can be no growth of that sense of community of interest, which is absolutely essential to secure the best results in the industrial world.

On the important question as to whether the American is on the whole better off than the English workman, the delegates point to the fact that while he receives higher wages, he has to work longer hours; and that though the wages are higher, the cost of living is greater. The general trend of opinion is that after income and expenditure have been balanced, the American is found to be better off than the British workman, to the extent of twenty per cent or so. This estimate, however, cannot be applied too broadly, for the reason that conditions differ considerably in different parts of the United States.

ELECTRIC POWER PLANT BELOW MOUNT RAINIER.

BY EARL MAYO.

The glacier-capped mountains of the Pacific coast offer excellent facilities for the development of hydraulic-electric power. To utilize the glacier flow, a power plant, the largest on the coast, is now being constructed, which will deliver electrical energy to the principal cities of Washington for the street railroads, interurban lines, and lighting plants, and also for mills, factories, and the principal commercial concerns.

The original source of the water power will be the great glacial cap of Mount Rainier, which towers 14,519 feet above sea level and is constantly reinforced by the warm mists and rain-clouds which are brought inland from the Japanese current which impinges on the neighboring coast. The moisture in the air, striking this great ice-cap, high above the limit of vegetation, is condensed, so that the glacial covering is constantly growing from the top while it is being melted away from the bottom. The present undertaking necessitates the damming of the Puyallup River below its junction with the Mowich at an altitude of about 1,700 feet above sea level. Owing to the peculiar formation of the mountain above this point, the Puyallup River drains not only the Mount Tacoma glacier, the Puyallup glacier, the South Mowich, North Mowich, and the Carbon glaciers, but also Crater Lake, into which the Carbon glacier discharges. From beneath the glacial ice, whether it ends in a precipitous cliff or presents a confusion of broken ice, cold water flows throughout the whole year. The hidden streams which flow for several thousand feet between the ice cap and the granite surface of the mountain, burst from beneath the edges of the glaciers with a loud roaring, and sometimes the curtain of water which leaps out, although of slight depth, may have sufficient force to carry a man off his feet.

Below the ice, in the almost impenetrable forests, the rainfall is perhaps greater than in any other part of the country. The wind which brings the mists ashore is always temperate, and the side of the mountain is sufficiently abrupt to catch the precipitation from clouds at varying elevations, while the dense woods tend to the preservation of all falling moisture. From experiments made in the neighborhood it is estimated that the annual rainfall on the western slope of Mount Rainier aggregates 150 to 160 inches. The rainy season begins in October and continues into the early summer—nearly every day during this period showing some appreciable precipitation. During this season there is more water available than is needed, and it happens therefore that the flow from the glaciers, although it never fails, is diminished by the cold weather. During the dry season, including the months of July, August, and September, when little or no rain is expected, the glacial flow is at its height and can be relied upon to provide an ample supply of water.

The water power which nature has stored in this cap of ice is regulated to the demands of man not only by its yearly variations, but also by the so-called glacial tides, which are manifest daily. The greatest flow from the glacier, owing to the influence of the sun, occurs from perhaps eleven in the morning until four or five o'clock in the afternoon. Owing to the distance that this water travels before being utilized for power, these high tides will reach the power station five or six hours later, and therefore the largest daily supply is available between five in the evening and eleven at night, when the city's illumination and street car travel make the greatest drain upon the plant. The glacial tides show a rise of perhaps two inches where the stream is broad, and of two feet where the water of the stream is crowded into a narrow channel, and they are the means of great economy, since, to a large extent, they regulate the power without artificial intervention.

At the point where the Puyallup River is being dammed, a series of rapids start, and extend to the comparatively level ground about 900 feet below. While the river normally travels down a cañon, it will be diverted by a flume and ditch along a bench or spur of the mountain, until it approaches a point above Lake Kapowsin, where there is an almost sheer decline to the foot of the rapids. The flume will be built with a section of eight feet wide by seven feet high, and will carry 2,000,000 tons of water daily. Here the canal, which will be ten and a half miles long, will discharge into a forebay or reservoir, which will hold sufficient reserve supply to operate the plant during any necessary repairs to the flume or ditch.

From the forebay, four steel pipes 1,700 feet long will carry the stream down the declivity at an average angle of 45 degrees, to the power station, which will be situated at the beginning of the level country below. When the necessary reductions are made for friction, the pipes will hold columns of water with a net head of about 850 feet. This is to say, although the pipes will descend diagonally, the water efficiency will be as great as if they descended vertically 850 feet. From these great steel pipes, which will be four feet in diameter at the top and taper to a five-inch nozzle, a compressed stream of water will be released with a spouting velocity of about 15,000 feet, or nearly three miles a minute. This stream will be released in the shape of a solid round bar which strikes the cups of an "impulse" or tangential water wheel, so that the greatest efficiency known to hydraulics may be attained. The four impulse wheels will be connected directly to the generators, which are now being built by the General Electric Company, and which will be unequaled by any now employed west of the Rocky Mountains, having a capacity of 3,500 kilowatts, or 5,000 horse power each. An alternating current of 2,500 volts will be generated and stepped up to 45,000 or 55,000 volts, and then transmitted to Tacoma, which is about 30 miles, and to Seattle, which is about 45 miles distant.

The engineers have completed the laying out of the flume and ditch line, and while the great generators and water wheels are being constructed, several hundred workmen are employed in clearing away the giant trees and rocky ledges that stand in the way of the free passage of the water between the diverting dam and the forebay. Meanwhile, also, preparations have been made for laying the great steel pipes down the face of the headland, and concrete anchors will be set into the hill to sustain the enormous weight of 1,700 feet of water, and prevent the pipes from forcing their way into the power house. Each tangential wheel receiving its impulse from this weight of water will revolve with a speed that would send its periphery 7,000 feet a minute, and the four wheels will develop 20,000 horse power.

CARRIER PIGEONS FOR THE GERMAN NAVY.

For some time past severe experiments have been conducted by the German naval authorities to ascertain the suitability of the carrier pigeon for intelligence service in the navy; and so successful have these trials proved, that permanent pigeon stations are to be erected. The chief of these will be at Wilhelmshaven and Helgoland for the North Sea, and at Friedrichsort for the Baltic. To assist the Admiralty in its scheme, sixty-one carrier pigeon clubs have placed their services at the disposal of the authorities. Six of these clubs have stations on the east coast—two at Kiel, two at Rendsburg, one at Nortof, and one at Lubeck—while there are no less than forty-two stations on the North Sea coast—sixteen at Hamburg, four at Bremen, the others being distributed over the country of the Lower Rhine, between Crefeld and Düsseldorf. The Naval Department will thus have sufficient birds and conveniences at their disposal and will defray the cost of conveying the baskets containing the birds to the various warships, and the return of the baskets to the respective clubs to which they belong.

From the results of the experiments it is estimated that the birds have sufficient endurance to fly home from a point 300 kilometers from land; and to insure the rapid delivery of a message to the desired quarters from a war vessel at sea, a system of duplicating the messages is to be adopted, varying with the atmospheric conditions prevailing at the time of dispatch, the distance to be covered, etc. For instance, up to 80 kilometers two birds will be released bearing the same message, and from 80 to 300 kilometers from three to five birds will be dispatched. Naturally, the time occupied by the birds in flying over the distance to be traversed depends upon the capabilities of the messenger, and the weather, but it is estimated that one kilometer per minute is the minimum speed likely to be attained.

The general practice of sending the message in a quill attached to a tail feather will not be adopted, as this has been proven to be generally unsatisfactory. Instead, the message will be inscribed upon thin vegetable paper, which will be slipped into an India-rubber case and secured to the bird's foot by means of a ring of the same material. As the birds arrive at their respective homes on land the messages will be detached and forwarded unopened to the news-collecting office and there dealt with. At the pigeon stations on the North Sea coast, there are wireless telegraph stations, and the messages will therefore be retransmitted thence to the head office. For this service special regulations have been prepared. In future every warship, except torpedo boats, leaving Kiel or Wilhelmshaven will be compelled to carry a consignment of carrier pigeons to be released at varying distances from the land stations. The utilization of carrier pigeons for intelligence purposes has long been in vogue in the German army, with conspicuous success, and this latest development will mark a new departure in naval warfare.

SCIENCE NOTES.

Dispatches from the Bourges observatory show that the sun after a long period of quiescence has again entered into a state of activity. On March 27, there was visible on the solar disk a large spot measuring 1,864 miles in diameter. Again, on March 30, four sun spots, two of them extensive, were observed.

C. Hartwich and W. Uhlmann state that the fat of gentian root is not a saponifiable oil, but a cholesterin-like body. The chloroformic solution, when treated by Hesse's test with concentrated H_2SO_4, colors the acid a bright red with a green fluorescence, and the chloroformic layer passes from yellow to red, and finally, after standing for twenty-four hours, to violet. By Liebermann's test, treating a solution in acetic anhydride with concentrated H_2SO_4, a red color, passing, on shaking, to bluish-green, and finally olive green was obtained. A similar cholesterin reaction also resulted with Salowski's test. The fat was extracted from the root by means of ether. It occurs to the extent of 5.67 per cent, and forms a dark yellow, viscous substance, having the characteristic odor and taste of the drug. By shaking out the petroleum ether solution with water and alcohol, 50 per cent, the odorous and bitter principle is removed.

That there are bacteria, some large fungi, and rotten woods which give phosphorescence or shine in the dark, has long been known, but it is a question whether there are shrubs or flowering plants that have the same property. Dr. H. Beckurts has recently, however, discovered a notice printed in 1845, stating that at the session of the Royal Asiatic Society, held April 5 of that year, the dry roots of an Indian plant were exhibited which possessed the property of shining or phosphorescing in the dark. An Indian officer, so goes the story, who took shelter from the rain under some projecting rocks, observed that the neighboring grass phosphoreseed, and he gathered several specimens of the grass and brought them to General Cullen. The latter stated that the plant was long known to the Brahmins under the name of "diotishmati," belonged to the family of the vegetable Sapindaceæ, and was identified as the *Cardiospermum halicacabum*. This, however, cannot be, since Lindley, who presented the root to the association, stated that it was a rhizome of a monocotylic plant of the Orchidaceæ or Iridaceæ. According to Watson the Indian plant "diotishmati" belongs to the grasses. It is, however, believed that the fact in the case was that the plant was probably covered with one of the phosphorescing fungi, which caused the error of observation in the young officer.

Mr. F. W. Very, of the Allegheny observatory, recently published a series of measurements on the radiations received from different portions of the solar disk. The measured amounts of radiation were found to diminish outwardly from the center, contrary to the assumption of a uniformly absorbing atmosphere. Taking Mr. Very's figures as a basis, Prof. Arthur Schuster, of Manchester, publishes in the Astrophysical Journal an examination which shows that the difficulty of explaining the law of variation of intensity across the sun's disk is readily removed by placing the absorbing layer sufficiently near the photosphere and by taking accounts of the radiation which this layer, owing to its high temperature, must itself emit. There is no reason to look to a different region in the sun's atmosphere for the cause of the observed diminution of radiation than that which gives the Fraunhofer lines. The simplest supposition to make at present, and one consistent with our knowledge of spectra, is that the layer which gives the line-absorption absorbs also to some extent all wave lengths extending from infra-red to violet, and that the diminution in the observed intensity of the solar radiation toward the edges of the disk is due simply to this absorption. The principles developed in this paper may find a wider application. Some observers have been puzzled by the fact that the radiation of the umbra of sun spots does not diminish as it nears the edge of the sun in the same way as that of the luminous disk itself, but, on the contrary, remains nearly constant. This investigation shows that in the case of the solar disk only about half of the radiation comes from the photosphere and that the rest is made up by the radiation of the absorbing layer itself. If that absorption, either by increased density or by greater thickness, is increased four or five times, practically the whole of the radiation would come from the absorbing layer and would be nearly constant for different portions of the solar disk.