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Contents.

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TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

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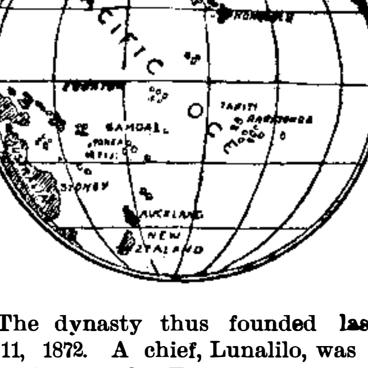
THE HAWAIIAN ISLANDS AND THEIR ANNEXATION.

Some two thousand miles from San Francisco in a southeasterly direction lies the group of the Hawaiian Islands, which have been the scene of the late revolution. The country is now in the hands of a provisional government who have deposed the queen, and the future disposal of the government is the question of the hour. Some advocate annexation to the United States. Great Britain would be hardly true to her nature did she not contemplate taking possession of the islands, so as to have one more stepping stone for the sun, which always shines on some part of her dominions. Germany's interest in the islands has not yet developed to any great extent.

About the year 1527 one or two Spanish ships were wrecked upon the islands, and the few survivors intermarried with the natives. Their descendants are identified to the present day by their light skin, liability to freckle, and by their facial contour, which is Caucasian. They are termed Kekea. The true discovery of the islands was effected in 1542 by Gaetano, a Spanish navigator, and in 1567 Mendana, another Spaniard, determined the true position of one of the islands, Kauai. In the beginning of 1778 Captain Cook visited the islands, whence his countrymen assign to him the honor of discovery. He left them and returned toward the end of the year. He excited the hostility of the natives and on February 14, 1779, was killed by them on the shores of Kealakeakua Bay, on the island of Hawaii. He was endeavoring to recover a stolen boat when killed. The name Sandwich Islands is derived from Lord Sandwich, of England, and was given by Captain Cook. Fortunately the beautiful native name, Hawaii, is now in the ascendancy and will, it is to be hoped, remain so.

A very elaborate system of feudal government originally obtained there, five or six independent monarchs holding sway. Wars were frequent. In one of them, in 1790, King Kamehameha was attacked by another king, and defeated the aggressor. He pursued his conquest and thirty years later was sole monarch of the



islands. The dynasty thus founded lasted until December 11, 1872. A chief, Lunalilo, was elected to succeed this house. On February 12, 1874, Kalakaua was elected king. He died in 1891, while visiting this country. His sister, the recent queen, Lilioukalani, the widow of John O. Dominis, the latter of American origin, succeeded him. She is the deposed ruler. Undoubtedly no native dynasty will again hold sway.

In the history of the country, which history is one tale of revolutions, some facts bearing on annexation may be noted. In 1810 Kamehameha I. wrote to George III. of England, desiring formally to acknowledge the British king as his sovereign and to place the islands under his protection. The offer, it is said, was accepted. Again, in 1843, a provisional cession of the islands to Great Britain is recorded, which was abrogated a few months later. By special treaty of 1889 the control of foreign relations was given to the United States.

The islands are twelve in number, with an area of 6,400 square miles, over three times that of the State of Delaware, or about four-fifths of that of the State of Massachusetts. One island, Hawaii, contains 4,000 square miles. Most of the rock formation is volcanic. On Hawaii are two active volcanoes—Kilauea and Mauna Loa. Between the effects of eruptions and accompanying earthquakes a number of lives have been lost. The highest point in the islands is Mauna Kea, on Hawaii, which rises to an elevation of 13,805 feet above the sea.

With such an immense range of altitudes, a great variety of climate can be secured. It varies from cool, frosty weather to very warm weather throughout the year. Sea breezes and northeast trade winds do much to temper excessive heat. In the winter heavy rainstorms occur, lasting sometimes for weeks.

The natives are supposed to be of the Malay race. At the time of Capt. Cook it is thought that the population was about 300,000. War and disease, the concomitants of civilization, have reduced the population, until the census of 1890 showed a total of 89,990, of which but 34,436 were of the aboriginal race. It is believed that they were originally cannibals. Except for this feature, they seem to have had many excellent features. Capt. Cook's death is believed to have been precipitated by his own cruelty and hypocrisy. The American whalers used to recruit their crews with Kanakas, as the natives were called, and tribute to their amiable qualities is easily found.

On April 4, 1820, seven American missionaries reached the island. Shortly before this time the natives had destroyed all their idols, and the missionaries found a nation without any religion. In 1825 the ten commandments were adopted as law by the government. The first missionaries reduced the language to a written form, with an alphabet of twelve letters *a, e, i, o, u, h, k, l, m, n, p, w.* Whether the limited alphabet has anything to do with it may be a matter of surmise, but the population is said to be on the average less illiterate than that of New York City or Pennsylvania. It is claimed that they have a well settled American society, comparable to anything in the States. The general feeling on the island is said to be opposed to Great Britain.

Last autumn the San Francisco *Examiner* had a poll taken of the Hawaiian parliament on the subject of annexation. The sentiment then was strongly in favor of independence. The queen's leaning toward absolutism is largely responsible for the revolution and presumable change of views of the leading men on annexation. Probably the sugar question is one of the factors at the bottom of it. At one time the sugar plantations paid a return of some fifty per cent on the investment. This state of things has been done away with by free West India sugar, so that a far smaller profit is made. The hopes of a bounty per ton of sugar is one element making the sugar planters anxious for annexation.

Practically Hawaii draws upon San Francisco for her supplies. In 1891 the tonnage of American ships entering the harbor of Honolulu was over three times that of English ships, or 173,891 tons. American imports aggregated $5,924,277, as against $1,201,329 of British imports. The sugar production is now 300,000,000 pounds per annum.

The leper colony on the island of Molokai, the scene of the heroic exertions of Father Damien, casts a shadow over a picture where there is so much that is fair. But Canada and Louisiana both have had lepers for many years; so in leprosy we would have no new acquaintance. Some thousands of miles to the south and east of Hawaii, Robert Louis Stevenson has established himself. But his lovely Samoa hardly yields to the charms of the more northerly group of Hawaii. The varied climate enables any form of vegetation to be raised that can be grown in a temperate or tropical climate. The establishment of a botanical garden, absolutely unique in the world's history, would be an interesting possibility. The islands are but six days from San Francisco, and by fast steamers could be brought much closer. Under proper conditions, they might attract and should attract many tourists. The fact that America is by far the nearest mainland seems to bring the islands within the operation of the Monroe doctrine, and goes to forbid the establishment there of a European power. The purchase of Alaska, under the advice of Seward, when United States Secretary of State, has proved an excellent operation for this government. The annexation of Hawaii, it may be believed, would prove in its degree equally good for us, and, it is to be hoped, would be good for the inhabitants also. As a touching point for ships, its value cannot be overestimated. In war the importance it would acquire, as a strategetical point, and as a depot for coal and supplies for war ships, is obvious. We already possess by treaty, rights in a species of harbor or coral lagoon, Pearl Harbor by name, which requires dredging before it will be available for ships of war. The bay of Honolulu, on the island of Oahu, is the principal harbor. It has 22½ feet of water. Good harbors among the islands are very few.

The islands now have a debt of $3,000,000. The necessary assumption of this debt is one of the principal reasons cited against annexation. It would virtually represent a price paid for the islands.

THE EDISON INCANDESCENT LAMP PATENT ATTACKED.

History repeats itself. Some years ago the great Bell telephone patent had arrayed against it a host of witnesses and able legal and expert talent. In the depths of Pennsylvania had been discovered an inventor who, it was held, had invented and had in operation a telephone and microphone antedating Bell and Hughes by many years. The case went to trial and one of the largest records ever produced in a lawsuit accumulated, and was produced before the Circuit Court in this city. The usual course was taken after an adverse decision in the lower court, but the appeal was without result. It was chiefly remarkable for the division of opinion of the United States Supreme Court. The Drawbaugh case to which we allude is a thing of the past. The expiration of the Bell patent in any case would relegate it to obscurity.

Now the electric light has found its Drawbaugh. Heinrich Goebel, born near Hanover in Germany, is the inventor cited to destroy the recently affirmed

Edison incandescent lamp patent. In Goebel's alleged inventions we find the exhausted glass receiver and the true filament of carbon. It is not a rod or segment of pencil lead but a true filament of Edison's favorite bamboo. Starr's early lamp, it will be remembered, was based on a rod of carbon. The distinctive feature of Edison's invention is the thin high resistance filament.

Goebel was engaged in work upon apparatus for the Technological School of Hanover. His attention was there called to the Starr lamp. He emigrated to America and started as a dealer in clocks in this city. He experimented with electricity. He produced a repetition of Sir Humphry Davy's arc light upon the roof of his residence. The exhibition of so powerful a light occasioned an alarm of fire and the inventor was, it is said, charged before a magistrate with breach of the peace.

He then turned his work in the direction of Starr's invention. He experimented with the incandescent lamp. From experiments with such material as a bit of a carbonized umbrella stick, he progressed through the list of various wood fibers, until he tried a fiber from the bamboo stem of a pipe. Like Edison, he found that bamboo answered the purpose admirably. He made a number of lamps as early as the year 1855. A number of what purport to be these identical lamps are produced at the trial now in progress.

The lamp chambers are of glass tubing. Leading-in wires of copper, platinum and iron are used. The fiber, there is no doubt, is what it purports to be. The leading-in wires enter the base of the chamber. The ends are wound into spirals and retain within their convolutions the ends of the filament. To make a good joint in some lamps a carbonaceous cement has been used. It is claimed that it was made from Dixon's stove polish. In other lamps the joint was made by electroplating with copper. In some lamps a straight filament was used, one leading-in wire reaching nearly to the top of the chamber. In others a spiral filament and in some the familiar horse-shoe shaped filament is seen. The last shape the inventor called the hairpin pattern.

The vacuum was the strict Torricellian vacuum. The lamp, after introduction of the filament, was sealed to the top of a glass tube over 30 inches in length. The whole was filled with mercury, and set up, open end down, with the lamp on top. Thus it constituted a barometer. The mercury descending to the height of the barometric column produced the Torricellian vacuum in the chamber. The chamber was then sealed by the blowpipe flame and melted off from the barometer tube.

In these early days Goebel is said to have frequently exhibited his lamps. He used to set them in operation on his show case. He left his shop in 1874. He used to exhibit a 12 inch aperture telescope which was carried on a wagon about the streets. He used to show his lamps from the wagon to attract attention. A battery was taken as part of the outfit. These street exhibitions go back of 1860, so it is alleged.

His imperfect knowledge of the English language and his limited association with the world are cited as reasons for the obscurity of his work and for his not pressing his claims. It is also doubtful if, assuming all the allegations to be true, a patent could have been secured by him after the repeated public exhibitions. There was less inducement to patent it at the first dates cited, because there was then no dynamo invented available for cheap production of the current.

Such is an abstract of the story presented. If he fares but a degree better than Drawbaugh, the humble German inventor may carry with him the whole body of the court of last resort, and may destroy the Edison rights to the filament of carbon of the modern incandescent lamp.

Trial of an American Armor Plate at Portsmouth, England.

A Harvey nickel steel armor plate, 6 inches thick, was tested on board the Nettle at Portsmouth on the 17th ult. The 6 inch breech loading gun was used, firing Holtzer's forged steel projectiles weighing 100 pounds each. The trial was of a very unusual kind, the gun and projectile being those regularly employed for testing 10½ inch plates, except, indeed, that for two out of the five rounds constituting the usual test, Palliser chilled iron shot are used, whereas in this case four rounds were fired with Holtzer projectiles. It was out of the question to attack this plate with the usual charge and striking velocity, and the following order was observed: Round 1 was fired with a charge, we believe, of 30 pounds; at all events, the striking velocity was 1,507 feet per second. The projectile was pulverized without cracking or seriously injuring the plate. Round No. 2 was fired with, we believe, 42 pounds of powder. The striking velocity was 1,813 feet per second. The shot was again broken up, but the plate was cracked. No. 3 round was fired, we believe, with 48 pounds of powder. The striking velocity was 1,960 feet per second. The projectile perforated the plate and was lodged in the form of fragments in the backing. No. 4 round was fired with the charge again reduced, so as to give a striking velocity of 1,815 feet per second. The shell was again broken up without perforation, and no further cracks were made, and no part of the plate fell off from the backing.

This is a most remarkable trial, says the *Engineer*, for it must be borne in mind that the resisting power of a plate is more nearly as the square of its thickness than as the first power, so that for a 6 inch plate to break up a projectile which until recently was a match for 10½ inches is a great triumph, and it may be seen from the account that any structure behind the backing would have been protected. Attention must be called to the fact that while the shot was broken up at 1,815 feet velocity in such a way that a great part of its striking energy must have fallen harmlessly on the plate, it cannot be argued, on the other hand, that a shot is only capable of delivering a fixed quantity of energy before fracture, and that all energy over and above that is lost, for it appears that at 1,960 feet velocity much more injury was done, because we suppose more energy was delivered before the work of fracture was complete. Probably the fracture of the projectile occupies such a period of time that more work is done on the plate by increasing the velocity, because, although the shot is the weakest element, there is not time to find the line of least resistance before additional injury is done to the plate. It is perhaps the same action as causes fulminate not to follow the lines of least resistance taken by slower powder in bursting a vessel.

Thermal Storage.

In the course of a recent lecture at the Society of Arts, London, Professor Unwin made the first public mention of a very important invention known for some time to a few, and likely to have a bearing, so *The Engineer* says, on the economic generation of electricity, whether in large or in small installations. It is the invention of Mr. Druitt Halpin, and consists in the storage of the continuous thermal work of one or a small number of boilers to do the work of several or a large number of boilers for short periods. That is to say, that he meets the difficulties which bring about a low load factor, and with an ordinary load diagram he is able to meet the varied demand on the part of engines and generators, with a uniform or straight line load diagram as concerns the boilers. His system is one which is equally applicable for continuous and for alternating current stations, and in many cases it will make secondary batteries unnecessary, except in very small numbers. We shall not now enter into a full description of Mr. Halpin's system, but we may briefly describe it as follows: At the present time it is necessary in electric generating stations to provide sufficient boiler power to meet the maximum demand, or the highest part of the load diagram. This only, even if we make its mean, represents about one-sixth to one-fourth of the twenty-four hours; yet boilers must be provided, and fires either lighted up or banked up to meet this short period, the boilers themselves being sufficient to meet the maximum demand continuously.

This not only enormously increases the fuel consumption, but it makes capital expenditure high, and the unit cost of current very much higher than if produced with boilers always working at full load. To avoid these difficulties and losses, Mr. Halpin, under this thermal storage system, employs boiler power of from about one-sixth to one-fourth the maximum load. These boilers he works continuously at their best and most economical rate of evaporation. During those of the twenty-four hours when the generating station demand is small, the thermal work of these boilers is stored by passing the water which they heat into a sufficient number of plain storage tanks, protected from loss by radiation or conduction. The boilers which he employs will work at a pressure of say 250 pounds on the square inch, and will be what we may call flooded boilers; that is to say, there will be no steam space within them. The storage tanks will, of course, also be worked at this pressure, but by very well known arrangements steam will be taken from them when the engines are working at a pressure of say 130 pounds. During the time of maximum load the water level in these tanks will fall by conversion of heated water into steam, and the level will again be made up during the fall to minimum demand. The storage tanks will be the equivalent of the gasholders in a gas supply system, and in number will be sufficient to give a capacity of about 14 pounds of water per pound of steam required during the period of demand which is above the mean load. The estimated cost of this arrangement is less than that for a sufficient number of boilers, and a saving on the present cost of [illegible] production in some of the well known generating stations will, it is said, probably be from 40 to 50 per cent, so great is the loss of fuel during the time when boilers are under fire with closed stop valves.

Mr. Halpin's system has never been employed in electric work, but the enormous cost of fuel per electric unit under existing circumstances, as compared with the easily practically possible 2¾ pounds of coal per unit, shows how much it is wanted, and how completely it has escaped all previous inventors. Yet the principle upon which it is based is old, and has received various applications. It is another of that important class of inventions which employs old means in new combinations and applications to the public benefit.

Half-tone Etching on Copper for Typographic Blocks.

A contributor to the *Photographic Times* says:

Copper, being tougher and harder than zinc, makes a particularly good metal for type press work. It will stand double the number of impressions, and show no wear whatever. Besides, the results are finer and better in every way. Inasmuch as nitric acid is not a useful mordant for copper, entirely different methods of procedure are necessary.

It has long been known that bitumen contained properties of being sensitive to light, and this article will form our sensitizing mixture. The formula below for preparing the bitumen is to *increase* its sensitiveness, which in this age of haste and "do-things-quickly" is an essential.

Dissolve 7 to 10 grammes of sulphur in a sufficient quantity of carbon bisulphide, and then add 100 grammes bitumen. The solution is then freed from carbon, and placed in a drying stove, in which the temperature is gradually raised to 356° F., until the odor of sulphureted hydrogen disappears, which requires about five hours. The bitumen, after this treatment, shows itself in the form of a black mass, brilliant, insoluble in alcohol, but equally soluble in benzine, turpentine, etc. Four parts of this bitumen are dissolved in 100 parts of benzole, which forms the sensitizing mixture.

The copper plate, having been polished with charcoal (which is made for this purpose), is dried, then coated with the bitumen solution, using a whirler to distribute it evenly over the plate. It is now placed in contact with the negative, exposed in bright sunlight for ten minutes, developed in a bath of turpentine in the dark room. The turpentine dissolves all the coating that has been protected from the light, leaving the image clean and clear.

The plate may now be touched up, using a fine brush, and the sensitizing mixture placed in the light for a time, when, after painting the back with shellac, it is ready for etching. One ounce of a saturated solution of perchloride of iron is added to four ounces of water, and the plate is placed in this solution, using a glass or porcelain tray. The biting commences immediately, and is to be continued until a sufficient depth is reached, which can be judged by scraping through the coating on the margin, and when the fingernail catches against the edge it is deep enough. It should be about the depth of the thickness of a tin plate.

This plate should be brushed during etching to aid the solution in getting at the metal, using a soft camel-hair brush. The plate is now ready for mounting, routing, or sawing away the edge, and nailing to a block of mahogany of a thickness to make the whole just type high.

Copper is being extensively used now, and half-tones on this metal command a higher price in the market than zinc work. This process is very simple, and gives excellent results.

A High Temperature Furnace.

M. Henri Moissan has contributed to the *Comptes Rendus* an interesting report upon his experiments with furnaces worked at extremely high temperatures. He observes that the highest temperature attainable by coal gas and an oxygen blast is about 2,000° C., at which no crucible other than one made of quicklime will stand. Having had occasion to submit substances to a still higher temperature than 2,000° C., M. Moissan thought of using the heat yielded by the electric arc, and to this end he planned an arrangement which has at least the merit of extreme simplicity. The furnace is formed of two bricks of quicklime, carefully cut out and placed one above the other, the lower brick having a longitudinal groove in it to receive the two electrodes, and a small cavity in the middle which serves for a crucible. This contains the substance to be ignited. In the first experiments, a small Edison dynamo driven by a gas engine was used, and with a current of 30 amperes and 55 volts a temperature of not much exceeding 2,250° C. was attained. Ultimately a force of 50 horse power was used, and the temperature of 3,000° C. was reached. Great care was necessary, in the experiments, to avoid injury to the eyes and the face by exposure to the fierce heat. Some remarkable results were obtained by employing these high temperatures. At 2,500° C., lime, strontia, and magnesia crystallize in a few minutes. If the temperature reaches 3,000° C., the material of which the crucible is composed (quicklime) melts, and runs like water. At the same temperature, carbon quickly reduces calcium oxide, and the metal is liberated in abundance. Some very fine crystals of the borides and silicides can also be obtained in this way, and many substances exhibit very striking reactions. M. Moissan is continuing his researches, and he promises to publish his further results.