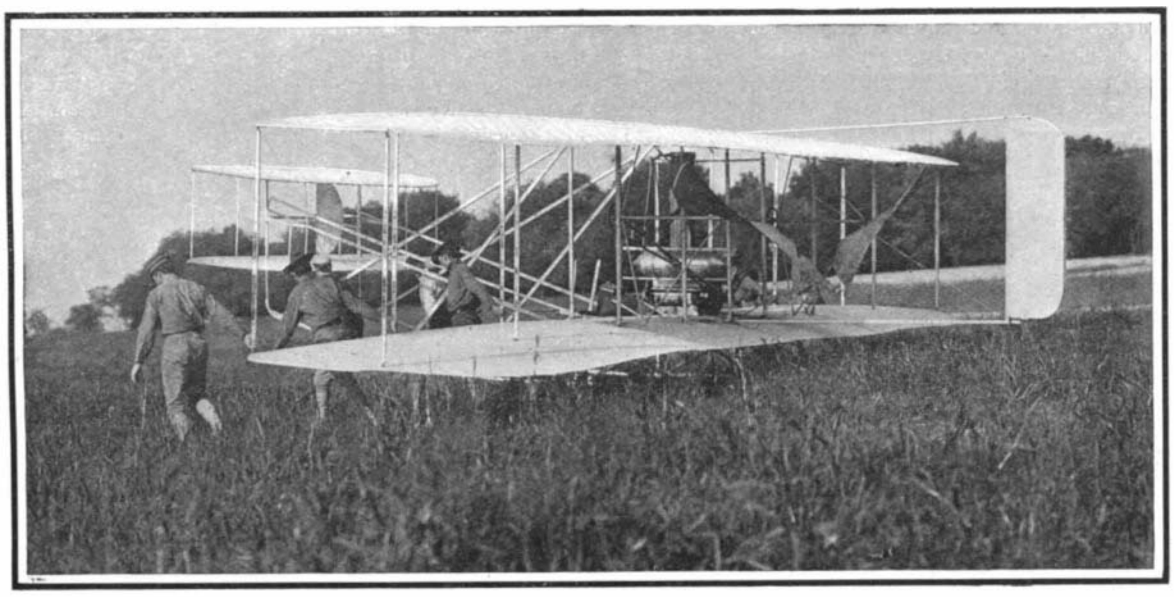
THE FIRST FLIGHT OF THE WRIGHT AEROPLANE AT FORT MYER.

BY OUR WASHINGTON CORRESPONDENT.

After several days of waiting, consumed in assembling and testing its various parts, Wilbur Wright's machine flew at its first attempt on the 3d instant, remaining in the air 1 minute and 10 seconds, and covering a distance of about a mile.

The aeroplane was launched from the starting rail shortly after 6 P. M., by the dropping of some heavy weights that were suspended from the tower and connected by a rope to the two-wheeled starting car.



Transporting the Machine to the Testing Grounds.

The aeroplane was placed upon this car, and as soon as it was jerked forward (the propellers having first been started) it left the car and ascended gracefully. The starting device is calculated to give the 1,000-pound machine a speed of 28 miles an hour in a distance of 50 feet. This speed is sufficient to cause it to rise readily in still air; but if there is a wind blowing from behind, no ascension can be made. This mode of starting, modeled somewhat after that devised by Langley, is peculiar to the Wright aeroplane, and while it enables the aeroplane to take the air in a short preliminary run, on the whole it does not appear to be so good a scheme as running on wheels on the ground. The use of runners or skids for alighting seems to be an excellent idea, however, and the combination of these with some arrangement of foldable wheels would seem to be a very good plan.

In its initial flight on September 3, the aeroplane went one and one-half times around the parade ground at Fort Myer, thereby covering a distance of approximately a mile. The speed varied somewhat, but it may be roughly averaged at 30 miles an hour. The flight was noticeable for its undulatory character in a vertical plane (which was occasioned by the aviator —Mr. Orville Wright—devoting himself chiefly to the side-steering lever), while the sharp turns that were made and the steep inward inclination of the planes in making them were other 'nteresting points. In attempting to make the turn the second time at the opposite end of the field to that from which he started, Mr. Wright pulled his steering lever a little the wrong way, after which he made a quick descent to avoid hitting a new shed that was in process of construction. The machine was being turned quickly as it struck the ground, and one of the runners, owing to faulty assembling, was slightly broken. The demonstration convinced the spectators that the machine was capable of repeating the performance of the old machine.

A close scrutiny of the Wright aeroplane astonishes one by its great simplicity. The main planes are slightly arched downward at their ends. Their front edges are perfectly rigid, only their ends and rear edges being flexible. The outer ends of the lower plane, at the end and second uprights, are connected by a wire that runs through pulleys attached to the upper plane; while the corresponding ends of the upper plane are attached in a similar manner, with the exception that the connecting wire, in the form of a chain, is carried forward through pulleys and around the hub of one of the three vertical levers, so that a fore-and-aft movement of this lever causes the rear edges of the planes to dip down at one end and to rise a corresponding amount at the other. Close beside this lever, and in reality forming part of it, is another vertical lever that moves the twin vertical rudder. In making a turn, the angle of incidence of the outside end of the planes is at first increased, which causes the machine to rise at this end. The tendency which it has to turn in the opposite direction as a result of the increased resistance resulting from the greater angle, is overcome by means of the vertical rudder. As soon as the machine has tipped inward and started to make the curve the positions of the wing ends are reversed, the greater angle then being given to the inner end. If this procedure is not followed, the aviator cannot turn the aeroplane; and it is for this very reason that a wind fails to upset it. The horizontal rudder is operated by a straight inclined rod running directly from the lever to the two superposed surfaces in front. This rudder is used to maintain the longitudinal equilibrium and also for varying the height. It is operated by the left hand of the aviator, and until his hand becomes used to working it, the aeroplane is bound to do considerable bobbing up and down.

From this account one can see that the Wright brothers have followed closely the soaring birds in the method of steering and maintaining their transverse equilibrium; and that this method works well in practice goes without saying.

A South Pole Trip.

Upon his return from his present expedition in search of the north pole Commander Robert E. Peary plans to organize a national American antarctic expedition to explore the southern polar regions, a project which, he says, has the approval of President Roosevelt. Mr. Peary, however, does not intend to accompany the party. Herbert L. Bridgman, secretary of the Peary Arctic Club, was a delegate to the International Polar Congress held in Brussels in May. At that time Mr. Bridgman presented to the congress the following communication from Commander Peary, the text of which he has made public:

"I beg to state that on my return from my coming arctic expedition I shall endeavor in every possible way, consistent with my other duties, to promote and organize a national American antarctic expedition, to secure for this country its share of the honors and valuable scientific information still awaiting the explorer in that region.

"The project would include the building of another special ship on the same general lines and in the light of the experience gained in building and using the 'Roosevelt,' and the utilization of the methods and equipment evolved during my past seventeen years of arctic work. It would not contemplate my personal association with the expedition in the field.

"While it is too early now to make any definite statement, it is hoped that the Peary Arctic Club may lend its encouragement to the work. This project, I am happy to state, has the approval of President Roosevelt."

At a subsequent session of the commission it is hoped to offer a more detailed presentation of the matter for such action or suggestions as the commission may see fit.

Commander Peary has long had under consideration such an exploration as outlined in his letter.

Villages Situated at Great Altitudes.

The most elevated permanent human habitations in Europe are found in Switzerland. According to the census of 1900, nearly 12,000 persons live at altitudes exceeding 4,900 feet, and more than 4,000 at altitudes exceeding 5,900 feet.

The most elevated communities are found in Grisons. More than half the inhabitants of this canton live more than 3,300 feet, and two-fifths live more than 3,900 feet above the sea level. In the canton of Valais 66 per cent of the population are found at altitudes exceeding 3,300 feet, and 4 per cent at altitudes above 4,900 feet.

The highest Alpine villages are:

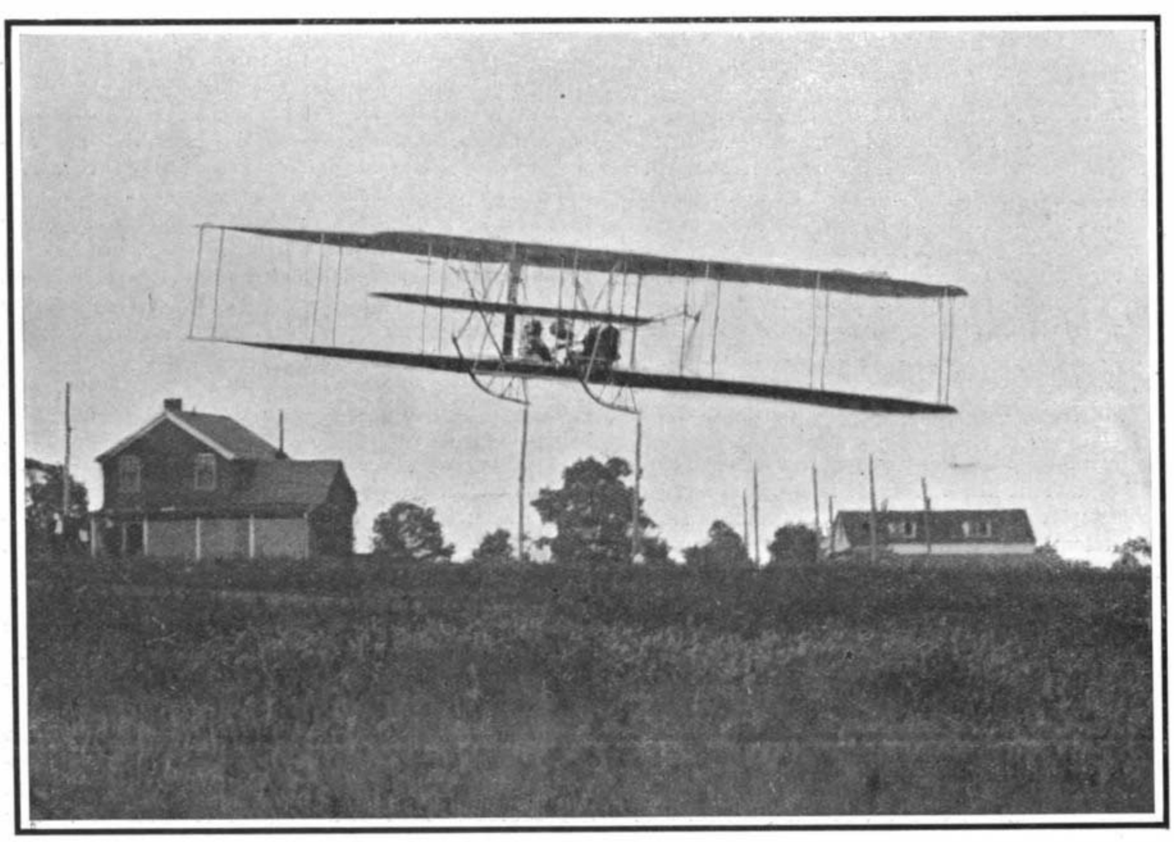
	Altitude. Meters.	Feet (Approx.).	Inhabitants.
Cresta (Grisons)	1,949	6,500	33
Juif (*écart* of Cresta)	2,133	7,100	24
Findelen (Valais)	2,075	6,900	..
Chaudolin (Valais) ..	1,936	6,450	123
Lue (Grisons)	1,918	6,400	59
Arosa (Grisons)	1,892	6,300	1,071
St. Moritz (Grisons) ..	1,856	6,200	..
Pontresina (Grisons)..	1,803	6,000	488

Arosa, which contained only 88 inhabitants twenty years ago, owes its recent increase of population to the establishment of a health resort. All of these villages, with the exception of Findelen, which is inhabited only in summer, are occupied throughout the year. The most elevated shepherds' huts, used only in summer, are those of the Lona Alp in Eringerthal (altitude 2,665 meters or nearly 9,000 feet).

Wilbur Wright in France.

On the 2d instant Mr. Wilbur Wright, after over a week of enforced waiting due to bad weather, again got in the air in France and made a flight in a figure 8 lasting 10 minutes and 40 seconds. He covered a distance of 6 miles in this flight. In a second flight, something went wrong with the starting apparatus.

Manganese steel is now generally recognized as being the only suitable material for street railway track work where any large amount of traffic is to be dealt with, and, as is well known by street railway engineers, this material cannot be dealt with by the ordinary cutting tools, i. e., chisels, saws, files, etc., owing to the extreme hardness of the material.



The First Public Flight of the Wright Aeroplane in America.

THE FIRST FLIGHT OF THE WRIGHT AEROPLANE AT FORT MYER.

SUGAR TESTING IN THE UNITED STATES CUSTOMS SERVICE.

(*Concluded from page 168.*)

this end, and in the Lippich system used in the U. S. Customs Service, the two beams of polarized light are produced by two separate Nicols, the smaller of which covers but one-half the field of the larger. Recently, at the National Bureau of Standards, Mr. Frederick Bates, who is in charge of the work on polarimetry, has devised a polariscope where the angle between the polarizing and analyzing Nicols can be varied for different conditions of solution, thus acquiring the greatest sensitiveness and adaptability to various liquids. A polariscope constructed on this system has the analyzing Nicol and the large Nicol of the polarizing system mounted in bearings and joined by gears with a connecting rod. By rotating the rod with a milled head, the two Nicols are rotated, and the analyzing Nicol receives one-half the angular displacement of the large Nicol of the polarizing system. A circular scale shows the polarizing angle for any position of the Nicols. The apparatus in addition possesses the advantage of having a sensitive thermometer, graduated to one-fifth deg. C., placed between the quartz wedges, and the instrument has a high range of accuracy, enabling the better grades of sugar to be measured with correctness to 0.01 deg. S. This type of polariscope is now used in the control tests at the National Bureau of Standards, and doubtless will be supplied to the chemical laboratories at the Appraisers' Stores.

The duties on sugar are collected under the provisions of the tariff law of 1897, which provides a specific duty of 0.95 cent per pound for sugar under Dutch standard No. 16 in color, testing not above 75 deg. by the polariscope, with 0.035 cent additional for every additional degree, while for sugar above No. 16 Dutch standard and on all refined sugar there is a duty of 1.95 cents per pound. Thus the duty levied by the government essentially is based on the percentage of pure sugar contained in the raw sugar imported as determined by polarimetric examination. In collecting the duty, therefore, the problem is one of determining, first, the exact amount by weight of sugar in a given cargo, thus verifying the invoice; second, a proper sampling of the individual packages of the cargo, in order to afford a basis for subsequent classification and examination; third, the chemical and polariscopic determination of the quality of the sugar, in order to appraise the duty according to the tariff act.

In the United States imports of sugar come almost exclusively to the four great sugar ports, New York, Boston, Philadelphia, and New Orleans, and more recently, since the prominence of Hawaiian and Philippine sugar, to San Francisco. At each of these ports at the Appraisers' Stores are maintained sugar-testing laboratories. The weights, measures, and polariscopic apparatus are standardized and tested from time to time by the National Bureau of Standards at Washington, which institution also maintains a general supervision over the accuracy of the work by checking the measurements of the different samples tested at the various ports by independent measurements of its own.

When sugar is imported and is discharged from the hold of the ship under the direction of the custom inspectors, the first duty is to see that it is properly weighed, the government weighers recording for each half day the weight of all wet sugar, damaged sugar not wet, ship sweepings, dock sweepings, and other sugar, making proper returns to the examiner or sampler in charge. Next comes the taring, or deducting the weight of the containing packages. If the sugar is in tierces, hogsheads, or other irregular or wooden packages, the sugar is removed and the actual tare is taken; while if the sugar is in bags, baskets, or mats, a certain percentage is allowed by the government regulations, unless the weigher in charge may deem actual weighing essential. As this weighing can be done and is done at the wharves of the sugar refineries, where sugar cargoes usually are discharged directly, it is of course possible to do the taring with considerable accuracy when the original packages are emptied.

The government samplers are required to take samples of the different kinds of sugar making up a cargo, and also samples of each package, using various forms of sugar triers, and emptying the samples thus obtained into tin buckets of specified size and form, which as soon as labeled are locked and sent to the Appraisers' Stores. Great care is taken in this sampling that the samples taken shall represent the different packages as correctly as possible, and that the sugar buckets shall be locked and under official custody from the time the samples are taken until they reach the Appraisers' Stores. In weighing, inspection, and sampling, the different government officers are kept in rotation on the various docks, and the greatest care is manifested over the discharge of cargoes of sugar. The sugar samples must reach the Appraisers' Stores by the following day, and there they come under the direct control of the appraiser and his subordinates. Refined sugars too must be tested, and also molasses, adequate samples being taken just as in the case of raw sugars.

At the Appraisers' Stores the first test is to classify the sugars by color according to the Dutch standard as provided in the tariff act, and this is done by experts in the Appraisers' Office, especially if any of the portions are found to be close to No. 16 Dutch standard in color. In case the samples are found above No. 16, they are preserved and sealed, with full data of the shipment, including name of the importer, dates, etc. At the classification room the samples are mixed from not more than three buckets for testing in the laboratory. Two tin cans full of this sugar, with a third as a reserve sample, are prepared, and these without other identification mark than the serial number, are transmitted to the laboratory. The regulations provide that not less than two complete tests by different experts shall be made of each sample sent to the laboratory. If the polarization shown by the two tests is at 92 deg. S (sugar degrees) or above, and if the tests agree within 0.2 deg. S., the average of the two polarizations is accepted as the test of the sample. If the polarization is less than 92 deg. S. and the two tests agree within 0.3 deg. S., the average of the two is taken as the test of the sample. In case the agreement is not within the limits mentioned, the regulations provide for additional tests and also for retests. Once the sugar is tested, the importer is notified by the appraiser of the average test of the cargo, and also the quantity and test of each lot from which such average test is obtained. The importer has two days within which to claim an error and request a retest, which may be allowed by the appraiser for reasons deemed by him sufficient. The classification of the sugar in case of retest is based upon the average of the test and the retest, unless the appraiser is convinced that one or the other is in error. In determining the duty on imported molasses, groups of packages are sampled and classified, and if the molasses is imported in a tank vessel, an average is made of the test of samples taken during the discharge of the vessel. If the samples are thought to contain syrup of cane juice, they are subject to chemical analysis. In this event, if the polarization of the dry substance is above 75 deg. S., the sample is considered syrup of cane juice within the meaning of the tariff; but if the polarization of the dry substance is less than 75 deg. S., it is considered as molasses, which, according to the Treasury Department, is the liquid residuum drained or purged from raw sugar, while the syrup of cane juice is the juice of the cane highly concentrated, but not to the point of crystallization.

To assure perfect uniformity in the testing of imported sugars, it is provided that on each alternate day a sample of the sugar shall be tested at each of the ports of Boston, New York, Philadelphia, New Orleans, and at the same time, duplicate samples of the same sugars shall be exchanged between the appraisers of the said ports and the Bureau of Standards at Washington for duplicate tests. These tests are all reported to the Treasury Department, and thus guarantee the uniformity of the work of testing and the classification. On alternate days also, samples of sugars are tested as to dry substance at these ports, and duplicate samples are prepared and exchanged in the same manner, the tests indicating the direct polarization and the percentage of moisture in the original substance. As the tariff provides in part that sugars after being refined, when tinctured, colored, or in any way adulterated, shall pay special rates of duty, special examinations must be made at the five sugar ports, and also in the case of sugars which are subject to an additional duty where foreign countries impose an export bounty, and the same depends on the polariscopic tests of the sugar, although all other refined sugars, such as cut-loaf, crystals, crushed, or granulated sugar, are deemed to have tested at least 99.5 deg. S. when exported from the country of production.

It will be obvious from the foregoing that the polarization test is the most important part of the proceedings, and it is a quantitative, scientific examination which must be carried on with the greatest accuracy. In fact, several years ago there was considerable discontent on the part of importers with the polariscopic work of the customs officials, and the matter was carried into the United States courts, as the accuracy of the determinations was disputed. The Bureau of Standards on behalf of the national government was able to demonstrate the accuracy of the polariscopic apparatus by evidence of the most conclusive tests, so that the government won the suit, which involved at least several hundred thousand dollars.

The sugar-testing laboratory, where the polariscope is installed, usually is a room as far removed as possible from the vibration of machinery and away from any source of heat which cannot be controlled. The polariscopes are placed in the darkest corner of the room, and the top of the table on which they are set is surrounded on three sides by blackened partitions or walls not less than three feet in height, or suitable curtains of opaque material are hung around the polariscope to cut off interfering light. The instruments themselves must be exposed to the free circulation of the air from the remainder of the room, and the lamp must be 200 millimeters from the instrument and back of the partition, with a small opening for the beam to go through. The great point is to keep the polariscope away from such essential features of a chemical laboratory as ovens, assay furnaces, hot-water heaters, or other sources of heat, and also away from the direct rays of the sun. The standard temperature for sugar testing is 20 deg. C. or 68 deg. F. All apparatus, such as the measures of volume, polariscope tubes, quartz control plates, thermometers, and weights, previously must be tested and standardized at the Bureau of Standards. The thermometers are graduated to the Centigrade scale of not less than one-tenth of a degree. In testing the sugar, the contents of the can are thoroughly mixed by stirring with a spoon, and then 26 grammes are weighed on the balance in a German-silver dish, the operation being done as rapidly as possible, so that the sample does not suffer loss of moisture, as may happen, especially in a warm room. This weighed amount of sugar is then washed by means of a jet of water into a closed flask containing 100 cubic centimeters, in which all the sugar must be dissolved. If the solution thus obtained is clear and transparent, it can be filtered and the 200-millimeter polariscope tube is filled and the cover glasses and screw caps placed in position on the ends. In case the liquid is not clear and transparent, a clarifying solution, such as subacetate of lead, is added, and the solution filtered as before, while in the case of a very dark solution, such as dark-colored molasses, when it is too dark to polarize even in the 100-millimeter tube, boneblack may be used in the filter. Before any reading is made on the polariscope tube, a quartz control plate that has been standardized is placed on the polariscope and a careful adjustment made. It is known that quartz of a certain thickness will rotate a beam of polarized light a certain amount as compared with a normal sugar solution, so that with a test plate thus measured with precision and its equivalent in sugar degrees determined, the direct readings of the polariscope can be tested. Then the polariscope tube is placed in the polariscope, after the observing telescope has been adjusted so as to bring the dividing line between the two halves of the field into sharp focus and to secure an equality of tint. The wedges then are adjusted to secure the same equality of tint and a reading is made on the scale, which is graduated direct in sugar degrees. The regulations provide that the tube shall be read on two different instruments by the same observer, and not less than three careful readings of the tube shall be made on each instrument. The average of the readings is taken, and is corrected by the quartz control plate.

To determine the moisture in sugars, a small amount is dried at a temperature of 98 deg. C. for two hours in a small nickel dish about two inches in diameter and three-fifths of an inch high. Molasses syrups and *masse cuites* are similarly dried in a flat dish.

Once the quality of the sugar thus is determined, the matter passes into the ordinary routine channels of the appraisers' and collectors' offices, unless some appeal is made from the duty. The great uniformity that has been reached in sugar testing is characteristic of the appreciation of scientific methods in the work of the United States government and the co-operation of the different branches of the government toward this end.

Helium Gas Heavier Than Liquid.

We are used to thinking of gases as always less dense than liquids, and in fact we have never hitherto been able to increase the density of a gas, either by compressing or by cooling, down to the point where it becomes heavier than a liquid in contact with it. This could not take place, of course, if the gas became liquid or dissolved in the liquid. Dr. Kammerlingh Onnes has, nevertheless, accomplished this surprising feat by causing a bubble of compressed helium to descend by its own weight through liquid hydrogen, like a drop of water in oil. He compressed a mixture of hydrogen and helium in a capillary tube plunged into liquid hydrogen. The hydrogen becomes almost entirely liquefied and, if the pressure does not exceed 49 atmospheres, occupies the bottom of the tube. Beyond this pressure a bubble of almost pure helium, which is floating on the liquid, is seen to descend below it, and to rise again when the pressure is decreased to 32 atmospheres. Besides its originality, this experiment will enable us to ascertain . . . the limit density of helium, which Van der Waals supposes to be that of the heavy metals.—Cosmos.

It is reported by Consul-General Robert J. Wynne that the ninth tunnel under the Thames, London, will shortly be opened. Of the tunnels under the Thames, five are used exclusively by subways and railroads, and the other four used for general traffic.