Correspondence.

The Invention of the Montgomery Aeroplane.

To the Editor of the SCIENTIFIC AMERICAN:

In the very fine account of the Montgomery aeroplane in your last issue, I take notice that I am credited as a collaborator with Prof. Montgomery in the invention of the machine. I would like to state through your columns that in this relation I have had nothing absolutely to do with it. The invention pure and simple is the work of Prof. Montgomery himself.

R. H. BELL, S. J.

Santa Clara College, Santa Clara, Cal., May 24, 1905.

The Moving Ball of Stone.

To the Editor of the SCIENTIFIC AMERICAN:

If the ball is of polished stone, and the base of unpolished stone, then, I think, the ball (if unfixed) would move under the influence of the heat of the sun. For the base would heat more quickly and, necessarily, cool more quickly than the ball.

But I do not think this can account for the regular motion to the south. Under the heat of the sun it would appear the motion should be a little west of south, with a possible cross rotation to the east.

If the motion be quite regular, it must be referred to some fixed physical relation between the ball and its base. If referred to the sun, its motion must vary.

F. C. CONSTABLE, M.A., Trin. Col. Cam.

Wick Court, England, May 17, 1905.

The Stone Ball.

To the Editor of the SCIENTIFIC AMERICAN:

The account of the stone ball's movement interests us here, as we have two similar balls which have not moved since they were placed upon their bases. One of them has been in position fourteen years. It is a polished granite, resting on a thin sheet of lead, in a saucer-like depression eight inches in diameter, on the top of the unpolished granite base. The other ball rests upon four pyramidal points about four inches high, standing twelve inches apart in a square on top of base. Both are of granite. The ball is polished. We have near the cemetery shocks from rock blasting and heavy freight railroad trains. It seems incredible that any shock short of dynamite or seismic could lift so heavy a ball nearly half an inch from its flattened disk, and roll it on its polished circumference. In this position and in its roomier basin would make more plausible various causes that have been given.

If the tables of expansion of granite by heat are correct, namely, 0.0000045 to 1 for every degree of heat (F.) then it will not account for the movement of that ball from August to April 15 of over five inches, as a variation of temperature of 20 degrees daily for 250 days, operating on the 8-inch base upon which it rests, would not altogether be more than the fractional part of an inch.

A workman of average weight on opposite sides of monument operating seven-foot levers on fulcrums four inches from the ball could readily, by a downward and slight lateral movement, lift and rotate the ball with ease.

SECRETARY WARWICK CEMETERY.

Warwick, N. Y., June 1, 1905.

The Motion of a Rolling Wheel.

To the Editor of the SCIENTIFIC AMERICAN:

As many erroneous conclusions have been drawn from the conception of a wheel as turning about its point of contact with the rail or ground, particularly in efforts to improve the counterbalancing of locomotives, I would ask the privilege of adding some related facts to your reply to query No. 9622 in the SCIENTIFIC AMERICAN of April 22. There is an important difference between the condition of a body (or a part of a body) which is motionless for some interval of time and that of a body having an ever-changing velocity which is 0 at the instant under consideration. In the first instance there is no acceleration, and the body has no unbalanced force acting on it. A stone resting on the ground has the attraction of the earth just balanced by the pressure of the material on which it rests, and no unbalanced force acts. But, if the stone is thrown vertically into the air, there is a time when its formerly decreasing, upward velocity is changing to an increasing, downward velocity; and at that instant the velocity of the stone is 0. The attraction of the earth is practically unbalanced. From Newton's laws of motion it follows that, when a body has an unbalanced force acting upon it, it has an acceleration. The stone, then, has an acceleration of 32.16, even though its velocity is 0. The piston of an ideal engine, at the end of its stroke, has a velocity of 0. It does not stand still for a millionth of a second, or for any interval of time whatever; its velocity simply passes through the value 0; but it has then its maximum acceleration.

It seems to make clear the motion of a rolling wheel to consider the wheel as turning at a uniform rate about a point on its rim while that point travels over a cycloidal path. When the point touches the ground, its velocity will be passing through its 0 value, and the velocity and direction of motion of every point on the wheel will be the same as if a shaft in fixed bearings in the ground passed through the point in the rim. The point is, therefore, called the "instantaneous center." But it then has a maximum acceleration; so the *forces* acting on the wheel are totally different from what they would be if the wheel turned about the shaft assumed above.

The actual path of the center of gravity of the wheel is a straight, horizontal line if the center of gravity is at the center of the wheel, and a prolate cycloid if it is "off center." If the wheel turned about a point on the ground, the path of the center of gravity would be a circle. The radii of curvature of the two paths at any point will not be the same. Therefore, since change of motion must be proportional to the forces that produce it, we have another proof that the forces acting on the wheel would not be the same in the two cases.

Now calculations of forces and accelerations, based on a rotation about the instantaneous center, will, if the acceleration of the instantaneous center itself is taken into account, give just the same results as the simpler calculation which considers the wheel as turning on its center while the center has a motion of translation in a straight line; while any calculation which neglects the acceleration of the instantaneous center will lead to absurd results. For example, such a calculation would require that, at a speed common on passenger trains, the centrifugal force of the wheels would lift the whole train from the rails.

Waltham, Mass., May 24, 1905. G. F. STARBUCK.

Can the Baalbec Stone be Moved?

To the Editor of the SCIENTIFIC AMERICAN:

I take advantage of an almost unprecedented rainstorm at this season in California, housing a busy man, to ask you if it would be a physical impossibility for modern mechanics to move to the shores of the New World the huge stone in the quarry at Baalbec, which evidently stumped the ancient builders of the great sun temple there. On the occasion of my visit there on horseback when completing a tour of Palestine, this was the question I brought away with me. If the ancients could quarry and put into the walls of a lofty building stones shaped and sized like box cars, passenger coaches, and the very largest Pullman sleepers, could moderns, with steam power and all the inventions of the later centuries, handle the mighty Baalbec stone? I can only give from memory approximate measurements. The stone is about 80 feet long, 18 feet wide, and 13 feet thick. It is estimated to weigh fifteen hundred tons. I can make only this contribution to the conditions of the case. When representing the United States Treasury Department, and inviting the various governments of the world to send their most wonderful achievements for exhibition at Chicago, this stone of stones fascinated my attention. From Baalbec to Beirut, from the back of a splendid Arab horse, I studied the roadway to the sea. Were the Sultan to give that mighty carved rock to America, to be put up as a tribute to the energy of a people who can build a Panama canal, there is not (or was not in 1893) a house that would need to be moved, or a tree that would need to be cut, to move the stone to a completed float. The boulevard is hard, wide, modern, splendid. The picturesque stone would interest your readers. My photograph of it is imperfect, or I would send it to you.

EDWIN SIDNEY WILLIAMS.

Saratoga, Cal., May 26, 1905.

Ethics of the Russo-Japanese War.

To the Editor of the SCIENTIFIC AMERICAN:

In your excellent editorial, "An Unparalleled Victory," you attribute, with much verity, the marvelous success on land and sea to the Japanese people themselves—to certain inherent qualities and to traits of character, most admirable, acquired by training, ethical and Oriental, "older than our western civilization."

There you sound the keynote, but permit me to say that the very characteristics that you mention, viz., "intense patriotism, self-denial, scrupulous honor in all matters affecting the welfare of the state, a keen sense of duty, strict discipline, unquestioning obedience to authority, absolute unity of purpose, a firm belief in the destiny of their race, patience and endurance, an absence of self-consciousness and posing that may well put our 'white' civilization to the blush, a close attention to detail, and lastly a combination of great prudence and forethought with a marked ability to adapt themselves quickly to the circumstances of the hour," are, with one or two exceptions, common to Russian and Japanese alike.

The "Ice Palace" of St. Petersburg melts away into utter insignificance under a tropical sun. Many of the excesses of the Russian garrison at Port Arthur, on the eve of its surrender, were committed with suicidal intent. The Japanese soldiers, like the Chinese, committed suicide rather than be taken prisoners. Many Russians did the same, but not on the open field, in the face of the enemy.

Russia is not disintegrating, as a nation, an empire. Notwithstanding all internal dissension and revolutionary plots, "intense patriotism" is a trait predominant in the Russian breast. Pride of country, of race, of nationality, is strong with the Russian peasantry, who hardly could define an absolute monarchy, and who venerate the power of the Czar, their "Great Father," temporally, in much the same manner as they revere the Universal Patriarch, the head of the Greek Church, spiritually. Neither church nor state in Russia favors the education of the masses, nor their elevation in the social scale, whereas, in Japan, it is just the reverse. The national government in Japan has adopted many of the customs and progressive methods of the United States, is open to all religions, zealous for education for all classes, eager to promote the best interests of her people, intellectually, physically, materially, spiritually.

Thus it will be seen that "self-denial" is inculcated and practised by the Russian as well as the Japanese, for his country, and for his religion's sake; also "scrupulous honor," and " a keen sense of duty." But ignorance and fear are the conditions under which the Russians live and die, fight and lose; intelligence and trust those with which the Japanese win. "Strict discipline," too, we find on both sides. The discipline of the Russian army and navy is not only strict, it is brutally severe. It is systematically cruel. That is its great defect. Military plans may be well laid, the tactics of the latest and best schools may be employed; every modern device, and newest invention, and additional improvement known to any warfare be adopted, but if the discipline be too severe on the one hand or too lax on the other, the colors will go down.

"Unquestioning obedience to authority" is by no means restricted to the "Land of the Rising Sun." On the steppes of the Russias and in bleak and dreary Siberia that trait is found, is made compulsory, not in the army and navy alone, but in the home. "Absolute unity of purpose" is seldom if ever found, in frail humanity, even in this country, not to mention Russia; hence, we will concede that to the Japanese, for the present, at least.

And in Russia, as well as Japan, we find "a firm belief in the destiny of their race, patience and endurance," also. As to "an absence of self-consciousness," every soldier, of any nationality, should have that almost pre-eminently, if he is to be a good fighter and win laurels for himself. "Posing" is necessary at times, alike with rank and file. Parade drills teach that to both officers and men, even in times of peace. In battle, there must be delicate and accurate maneuvers, which require not only skill and plenty of posing and self-consciousness, but self-sacrifice, as well.

Every army knows the importance of "a close attention to detail," and that has heretofore been as marked in Russian successes as, during the entire course of this war, in their constant and successive series of defeats. We may say that the Japanese excelled the Russians in this respect, but certainly the latter were not lacking therein.

The strongest characteristic is the last, "a combination of great prudence and forethought with a marked ability to adapt themselves quickly to the circumstances of the hour." That is essentially Japanese. With marvelous rapidity they struck their blows, with unerring aim at the foe's weakest and most exposed points, meanwhile availing themselves of the best strategic bases of operation.

The Japanese in every engagement seemed to possess a hidden insight, not only "forethought," but foreknowledge of all the enemy's plans and positions. The Russians took every precaution, as they thought, to protect themselves from traitors within their own ranks, and from Japanese spies; but the result was always the same. The intelligence was conveyed from one to another with Oriental rapidity. But the Japanese did not rely upon such intelligence alone. From the Occident, they had previously fortified themselves with the best munitions of war, they had acquired materials and resources and financial backing, of which the world at large knew nothing.

MRS. EDWARD P. FOSTER.

Cincinnati, Ohio, June 14, 1905.

The Current Supplement.

The petroleum and coal fields of the Pacific coast of Alaska is the subject of the opening article in the current SUPPLEMENT, No. 1538. Dr. Richard Lucas writes briefly but instructively on the Coloration of Glass by exposure to the light. How a vertical sun-dial can be made is very exhaustively described and illustrated in a well-written article. Why is the silica brick better than the clay brick? An answer to the question will be found in an authoritative discussion of the subject. The Hammurabi Code is without doubt the earliest legal document extant. In the SUPPLEMENT a splendid comparison of this ancient code with the Code of the Covenant, with which it has much in common, is drawn by Prof. Max Kellner. Dr. E. Branly, whose name will be forever linked with the invention and commercial introduction of wireless telegraphy, writes on an Experimental Study of Electric Waves and Their Applications.

Cultivation of Chicory in Belgium.

During the months of January, February, and March attention is attracted to the immense quantity of a special vegetable sold by marketmen, greengrocers, and hucksters, and eaten by all classes throughout Belgium, prepared in various appetizing manners, and frequently eaten as a salad, either raw or cooked. I refer to the white chicory, the cultivation of which is a specialty of Brussels and its suburbs.

There are two species of chicory grown in Belgium. The wild chicory (*Chichorium intybus*) is cultivated in the neighborhood of Roulers, Thourout, and one or two other localities, in close proximity to the chicory manufactories, where the roots of the plants are parched, ground, and sold loose or in half-pound packages, to be used in connection with coffee, especially by the working classes.

The white chicory was originally brought to Belgium from India, and the principal center of cultivation is in the immediate neighborhood of Brussels, especially in Schaerbeek, Evere, and Woluwe. The root of this plant is of inferior quality and is consequently used as cattle feed.

The growing of this essentially winter vegetable requires great care, trouble, and hard work, beginning early in April, when the seed is sown. As soon as the plants are an inch or two high they are carefully thinned out by hand, leaving the most vigorous undisturbed a given distance apart. In September and October, when the plants are in full maturity and the leaves very long, they are taken out of the ground and the leaves carefully cut off about two inches from the root. Trenches are prepared, and the plants are disposed in them in three layers, each layer being covered by 10 inches of earth and from 12 to 14 inches of horse manure. This manure produces an artificial heat, which causes the chicory to sprout, and the earth being compactly pressed upon the plants, the leaves adhere closely together, and as no sunlight penetrates the covering, the plants are bleached white and present a most attractive and appetizing appearance when removed for consumption. This is done according to the demands of the market. The vegetable is available all the year round, but the most active demand is in the months of January, February, and March, during the scarcity of other garden vegetables.

The above-described method of bleaching chicory has existed since the commencement of the cultivation of this popular vegetable, but much complaint is heard concerning it, principally on account of the germs contained in the horse manure, which is likely to render the vegetable unwholesome and unfit for consumption, and also on account of the danger of a sudden frost, which, by lowering the temperature of the manure covering, checks the growth of the plants and correspondingly affects the selling price. To combat these inconveniences the cultivators of chicory at Schaerbeek, one of the most important suburbs of Brussels, have for some time been experimenting—heating the layers of plants by the system of thermo-siphons. The system has the advantage of giving a regular, constant heat, and greatly reduces the manual labor connected with the cultivation.

Although an immense quantity of chicory is consumed in Belgium, the yield is sufficient to supply Paris with large quantities, where it is largely used in the hospitals of that city. The average wholesale selling price in Belgium is 7 cents per kilogramme (2.20 pounds), and in Paris from 14 to 16 cents. To perform all the different operations connected with chicory growing demands hard work and constant attention. The most dangerous part of the work is the loading and transportation of manure, which has to be done before 8 o'clock in the morning. The great differences in the temperature of the cavalry and other stables, where the horse manure is obtained, and the temperature of the outside cold and chilly morning air frequently results fatally to the men employed in this work.—Geo. W. Roosevelt, Consul, Brussels, Belgium.

Modern industry, by improving and multiplying its methods of action, has increased the danger for the operative, who depends for his livelihood on his daily labor. Machinery, to-day replacing and decupling human force, constitutes not only an admirable source of production, but also a terrible source of danger. An industrial establishment, as has been said correctly, is a battlefield, having, like war, its victims, some mortally attacked, others more or less grievously wounded, and for a longer or shorter period rendered incapable of providing for their personal needs. The legislator should not be indifferent to these misfortunes. One of his prime duties is to prevent or mitigate their effects as far as possible. M. Riard says these things in La Revue Technique.

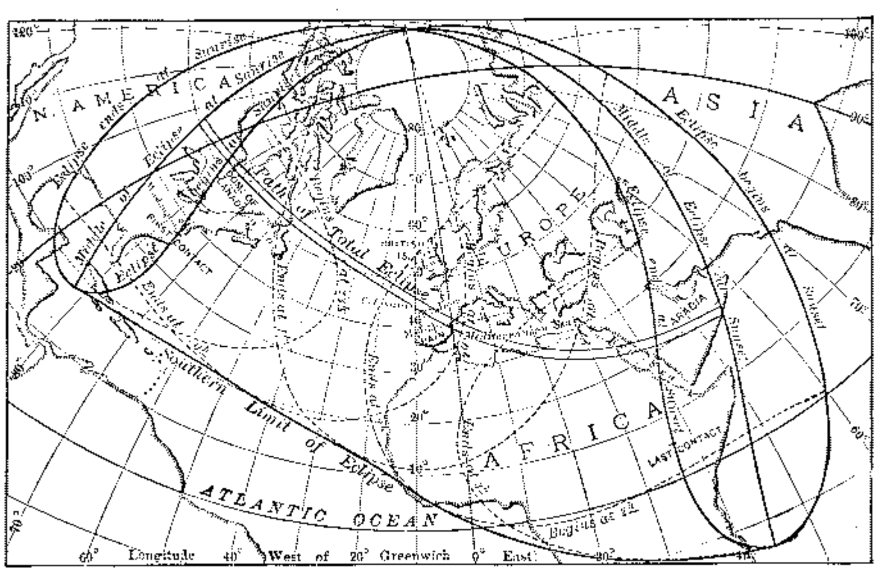
THE UNITED STATES NAVAL OBSERVATORY ECLIPSE EXPEDITION.

BY C. H. CLAUDY.

An eclipse of the sun, visible in part to the greater area of North America, Europe, Africa, and Asia, will take place on August 30, 1905. The eclipse is total to parts of Canada, Atlantic Ocean, Spain, the Mediterranean Sea, Africa, the Red Sea, and Arabia. To observe the phenomena attendant upon the total eclipse of the sun, the United States naval observatory is equipping three expeditions to go to Spain and Africa.

The exact locality in which the three expeditions will locate has not been absolutely determined, but it is probable that the two parties who go to Spain will station themselves on the central line of the eclipse near Burgos, and near Sagunto. The African party will in all probability locate at Sauk Ahauras, Africa.

The equipment of the parties has been a matter of deep thought and much work to the observatory officials. Experiences in the past have proved that, other things being equal, the best equipment yields the best results, and that carelessness in equipment means an irreparable loss. For the time of totality is very short, and all the work which is done on the total eclipse phenomena must be accomplished, in this instance, within the limits of three minutes and forty seconds at Burgos, two minutes and twenty-nine seconds at Sagunto, and three minutes and thirty-four seconds at Sauk Ahauras. Naturally, the apparatus must be as perfect as ingenuity and skill can make it, and the men operating it drilled in every movement, in order that everything may go off without a hitch, and that the maximum amount of photographs be taken in the allotted time. Unlike the eclipse expeditions of several years back, almost all the work done, both telescopic and spectroscopic, is now accomplished with the camera as the most important part of the outfit. Photographs taken during the hurried work can be studied at leisure and are at once more accurate and more reliable than visual observations and the most painstaking drawings. Of course, the camera cannot record the colors, but that is about its only limit.



PATH OF THE ECLIPSE OF AUGUST 30, 1905.

Taking up each party in turn, the equipment is as follows:

For Party No. 1, which will go to Burgos, there is provided, first a stationary camera provided with a 40-foot focus lens of 5 inches diameter, which produces the image of the sun on a 14 x 17 plate. A more detailed description of this instrument will follow. Next is a polar axis, on which is mounted a camera with an 8½-inch lens of 12 feet focus, using 11 x 14-inch plates, and a 6-inch Dallmeyer lens of 36 inches focus, both of which are for photographing the extensions of the corona. This polar axis will also carry a spectroscopic camera. The stationary camera uses a cœlostat (a device in which a mirror, run by clockwork, keeps an image of the sun in one position as the earth moves under it), and upon the other end of the shaft carrying the mirror will be a plane-grating spectroscope, with a 5-inch aperture and 72-inch focus lens, taking photographs on plates 14 x 1½ inches. It is expected to make at least twelve exposures with this instrument during totality. Dr. S. A. Mitchell, of Columbia University, New York city, will be in charge of the spectroscopic work at this station, and besides using the instrument just described, will have, in addition, a cœlostat used on one of the old transit-of-Venus expeditions to which will be attached a parabolic grating spectroscope.

Station No. 2, near Valencia, Spain, will have the giant camera of the three expeditions, which is illustrated herewith. It is 65 feet long and has a lens triple achromatic, made by Brashear after curves computed by Prof. C. S. Hastings, of Yale. The lens is 7½ inches in diameter and produces an image of the sun 7 inches in diameter. Next in the equipment of this station comes a polar axis, on which is mounted a camera provided with a 6-inch lens, of 104-inch focus, and using 8 x 10 plates. This camera is provided with a color screen, and, like the cameras on the various polar axes, is for work on the outer corona. On this axis will be a 21-foot concave grating spectroscope, used direct.

The third party, in Africa, will be provided with a camera containing a lens of 5 inches diameter and 40 feet focus, a polar axis, and on it a camera with a lens 9.6 inches in diameter and of 14-feet focus, for 11 x 14 plates, and a 10-foot spectrograph pointed directly at the sun. This party also will have a transit-of-Venus cœlostat and a new instrument, termed the chronospectrograph, which will give a continuous spectrum with indicated time, in seconds, during the time of totality. Prof. L. E. Jewell, of Johns Hopkins University, will be in charge of the spectroscopic work of this party.

If the illustration of the big camera herewith printed is examined, it will be seen that it is composed of a series of wooden frames, ending in a little house. This house is knock-down and portable, and contains a double door, so that members of the party may enter and leave it without admitting light. It has no windows, but the roof lifts up to allow ventilation and light when desired. It was photographed while set up in the Observatory grounds, where it was being tested. The thoughtful reader will at once inquire why, if the frames are made at all, they are not covered? The answer lies in the fact that for testing the action of the cœlostat and the working of the plate holder, etc., experimental photographs are taken with a focal plane shutter, of the sun as it is. The exposure is less than a thousandth part of a second, and what little light can get through the small opening of the two covered sections in that time is immaterial. When the sun is in eclipse, however, the exposure will be much greater, possibly thirty seconds. Hence the need of an instrument which will keep the sun still, in reference to the plate, and the covering, to exclude every bit of extraneous light.

The cœlostat on this instrument is one which the Observatory has had and used before. The cœlostats for the other two long-focus cameras, however, are new. They were designed by Mr. W. W. Dinwiddie of the Observatory staff, and made by William Gaertner, of Chicago. They are at once simpler, lighter, and much less expensive than any similar instruments ever carried on an eclipse expedition. Another illustration shows one of these cœlostats being tested by its designer. The cœlostat is simply a polar axis, a means for revolving it in the opposite direction to the earth's movement at a speed equal to that of the earth about its axis, and a mirror on one end of this axis. When the mirror is so adjusted that the rays of the sun fall in any one particular spot, and the clockwork set in motion, the rays of the sun continue to fall on that selected spot, for as fast as the earth carries the spot away from the place of reflection, the mirror alters its position so that the rays follow the spot. In this case, of course, the spot is the target placed over the sensitive plate in the end of the camera.

The polar axes are, as seen in the illustrations, simply triangular frames, which support a trussed structure forming the axis. This trussed structure has attached to it another trussed structure, which, when covered, and provided with a lens and plate holder, forms a camera, adapted to follow the sun as the earth turns upon its axis. These cameras, having a focus of from 12 to 15 feet, yield a much smaller image of the sun than do the huge stationary cameras of from 40 to 65 feet focal length. The smaller cameras, therefore, are adapted to picture the eclipse and all the coronal prominences and streamers. The larger cameras are devised to make large pictures of the sun and devote their particular attention altogether to the phenomena in the immediate vicinity of the sun. The polar axes also carry the spectroscopic apparatus, for making spectrographic photographs. The means by which the clock motion is transmitted to these polar axes is extremely interesting, as being so simple. As seen in the illustration, the clockwork, which is in the metal case in the foreground, is connected to the instrument by a horizontal shaft. This shaft meshes, by means of cogs, with a drum, around which passes a small wire cord. This cord is supported, on the right, by an idle drum, and on each end of the cord is a weight. As the shaft turns, the cord moves, and when, by means of a clamp, the truss rod which leads to the polar axis is connected to the cord, the polar axis will move in an opposite direction to the cord. The clamp, which connects the connecting rod with the cord, allows the polar axis to be set, within sufficient limits for the short period wanted for photographing the eclipse, at any desired position. The whole thing has the merit of simplicity and strength, and can stand weather,