A NINETY MILLION CANDLE POWER ELECTRIC BEACON.

A truly gigantic electric light beacon, shown in the accompanying illustrations, is just now being made the subject of a series of tests at the United States Lighthouse Depot, at Tompkinsville, Staten Island, N. Y. It was manufactured by Henri Lepaute, of Paris, and was first exhibited at the Chicago World's Fair and subsequently at Atlanta and Nashville. It consists of two great lenses, each 9 feet in diameter, between which, in their focus, is placed a 9,000 candle power arc light. The valves and the light are carried

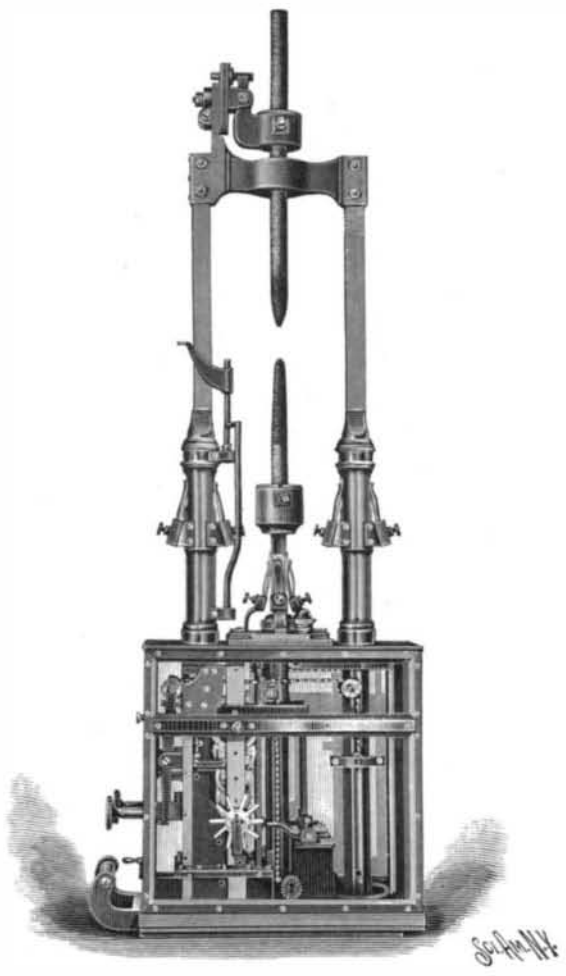

Fig. 1.—THE NINE THOUSAND CANDLE POWER ARC LAMP.

by a vertical shaft which terminates at its lower end in a hollow drum, which latter floats in a bath of mercury, Fig. 2. The great weight of the lantern, estimated at several tons, is thus carried by the mercury, and friction is reduced to such a point that the whole mass may easily be rotated by the pressure of one's finger.

Each lens consists of a set of lenses and prismatic segments, Fig. 3, which are built up concentrically within a stout framework of brass, into which the segments are carefully cemented. The center of the lens consists of a solid disk. Surrounding this are eight concentric prisms, whose edges are in contact, and surrounding these are fourteen larger prisms, making 190 separate segments in the whole lens. The angles of the prisms are such that the rays of light are refracted so as to leave the lens in parallel non-divergent rays, and it is estimated that the 9-foot beam of light thus projected is of 90,000,000 candle power. The lantern is rotated by means of the clockwork which will be noticed at the right hand side of the framework. As there are two beams of light and the period of rotation is 10 seconds, every part of the horizon receives a flash once in 5 seconds, the duration of the flash being about one-twelfth of a second.

The illuminant is an arc lamp of 9,000 candle power, which is so constructed that the arc will always remain in the exact focus of the lenses, the latter being so placed that their foci coincide. The maintenance of the arc in a fixed position is secured by connecting the carbon holders so that they both travel simultaneously and at the same speed, as the carbon points are burnt away. The carbons are fed together by the clockwork which will be noticed in Fig. 1, inclosed in the base of the lamp. The mechanism is controlled by an electromagnet arranged in shunt around the arc. As the carbons are burnt away the resistance of the arc increases and the magnet releases the clockwork escapement, permitting it to bring the carbons together. The feed is slow and frequent, maintaining the arc at a practically uniform length

The carbons vary in size from ⅝ to 2½ inches diameter, and the 55-volt current will vary from 25 to 100 amperes, according to the carbons used. The current will be furnished by an alternating generator made by the General Electric Company, driven by a 25 horse power Ideal engine, steam being supplied by a 25 horse power Fitzgibbons boiler. When the lens is installed at a station the steam and electric plant will be furnished in duplicate, so that, should one set be disabled, the other can be brought at once into use.

As a precaution against the extinction of the light through the failure of the lamp, the whole lamp with its mechanism, as shown in Fig. 1, is provided in duplicate, the two lamps being carried at each side of a turntable, which is a permanent fixture within the bivalve lens. The turntable is placed to the left of the common focus of the lenses in such a position that on rotating it either of the lamps may be brought at will into the focus. The lamps are carried on a sliding rest on the turntable, and by means of an endless screw operated by a handwheel on the outside of the lenses they may be drawn out for inspection or repairs.

The theoretical luminous range of this giant lens in clear weather is 146·9 nautical miles; and if the light were placed on a sufficiently lofty eminence to compensate for the curvature of the earth, it would be possible, under favorable circumstances, to see it at this distance. The geographical range, as it is called, depends on the height of the focal plane above the sea level. If the light were to be installed at Barnegat, where the height of the focal plane is 165 feet, the light would be visible from a vessel's deck at a height of say 15 feet above the water at a distance of 19 nautical miles in clear weather, and, on account of its great power, at the same distance in hazy weather.

In a dense fog, however, even such a great light as this would be practically extinguished. In this latitude the light may be expected to be seen to the limit of the geographical range for 330 nights out of the year.

The present tests are being carried out by Lieut.-Col. D. P. Heap, Corps of Engineers, U. S. A., engineer of the Third Lighthouse District, to whom we are indebted for particulars and photographs used in the preparation of the present article.

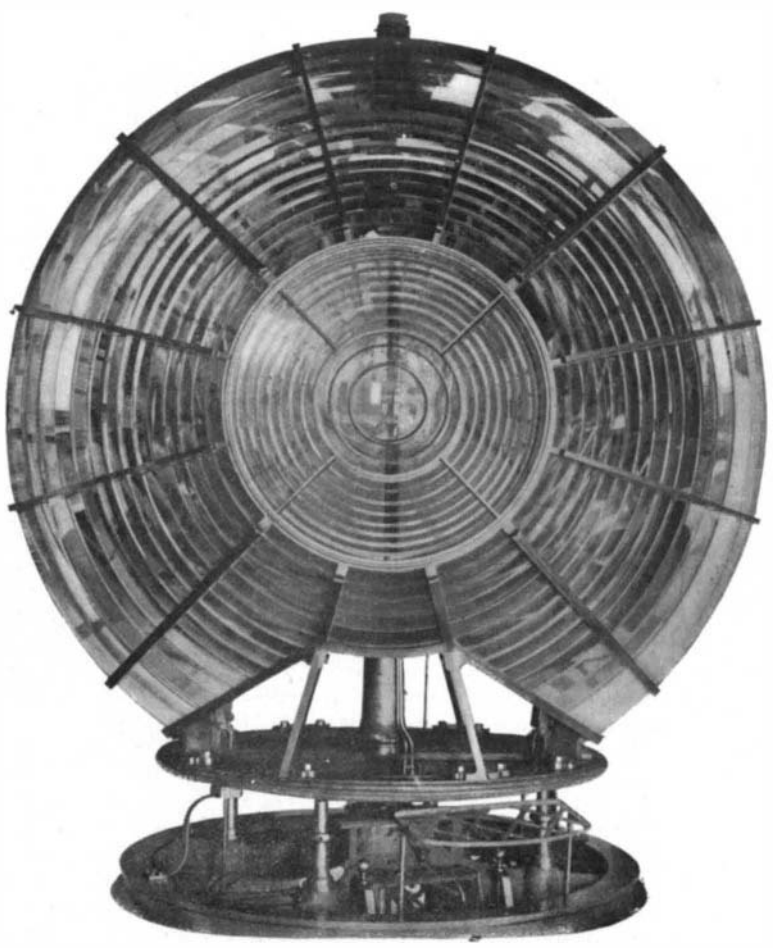

Fig. 3.—FRONT VIEW OF LENS.

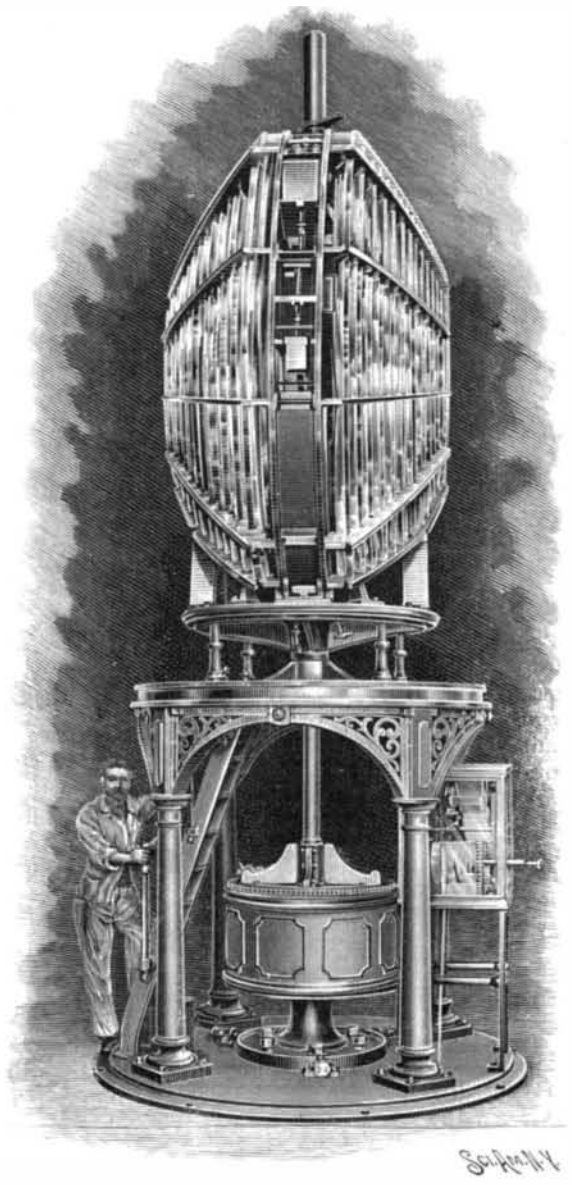

Fig. 2.—NINETY MILLION CANDLE POWER BIVALVE LENS FOR UNITED STATES LIGHTHOUSE SERVICE.

Prof. Marsh's Gift to Yale.

No gift for natural science which Yale, or perhaps any other American university, has received equals in value the collection that Prof. Marsh has just presented to Yale University. It represents not only the untiring labors of a lifetime of a great specialist, but a large expenditure of money by Prof. Marsh, especially in the organization and work of the expedition which he led with fruitful results in the Rocky Mountain region of the far West.

The collection includes, first, the collection of vertebrate fossils. This is most important and valuable, as it is very extensive and contains a large number of type specimens, many of them unique and widely known from the description already published. In extinct mammals, birds and reptiles of North America this series stands pre-eminent. It was pronounced by Prof. Huxley to be surpassed by no other in the world, and as far back as 1878 Darwin expressed a strong desire to visit America for the purpose of seeing the collection. Since that time it has been more than doubled in size and value. The second collection is of fossil footprints, which form one of the most extensive and complete collections of the kind in the country, if not the most valuable. Third, the collection of the invertebrates, which is very large. Fourth, the collection of osteology. Fifth, the collection of American archæology and ethnology. Sixth, the collection of minerals. Besides the six main collections, several others of less value were also presented.

Prof. Marsh, in his letter, says that it has always been a part of his plan that these scientific collections should eventually become the property of Yale University. The deed of gift which he inclosed bears the date of January 1, 1898. The resolution of the corporation of Yale University gratefully acknowledged the magnificent gift which represents the unselfish devotion of the time, talents, energies and money of Prof. Marsh for more than thirty years.

To Seal Letters so That They Cannot Be Opened.

Steam or hot water will open envelopes closed with mucilage and even a wafer; a hot iron or a spirit lamp dissolves sealing wax, an impression in plaster having been taken of the seal. By the combined use of wafer and sealing wax, however, all attempts to open the letter otherwise than by force can be frustrated. All that is necessary is to close the letter first with a small well moistened wafer, and to pierce the latter with a coarse needle (the same applies to mucilage), whereupon sealing wax may be used over it in the usual manner. This seal can neither be opened by dry heat nor by moisture.

A NEW form of electric seismoscope is described by Dr. G. Agamennone in the last Bolletino of the Italian Seismological Society, the chief merits claimed for it by its inventor being its comparatively slight cost (about 30 f.) and its great sensitiveness. In most seismoscopes the movement of a pendulum is magnified by a long pointer, whose tip just passes through a hole in a metal plate, contact with which completes an electric circuit and starts a clock previously set at 12. In the new instrument the metal plate is not, as usual, fixed, but is connected with a second inverted pendulum, the bob of which is near the top of its supporting rod, while that of the first is near the base.

A Curious Type of Swing Bridge.

The Neumunster-Rendsburg railway crosses the Kiel canal near Osterroenfeld, Germany, by two duplicate single-track swing bridges about 156 meters (512 feet) apart, and both operated by hydraulic power. Each bridge is a 70 degree deck structure with two unequal arms, one of 59·4 meters (195 feet) and oneof 39·75 meters (130 feet), supported on a 9-meter (29½ feet) pivot pier, set close to one side of the waterway so as to give a clear opening of 50 meters (164 feet). The long arm has a rest pier 5 meters (16·4 feet) wide, which also receives the end of a 19·05 meter (62½ feet) approach girder from the shore abutment. The short arm has a very small rest pier near the end, which it overhangs 3·62 meters (12·8 feet), the extremity reaching beyond the pier to the other shore abutment. The short arm is loaded with a counterweight of 20 tons and its vertical surface is covered with corrugated iron sheathing to balance the wind pressure on the long arm. The principal peculiarity is the manner of operation: under railroad traffic the bridge is a continuous girder supported at the pivot and both rest piers, with the short projecting extremity of the short arm extended freely as a cantilever arm. To swing the bridge, the whole structure is raised by the vertical motion of the pivot support in such a manner that it first revolves as a whole in a vertical plane about the rest pier of the short arm as a center until the extremity of the cantilever end is sufficiently depressed to come in contact with the abutment, after which the further elevation of the pivot lifts the bridge from its former bearing on the rest pier of the short arm, so that it rests on the pivot and the extremity of the short arm, the latter being provided with wheels running on a short segment of turntable track. After being raised, the bridge is revolved 70 degrees to open it for navigation by means of a hydraulic ram operating a wire cable led around a horizontal arc on the pivot pier and anchored to its masonry. Each bridge has a separate power station, with two boilers carrying 90 pounds pressure and operating an engine which drives two pumps that develop a water pressure of 750 to 900 pounds, delivering into a 0·4 meter (15¾ inch) accumulator with 6 meter (19·68 feet) stroke. This apparatus will open and close the bridge in two minutes. The liquid used is composed of 100 parts of glycerine and 80 parts of water, and a pressure of 55 atmospheres (808 pounds per square inch) is sufficient to swing the bridge slowly against a wind pressure of 100 kilogrammes per square meter (20·48 pounds per square foot).—Railway and Engineering Review.

The Catacombs Lighted by Electricity.

The visitor to Italy complains of modern steam tugs on the Grand Canal in Venice, and the new fangled ideas of cleanliness in the streets of Naples and the new quarters in Rome, but the height of the prosaic seems to have been reached with the illumination of the catacombs by electric light. No more dim distances, in which one must take care not to be lost, no more monk guides, holding lighted tapers, no more darkness, mystery and imagination. This being the feast of St. Cecilia, says the Rome correspondent of The Pall Mall Gazette, the catacombs of St. Callixtus, where the Roman virgin was buried in 177 A. D., were for the first time all glowing and glaring with thousands of electric globes illuminating even the most remote corners, and giving to the whole a mundane rather than a mystic air.

These catacombs are outside the Porta San Sebastiano, on the magnificent Appian Way, that the Romans called the Queen Road, and near the world-renowned tombs of Cecilia Metella. St. Cecilia is not the only prominent martyr of the early Christian era whose name is connected with this burial place, for the remains lie there of several popes of the third century, as witness the original tombs of St. Antherus, St. Fabian, St. Lucius, St. Cornelius and St. Eutychianus, who all sat in the chair of St. Peter.

Thousands of Romans and foreigners have to-day visited this sacred spot. The crowd itself formed a picturesque view, as from below one looked up at the pilgrims descending and ascending the long, steep flight of stairs, or at the long procession of cowled monks and black-robed nuns, showing in vivid contrast to groups of students of the German College in their scarlet gowns, a garb that causes them to be called, in fun, the little cardinals. The corridors responded in echoes to their chants at the different altars, while there was a subdued hum from the less devout sightseer. What would be unperceived by the visitor, if he were not preinformed, is that the five miles of corridors and chapels are not on the same level, but form three different floors, one under the other. The most interesting spot is where St. Cecilia's tomb was found, and where also stands a copy of the statue of the saint designed by Maderno, representing her after her martyrdom. Next stands a most interesting marble tablet, the inscription on which was originally a pagan one dedicated to Marcus Aurelius. The Christians utilized the tablet by turning it and writing on the back a new epitaph to Pope St. Damasus.

Bones and skeletons of the ancient martyrs are found all along the walls, in three rows, one above the other. The lower room is the more disturbed, as almost every one tries to take something away as a sacred relic. But the electric light on these bones turns the catacombs into a museum.

The Business of the Patent Office.

The following summary of the business of the Patent Office during the past year will be of special interest to our readers. We draw particular attention to the remarkable increase in the number of applications over that of the previous year. In 1896 there were 49,774 applications, whereas this year the total has risen to 53,266. No stronger indorsement of the request of the Patent Office for larger appropriations could be found that is presented by these figures.

PATENT, TRADE MARK FEES, ETC.		
Cash received	$1,224,291.00	
" refunded	5,834.00	
Net cash	1,218,457.00	
Certificates of deposit	33,540.00	
Total cash and certificates		$1,251,997.00
COPIES.		
Cash received	$96,782.46	
" refunded	8,573.28	
Net cash	88,209.18	
Certificates of deposit	322.27	
Total cash and certificates		$88,531.45
RECORDING ASSIGNMENTS.		
Cash received	$22,719.66	
" refunded	1,093.68	
Net cash	21,625.98	
Certificates of deposit	134.00	
Total cash and certificates		$21,759.98
SUBSCRIPTIONS TO OFFICIAL GAZETTE.		
Cash received	$13,069.54	
" refunded	47.35	
Net cash	13,022.19	
Certificates of deposit	55.10	
Total cash and certificates		$13,077.29
REGISTRATION OF PRINTS AND LABELS.		
Cash received	$546.00	
" refunded	270.00	
Net cash (total)		$276.00
AGGREGATES.		
Cash received	$1,357,408.66	
" refunded	15,818.31	
Net cash	1,341,590.35	
Certificates of deposit	34,051.37	
Total cash and certificates		$1,375,641.72
Total receipts of the Patent Office for the year		$1,375,641 72

BALANCE IN TREASURY OF UNITED STATES TO CREDIT OF PATENT FUND.

Amount to credit January 1, 1897	$4,718,639.47
" of receipts in year 1897	1,375,641.72
Total	$6,094,281.19

From this deduct total expenditures, which are not known at present.

SUMMARY OF BUSINESS OF PATENT OFFICE IN PAST YEAR.

Number of applications for inventions	45,661	
" " " designs	2,150	
" " " reissues	94	
Total		47,905
Number of caveats filed	2,176	
Applications for regietration of trade marks	1,946	
" " " " labels	66	
" " " " prints	26	
Disclaimers filed	5	
Appeals on the merits	1,142	
Total		5,361
Total number of applications requiring investigation and action		53,266
Number of patents issued (including designs)	23,729	
" " reissued	65	
Total		23,794
Number of trade marks registered	1,671	
" " labels "	14	
" " prints "	16	
Total		1,701
Number of patents expired during the year	12,926	
" " withheld for non-payment of final fees	4,891	

Applications filed in 1896 were 42,077; designs, 1,828; reissues, 77; total, 43,982. Caveats, 2,271; trade marks, 2,005; labels, 59; prints, 36; disclaimers, 9; appeals, 1,412; total, 5,792. Total number for investigation and action, 49,774. Patents issued, including designs, 23,312; reissued, 61; total, 23,373. Trade marks registered, 1,813; labels registered, 1; prints, 32; total, 1,846. Patents expired, 12,133; patents withheld for nonpayment of final fees, 4,736.

It is noteworthy that not only is there an increase of the whole year's business over that of the previous year, but the last month of the year shows a considerable increase over its predecessors. The total number of applications for mechanical and design patents and reissues for December was 5,002, and in the last five days of the month the number of mechanical applications alone filed was as follows:

December 27	375 applications.
" 28	372 "
" 29	316 "
" 30	254 "
" 31	500 "

The last figure is, we believe, the largest single day's filing in this or any other country.

In this connection it is interesting to note that the number of applications filed last year in the British Patent Office was 30,938, or some 750 more than in 1896. These figures, however, are no indication of the number of patents granted; for, although during 1896 the number of applications was 30,194, some 17,000 were allowed to lapse, only 13,360 being completed before the nine months allowed between the filing of the provisional and complete specifications had elapsed.

The London Fire Inquiry.

As a result of the investigations which have been in progress for several weeks past into the great fire which occurred recently in the Cripplegate district of London, involving a loss of $3,750,000, the jury decided, on January 12, after five hours' deliberation, that "the fire was not caused by gas explosion or by spontaneous combustion, but was the work of some person or persons unknown." The foreman added that the jury was not satisfied that the Fire Brigade was fully equipped with steam fire engines and was not unanimous in the opinion that the water supply was efficient, and recommended that an engine with steam continually up be always kept at the Central City Fire Station.

London Engineering makes some remarks upon the Fire Brigade, which it is to be hoped will be taken to heart by the authorities that have charge of this force. This journal states, on authority of the report of the Hamburg experts, that there were 300 men actually at the fire and that 250 men available for outdoor work did not attend. It says: "A whole district was burned down while a quarter of the brigade was standing idle at their stations. To argue that these men were simply waiting in readiness to turn out to any minor fire is ridiculous, for to begin with there were no horses to carry them at their stations, even if the old manuals were taken. . . . A system which allows so many men to be doing nothing on an occasion like the Cripplegate fire surely must be very bad indeed; or, are we, perhaps, rightly informed that there is some custom in the brigade according to which the foremen do not care to overload their engines with too many men, as they think it might spoil their 'running' to the fire at a dashing gallop? . . . If we are rightly informed, the salvage corps actually went to the extent of calling up every available man in their force."

According to the report, to be short-handed is a mistake common to the London system. Speaking of the way in which the firemen were handled, the report referred to states that "the commissioners could not learn anything from the London Fire Brigade. How can a chief officer give the necessary directions when he has not the sufficient number of officers to keep him posted on what is going on? How can an attack be conducted when every steamer which arrives takes up any position which its foreman may think suitable, and is then got to work in what, for practical purposes, is comparatively slow time, owing to the small crew? How can we expect, with the few men at our disposal on each steamer, to run out long lengths of hose with the necessary rapidity to cut off a fire? It will, of course, be almost impossible to reorganize the London system of small stations with a few men into a system of large stations which can turn out in strong force; but whatever the system may be, it would be well to remember that one steam fire engine with a strong crew placed in the right position can do a great deal more work than three steamers taking up positions indiscriminately. We would only wish, in the interests of London, that the Metropolitan Fire Brigade should have at least a sufficient staff and use it; and, further, that the number of officers be increased."

The extracts given above are taken by Engineering from are port of a special commission of experts from Hamburg, who journeyed to London to inquire into the Cripplegate fire, and, of course, the report of these experts is entirely unbiased.

Engineering says: "Whatever may be said in the London County Council as to the fire protection in London, there is no doubt that we are far behind many other large centers; and though it is most unpleasant to be reminded of this by a foreign critic, we ought, perhaps, to be very thankful for the trouble which the commissioners have taken to explain our deficiencies to their authorities, with a view of avoiding similar mistakes in their own locality, and their letting us have the benefit of their research."

Mr. Fitz Gerald's Ascent of Mount Aconcagua.

Mr. Fitz Gerald, the leader of the expedition which, on April 11 last, ascended Mount Aconcagua, in the Andes, has just been interviewed in London. He describes the extreme difficulty and danger of the ascent. He had to struggle upward in deep masses of rotten, rocky material, in which the traveler slid back two feet out of every three he advanced. The party lived for two weeks in a small tent on the mountain side, at an altitude of 19,000 feet. The cold was intense and the wind blew a gale. Sometimes it took two hours to light a fire.

Mr. Fitz Gerald says that life at this altitude was extremely uncomfortable, the dust being very disagreeable, causing an exhausting cough. He said he was constantly sick, and the dust storms obliterated the whole sky. The mountain streams were poisoned, owing to some chemical that was dissolved in them from the surface, so that the water made all the party ill. Rain never falls on the mountain, and all the water had to be carried up. Of course, it froze on the way, and had to be thawed out when wanted. At times the view was splendid, the Pacific being stretched out before them, though the coast line is one hundred miles away.