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.

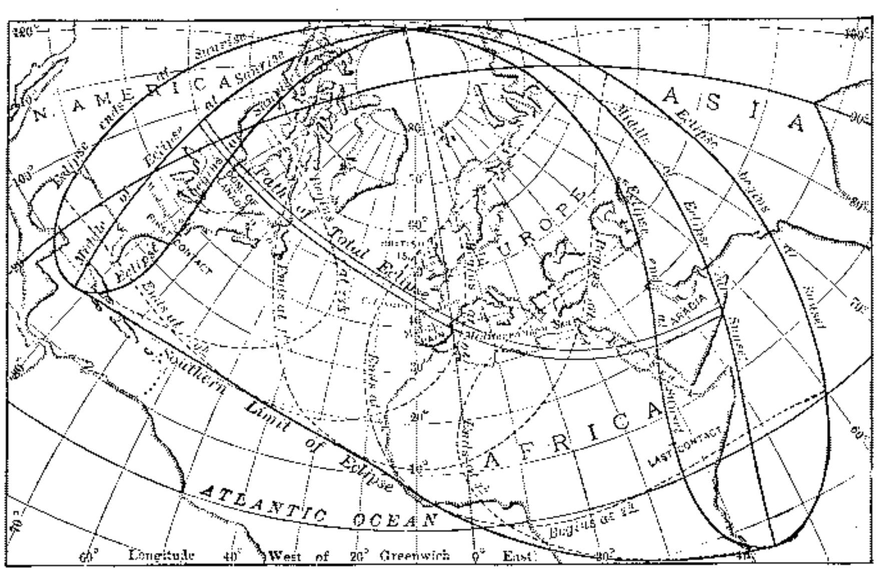
THE UNITED STATES NAVAL OBSERVATORY ECLIPSE EXPEDITION.

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.

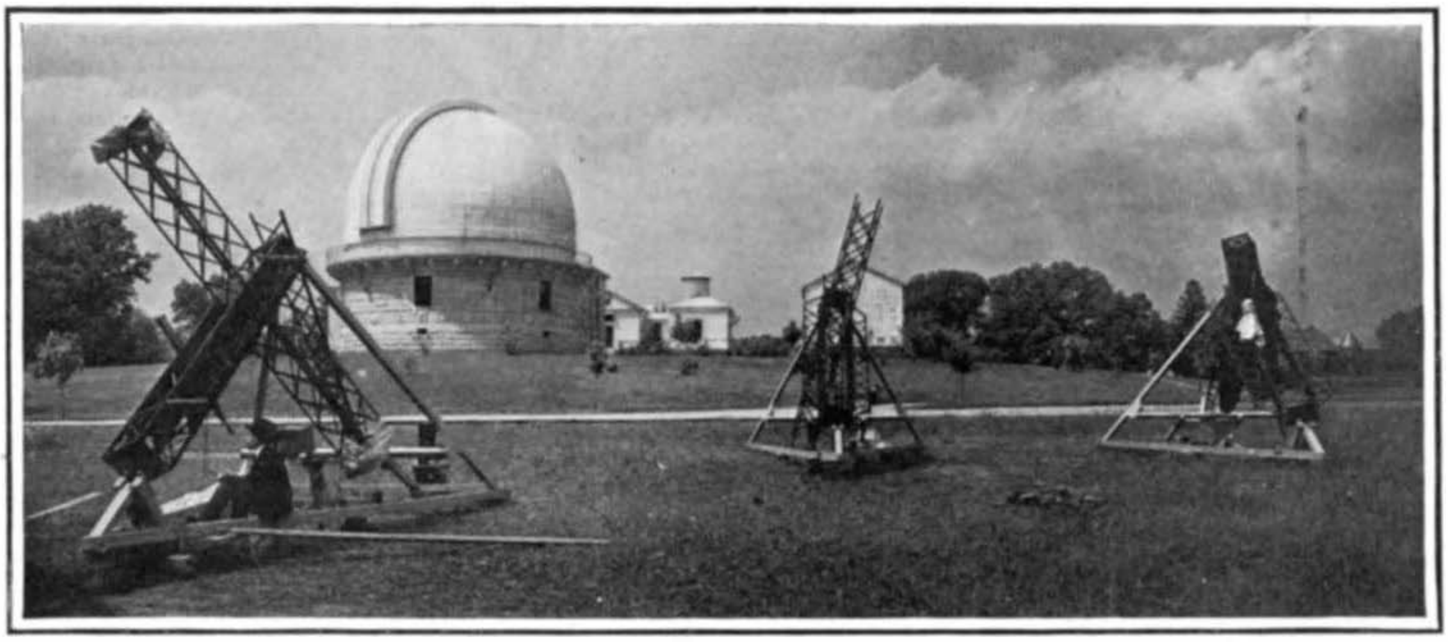
The polar axes are, as seen in the illustrations, simply triangular frames, which support a trussed structure forming the axis. This trussed structure has attached to it another trussed structure, which, when covered, and provided with a lens and plate holder, forms a camera, adapted to follow the sun 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, while at the same time it is, for all intents and purposes, absolutely accurate. Even supposing there exists a slight error in the rate of the clock, which should escape the vigilant tests made for such aberrations, the error would be small for a day's journey of the sun across the sky, and for a period of a few seconds would be *nil*. Nevertheless, no errors not known, and so to be accounted for, will exist if careful testing, both before shipment and after it is set up on the ground at the eclipse station, can help it. The illustration showing the three polar axes, in different stages of completion, also shows an observer testing, with a small telescope and micrometer, for periodic errors in the clockwork. Many observations are taken of the actual rate of the clock, and the mean compared with the known rate of the earth's motion. The error, if error there is, is obviously easily detected.

It will be noticed that these polar axes, as well as the big cameras, are all of such construction that they may be taken to pieces and put together easily. It is necessary to ship all the instruments very carefully, and to have them packed with the greatest nicety. To this end everything comes to pieces and is packed in boxes specially made for the purpose; and to guard against possible damage, every part of the delicate instruments, such as clockwork, axes, lenses, shutters, etc., is wedged into specially built compartments in the boxes.

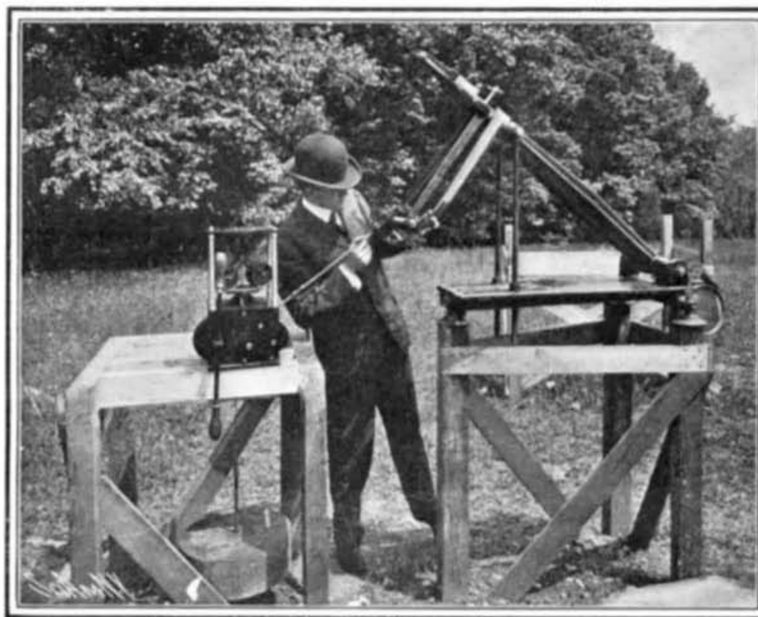
Besides the instruments mentioned, each party will have a large portable transit, for determining latitude and longitude and for setting the instruments, and distributed among the parties are five 5-inch portable equatorial telescopes, for visual observations.

As far as determined, the personnel of the parties is as follows, all under the general direction of Admiral Chester, who is at the head of the Observatory:

First party: Prof. W. S. Eichelberger, Mr. E. I. Yowell, Dr. S. A. Mitchell. Second party: Prof. F. B. Littell, Mr. George A. Hill, Mr. G. H. Peters, Commander Hayden in charge. Third party: W. W. Dinwiddie, Prof. L. E. Jewell, Capt. Norris in charge.

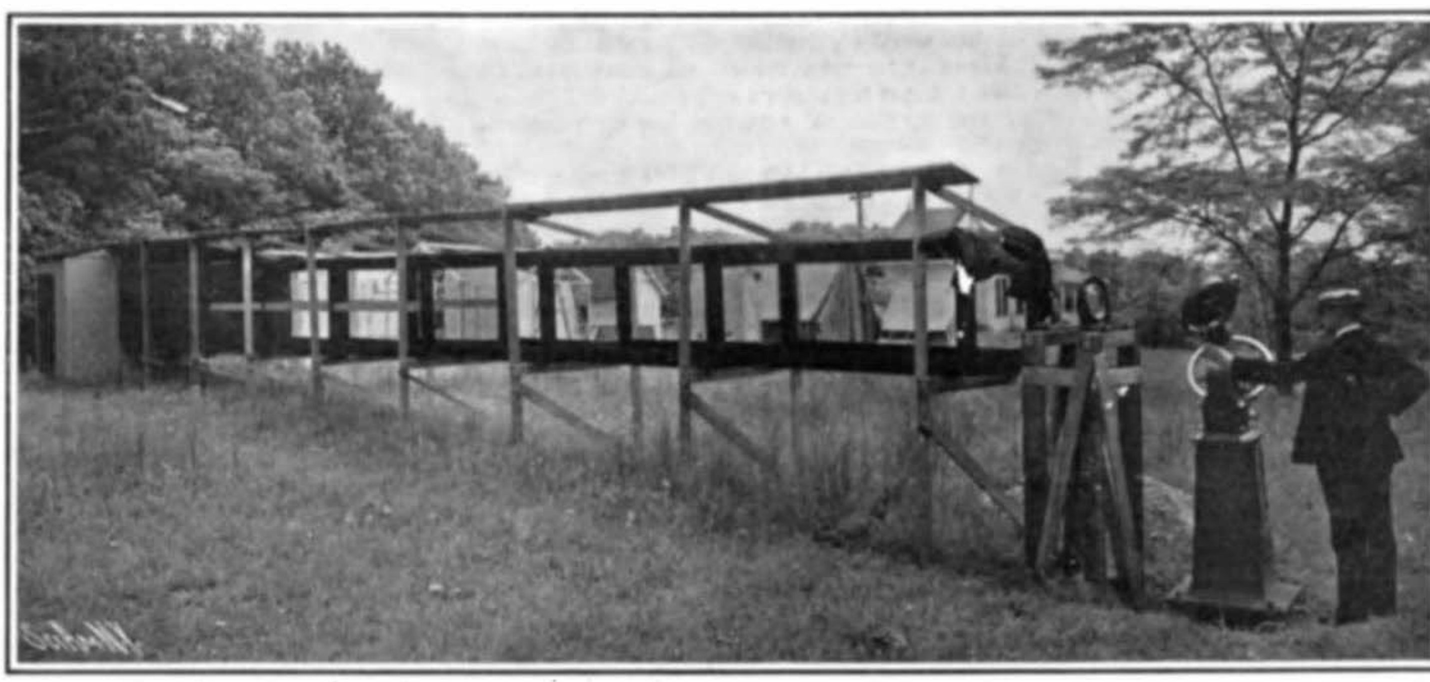


The Three Polar Axes in Different Stages of Completion, Set up for Clock Tests in the Naval Observatory Grounds.



Mr. Dinwiddie Examining His Coelostat. This Instrument is One of Two Built for the Coming Eclipse.

One of the Polar Axes with Camera Mounted and Temporarily Covered for Testing.



A Sixty-Five Foot Camera Erected for Tests in the Naval Obervatory Grounds.

THE UNITED STATES NAVAL OBSERVATORY ECLIPSE EXPEDITION.

The instruments have been largely made at the Observatory, and many of them were designed by Mr. Dinwiddie. He is responsible for the two new cœlostats, the three portable dark-rooms, the three portable houses which are the ends of the big cameras, the three polar axes, and the chronospectrograph, besides the 10-foot concave grating spectrograph. The parties and their equipment will start from Alexandria, Va., on the U. S. N. collier "Cæsar," about June 15 or 20. Arriving at their stations, the instruments will be immediately set up and tested, and when in perfect running order the members of the party will drill daily until all are letter-perfect in the actions that each is to perform. So much attention is paid to the details of the drilling, in order to have every man perfect, that dummy glass-plates, for the big cameras, are carried, with ground edges to prevent accidents. These big plates are handled naked, and as everything depends upon getting them into the holder in the portable house, exposed, out of the holder, and put away, and another one in place, with the utmost dispatch, the importance of this provision is at once seen. As the entire party is divided into three stations, there seems to be a good chance of good results. The only thing to fear in the weather line is thunder-storms, and should three thunder-storms occur at the three different stations at the time of the eclipse, the laws of chance would stand in serious need of revision. Inasmuch as the equipment is superior to any heretofore carried on such an expedition, and long experience in such work is behind the various members of the parties, much is looked for in the way of new data concerning the many only slightly understood phenomena of a solar eclipse. No eclipse has ever been photographed with the thoroughness with which this one will be; naturally superior pictures are looked for. Beside the expedition of the Naval Observatory, almost every prominent astronomical observatory in the world will send out parties. Many private expeditions are also bound for Spain and Africa to view the eclipse.

A recent invention renders the barrels of both firearms and pneumatic guns thoroughly rust-proof, durable, and cleanable by the use of a rifled glass lining. The gun barrel comprises an outer shell of usual gun metal, which may be cylindrical or octagonal or any other shape. The bore of the barrel at the rear end is increased in diameter, to form the firing chamber, in which the shell of the cartridge is received, and from the forward end of this chamber to the nozzle of the barrel is a lining of glass, which has any desired thickness and the requisite toughness. The position of the glass lining is such that the products of combustion do not come in contact with any metal surface but only with the glass. The glass is rifled throughout its length, so as to give the projectile its proper rotation. Some expert opinion may question whether the process can be of more than speculative value, yet the invention is made attractive at least by its originality.