NERNST LAMP AT THE EXPOSITION.

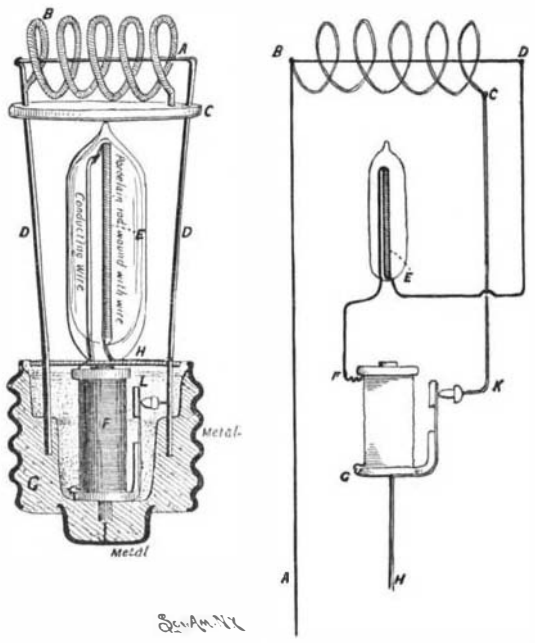
One of the most interesting displays in the Electrical Palace is that of the Nernst lamp shown in the pavilion erected by the Allgemeine Elektricitätsgesellschaft. Two different types of the Nernst lamp are made at present; in the first it is necessary to heat the conducting filament by a match, an alcohol lamp, or the like. The general appearance of this type of lamp will be seen in our engraving. From the base project two metal rods, which are braced at the ends by a short tube of porcelain, and to the ends of the rods is soldered a rather thick platinum wire; to this wire the ends of the conducting filament are soldered by a process analogous to that employed for the incandescent lamp. This filament, made up of refractory oxides, is perfectly white and homogeneous, resembling otherwise a short carbon filament. As the resistance of the filament diminishes when in a state of incandescence, it becomes necessary to insert a resistance in the circuit to cut down the current to the right amount.

The form of resistance used here is shown below the porcelain rod; a very fine platinum wire is wound around a porcelain rod about one inch long, and this is contained in a small glass bulb; the outer end of the wire is connected with a stout wire which passes back parellel to the rod. The terminals are formed of two wires fused into the glass. A lamp base of the ordinary Edison, or screw type, is used, to which is fitted a globe somewhat resembling an ordinary incandescent lamp globe; this, however, is open at the end and serves only to protect the filament from dust, etc. When the flame of a match is applied to the filament, it soon commences to glow, and finally reaches a brilliant incandescence, giving off a white light which is very pleasing in color. The light is much whiter than that given by a carbon filament, owing to the higher temperature of the refractory oxides, and is entirely free from the disagreeable green hue of the Welsbach burner.

It is, of course, quite desirable to have a lamp which is entirely automatic in its action, particularly when it is placed in inaccessible positions, and accordingly an automatic form has been devised, in which the filament is heated by the passage of current through an exterior conductor, and when its resistance has been thus reduced and it allows the passage of a sufficient current to bring it to incandescence, the circuit of the heating conductor is interrupted by a special device. The general disposition of the working parts is seen in the sectional view. From the socket rise two stout wires, *D D*, which support a porcelain disk, *C*. Upon the disk is supported the filament, *A*, and surrounding it is a spiral tube of porcelain, *B*. The porcelain tube carries on its surface a great number of turns of fine platinum wire, which has been wound on while the tube is still straight and before baking the porcelain; the wire is almost completely imbedded in the porcelain and is visible only upon close examination.

This exterior tube serves to heat the filament by the passage of current in the fine platinum wire; a thick wire, not shown in the diagram, passes below from the right-hand end. A small glass bulb placed below contains the resistance wire, wound around a porcelain rod, *E*. This resistance is of the same type as for the first lamp, only one form being used throughout. The lamp base, *G*, resembles the ordinary screw type, but the interior body, of porcelain, is recessed to receive the automatic cut-out device; it also supports the wires, *D D*. The cut-out consists of a small electro-magnet, *F*, fitting in the cavity of the socket; the upper end of the bobbin is of soft iron, and below an iron piece curves up and supports a small armature, *L*, by means of a flat spring. The armature rests normally against a contact piece to the right, but when a sufficient current passes in the coil, the armature is attracted and leaves the contact point, thus cutting off the current from the heating spiral. The action will be clearly seen by referring to the diagram of the electrical connections. The current takes two paths; first, through the filament, the resistance bulb and the magnet, following the circuit, *A*, *B*, *D*, *E*, *F*, *G*, *H*; or, second, through the heating spiral, the contact, *K*, the armature of the magnet, and return, or *A*, *B*, *C*, *K*, *H*. Owing to the high resistance of the filament when cold, the current passing in the circuit of the magnet is not sufficient at first to attract the armature, but a few seconds after it is turned on the spiral commences to heat up, and the temperature of the filament is raised sufficiently to allow a large current to pass; it thus becomes incandescent, and, its resistance being lowered, a large current passes in the magnet; the armature is attracted and the circuit of the heating spiral broken at *K*. When the lamp is turned off, the reverse action takes place; contact is made at *K*, restoring the original conditions.

The price of a lamp with the automatic illuminating device is, of course, much higher than for the ordinary type, on account of the two extra pieces, the magnet and the heating spiral. The magnet, of course, does not deteriorate; the spiral, being subject

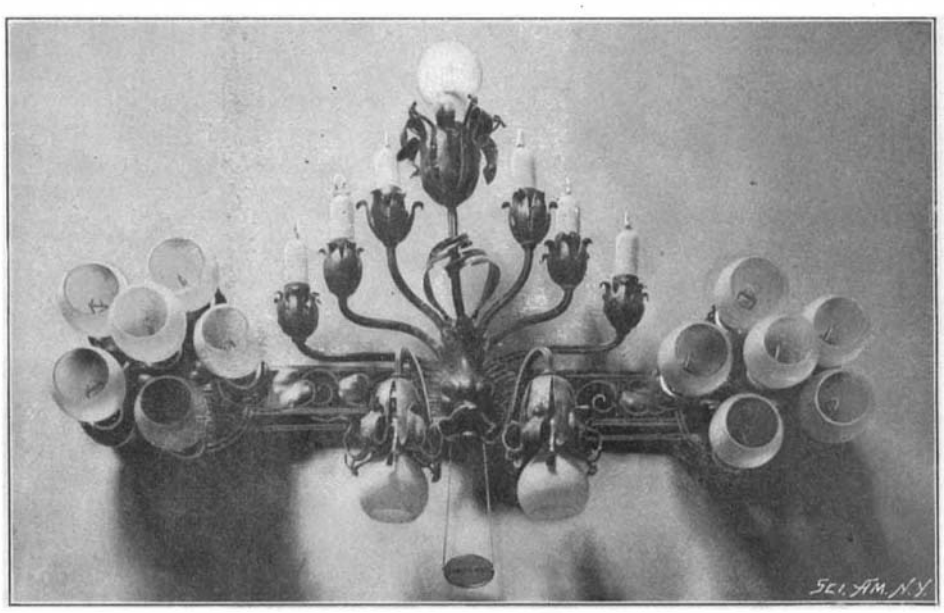


AUTOMATIC TYPE—SECTIONAL VIEW AND DIAGRAM OF WIRING.

to alternate expansions and contractions, lasts a reasonable length of time, but not indefinitely. It is, however, easily replaced, and is taken back for two-thirds of its original value. It is probable, besides, that the platinum wire will be replaced by a material which will give the same service at a less cost. The parts of the lamp which need to be replaced, the spiral

NERNST LAMP—ORIGINAL TYPE.

and the filament, cost but little, and it is estimated that the cost of lamp renewals is not greater than in the case of the ordinary incandescent lamp. The duration of the filament depends somewhat upon the manner in which it is brought to incandescence, whether heated quickly and thus subjected to a violent rush of current, etc. In general, it is less than that of a carbon



CHANDELIER OF NERNST LAMPS.

filament; if the changes in voltage do not greatly exceed the normal, one may count upon an average life of 300 hours for this lamp. The life is diminished gradually by a molecular change, which is produced little by little under the action of heat, accompanied by a diminution of solidity and often an increase of resistance which diminishes its brightness. The expenditure of energy in the present type of Nernst lamp is from 1½ to 1¾ watts per candle power, which is about one-half that of an incandescent lamp; for a 16-candle power lamp the energy consumed is thus from 24 to 28 watts, representing 27 to 30 lamps per horse power. At present the Nernst lamp is manufactured for 25, 50, and 100 candle power, under a tension of 110 or 220 volts.

South America's Dying Races.

THE FUEGIANO AND THE BAKAÏRI PEOPLE.

BY JOHANNES HROLF WISBY.

Before the end of the next century two of South America's most ancient peoples, the Bakaïri and the Fuegianos, will be practically extinct. Both tribes together amount only to a few thousand individuals, and have been rapidly decreasing in number for the last twenty years. The Bakaïri, a branch of the famous Caraïbian race, live in the heart of Brazil. The Fuegianos inhabit the island groups in which the South American continent terminates, and form a distinct tribe of their own.

In olden times, when Spanish ships beat around Cape Horn, these islanders were first discovered by their habit of lighting fires on the shores; for which reason the Spaniards called them Fuegianos or "fire people," and their island home, Tierra del Fuego or the "Land of Fire." Behind the thundering surf they live, almost naked, in a climate as rigorous as that of northern Norway, surrounded by the great oceans of the Pacific and the Atlantic, and with great snow-capped mountains behind them. The climate is a succession of chilling rainfalls and violent storms; a quiet, sunshiny summer day is almost unknown. One would suppose that conditions like these would tend to draw the members of the tribe closer together. On the contrary, everyone lives for himself, and the tribe unites only to fight its enemies. The people have no religion. They believe merely in devils; they do not worship; and they have no idols of any kind. If they hear a noise they cannot account for, they fancy it is some devil on the warpath, and take to their heels. They offer no prayers in such cases, but simply turn about and run, acting apparently on the principle that they can outfoot any devil. Easily frightened as they are in this way, they exhibit no fear when the object making the noise is visible to them. Darwin, who was the first scientist to visit the tribe, as early as 1840, maintained they were cannibals, but his theory has been contradicted by later scientists, a few of whom have succeeded in finding out the real habits of the people by living with them. That they have cannibalistic tendencies is, however, admitted by several travelers; for they make a practice of eating the old women of the tribe when they are no longer of any use. As the family ties are not very strong, and as the children seem entirely to forget the parents as they grow older, it is not unlikely that many a poor old Fuegiano mother has been partly eaten up by her own offspring.

That which more than anything else has made the Fuegianos hardy and able to withstand the trying climate, as well as the fierce onslaughts of the warlike Onas, is their ancient habit of killing the weaker children, permitting only the robust to live. Children thus killed are buried in the ordinary manner of the tribe, entirely without ceremony. If not merely thrown on the charnel heap they are burned in the camp-fire and their ashes strewn to the winds. It is characteristic of the Fuegianos that they endeavor to forget their dead, whose possessions are conscientiously burned, and whose names must not be uttered.

The only animals met with in the country are a species of fox and a species of mouse, but the river-like channels which separate the islands swarm with seals and fish. Occasionally a whale is captured, the oily blubber of which is considered a delicacy, and the bones an excellent material for arrow and spear-heads. Their manner of fishing is peculiar. At dark they set out in their frail, flat-bottomed, bark canoes armed with long fishing spears. Clay is placed in the bottom of the boat, on which they light a fire. Attracted by the fire the fish gather around the boat and are then speared with unerring skill. How the Fuegianos succeed in keeping these badly-leaking and extremely frail shells afloat on the turbulent waters of the ocean around Cape Horn is a puzzle to sailors. They even venture far out to sea, paddling against the current to reach certain shoals frequented by the seal; but often it happens that a fisherman, after battling the tide and the wind, is upset and drowned in the tremendous surf which is at all times thundering on the shores of the island.

From the raw, forbidding climate of the ugly-tempered Fuegianos, we shall repair to the luxuriant tropical regions of the Bakaïri tribe, living in the heart of

Brazil, some forty degrees of latitude north of Tierra del Fuego. By the River Xingo, which pours its waters into the Amazon, the Bakaïri hunters live, the southmost outpost of the Caraïbian race. Plague and disease, doubtless spread by the numerous poisonous insects inhabiting the forest regions, have thinned out their race, and the days of the Bakaïri are numbered. Like the Fuegianos, their life is that of the Stone Age, but as a race they are somewhat superior, although they are also cannibalistic. But it is not the necessity of disposing of a surplus of old women which has whetted the appetite for human flesh. Although the real cause of their cannibalism is not definitely settled, it is extremely probable that through their habit of eating roasted monkeys, which resemble the burned corpses of the native children, they have acquired a taste for human flesh.

Unlike the Fuegianos, they have a kind of "religion." They are great story tellers and dancers, and their sociability and good-nature generally win the confidence of the traveler. Their chief weapons are the bow and arrow, a kind of boomerang, and, above all, the blowgun, from which they shoot the poisonous arrows which are the dread of their enemies. The bow often measures six feet in length, and the feathers which guide the arrow on its flight are set spirally, so as to impart a revolving motion to increase the velocity; the principle is somewhat the same as that of the rifled musket barrel.

Their boomerang somewhat resembles the Australian weapon; it has an aperture where a "demon" in the shape of a pierced nut-shell is inserted. This arrangement causes a strange, ominous whistling as the weapon is hurled against the enemy, who is supposed to be very much frightened at the noise. The blowgun is one of the most dangerous and ingenious weapons ever invented by a savage, and in the hands of an expert Bakaïrian is almost a match for a modern firearm in the dense jungle.

The "projectiles" consist of the slim, tough, feather-weight arrows made from the ribs of a certain palm leaf; they are sharpened to a needle's point, but instead of being mounted with feathers they are merely wound round with a bit of raw cotton. The arrow is placed in the gun so that the cotton just fills the bore; it is blown out with sufficient force to bring down game at a distance of 250 feet, if the wind does not interfere. It is not the force of the dart that kills, but the poison with which it is saturated. A mere scratch by such a dart is invariably fatal.

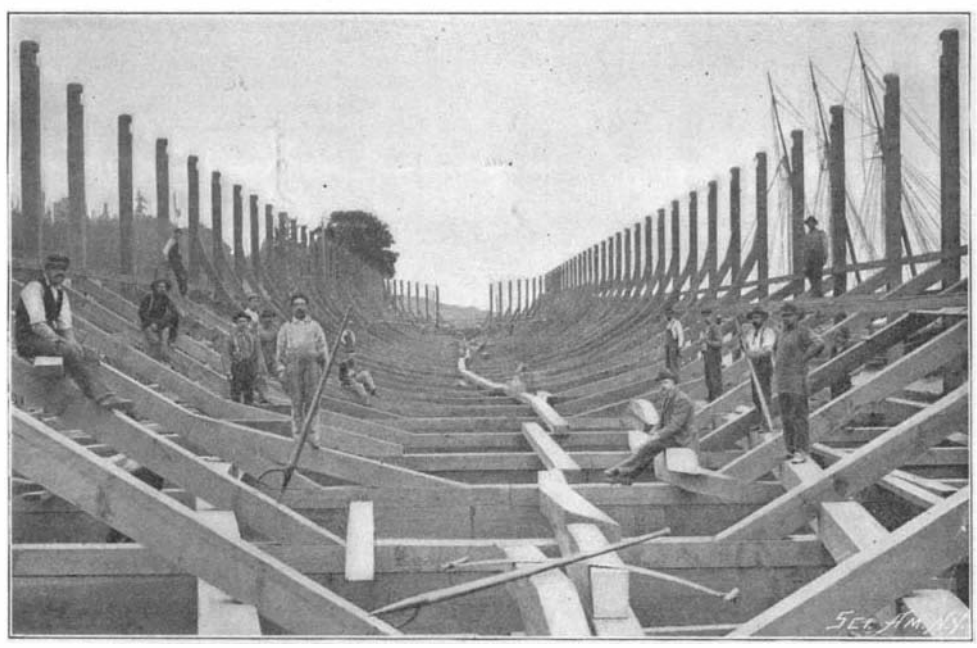
The Bakaïri tribe is famous for some very queer customs, such as the eating of earth, and the rules attending childbirth and the burial of warriors.

The rising of the River Xingo during three months of the year scatters the fish, making it impossible for the tribe to obtain any other food than the baked mud of the river, which is by no means unhealthful. This river mud is very rich in mineral substances, and while it cannot be said to contain nourishing properties to any extent, it fills the stomach and appeases hunger. It is baked in a sweltering sun, eaten in the shape of small balls about 3 inches in diameter, the average daily consumption being about three-quarters of a pound for each Bakaïri.

Like most American Indians, the Bakaïri attach a great deal of importance to tattooing, but in their case the custom owes its origin more to the necessity of averting the insects than to the device for personal adornment. The mosquitoes on the Rio Xingo are so ferocious and pugnacious that extraordinary measures must be taken against them, and when, centuries ago, it was found that a mixture of clay and vegetable oil applied to the skin would keep off the insects, the idea of mixing colors suggested itself, and then and there was the beginning made to the art of tattooing.

The language of the people is poor in words. To illustrate the poverty of the Bakaïri dialect, there is no name for "parrot," although a variety of parrot species are known by separate names. The various kinds of palm trees are designated, though no given name exists for the word "palm." "We" also means "good;" "others" (which they express by saying "not we") also means "evil." The Bakaïri can only count two; if you ask him to count on, he will continue; two-one, for three; two-two, for four; two-two one for five, etc., reminding us of the manner in which bells are struck on shipboard.

Unlike other Brazilian aborigines, the Bakaïri know nothing of intoxicating vegetable drinks. They maintain their ancient custom of shaving the top of the head with a keen-edged native grass. Early explorers supposed that they borrowed this custom from the Jesuit monks, who were the first white men to visit them, but it has been proven lately that the bald spot on the head was characteristic of the Bakaïri centuries before any white man penetrated the tropic wilds of their home.



CRADLE IN WHICH RAFT IS BUILT UP.

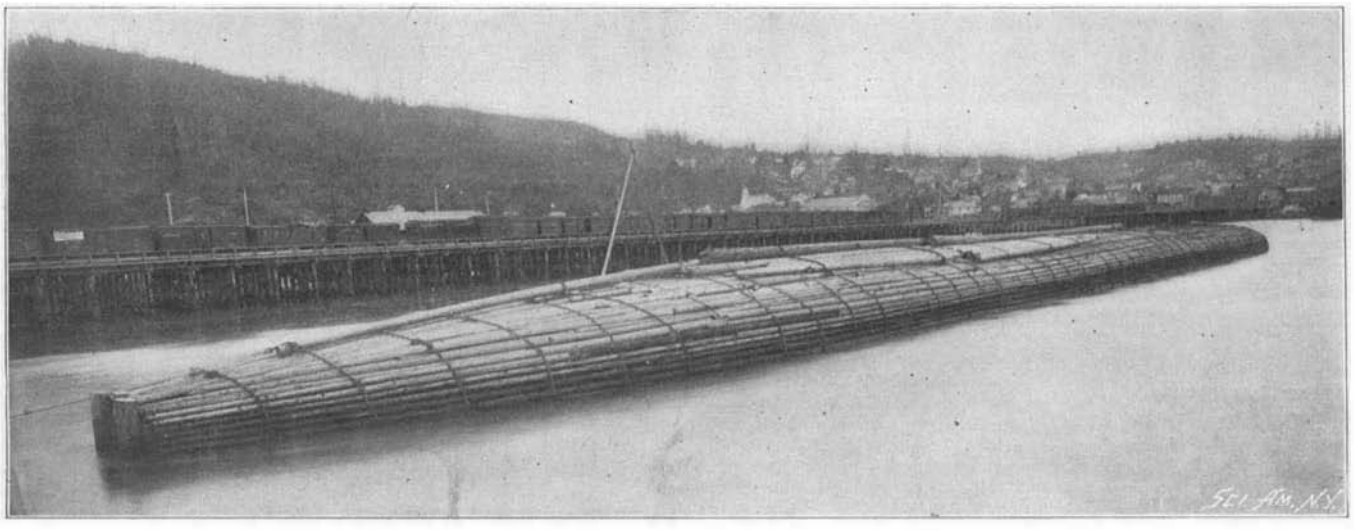
LUMBER RAFTS ON THE COLUMBIA RIVER.

The States of Oregon and Washington have seen a remarkable development of the method of transporting lumber to California by sea in the form of large built-up rafts, and although the increase in the price of timber of the kind which has been shipped by this method makes it likely that no more rafts of the kind will be built, this unique and daring means of transportation will always remain as one of the curiosities of the lumber trade of the Pacific coast. We present illustrations of the last of these large rafts to be constructed. Like several of its predecessors, it was built at the little town Stella, which is located on the Washington shore of the great Columbia River, and about twenty miles from its mouth. The accompanying illustrations are of particular interest, as showing the means by which the huge rafts are built up to the desired cigar shape, prior to their launching.

This particular raft was some 400 feet in length and over 100 feet in circumference. It was built up of fir piles, which varied from 80 to 111 feet in length. It is readily perceived that to form a strong and flexible structure of this length out of such relatively short pieces, and mould it to a true cigar shape, would be an impossible task, unless a permanent form of cradle were first built in which to contain it during the process of building it to form. The cradle, as will be seen from our illustrations, is not unlike the skeleton of a large ship in the days of wooden shipbuilding. It is constructed with a double keel and a series of heavy frames of 12 by 12 timbers with heavy knee-bracing between the floor timbers and the verticals at a point which would be known as the bilge in a ship. The keel is constructed in two sections, which are held together by massive locks or clamps, to maintain the cradle in position while the raft is being formed. The piles of the raft are laid to break joint as far as possible, the abutting ends of one line of the piles coming opposite the center of the piles adjoining.

When the raft is completed it is wrapped around several times with massive cable chains, which hold the mass firmly, but flexibly, together. After the raft is launched, the locks are sprung open by hauling upon ropes which are securely connected to them, and the two halves of the cradle, thus unlocked, float apart, leaving the raft free to be towed away. The tug's hawser for towing is made fast to a very heavy chain, which runs through the entire length of the raft. This towing chain is made fast by transverse chains to each of the binding chains, which run around the circumference of the raft. The effect of this arrangement is that when the strain of towing comes upon the central chain, the binding chains are also tightened, and, consequently, when the raft is in a sea-way, the greater the strain upon the hawser, the tighter is the clamping effect of the binding chains. Although the earlier rafts frequently came to grief, those which have been constructed of late years on the system, as outlined above, have proved themselves well able to stand the stress of an ocean trip.

The distance from the mouth of the Columbia River to San Francisco is about 700 miles, and under ordinary conditions of weather one of the powerful tugs which are detailed for the work of towing will take a raft of this kind from the Columbia bar to the Golden Gate, San Francisco, in about twelve days. The raft, which is herewith illustrated, contains about 500,000 linear feet of timber, or say about 6,000,000 board feet, a sufficient quantity of timber to load a half dozen vessels each of 1,000 tons burden.



RAFT OF PILES ON THE COLUMBIA RIVER READY FOR TOWING TO SAN FRANCISCO.

Length, 400 feet; circumference, 100 feet; contents, 6,000,000 feet board mea ure.

The Current Supplement.

The current SUPPLEMENT, No. 1287, has many papers of unusual interest. "Problems in China," is by James M. Hubbard. "China and Her People; Some Reflections Upon Their Manners, Customs, Habits, and Lives," by Commander Harrie Webster, U. S. N., is another timely article. Both are illustrated. "Peary Supply Ship Sails" describes in detail the construction and stocking of this vessel. "Old St. Peter's, Rome," is an important restoration. "The Panoramas of the Paris Exposition" describes the Balloon Cineorama at the Fair. The eighth instalment of "American Engineering Competition" is given in this number. "The Opening of the Metropolitan Railway at Paris" is fully illustrated. "The Biological Laboratory at Cold Spring Harbor, L. I.," is by W. G. Bowdoin. "Tetanus and Its Treatment," and "The Coloring of Soap and Candles," by George H. Hurst, are valuable articles. The usual Trade Notes and Consular matter will also be found in this number. "My Experience with a Siphon Pipe Line," by John K. Prather, B.S., describes a simple and convenient device.

Contents.

(Illustrated articles are marked with an asterisk.)