main body. Ordinarily the fore and aft compartments will be closed, but there is a special arrangement by which the gas can be allowed to escape on the pressure becoming too great after the full expansion of the diaphragms, which will be allowed to bulge into the main body when the gas in the nose and tail expands.

Inside the center partition will be a small subsidiary spherical balloon—or ballonette—filled with air, with



One of the Three 50-Horsepower Engines.

a capacity of 17,000 cubic feet, the function of which may be thus explained: When the airship rises or when the sun shines and the gas expands, the air in the small balloon inside is forced out, the rear end of the aeroplanes being raised so as to prevent the balloon rising as it passes through the air, which it otherwise would do, owing to the diminished weight of the air. If the reverse occurs, and the gas contracts, air is automatically pumped into the internal balloon, so as to preserve the shape of the external balloon. The total weight is thus increased, whereupon the aeroplanes are again employed to prevent the balloon from sinking.

It is of course well known that balloons are usually unable to remain for very long periods in the air (though the Comte de la Vaulx has made a record trip of 1,100 miles from Paris to Russia in under forty hours), owing to variations in temperature, causing the gas to expand or contract and necessitating the loss of gas or ballast.

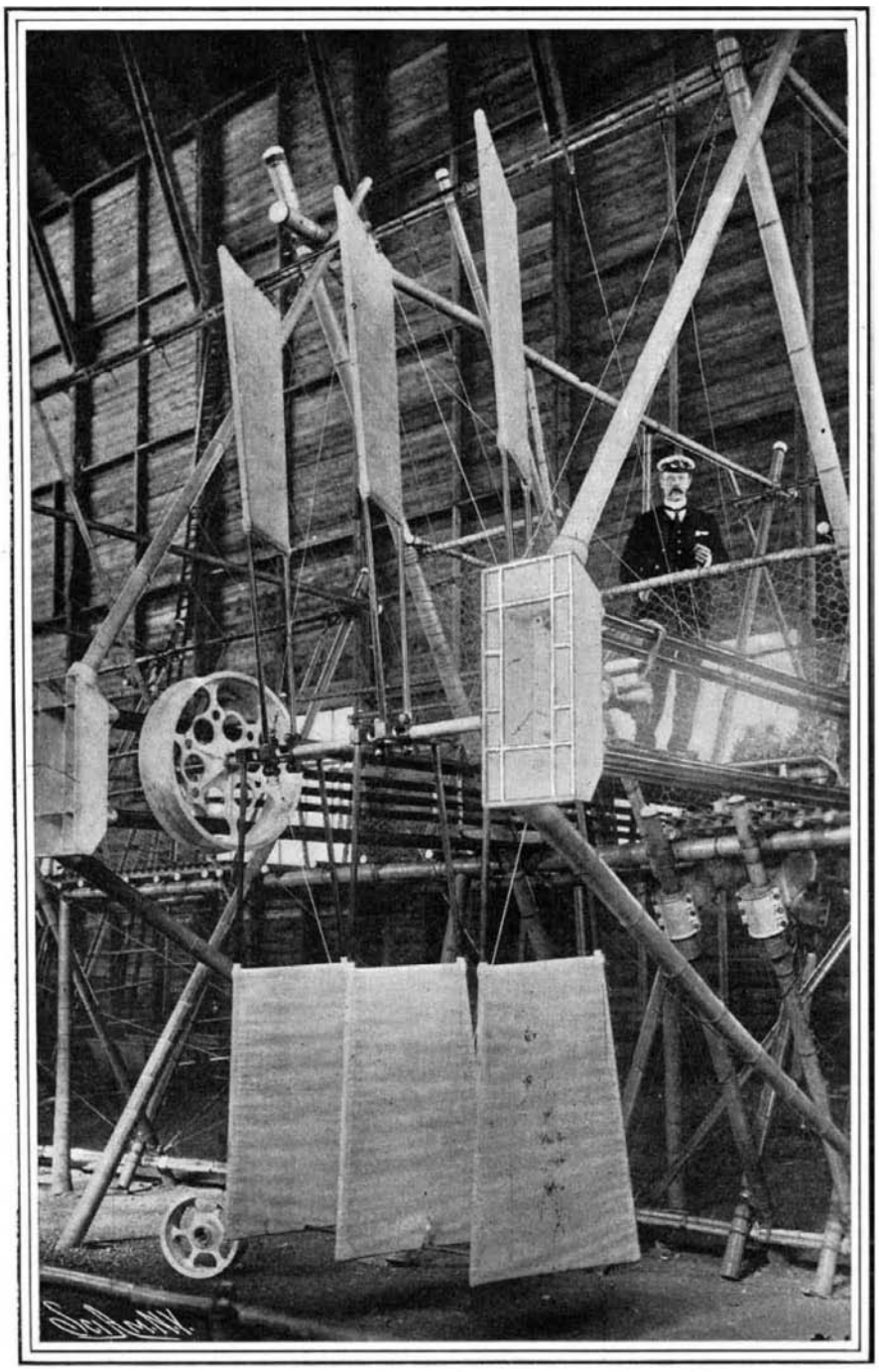
Dr. Barton's ingenious arrangement was designed to overcome this difficulty.

With regard to the balloon portion of his airship, he has said that he looks upon it solely as a lifebuoy to afford him the facilities he needs for experimenting with aeroplanes, as the balloon above will support the total weight. Gradually he hopes to diminish the size of the balloon and increase the size of the aeroplanes, and finally to dispense with the balloon altogether, evolving a vessel which will resemble those of Sir Hiram Maxim and Prof. S. P. Langley in that it will be heavier than the air it displaces, and be kept in the air and raised and depressed solely by the aeroplane surfaces.

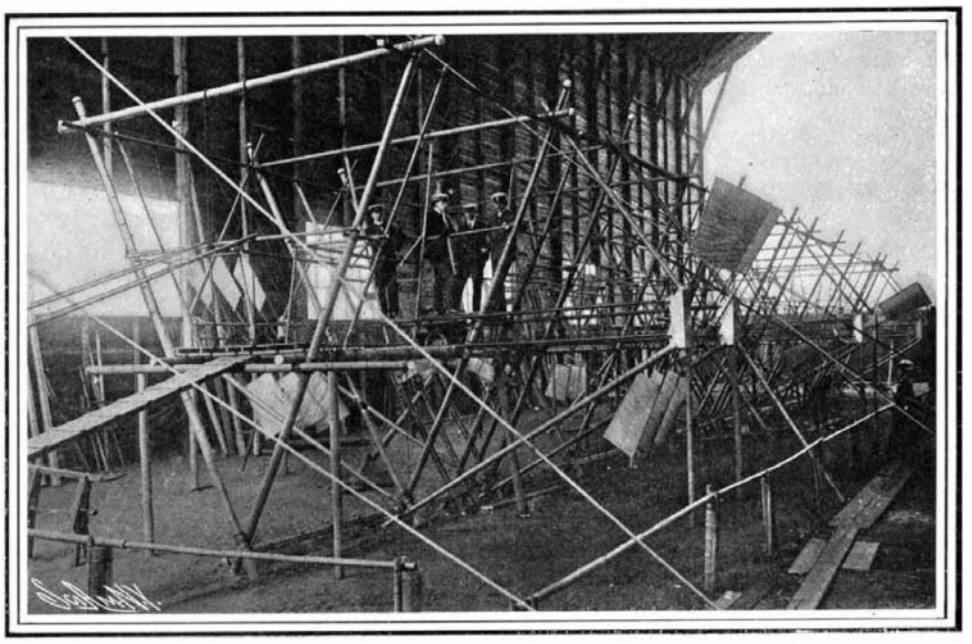
The framework of the car is constructed of bamboo varying in size from 1½ inches to 5½ inches in diameter. There are two large longitudinal members, which run from end to end and support the decks. Outside these, projecting both above and below, and placed diagonally to form a V, are at intervals other large-sized members, which are secured at their lower ends to the keel. The keel is constructed of three bamboos lashed side by side. The upper ends of the sloping members are connected together by longitudinal and transverse bamboos. The frame is left square at the back, but tapers off in front up to the sloping bamboo to form the bows. The frame thus formed somewhat resembles the skeleton of a ship, except that the sides are straight.

The two large longitudinal members carry smaller cross bamboos at close intervals, and along the center of these is laid a narrow deck, which is widened out at certain points to form the captain's and motor decks. The deck is made of latticed wood, and a light bamboo framework filled in with wire netting incloses it on all sides.

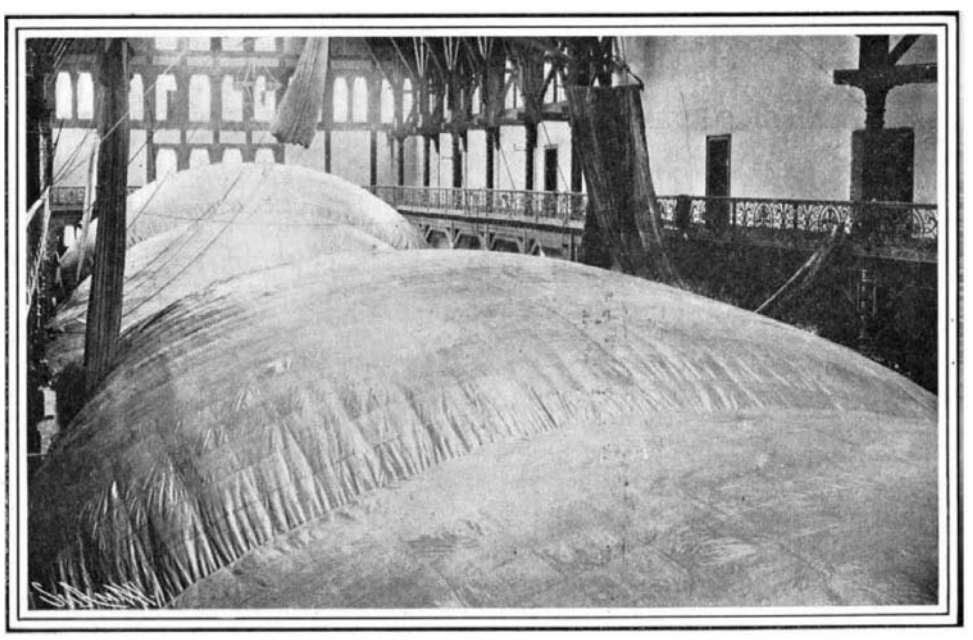
The bamboo members forming the frame are lashed



Dr. Barton on the Deck. Part of the Airship Frame, Showing a Propeller and the Method of Bracing.



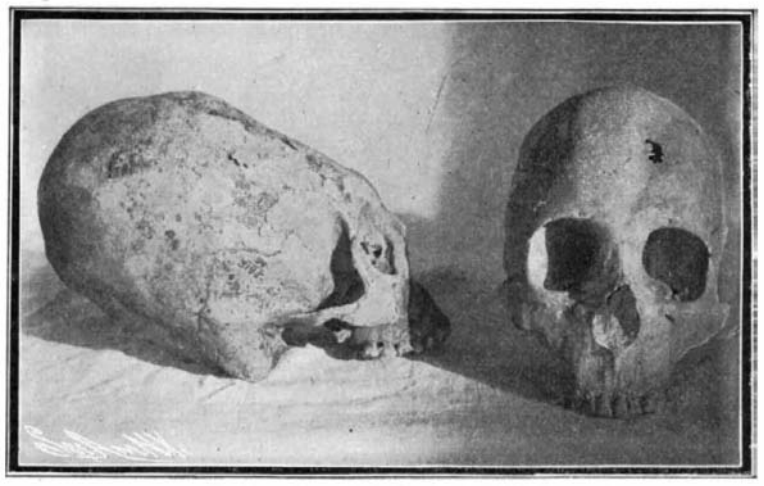
The Bamboo Frame and the Propellers.



Part of the Gas Bag Temporarily Inflated, Filling Nearly the Whole of Banqueting Hall in Alexandra Palace.

BUILDING THE BARTON AIRSHIP.

Cup of Solid Gold 8 Inches High.

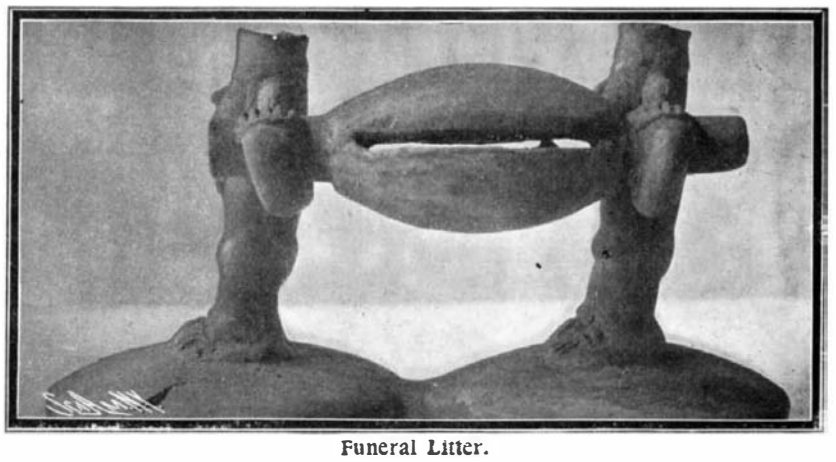


Deformed and Trephined Skulls.

Water Jar.

King Condor and His Prey Water Jar.

Inca Warrior Water Vessel.

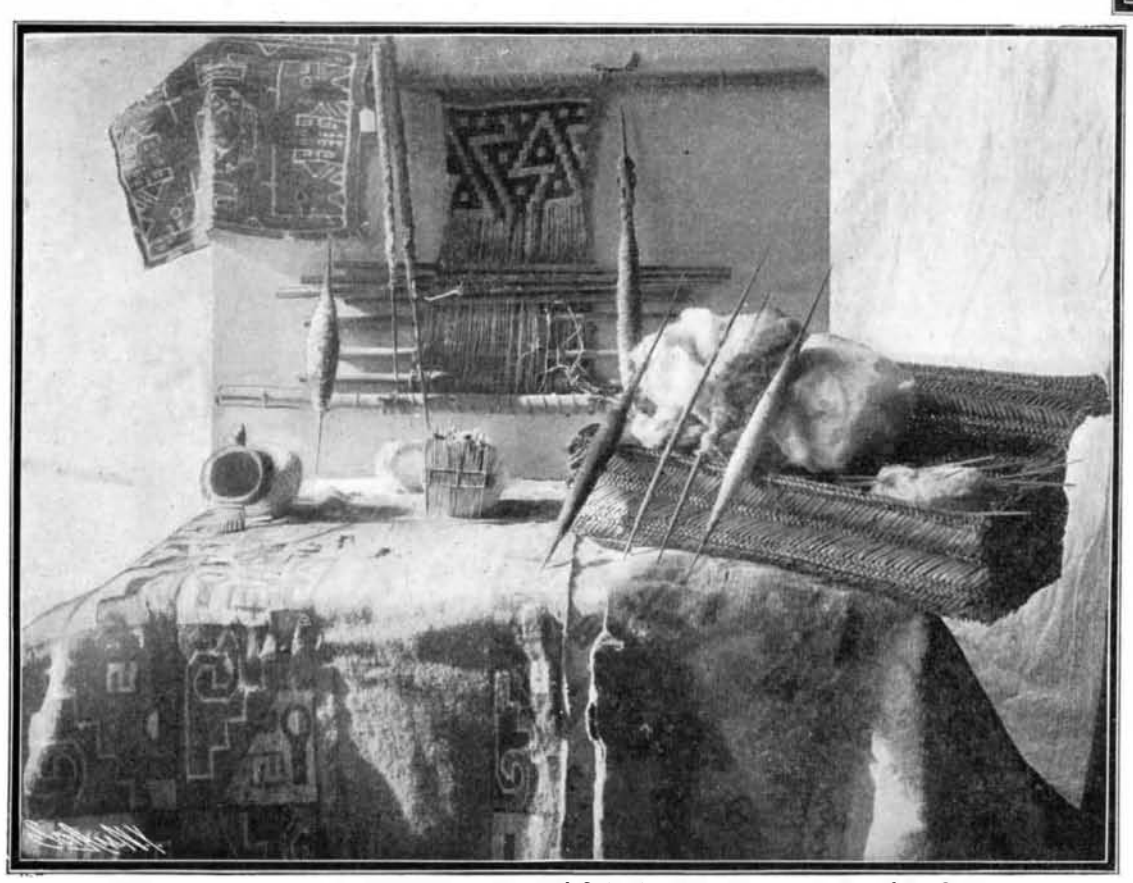


Funeral Litter.

Water Vessel—Sleeping Child on Llama.

Silver Cup 12 Inches High.

Coast Mummy, With False Head and Funeral Offerings.



Woman's Work Basket, Weaving Loom, and Spinning Implements as Found in Grave.

Llama of Solid Silver and Image—A Sacrificial Offering.

Photos by the Author.

INCA RELICS UNEARTHED IN PERU BY THE BANDELIER EXPEDITION.

[See next page.]

together with stout, specially-made, hand-laid cable cord of Dutch flax at the joints, and there is not a nail, screw, or bolt used in the whole framework, which is lashed together by steel wire cable to tension.

The keel is 120 feet long, the deck 123 feet long, and the upper frame 127 feet long.

There are three "motor decks," in each of which will be two of the crew, one to look after the motor, the other to control a set of aeroplanes. The full complement is seven, and the captain on the center deck can communicate with the crew by means of ship telegraphs, speaking tubes, etc. The telegraphs will ring in front of each motor, and on the captain's table will be arranged the lines connected with the valves, pressure gages, etc.

The vessel will be driven through the air by three 50-horsepower Buchet gasoline motors, each of which drives two six-bladed propellers, arranged three on one side of the deck and three on the other. The motors are bolted down to strong aluminium castings, which are clipped to the large bamboo members, and they are placed longitudinally of the airship. The power is transmitted from countershafts by belts to the propeller shafts.

Large Clarkson radiators for cooling the circulating water are attached to the steel tubes forming the framework supporting the propellers. The normal speed of the engines is about 1,600 revolutions per minute, and there is a speed reduction of 8 to 1 employed between the motor and the propeller.

In conjunction with Mr. Walker, Dr. Barton has recently designed a new gasoline motor which develops 20 horse power and weighs only 90 pounds. This works out at only 4½ pounds per horse power. The present Buchet engines weigh 6 pounds to the horse power, exclusive of the flywheel, which will add another hundredweight.

Each of the six propellers is made up of three two-bladed propellers, the blades of each, which are rigid, lying behind one another. The propeller shafts are of solid steel 2 inches in diameter and 7 feet, 8 inches long. They are fitted with aluminium pulleys.

Dr. Barton points out that Count Zeppelin's balloon could be slightly inclined by the aeronaut, so that the propellers drive it upward or downward. Instead of having, like the Count, four propellers 4 feet in diameter driven by 32 horse power, Dr. Barton has a balloon less than half the size, with six propellers 12 feet in diameter, driven by 150 horse power, which by means of the aeroplanes should suffice to sustain the airship even without the help of a balloon.

The inventor calculates that 150 horse power will keep in the air a weight of 18,300 pounds to 34,650 pounds, whereas the total weight of the balloon fully loaded with crew and all accessories is under 16,000 pounds. There is no doubt that an airship using aeroplanes alone could obtain a very high rate of speed, as the resisting medium of the air is so much less than that of water or the friction of rails. It is calculated that the six propellers of the Barton airship, when revolving at their full speed, displace 1,200,000 cubic feet of air per minute, and a speed of 17 to 20 miles an hour is anticipated.

There will be no less than thirty aeroplanes for the steering of the ship in the vertical plane. They are mounted between the deck line and the top of the frame in three banks of ten, one in front of each motor, five of the aeroplanes in each bank being placed on each side of the flying deck.

Three aeroplanes in each set of five are mounted one above the other nearer to the motor than the other two, which are also above one another, but placed somewhat further forward and in such a way that they lie between those behind them. Each aeroplane is 15 feet long by 3 feet across, giving a surface of 45 square feet. The total surface is 1,350 square feet. The aeroplanes are pivoted to the frame at their forward end and the surfaces can be raised or depressed by the man in charge of them. By means of a large rudder at the stern the vessel is steered in the horizontal plane.

The ingenious system of shifting water ballast employed by Dr. Barton to keep his vessel on an even keel, when she shows a tendency to shove her nose or tail into the air, owing to the moving about of the crew or other cause, has been used by some inventors of submarine boats, notably by the late M. Claude Goubet, but has never, so far as we are aware, been adopted in aerial machines. At each end of the vessel is a 50-gallon water tank; the two are connected by a pipe, and will contain only 25 gallons each. When the longitudinal stability shows signs of being disturbed, water is automatically pumped from the forward to the aft tank, or *vice versa*. The motor-driven pump is situated on a separate deck in the fore portion of the airship.

Five hundred thousand incandescent electric lamps will be employed in the illumination of the World's Fair grounds and buildings.

REMARKABLE DISCOVERIES BY BANDELIER OF INCA CIVILIZATION IN PERU.

BY WALTER L. BEASLEY.

In recent years, one of the most interesting regions of the New World, interesting both to the historian and excavator, has been the western coast of Peru and the lofty Bolivian plateau. On the latter was situated the far-famed Inca tribe, who had developed in pre-Columbian times an advanced culture which for centuries has been the object of vain study. Mr. A. F. Bandelier and his gifted wife have carried out researches under the auspices of the American Museum of Natural History, the first two years' exploration, however, being supported by the late Henry Villard. The discovery by the Bandeliers of many relics of the ancient Indian empire of the Incas has been considered a brilliant achievement, and has won additional fame for this eminent investigator, whose discoveries now add so greatly to history and the early culture of South American civilization.

Chief among the curious features of the Inca people was their manner of interring the dead, and the unusually large number of objects placed in the grave as funeral accompaniments for the body on its long journey to the future world. The scattered population of the coast of Peru, for some five or six hundred miles, cultivated every available foot of good land and used the desert and barren stretch near the water as a cemetery. The people of the high plateau of the Andes used the sides of steep cliffs or stone towers, called Chulpas, as burial places. The graves of the coast were arranged in groups, being sometimes round or square-shaped pits, varying in depth from 2 to 12 feet. A matting and framework of reeds was used as a top cover to protect the contents from the pressure of the sand above. Some graves contained only one body, others three or more on the same level. The standing of a person was usually determined by the character and number of objects deposited, as well as the embellishment of the outer covering or dress of the mummy pack. The latter usually consisted of a finely woven woolen fabric, having a rich border. A typical mummy is here shown just as it was unearthed by Mrs. Bandelier. An interesting statuette found shows the Inca method of carrying the dead to the grave. An oval-shaped litter, having projecting ends resting on the shoulders of two men, was used. The right hand of each is placed over his heart as a method of expressing sorrow. Weaving was one of the industries in which the Peruvian Indians excelled. Articles associated with this occupation were the most frequent of those found in the graves. A number of reed rods, having their ends wound round with bright thread, so as to form a pattern, are placed within the folds of the outer pack. Other peculiar adornments of the outer mummy dress are small hanging pouches or bags, embroidered in rich design. These are filled with coca and various foodstuffs. As the Indian dress in life consisted of a short poncho and a loosely-worn wrap, a dangling pouch or pocket for the keeping of provisions and other necessaries which were indispensable on a journey while he was living, the same were thought necessary for comfort in death, and were therefore attached to his body. The peculiar crouched position which was given to the dead body seems to have been a long-established mortuary custom of the people. In this they simply imitated the every-day life of the inhabitants; for as the wearied Indian at the close of his daily labor seeks rest in a squatting position, he is correspondingly consigned to his eternal rest in the same attitude. The method of packing the body was to tie it in skins and matting. The whole was then bound tightly together with cords. The square form of the mummy is produced by a stuffing of the white cotton sack with seaweed and leaves. The poorest style of burial was of plain white cloth. Children in a great many instances were found wrapped and fastened full length on a bed of rushes or reed cradle surrounded with toys, domestic pets, and their favorite playthings in life. Some of the ever-recurring and characteristic objects met with in the graves of the coast were work-baskets made of plaited reed-grass used for containing the wool-spinning and sewing implements, dove-shaped wooden receptacles, combs of thongs, and other articles of daily life employed by the women. Often a complete loom having a partly completed pattern would be found. Among the most noted of the contents of such a work-basket are the beautifully finished and decorated spindles. These are looked upon as some of the most elegant and tastefully ornamented articles of Peruvian handiwork. They are of hard smooth wood, painted in showy colors. The elaborate embellishment of these spindles is somewhat surprising, as when in use the ornamented parts are hidden from view by the thread wound around them. The designs are either painted on, burnt in, or incised. Some of the textile work obtained in grave deposits is to-day fresh and magnificent in color and appearance, equaling some of the choicest Gobelin tapestries of modern times. Some contain 62 threads to the square inch. These beautiful fabrics are decorated in bird, animal, and geometrical patterns. They were woven from the wool of the alpaca and vicuna. One of the striking forms of burial was the addition of a false head. This was stitched on top of a square pack, which contained the wrapped body inside, and was stuffed with seaweeds and leaves. The eyes, mouth, and lips were generally indicated by a white thread, the nose by wood and occasionally padded white material. Frequently, though, these organs are represented by thin, cut-out pieces of copper and gold. Often the whole mask is made out of thin silver and attached to the head. The complexion of the face is often indicated with red and blue ocher painting, and the hair by a long fiber, dyed black. The false head is usually wrapped by bandages of bright cloth. The idea of this extra death-mask or head was seemingly to give a human appearance, which they wished their dead to retain even in their buried abode.

Of all the industries which occupied the attention of the greater part of the population, undoubtedly that of pottery was one of the most prominent. Specimens of this art are the most abundant and diversified of all the objects found in the graves. It was in the production of water vessels, jars, and vases that the inventive faculty of the Indian artisan was displayed to its fullest extent. Leaving no written language, nearly all of our knowledge of the people is due to the handicraftsman in clay, who made it a practice to represent faces, architecture, costumes, and characteristic scenes of every-day life on his creations in pottery. Thousands of these fanciful shapes were taken from coast burials and those of the upland plateaus. The material is of red, black, light colored or gray, and varies much as to ingredients and execution. The most elegant types are of fine gray and brown clay, with glazed surfaces, and show little or no granular mixture. These are considered the most beautiful form of Peruvian ceramics. In general, the bulging form prevails, although the shape varies according to the skill of the artist and the use intended. Some have a flat, others have a cone or egg-shaped bottom. The latter were set on a clay base with funnel-shaped opening. This kind of pottery, with little or no plastic decoration, but handsomely painted and of chaste form, is the true Inca pottery, made near Cuzco. The more showy results of the potter's art were displayed to the best advantage in the employment of animal and human figures.

The most satisfactory and artistic productions in clay are thought to have been when the whole vessel was treated as a human head, with the attached mouthpiece serving as a head-dress or covering. These portrait jars are especially noteworthy and highly prized, as they afford in most cases a lifelike representation of the face and features of the Peruvian coast Indians, as well as illustrating the technique. One of the types is unusually interesting, for it portrays a personage clothed in warrior's garb. Possibly here is depicted one of the chiefs, armed and equipped for battle. The striking feature of the costume is the high head-dress or conventionalized human face, with immense ear plugs. The left hand grasps a shield made of llama skin, to which are fastened short throwing-darts. The right holds a battle-ax. The other weapons used in warfare by the Incas and coast people were slings, for hurling stones, clubs four to five feet long, having five or six sharp points of metal or stone, and throwing-lances fifteen feet in length. Forest animals and maritime creatures of the period, notably the great condor with his helpless victim, were on the various forms of pottery met with. Probably one of the most extraordinary and remarkable pieces of pottery from an imaginative standpoint, at least, is one depicting a resting llama, with a sleeping child snugly clinging to its warm and fleecy back.

The great abundance of gold and silver in the time of the Incas, and their skill in soldering and fashioning these metals into striking shapes, are exhibited by the hundreds of personal ornaments, statuettes, and ceremonial objects wrested from burial places. Mosaic work on shells, supplemented by wide bands of gold, the ends terminating in a parrot's head, were evidently common household adornments, a number of such being recovered. Necklaces of golden balls, nearly the size of a twenty-five cent piece, were evidently commonly worn. Huge drinking or ceremonial cups a foot high, of silver, and more than half that length, in gold, wrought into portraits, attest the lavishness of display which flourished among the people. Long wrist-bands of solid gold and silver were worn. Instead of sacrificing the living llama, on some occasions, figures of this animal ten inches high, of solid silver, were buried as an offering. Gold was secured by washing in the mountain torrents and streams. Silver was obtained from easily fusible ores by reduction on the site where the ore cropped out, and also by fusion in small and rude ovens, placed in the open air. Copper was treated in the same manner. Silver and gold were mostly hammered.

The foregoing sketch has been intended more as a general pictorial display from the recent finds, showing