

he will have completed his mathematical calculations in order to give the exact height. Barometric pressures and triangular measurements from twelve different points were taken. In scaling the mountain Dr. Cook realized a life ambition, and besides obtained geographical information about a country of which very little is known.

TOTAL ECLIPSE OF THE SUN IN JANUARY, 1907.

BY MARY PROCTOR.

"Eclipses are predicted, and science bows them in."

The next total eclipse of the sun takes place on January 13, 1907, and will be visible in central Asia. The track of the eclipse is wholly on land, and gives the last favorable opportunity for observing an eclipse until that of April 17, 1912, which may be witnessed for one minute in South America, and for a brief interval in Spain.

The best region for observing the 1907 eclipse is available by means of railways recently constructed in Russian territory. On this railway, and about two-thirds of the way from Tashkend to Samarkand, lies Jizak, only a few miles from the exact line of central eclipse. Fortunately, the railroad from Orenburg to Tashkend, practically a branch of the Trans-Siberian Railway, which has been in course of construction, is now completed. Other easily accessible places near Jizak, and well within the belt of totality, are Zaamin, Nau, and Ura-Tiube. The last is practically central.

From the United States, the best way to reach Jizak is by means of Naples, Constantinople, the Black Sea, Tiflis, the Caspian Sea, Bokhara, and Samarkand. From Krasnowovsk on the Caspian Sea to Tashkend trains run regularly, there being two trains which leave Krasnowovsk daily at 5 A. M. and 7:15 P. M. respectively.

If we go farther east, the track of the eclipse leads into a region more and more difficult of access, although the totality lasts a few seconds longer, and the eclipsed sun is a few degrees higher. Only one station in Mongolia, Tsair-osu, seems likely to be considered. In *The American Journal of Science*, for March, 1906, Prof. David P. Todd, of Amherst Observatory, has given the position of ten possible observing stations, exact local times of the four phases, durations of totality, and other interesting facts.

As shown by the map (taken from the *Nautical Almanac* for the year 1907) the middle of the eclipse occurs at sunrise in a region north of the Black Sea, the track crossing the Caspian Sea, where the eclipse begins at sunrise. It reaches Jizak in Turkestan about a quarter to nine, totality beginning at 9 h. 59 m. 58.4 sec., and ending at 10 h. 1 m. 55.2 sec., the duration being about two minutes. Jizak is thirteen miles south of the central line, while Ura-Tiube is only two miles south, and practically central. There the eclipse begins at 8 h. 50 m. 52 sec., totality being at 10 h. 6 m. 37.1 sec., and ending at 10 h. 8 m. 40.9 sec., a duration of two minutes and seventeen seconds.

At Tsair-osu in Mongolia, which is two miles north of the central line, the eclipse begins at 12 h. 29 m. 58 sec., with totality at 1 h. 49 m. 41.6 sec., and ends at 1 h. 51 m. 36.7 sec., a duration of about one minute and fifty-five seconds.

It appears that no expedition from any of the well-known American astronomical institutions will observe the eclipse, and in all probability no eclipse expeditions from Europe will attend, on account of such unfavorable weather conditions liable to prevail, and uncertain communication with the difficult region (Russian Turkestan).

The following eclipse will be that of January 3, 1908, and will be wholly confined to the Pacific Ocean, with the possibility of observing stations on two islands. A brief account of these islands will show how little they are adapted for such work. One named Flint Island, one of the Line group, is situated west of the Marquesas Islands, in long. 151 deg. 48 min. W., and lat. 11 deg. 26 min. S. It belongs to the British, and was discovered in 1801. It is covered with brushwood and trees, and is visible from the masthead of a ship from a distance of sixteen miles.

This little island is about $2\frac{1}{2}$ miles long N.N.W. and $\frac{1}{2}$ mile broad S.S.E., and is fringed by a steep coral reef which dries at low water, and extends seaward quite a distance. In the interior of the island are two small lagoons of brackish water. Not a very promising prospect for the most enterprising observer, despite the fact that the duration of totality will be four minutes, and the sun's altitude will be 74 deg.

In 1880 the island was uninhabited, and the buoys formerly in use were gone. There is no rise and fall of tide, and the landing is said to be very bad, even for surfboats. These interesting facts are to be found in the *Monthly Notices of the Royal Astronomical Society* for March, 1906, and were contributed by Dr. A. M. W. Downing, F.R.S. He gives a still less favorable report of Hull Island. This island is situated halfway between the Marquesas Islands and Solomon Islands, in long. 172 deg. 13 min. W. and lat. 4 deg. 30 min. S.

Hull Island, one of the Phoenix group, belongs to

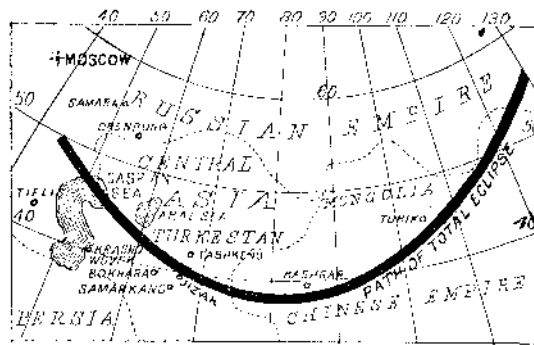
the British, and was discovered and so named by Wilkes in 1840. It has a lagoon and a little fresh water, and there are some coconut trees on it, about 50 feet high. A coral reef fringes the island, and landing is difficult except by entering the lagoon by means of the boat passages on the northwest side. There is no anchorage. In 1899 the island was uninhabited.

The winds are almost constantly from the eastward, but squalls accompanied by light rain occur in the neighborhood all the year round. The wind is variable from January to May, during which period bad weather is most common. Small chance there is there of observing the eclipse with any success, since it occurs on January 3, and totality only lasts 2 m. 51 sec. The sun's altitude will be 43 deg.

Both these islands have been leased to Lever's Pacific Plantation Company, and intending observers are requested to communicate with the officers of this company, situated at Port Sunlight, Cheshire. Such is the irony of fate, permitting one of the grandest sights the eye of mortal can ever behold to waste its glory on these almost inaccessible islands! On December 23, 1908, another eclipse track will cross the South Atlantic Ocean, and on June 17, 1909, an eclipse will occur in the neighborhood of Greenland.

The South Antarctic regions will be crossed by an eclipse track May 9, 1910, and another will visit Australia, May 28, 1911. On all these occasions, since the eclipse tracks lie almost wholly across oceans, or in inaccessible parts of our globe, no observations of value can be made. This is due to the fact that no device for securing accurate astronomical observations from the deck of a ship has yet been perfected, while to reach the inaccessible regions tedious and expensive expeditions are necessary.

At a meeting of the British Astronomical Association which met at Sion College, Victoria Embankment, on June 20 last, Mr. W. T. Lynn, one of the members, read a paper on the total eclipse of January 13, 1907.



PATH OF THE ECLIPSE OF THE SUN, JANUARY, 1907.

In it he referred to the fact that "the Russian government has recently established an observatory at Tashkend, nearly due north of Samarkand, and no doubt the astronomers there will observe the total eclipse at the latter place." He also referred to the fact that the second catalogue of stars ever made was formed at Samarkand by Ulugh Beg. In 1437 Ulugh Beg, the grandson of Tamerlane, built at Samarkand the greatest astronomical observatory in the world, one hundred and forty years before Tycho Brahe erected Uraniborg in Denmark.

After Mr. Lynn read his interesting paper, Mr. A. C. D. Crommelin, the president of the Association, remarked that "unfortunately the next eclipse is one that only those should venture to go to see who are prepared to brave an Arctic degree of cold. As a general rule, they regarded an eclipse as a favorable one when its track is mostly over land, and as an unfavorable one when its track is mostly over water. The track of the eclipse of next January is entirely over land except for a few of the lakes of central Asia; and yet it is a very inaccessible eclipse, for it is over Tibet and Siberia in the depths of winter, and he is afraid the cold there will be very severe indeed." The president, however, called particular attention to the total eclipse of January 3, 1908, and hoped that some of the members of the association would be represented at this, although the journey would be a long one.

Is it any wonder, when we realize that although a total eclipse occurs every year from 1907 to 1912, and that none are easy to observe between those dates, that no effort has been made to observe the total eclipse of January 13, 1907, at one at least of the ten possible stations whose positions have been so carefully computed by Prof. David P. Todd.

Inasmuch as there is a difference between the civil and the astronomical day, some confusion may arise from the conflicting dates on which the eclipse will occur. The astronomical day begins at noon; the civil day at midnight, twelve hours earlier. Hence according to the one system the eclipse will occur on January 13, and according to the other on January 14.

Correspondence.

Alcohol from Cacti.

To the Editor of the SCIENTIFIC AMERICAN:

The profitable manufacture of denatured alcohol from cacti has been found to be feasible by G. A. Burns, chemist, manager of the Southern Pacific Hospital, San Francisco, prior to the fire, who is now in Los Angeles. Mr. Burns declares that much desert land in California and New Mexico can be reclaimed by the growing of cactus, the manufacture of alcohol from the plant, and the use of the alcohol as fuel for power plants to pump water for irrigating. Mr. Burns says he knows for a certainty from his own experiments that denatured alcohol can be produced in sufficient quantities from the common desert tree—so monotonous to the tired eyes of the tourist coming from the East—to furnish heat, light, and power for all general farming purposes. From five pounds of pulp he distilled, in a crude way, more than a gallon of alcohol, which was clear in color and burned readily with a very bright, warm glow.

The product contains four times as much energy as wood alcohol. He believes it can be produced cheaply, and that five acres planted to cacti would be large enough "power plant" to run a farm of 160 acres. The plants could be cut down, ground up by special machinery, and put through the process of fermentation and distillation like corn, wheat, or barley. The surplus steam escaping from a stationary engine on the farm could be utilized in the process of distillation. The Nevada cactus grows from two to five feet high and with great rapidity, or about as fast as corn in Kansas. This being the case, it would soon grow up from the stubble or stump, and in about six or eight months would again be ready to produce non-taxable alcohol for commercial purposes.

Mr. Burns first got his idea of the possibilities of the commercial value of the cactus from Mexico, where it is well known that the natives make a very potent liquor from cactus.

Cactus alcohol could be produced more cheaply than wood alcohol, besides being four times as powerful. The raw material too would be right on the farm.

The plan could be adapted readily to the valley of Las Vegas. It is fifty miles long and on an average thirty miles wide. It is of a sandy loam, very fertile and very level, and with only a trace of alkali at odd places, and those places are few.

"Everything," said Mr. Burns, "that California produces, with the possible exception of oranges, can be grown in this valley. Water can be had at from ten to twenty feet, and with cheap fuel to pump it to the surface, such as I am convinced can and will be obtained from the cactus, Las Vegas will become a little Eden."

ALLIE ALGER.

Sawtelle, Cal.

A Plea for the Preservation of the Salton Sea.

To the Editor of the SCIENTIFIC AMERICAN:

Conditions and circumstances connected with the flow of the Colorado River into what is known as the Salton Sink have occasioned considerable comment in various publications; and since the strenuous efforts of government and railroad engineers to divert the river back into its original channel have succeeded, it has been advocated that means should be taken to retain the new sea in approximately its present dimensions, the argument being advanced that evaporation from this new body of water has caused rains the past season in sections of the Southwest where like precipitation has been almost wholly if not entirely unknown before. In opposition to this it is contended that the unusual rains have been merely coincident, without being caused either directly or indirectly by the new lake.

When considered with more than passing notice, and contemplated from the standpoint that from a seemingly not greatly important incident might come results of unthought-of beneficent effect to a very great part of the whole country, and when such effect really seems developing, then the matter becomes an interesting one, and is apt to attract the attention of anyone who looks forward to future eventualities, as well as to the first visible results. I am of the opinion that those who contend for the permanent retention of the Salton Sea are correct in their conclusions that the new sea has caused and indicates a decided modification in climate; and the unusual rains in the West and Southwest, especially in the latter section, the past season may only have been an indication of what is to continue through other seasons of the year—as instance the recent unprecedented storms in the Southwest. Also I anticipate that if the Salton Sea is retained, climatic conditions in the West and Southwest will experience great if not wonderful changes; and if such changes do result, I apprehend that they are brought about, not entirely alone because of fresh water evaporation from the new lake, but also and very considerably because of the attendant chlorine evaporation, that has its source in the immense salt

beds at the bottom of the new sea. To achieve similar results (though as far as I know an unrecognized fact) is one of the purposes of the saltiness of the ocean; that is, that the evaporation of chlorine assists in producing rains; and, again, another purpose is that the evaporation of chlorine from the ocean provides the chlorine constituent of the ozone of the air.

It might not be an absurdity to anticipate that the permanent preservation of the Salton Sea would reclaim the arid waste, and make the desert to blossom as the rose; prevent and do away with the "hot winds" that sweep up from New Mexico across western Kansas and up into Nebraska, destroying millions of dollars' worth of crops; save the government millions of dollars that would otherwise be necessary for irrigation projects, which produce only small local results at great cost in comparison with the extensive benefits which might possibly be permanently secured without cost and without attention by the retention of the new sea.

There seems to be a chance for realization of anticipated hopes, and the matter may be worthy of serious consideration, as with sufficient rainfall the section now known as the arid Southwest would develop into the most wonderfully fertile region of the entire country.

M. REED.

Chicago, December 1, 1906.

THE MOTIVE POWER OF A 25¼-K

One of the most impressive manifestations of the modern steam engine is up-to-date freight locomotive starting or fifty cars, and gathering way, until it is thundering over the rails at a speed of thirty miles an hour. When we attempt to stand very well what is meant by the strength to move a heavy piece of machinery, it is necessary to compare the power of a single loaded freight car with the power of forty loaded cars, started from rest and swung into their full stride by a single locomotive, the latter becomes symbolical in the popular mind of majestic power.

It is for this reason that, in our attempt pictorially to represent the horse-power which will be necessary to drive the new Cunard liners at 25¼ knots an hour, we have taken the average-sized freight locomotive as our unit of comparison. The least amount of power which the designers of the "Lusitania" and "Mauretania" found would be necessary to drive these ships at their contract speed was 68,000 horse-power. Now, the horse-power of the average freight locomotive is about 2,100, and, consequently, the total thrust on the four propellers of each of these ships will be equal to the total pull exerted by thirty-two modern American freight engines. One of these locomotives could haul on the level a train of fifty cars, whose total length would be just a third of a mile. Consequently, the whole 68,000 horse-power of the Cunarder, expressed in terms of locomotive work, would be sufficient to haul a train of 1,600 cars, whose total length would be over five miles. In our front page illustration the artist has given a graphic representation of these figures by grouping together sixteen double-header freight trains on parallel tracks.

To develop a minimum of 68,000 horse-power, and a maximum that will possibly run up to 75,000 or 80,000 horse-power, calls for a boiler and engine plant of truly titanic proportions. Steam will be supplied by twenty-five cylindrical boilers, of which twenty-three are double-ended and two single-ended, the former being 17 feet 3 inches in diameter and 21 feet long. The coal will be burned in these boilers on 192 furnaces, the total area of whose grates would be represented by a square measuring 64 feet on each side, containing about 4,000 square feet of surface. Night and day, an army of several hundred firemen will be continuously shoveling coal into these furnaces, where it will be burned at the rate of about 1,000 tons every twenty-four hours; and to insure that the coal is burned at a fierce white heat, the air will be forced through the grates continuously by means of powerful electrically-driven fans, the rush of air being also assisted by the four great smokestacks, through which the products of combustion will be discharged high up in the air at about 150 feet above the level of the grate bars.

These smokestacks are worthy of special mention, for in addition to their great height, they will be far larger in sectional area than any that have been previously constructed. In order to present less resistance to the atmosphere, which, even on a day when there is not a breath of air stirring, will be, on account of the great speed of the ship, equivalent to a 30-mile gale, the smokestacks will be made of a general elliptical section, slightly more pointed at the ends and not so flat on the sides as the sectional view shown on our front-page illustration. Each smokestack will measure 17 feet 6 inches on its minor axis

and 23 feet 6 inches on its major axis. That these are extraordinary dimensions is shown by the fact that two large limousine automobiles could be contained within one of the smokestacks, one standing in the direction of the axis and the other transversely to it, as shown in the illustration referred to. Another standard of measurement is afforded by the fact that two modern steam railroad tracks could be laid side by side within one of these smokestacks, and full-sized trains run within it with a slight clearance in every direction.

When the completed engine room is entered, it will be found that the machinery has been designed on the same colossal scale. Here are four turbines driving as many shafts, the two outer shafts being driven by two high-pressure turbines and the two inner shafts by two low-pressure turbines; while at the after ends of the low-pressure turbines, and on the same shaft, are two additional turbines for driving the ship astern. Each high-pressure turbine casing is 10 feet in internal diameter and 25 feet in length. These are big dimensions, but the surprise will come when one enters the low-pressure turbine engine room; for each of the low-pressure turbine casings has an internal diameter of 16 feet 6 inches. Here again, for comparison, we turn to the modern locomotive; for if a pair of rails were laid along the bottom of one of these massive cylinders, it would be possible for one of the largest of our modern express locomotives to pass through the casing and still have a slight clearance between its smokestack and the walls of the cylinder. As a matter of fact, this casing is larger than the cast-iron tube of the Subway tunnel, now being driven from the Battery to Brooklyn, which has an internal diameter of 15½ feet.

Attention is directed to the comparative profile diagrams at the top of the front-page engraving, in which is shown the rapid growth in size of turbine-propelled vessels. The diagrams start with the year 1894, when the little experimental "Turbinia" made her phenomenal speed, and finish with the year 1907, in the summer of which the new turbine Cunarders will make their maiden voyages to this port. The diagram is based upon a paper recently read by the Hon. C. A. Parsons, the inventor of the marine turbine, at a meeting of the Institute of Marine Engineers of Great Britain. The "Turbinia," which was built especially for experimental work, was launched in 1894, and her first engine was of the radial flow type, and gave about 1,500 horse-power. The success of the "Turbinia" led the British government to build two destroyers, the "Viper" and "Cobra," the first of which made a speed of 36.86 knots, which is equivalent to 42.5 miles per hour, the speed of the "Cobra" being slightly less. The "Viper," by the way, holds the record as the fastest vessel of any kind yet constructed; for, as far as well-attested official records go, no vessel of any kind has approached within several knots of this speed.

The next advance, shown in the diagram, was represented by the river Clyde passenger steamer "King Edward," 1901, which was 250 feet long, of 562 gross tonnage, and 3,500 horse-power. She was followed in 1903 by the "Queen," built by the Southeastern and Chatham Railway Company, which was 310 feet long, of 1,676 gross tons, and 7,500 horse-power. The turbine having proved itself for river and channel service, the next advance was the bold one of installing turbines in an ocean liner, and Allan Line steamers, the "Virginian," and "Victorian," each 520 feet in length and of 10,754 gross tons, were equipped with turbines of 12,000 horse-power. It was found that in these larger sizes important modifications of design were necessary, and the lessons thus learned were incorporated in a much larger ship, the "Carmania," built in 1905 for the Cunard Company. This vessel is 678 feet long, 72 feet beam, and 52 feet in molded depth, her gross tonnage is 19,524, and her horse-power 21,000. In the summer of 1907 the "Lusitania" and "Mauretania" will serve to put the marine turbine to a supreme test. These vessels are so much larger than anything existing as to be in a class entirely by themselves. They are 785 feet long, 88 feet broad, and 60½ feet deep. Their gross tonnage will be about 33,000, and they will displace 45,000 tons. Their horse-power, as already stated, is 68,000, and will probably work up to between 75,000 and 80,000.

The contract speed of these ships is 25¼ knots an hour on trial, and they are to show an average of 24¾ knots for a whole trip across the Atlantic.

When the Acetylene Flame Begins to Flicker.

When the flame of an acetylene lamp begins to flicker, showing the presence of wet gas, the strainer should be examined to see whether it is clean and dry, and if not, renewed. Failing this, it is possible frequently to insert a piece of blotting paper between the carbide and the metallic disk which rests upon it, thus drying the gas as it leaves the base of the container. In generators which are fed from above to the top of the carbide, this method is, of course, out of the question.—Bicycling World.

THE SECOND ANNUAL EXHIBITION OF THE AERO CLUB OF AMERICA.

In connection with the seventh annual show of the Automobile Club of America, the sister Aero Club gave its second exhibit of aeronautical apparatus both historic and modern. The exhibit this year was characterized by the up-to-date and practical character of the articles displayed, rather than by their historic interest, as was the case with the exhibit last year. There were, however, several historic machines that were not displayed last year. As heretofore, the walls of the room were covered with interesting photos, enlargements of balloon ascensions and airship flights. Besides a number of enlarged photos of the Wright brothers' gliding experiments, there were prints of Santos Dumont making a flight in his motor-driven aeroplane, as well as enlargements of this machine and its motor. Several baskets of the club balloons, one of them being that of the "United States," in which Lieut. Lahm and Major Hershey won the Bennett trophy, were on exhibition. Hung from the ceiling were the nacelles of two of the most successful American dirigibles—the "California Arrow" of Capt. Baldwin, and the airship which Leo Stevens built for Major Miller, and which is the only one in which a woman has made a flight.

The former airship, which has a cigar-shaped envelope of 9,000 cubic feet capacity, holds a record for speed of about 17 miles an hour. This is remarkable considering the size of the engine, which is only a 2-cylinder, 7-horse-power V motor, similar to that shown on page 449. The propeller, which is about 8 feet in diameter, makes about 400 revolutions per minute. Another interesting exhibit that hung from the ceiling was a peculiar winged kite exhibited by Henry Rodmeyer. This gentleman also demonstrated a model of a flapping-wing machine on the roof of the building on one day during the show. Another crude model of a beating-wing machine was exhibited and demonstrated daily by Mr. A. V. Wilson, who was one of the first American aeronauts to make a balloon ascension and parachute jump. This gentleman claims to have made a flight of over 1,700 feet in a beating-wing machine two years ago, the *reductio ad absurdum* of his claim being found in the fact that the machine—a cumbersome wood affair—was propelled by himself alone. A full-size flapping-wing machine, invented and constructed by Amos Drew two years ago, was one of the historical exhibits. This machine, which weighs 600 pounds and has 350 square feet of supporting surface, is fitted with a 3-cylinder air-cooled motor that is ridiculously small for doing the heavy work of flapping the long, narrow wings of the machine. The Gillespie aeroplane (which we illustrated some time ago) was another historical exhibit. Mr. Gillespie also had on exhibition a new double-surface model made up of four sets of twin planes.

Passing now to the new apparatus, about the only thing in the aeroplane line was a large model built of wood and cloth by the inventor, Miss E. L. Todd, who has sought to obtain automatic stability of the aeroplane by suspending the framework below it in a novel manner, while she has also provided for a rigid connection of the planes and the car when necessary. A. Roy Knabenshue showed the framework and motor of his aeroplane, all of which looked too light to be very practical. There was also shown an experimental helicopter apparatus of Carl Dienstbach. The body framework of Gustave Whitehead's latest bat-like aeroplane was shown mounted on pneumatic-tired, ball-bearing wire wheels and containing a 3-cylinder, 2-cycle, air-cooled motor of 15 horse-power direct connected to a 6-foot propeller placed in front. This machine ran along the road at a speed of 25 miles an hour in tests made with it last summer. When held stationary, it produced a thrust of 75 pounds. The engine is a 4¼ x 4 of an improved type. Whitehead also exhibited the 2-cylinder steam engine which revolved the road wheels of his former bat machine, with which he made a number of short flights in 1901. He is at present engaged in building a 100-horse-power, 8-cylinder gasoline motor with which to propel his improved machine.

The main feature of the show this year was the display of light-weight aeronautical gasoline motors. The lightest of these for its horse-power was the 5-cylinder, water-cooled motor built by Prof. Langley in 1903 for use on his full-sized aeroplane. This engine, the cylinders of which are in the same vertical plane arranged radially around the crankshaft, weighs but 125 pounds and develops 52.4 horse-power. Its weight per horse-power is therefore but 2.3 pounds. With spark coil, batteries, 25 pounds of water, etc., the total weight is but 200 pounds, or 3.8 pounds per horse-power. As it is only within the last two years that any motor of such small weight per horse-power has been produced, it will be seen that Prof. Langley was ahead of his time in this line as in others.

The next lightest motor per horse-power developed was a 4-cylinder, two-cycle, air-cooled engine, the invention of Mr. George J. Altham. This consists of two pairs of opposed cylinders placed side by side in adjacent vertical planes. One piston of each pair is con-