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NEW YORK, SATURDAY, FEBRUARY 11, 1899.

OUR FIRST AND LAST SIXTEEN-INCH COAST-DEFENSE GUN.

According to recent dispatches from Washington, the work of completing the first and probably the last "monster" gun to be built in this country is proceeding satisfactorily, if somewhat slowly. The new plant which it was necessary to install at Watervliet Arsenal to accommodate the great size of the gun has been completed, the forgings are delivered, and, if nothing goes wrong, the firing tests will take place in October of the present year.

By the time it is completed the new weapon will have afforded strong evidence of the fact that the fabrication of heavy ordnance is extremely slow and laborious; for several years will have elapsed between the date of its authorization by Congress and its completion. It will also demonstrate, in comparison with heavy guns of the latest type, that in the few years since it was commenced the manufacture of ordnance has advanced with such rapid strides as to render it, by comparison, an inferior weapon—slow in its rate of fire, of low velocity, and greatly inferior in the proportion of its energy to its weight.

For which reasons we shall not build any more 16-inch, 125-ton guns.

The idea of building this huge gun was conceived in the days of hooped guns, smoking powder and low velocities, when 2,000 feet per second was the standard velocity for the best ordnance of the day. At that time the heaviest and most powerful weapon in service was the 110½-ton gun of the British navy, of the kind mounted on the "Benbow" and "Sanspareil," which fired an 1,800-pound projectile with 2,087 foot-seconds velocity and 54,390 foot-tons energy, the penetration being 38 inches of iron at the muzzle and 26·5 inches at a distance of two miles. These huge guns were out of favor with the British authorities for several reasons, the chief of which was that the earliest of them showed longitudinal weakness. Although this was corrected in the later weapons, no more of the pattern were built.

The good results which were obtained with our own hooped guns, and the desire to mount a few weapons of extraordinary power to command our most important channels, led to the authorization of the present weapon. It is of the hooped pattern, and there is not a question that the improvement in materials and manufacture which has taken place in the fifteen years since the big English guns were built, will result in the new 16-inch weapon possessing ample strength and durability in every particular.

The finished gun will be 5 feet in outside diameter at the breech and 2 feet 3 inches at the muzzle. Its total length will be a few inches under 50 feet. The powder chamber will be 18 inches in diameter by 9 feet in length and will hold for a full charge over half a ton of brown powder. The projectile will weigh 2,370 pounds. It will leave the muzzle with a velocity of 2,000 feet per second, and at this velocity the flying mass will have a striking energy of 64,084 foot-tons, or sufficient to lift sixty-four of the biggest freight locomotives 10 feet in the air. At the muzzle the shell would punch a 16-inch hole through an iron plate over a yard in thickness and at two miles distance it would pass through a 27½-inch plate.

In spite of its great power, however, we shall probably never build another of its kind, for while it is the most effective weapon of the type in favor eight or ten years ago, it does not compare in efficiency with ordnance of the modern type, as the following considerations will show. The test of the efficiency of an armor-piercing gun is (other things being equal) the ratio of its penetration to its weight. Of two guns, if one will shoot through the 18-inch belt of a ship and the other will penetrate only 16 inches, the former gun is worth half a dozen of the latter; for the one shot that finds its way into the engine room will cripple the ship, where the half-dozen partial penetrations would leave her free to continue the fight. Again, if two heavy guns, each capable of penetrating 18 inches of armor, weighed respectively 30 and 60 tons, the first would be a vastly more efficient weapon, for two of the lighter type could be mounted on a ship to one of the heavier, or in the case of coast defenses two of the former could be employed for the cost of one of the latter.

Applying this to the 16-inch gun, we find from the accompanying table that it ranks far below the latest guns in efficiency; for although its total energy is about 33 per cent greater than that of our proposed 12-inch navy gun, its penetration is about 20 per cent less, while its energy per ton of gun is over 40 per cent below that of the English gun. Moreover, at the rate of $1,000 per ton, the 16-inch weapon will cost $125,000, as against $55,000 for our new navy weapon. Hence we see that as between the 16-inch and 12-inch guns for a given appropriation we can, by building the smaller weapons, secure over twice as many guns, of much greater penetration and efficiency.

TYPE OF GUN.	Weight in tons.	Length in feet.	Weight of projectile.	Muzzle velocity, feet per second.	Muzzle energy, foot tons.	Penetration at muzzle, iron in inches	Muzzle energy per ton weight of gun.
U. S. Coast Defense 16-in........	125	50	2,370	2,000	64,084	39 0	513
English Wire-wound Navy 12-in...	50 3	41·4	850	2,750	44,573	45 9	886
Proposed U. S. Navy 12-in........	55	50	850	3,000	48,000	48 8	873

In respect of rapidity of fire, the superiority of the 12-inch guns is even yet more marked. If the big weapon delivers a shell once in every five minutes, it will be doing good work; whereas, the 12-inch weapon, with its new Weling breech-mechanism, will be capable of firing a shell every minute or minute and a quarter. When we bear in mind the great speed of modern battleships and the short time they would be within close range in passing a fortification, the slowness of fire of the big gun will rob it of 75 per cent of its value.

It should, of course, be remembered in the above discussion that a new 16-inch gun would be built to use smokeless powder with its high velocities, and that its energy would be increased in proportion. But such an increase is not necessary—we have in the present guns all we need—and the objection of slowness of fire, unwieldiness and cost would still remain.

THE WATER SUPPLY OF THE PANAMA CANAL.

In the planning of a great ship canal like the one now building at Panama, or that proposed at Nicaragua, in which an elevated "divide" is surmounted by means of a series of locks, the fundamental problem to be solved is that of securing a sufficient and permanent supply of water at the summit level to compensate for losses due to the intermittent flow of water from the higher to the lower levels, which occurs whenever a vessel passes through the locks. In addition to the loss due to lockages, there is a steady diminution of the water in the canal as the result of evaporation and of seepage through the material in which the canal is built. Now, while all the other problems of canal construction are of a kind which, given time and money, the engineer can ultimately overcome, this question of water supply is one which is absolutely determined by the natural conditions of the locality. In other words, if there is not available a watershed whose annual rainfall will provide the necessary supply, the canal can never be built.

In our article of last week on the Panama Canal, we showed how the floods of the Chagres are to be stored in two great reservoirs with a combined capacity of 66,000,000,000 gallons, and that this turbulent river, which threatened to be the worst enemy of the undertaking, has, by skillful engineering, been turned into its best friend, a part of its flood waters being converted into a navigable lake, lying along 13 miles of the route of the canal, and a part being stored in a great reservoir far up the river, which provides ample supply for the canal during the season of drought.

For nine months of the year the natural flow of the Chagres River is sufficient to feed the canal and meet the losses due to evaporation, seepage and lockage; but during the dry season, which lasts from January 15 to April 15, there will be a deficit, which must be made up by drawing upon the water impounded within the Alhajuela reservoir, above referred to. The amount of water used by the locks, assuming 24 passages per day as a maximum and a mean of 15, will be, after allowing a liberal margin, 319,674,256 United States gallons per day. Adding to this the waste and loss of various kinds, the total daily use would be 528,388,000 gallons, which for three months, or 90 days, would equal 47,555,000,000 gallons. Now, the mean discharge of the Chagres during this period is 34,345,000,000 gallons. The deficit is, therefore, 13,210,000,000 gallons. To meet this there is stored in the Alhajuela reservoir a reserve of 35,000,000,000 gallons, which would carry the canal through a dry season lasting for over half a year, or through a drought the like of which is not written in the history or told in the traditions of the Isthmus.

With a view to making it possible to add at any time to the capacity of the dam, the structure was given a sufficient margin of stability to permit of the height of the crest being raised ten feet above its present level. This would increase the storage by 23,800,000,000 gallons, and give a total reserve of 58,800,000,000 gallons to meet a deficit of 13,209,680,000 gallons. Should a further margin be deemed necessary, that part of the flood waters of the Chagres which, in the present scheme, will flow through the weirs, could be impounded in various smaller up-stream reservoirs, as is now done in the Croton River watershed, in connection with the water supply of New York city.

EXPLORATIONS IN ICELAND.

Mr. T. Thoroddsen has completed the exploration of Iceland, to which he has given up his vacations for the past fifteen years. He will now write a full account of the results of his labors, which will be published with his map of Iceland. The New York Sun of recent date published a résumé of his labors. For years his articles on Iceland have been in great demand, and he is regarded as an authority on the inner parts of Iceland. In the fifteen years which he has spent exploring Iceland he has visited every nook and corner, found hundreds of lava fields and glaciers, and traced all the indentations of the coast line, and in valleys scooped out of tough basalt has discovered deep lakes, one of the lakes being 100 feet above the sea level, and its bottom is 275 feet below the level of the ocean. In the fifteen years he has traveled over 8,000 miles among the sandy level wastes. It is not surprising that the exploration of inner Iceland has been left so long, as the field was so small and far away that explorers thought they might win greater laurels in other parts of the world in which the public was more deeply interested. Travel in Iceland is particularly difficult, owing to the fact that large areas of lava-strewn land are destitute of verdure and Mr. Thoroddsen has often been compelled to carry fodder for his horses for many days at a time. There are no roads, and the summer season, which is the only time when travel is possible, is short. He has discovered scores of crater lakes scattered all through the interior. Many craters that help to cover the surface of Iceland with lava have become the receptacles for the drainage from the mountains. We are all familiar with photographs of the moon showing the parched expanse of rock pitted deeply with great numbers of craters. The Iceland explorer thinks that the country around Vatna Jokull would be a terrestrial counterpart of the surface of the moon were it not for the atmosphere and the water of greenish tinge that fills two-thirds of the yawning cavities.

HONOLULU'S GREAT MUSEUM.

In the Bishop Museum of Honolulu, the history of Hawaii is spread out as on a printed page. The New York Tribune recently had an interesting account of the museum. Funds were needed for the library of the Historical Society at one time, and an exhibit of Honolulu's antiquities was suggested as a means of raising money. Mrs. Bishop, who is descended from a long line of native kings, and Queen Emma showed the relics that they possessed. Others also contributed, and for the first time these various small collections were seen together; the effect was a surprise to every one interested in such matters. So much interest was taken in the exhibition that it was decided to keep the objects all together and the collection grew rapidly.

Mrs. Bishop endowed the museum with property which yielded $86,649 last year. The museum is in a western suburb of Honolulu. The idea was to exhibit and preserve the relics of Mrs. Bishop's people and the kindred races of the Pacific Ocean. The most interesting thing in the museum to any one not a specialist is easily the great collection of "kahilis." Before the revolution there were 105 in the museum, and since that time the number has been augmented. The "kahili" is the glorified descendant of the common fly brush, and but few great ones remain outside of the museum. Only royalty is entitled to the extraordinary insignia of the "kahili."

These affairs are carried before royalty or left to mark its tomb and perish by the weather. Some of them are gorgeously shaped like enormous bottle brushes, the feathers being splendid plumage of all kinds of birds and the long wooden handles embellished with ivory, mother-of-pearl, and costly woods, and occasionally a shark or human tooth to give interest.

In the same room with the "kahilis" the other relics of Hawaiian royalty, the "ahullas," or feather cloaks and capes, are kept. These are truly wonderful affairs made from feathers of the mamo bird, now said to be extinct, or from the small tuft of feathers found beneath the wings of the oo bird. The collection of enough feathers to make one of the magnificent cloaks often took many years. Only pre-eminent chiefs were entitled to wear the gorgeous mantles of golden feathers, and the appearance of the sable warriors when clad in these was regal.

The helmets which covered the heads of the ancient warriors are extremely interesting, resembling the Roman helmets and the Greek headdress. Most of them are covered with canary and red feathers, which were the favorite form of ornamentation in Hawaii. There are weapons edged with sharks' teeth, which went with these feathered marks of state, and hand daggers, which were fashioned at the time the first voyagers came to the island. In the museum there is also a collection [of Hawaiian birds, containing many choice specimens, not a few of which are now extinct. The museum also includes many specimens of mats, native Hawaiian cloth beaten from the inner bark of the paper mulberry tree, wooden bowls and dishes, some of them being nine feet in circumference, nets, hooks, native sleds, weapons, etc.

Very few of the images of the Hawaiian gods remain in Hawaii. Most of them were taken away to American and European museums. There are a few, however, in the Bishop Museum, and an effort is being made to buy back as many as possible. The collections from Fiji, Society and Solomon Islands are very interesting. The art gallery is not particularly notable. The Bishop Museum is destined in time to become one of the most noteworthy institutions in the world. It is not likely that any similar collection will be founded in any of the other Polynesian islands for many years. Meanwhile the museum is collecting and preserving objects that are of priceless value in throwing light upon the history and evolution of a most interesting people.

THE EIGHTH INTERNATIONAL GEOLOGICAL CONGRESS, PARIS, 1900.

The Seventh International Geological Congress, at its meeting on September 3, 1897, decided to accept the invitation of the geologists of France to hold the eighth congress in Paris in 1900. The French geologists have formed a committee of organization, consisting of sixty of their number, and have just issued the first circular of information regarding the congress, and they present a very attractive programme. The officers of the committee are: President, Albert Gaudry; vice-presidents, A. Michel-Lévy and Marcel Bertrand; secretaries, Charles Barrois, Cayeux, Léon Bertrand, Thévenin and Thomas; treasurer, L. Carez.

The sessions of the congress will begin on the 16th and close on the 28th of August, 1900. The length of the meeting will allow members of the congress time to visit the "Exposition Universelle," to study the geological museums in the city, and take part in the geological excursions offered in the vicinity of Paris. The sessions will take place in one of the buildings of the Exposition, and those members of the congress who desire to exhibit geological maps, sections, photographs, and specimens are asked to apply to the commissioner of their own country, who will reserve for them a place in the proper class.

The committee of organization will strive to show the geology of the whole of France to the members of the congress; but to avoid too great crowds and to facilitate as far as possible the studies of specialists, it has been decided to organize a large number of simultaneous excursions, which will take place before, during, and after the business sessions. The excursions will be of two kinds; the general, open to the greatest possible number of members; and the special, reserved for specialists and limited in numbers to twenty participants each. The full itinerary of the excursions has not yet been published, but a preliminary skeleton can be given now which will show what rich treats are in store for those who can avail themselves of the opportunities offered.

Three general excursions are planned: A series of short ones among the celebrated fossil localities of the Tertiary basin of Paris, which will take place during the sessions of the congress; one of ten days into Boulonnais and Normandy for the study of the cliffs of the Manche River and the classic fossiliferous beds of the Cretaceous and Jurassic from Boulogne to Caen; another of ten days for the comparative study, from the standpoint of physical geography as well as of geology, of the three great volcanic regions of the massive of central France. The complete chronology of eruptions from the Miocene up to the end of the Quaternary will be displayed, and the excursion will then be continued through the Causses of the Lozère, and the gorge of the Tarn to the mountain of Aigoual. Nineteen special excursions are proposed, varying in length from four to twelve days. They and the special object of each are as follows: To the Ardennes for the stratigraphic study of the Cambrian and the Devonian; to Picardy for Cretaceous phosphates and Quaternary clays; to Brittany to see the metamorphism of fossiliferous paleozoic strata under the influence of intrusive granites; to Mayenne for the study of the section of the basin of Laval and the crystalline rocks of the Coëvrons; to the Cher and the Sarthe valleys for Upper Cretaceous strata; to Pont Levoy and Manthelon, to visit the celebrated fossiliferous localities of the shell marls of Touraine; to the Liassic and Permian regions of Morvan, with their associated eruptive rocks; to the coal mines of Commentry and Decazeville; to the massive of Mont Dore and the chain of the Puys and Limagne, for the study of the volcanic craters in the vicinity of Clermont, the succession of eruptions of Mont Dore, and the peperites, basalts, and phonolites of the Limagne; to the Jurassic terrain of the Charentes, with its varied facies of cephalopods, oolites, and coral reef, and the Cretaceous cliffs with their rudistids; to the basin of Bordeaux, where a section from the beds of the Middle Eocene to the Miocene is to be studied; to several Tertiary basins of the Rhone, and Mesozoic and Tertiary areas of the Lower Alps; to the Alps of the Dauphiny and Mont Blanc for the study of folds; to the High Alps near Mont Pelvoux to examine metamorphic schists and gneiss, granite massives with syenites, diabases and lamprophyres, coal with eruptions of orthophyres, other sedimentary and eruptive rocks, and numbers of tectonic problems; to Mont Ventoux and Mont Lure for overthrusts and unconformities among Upper Cretaceous, Eocene, and Oligocene strata, and for fluvio-glacial terraces; to Lower Provence for lacustrine Cretaceous and other formations; to the region of the Montagne Noire, where fossiliferous and metamorphosed paleozoic strata, and fossil-bearing lower Jurassic and Tertiary beds are to be studied; and, finally, two excursions to the Pyrenees, one of which will be for the purpose of studying the eruptive rocks near Lake Lherz and the granites and their contact phenomena in the upper valley of the Oriège, and the other to examine the sedimentary areas of Corbières, Haute Garonne, Lourdes, etc., comprising Jurassic, Cretaceous, and Eocene rocks, giving numerous fossiliferous exposures, including the nummulitic beds. Later in the year another circular will be issued giving more detailed information about the excursions and membership in them.

A NEW POWER IN PHOTOGRAPHY.

Just when to stop the development of the photographic negative on a gelatino-bromide plate has always been more or less of a problem even to the expert; and as over is more easily corrected than under development, it has been the practice, when in doubt, to carry it beyond what was known to be necessary, trusting to reduction to bring the image back to the required density.

For this purpose various methods or reducing agents have been employed, but hitherto they have all had one fault in common—the altering of the values, tonality, or gradation, the most important feature of a negative. This they do in consequence of the fact, hitherto supposed to be unalterable, that reduction goes on equally all over the plate, as much being removed from the delicate detail, in what will be the shadows, as from the denser deposit of the half-lights and lights, resulting in negatives that give prints of the white and black or "soot and whitewash" variety.

Recently, however, the brothers Lumière, to whom photography is already much indebted, have given to photographers a new power in the shape of ammonium persulphate, a solution of which has the property of attacking only, or at least first, the higher and half lights without touching the weaker deposits in the shadows, thus enabling them to reduce contrasts and secure such values or gradation as they may desire.

It will be evident that with one of the older reducing agents that reduce equally all over the plate, and the new agent which acts only on the denser parts of the image, the photographer may with confidence develop to any degree of opacity, knowing that he has the power, by reduction, to produce any degree of gradation that he may desire.

Hardly less of a problem, especially to beginners, has been how to secure correct exposure; and, according to at least one expert, the solution is to be found in ammonium persulphate. It is well known that over-exposure tends to flatness. The negatives may have all necessary detail, but the lights and half-lights are so translucent as to give only weak, flat prints. If, however, ammonium persulphate in conjunction with a bromide be added to the ordinary developing solution, any degree of contrast may be obtained, even to simple white and black, the degree being in proportion to the quantity of persulphate added. For this purpose W. B. Bolton recommends a solution of ammonium persulphate 25 grains and ammonium bromide 5 grains in one ounce of water, and a few drops added to the developer. The action will be slower, and the degree of contrast greater, in proportion to the quantity of solution added; but a few experiments will show just what that quantity should be for any reasonable amount of over-exposure.

It may be well to add that the new reducer is not the acid or hydrogen-sulphate, NH_4HSO_4, sometimes called the persulphate, but the true persulphate, NH_4SO_4, said to be produced by electrolysis from the hydrogen-sulphate, thus $NH_4HSO_4 = NH_4SO_4 + H$, the atom of hydrogen being eliminated and the persalt formed at the negative electrode.

COLONIES OF THE WORLD.

"The Colonies, Protectorates, and Dependencies of the World, their Area, Population, Revenues, and Commerce, and the Share of the Mother Country in their Commerce," is the title of a publication just issued by the Treasury Bureau of Statistics. The colonies, protectorates, and dependencies of the world number 126. They occupy two-fifths of the land surface of the globe, and their population is one-third of the entire people of the earth. Their total imports average $1,500,000,000 worth of goods annually, and of this vast sum more than 40 per cent is purchased from the respective mother countries. Of their exports, which considerably exceed their imports, 40 per cent go to the respective mother countries. Large sums are annually expended in the construction of roads, canals, railways, telegraphs, postal service, schools, etc., but in most cases the present annual expenditures are produced by local revenues or are represented by local obligations. The revenues of the British colonies in 1897 were £151,000,000, and their expenditures £149,000,000. While the public debt in the more important and active of these communities aggregates a large sum, it is represented by canals, railways, public highways, harbors, irrigation and other public improvements intended to stimulate commerce and production, the railways in operation in the British colonies alone aggregating 55,000 miles.

Of the 126 colonies, protectorates, dependencies, and "spheres of influence" which make up the total list, two-fifths belong to Great Britain, their area (including the native feudatory states of India) being one-half of the grand total of colonial territory, and their population considerably more than one-half the grand total of colonial population. France is next in order in number, area, and population of colonies, etc., though the area controlled by France is but about one-third that of Great Britain, and the population of her colonies less than one-sixth of those of Great Britain. Commerce between the successful colonies and their mother countries is in nearly [illegible] cases placed upon practically the same basis as that with other countries, goods from the home countries receiving in the vast majority of cases no advantages over those from other countries in import duties and other exactions of this character. In the more prosperous and progressive colonies the percentage of importations from the mother countries grows somewhat less as the business and prosperity increase. The chief British colonies in North America (Canada and Newfoundland), which in 1871 took 50 per cent of their importations from the home country, took in 1896 less than 30 per cent from Great Britain; those of South Africa (Cape Colony and Natal), which in 1871 took 83 per cent from the home country, took but 71 per cent in 1896; those of Australia and the adjacent islands, which in 1876 took 48 per cent from the home country, in 1896 took but 40 per cent. The French colonies now take from the home country about 42 per cent of their total imports, while the British colonies obtain about 40 per cent of their total imports from the home country. The tables show:

1. The colonies, protectorates, dependencies and "spheres of influence" of various countries of the world having possessions of this character, with area, population and number of colonies in each case.

2. The British colonies, protectorates, dependencies, etc., with area, population, revenue, expenditure, indebtedness, shipping and railways, also the imports and exports and the share of the home government therein.

3. The commerce of the British colonies and the share of the United Kingdom therein, at twenty-five one-year intervals from 1871 to 1896.

4. French colonies, protectorates and dependencies, showing their area, population, location and date of acquisition.

5. Commerce of the principal French colonies, with the share of France in the same at the latest attainable dates.

6. The German colonies, protectorates, and dependencies, with area, population, location, date of acquisition, and form of government.

7. Netherlands colonies and dependencies, showing location, area, population, etc.

8. Portuguese colonies and dependencies, showing area, population, and general location.

9. Colonies, protectorates, dependencies, etc., of other countries, with area, population, etc.

10. Condition of each colony separately stated, showing its location, area, population, revenues, expenditures, imports, exports, and method of government, with additional data regarding roads, telegraphs, railways, and postal service, where practicable.

Colonies, dependencies and protectorates of the world, showing area and population of the colonial possessions, protectorates, dependencies and "sphere of influence" of each country:

Countries.	Number of Colonies.	Area (Sq. Miles.)	Population.
United Kingdom...	48	11,250,412	344,059,122
France..............	32	3,617,327	52,642,930
Germany............	8	1,020,070	10,600,000
Netherlands	3	802,863	38,911,744
Portugal	9	801,060	9,216,707
Spain................	3	245,877	256,000
Italy.	2	104,000	650,000
Austria-Hungary....	2	23,262	1,568,092
Denmark	3	86,614	114,229
Russia....	3	255,550	5,684,000
Turkey..............	4	564,500	17,489,000
China................	5	2,881,560	16,680,000
United States*......	4	168,287	10,177,000
Total............	126	21,821,382	503,048,824

* Subject to ratification of treaty.

Note.—United Kingdom includes Indian Feudatory States; Russia includes Finland.