

by special printings of the maps constructed by the Royal Prussian Land Survey, and it is planned to extend the system over the whole country. The scale is 1 to 300,000, and the elevation of the land is indicated by the ground tint of each part of the map, according to the following scheme:

Elevation in Meters.	Color.
0—250.....	white
250—500.....	orange yellow
500—750.....	raw sienna
750—1,000.....	burnt sienna
1,000—1,500.....	lilac gray
1,500—2,000.....	dark lilac gray
2,000—2,500.....	dark violet
2,500—3,000.....	light violet
Above 3,000.....	white

Contour lines of three types, continuous, interrupted and dotted, printed in sepia, are also used. All information which is needed by aviators and aeronauts and not contained in the ordinary Land Survey maps is printed in red, appropriate symbols being employed to designate various objects.

Albert Senouque who was a passenger and observer on the Maurice Farman biplane, with which Eugene Renaux won the Michelin Grand Prix by a flight from Paris to the Puy de Dôme, on March 7th, regards a compass as absolutely indispensable for long flights and says that Renaux steered entirely by the compass during the first sixty-five miles of this journey, which began at 8.50 A. M., when even the river Seine was not discernible at any great distance. The compass, of course, should be compensated for the influ-



Fig. 10a.—The roof of one of the military hangars of Camp de Chalons, on which an aeroplane signal is painted.

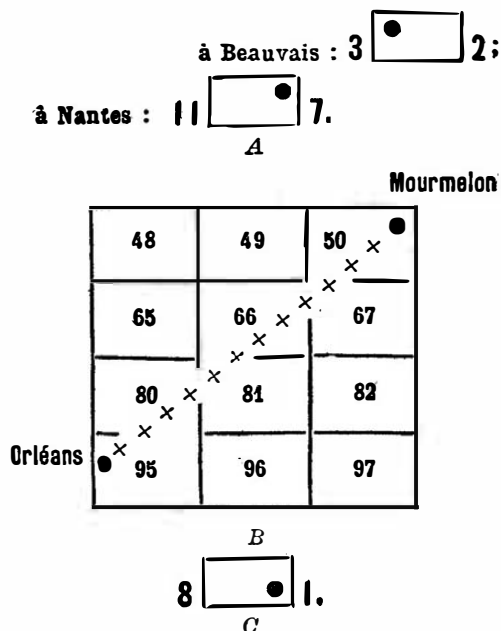


Fig. 10b.—How towns are marked to guide the airman.

ence of iron masses in the aeroplane and should have its outstanding deviations carefully determined, as had been done in this instance.

Daloz has invented a special compass which not only facilitates the task of holding an aerial vessel, traveling overland, to a prescribed course, but also indicates the velocity of flight. The compass card is transparent and bears a number of parallel lines. The circumference is graduated in degrees, the zero marking one end of the median parallel line. The needle is not rigidly attached to the card, but can be clamped to it in any azimuth. The card is set so that the parallel lines point in the direction of the prescribed course and the vessel is so steered that the image of the landscape, thrown on the transparent card by a lens beneath, moves across the card in the direction of these parallel lines. The velocity is determined by means of two lines which intersect these parallels at right angles. From the time which a conspicuous point in the image of the landscape occupies in passing from one of these lines to the other, in connection with the height of the vessel above the ground, as determined by the barometer, the speed of the vessel is easily computed, for the distance between the lines corresponds, in the image, to a real distance of 100 meters, when the instrument is 100 meters above the ground.

Mr. A. G. Marquis, of Rochester, N. Y., has invented a compass with a south-pointing needle and a card which is attached to the frame instead of to the needle, and is marked with the points of the compass in reversed order. When the needle and card are

viewed by reflection in a mirror inclined 45 degrees to their plane, the card appears to remain stationary and the needle appears to point in the direction in which the vessel is moving. (SCIENTIFIC AMERICAN, March 4th, 1911.) The oscillations of a compass used in aviation should be deadened by flotation or partial immersion in a liquid, or otherwise, and it is also desirable to protect the instrument from the vibrations of the motor. One aviator uses a compass floating on oil in a vessel which is packed loosely in horsehair.

Two beacons have been installed at Spandau, near Berlin, for the guidance of aeronauts and aviators at night. One of these beacons is a revolving light provided with a Fresnel spherical lens of $7\frac{1}{2}$ inches focal length surrounded by catadioptric rings, of the type commonly employed in lighthouses. The rays which are emitted directly and obliquely downward are brought above the horizon by a reflector and a series of prisms. The illuminant is acetylene, obtained from the steel cylinders in which it is sold in condensed form. The light is revolved by a turbine operated by the pressure of the acetylene, which passes through the turbine on its way to the burner. The consumption of acetylene is about 8 gallons per hour, and the range of the light is about 10 miles. The range can be doubled by substituting an electric arc and a lens of 12 inches focal length.

The smaller beacon is illuminated by 30 incandescent electric lamps of 50 candle-power each, arranged in six circuits, each of which consumes 6 amperes of current. A triphase current of 220 volts is employed. The light is stationary but intermittent, the circuit being made and broken by an automatic interrupter at intervals of two seconds. The range of the light is about 1,600 feet.

Naval Aviation

By Capt. W. Irving Chambers, U. S. N.

A SHORT time ago, when flights were made in perfect weather only, the navy regarded aviation with complacency. Now that the greater possibilities of flight under average weather conditions have been demonstrated, a majority of our officers are eager to have a hand in the development of aviation for naval purposes, and the fascination of aerial navigation now appeals so forcibly to the spirit of daring in our young officers and men, that our chief difficulty in the future may possibly be so to temper their enthusiasm for flying as to insure the performance of other more necessary and more important duties with the usual degree of efficiency.

I have not the least doubt that these fine young fellows would soon be capturing altitude and other records if allowed to do so, and that to advocate conservatism in aviation now, in the face of its present popularity, will seem almost heretical to them.

But a certain amount of conservatism, at least in the naval branch of aviation, is imperative, and, as aeroplanes are quickly made, it seems to be sound policy for the navy to make haste yet a little slowly until the machines are better adapted to our special needs or, at least, until we have a sufficient number of aviators trained to use them and to measure their efficiency under service conditions.

A conservative policy is evidently that of foreign navies also; but it is known that France has already two naval aviators and one naval aeroplane, that the English navy has two naval officers under instruction through the courtesy of the Aero Club of Great Britain, and that Italy, inspired by some aeroplane experiments recently made here, in conjunction with our ships, is about to develop a suitable machine of the class that we have already evolved in this country.

In fact, although the United States Navy does not as yet actually own an aeroplane, our small beginnings in the development of naval aviation, or the practical efforts that we have made within the last six months have attracted the attention of other naval powers, and we will doubtless soon learn of great advances in the improvement of aeroplanes for naval use generally.

It was only last summer that demonstrations of air flight in this country made it seem probable that aeroplanes could be used from a ship. At that time the principal factor in the general development of aviation seemed to be the stimulus afforded to aviators by substantial money rewards for exhibition flights, and Mr. Eugene Ely deserves special credit for cheerfully and enthusiastically entering into the spirit of naval aviation without the prospect of any reward whatever.

Mr. Ely may be regarded as a pioneer in this branch, although it should be recorded that he might not have been able to attempt his brilliant work under the auspices of any other than the liberal, yet safe, management of Mr. Glenn Curtiss.

It was fortunate for us that one school of aviators was ready and eager to co-operate with the navy;

for this connection with the Curtiss school led to a series of progressive experiments that have resulted in the production of a naval aeroplane that is almost perfect.

With this machine Mr. Curtiss is able to arise from or alight on either land or water. He can land on water that is comparatively rough. His "Triad" can be hoisted in and out like a ship's boat and, in accordance with plans already perfected by Mr. Curtiss, we will probably soon be able to launch this machine from shipboard without the necessity for any special platform or the provision of any extra gear that may not be rigged or unrigged in a few minutes.

In my opinion, Mr. Curtiss has recently done more for the development of naval aviation than any other man in the world and he deserves special honor for his liberality and foresight.

The usual policy of aeroplane builders is to make the training of military aviators contingent upon the sale of their machines but Mr. Curtiss early adopted the policy of offering to instruct officers of the army and navy in aviation unconditionally, and it is due to this liberality that the navy is ready, now, to train its own aviators, although the money appropriated for independent work in aviation will not be available until the first of July.

The Wright brothers, of whose work the country is justly proud, have also offered to train a naval aviator, and we anticipate the early inauguration of a systematic course of instruction in aviation, entirely under the auspices of the navy, at our own aerodromes, which for obvious reasons it is desirable to have so located as to be accessible to naval vessels.

I regard the development of the naval aeroplanes, or hydro-aeroplanes (the Curtiss type of which has been named the "Triad" from its triple power to function on any of the three elements, air, land or water) as marking an important epoch in aerial navigation.

If ever trans-oceanic flight by aeroplanes is accomplished, I presume it will be due to the further development of this class of machine. By its use aerial navigation becomes a matter of comparative safety and a means of delightful pleasure trips and sporting events over water.

There is now and always will be sufficient talent in the navy to build its own aeroplanes as well as to operate them and to keep them in the van of progressive aerial architecture. But it is a well known policy of the Department to encourage private industries in the development of war material and, as this policy will doubtless prevail for some time with respect to aeroplanes, I see no good reason for the navy to attempt now to build its own aerial machines. It is hoped, however, that this policy will not prevent the navy from making its own laboratory experiments, conducting its own scientific investigation of the problems of aerial naval architecture and engineering and establishing a sound system of standard tests for workmanship. It is also hoped that this policy will not prevent the navy from eventually embodying, in its standard machines, the best points of all makes that are specially suited for naval purposes.

From my point of view, the principal problem in future flight is the improvement of the motive power. It is the most important because most difficult. Of course, there will be great improvements in the details of shapes and materials and in the assemblage of various other accessories, but we would have been flying fifteen years ago if we could have commanded then the same degrees of efficiency and reliability of the motive power that are at our command to-day. It seems to me, therefore, that there should be some recognized and authoritative government testing or comparing station for motors and propellers in order to make effective progress in their development. Suitable facilities for this work already exist in the navy. The motors and propellers for future naval aeroplanes will doubtless be thoroughly tested and compared, both in the shop and during flight, at the Engineering Experiment Station at Annapolis and at the aerodrome in that vicinity. In this way the navy may be able to assist in the desired general development.

As for laboratory work connected with the test of models and the materials that enter into the architecture of aeroplanes, the government model plant at the navy yard, Washington, is already well equipped for prosecuting scientific investigation in this direction. There we have suitable delicate recording instruments, a corps of expert woodworkers or model makers and draftsmen under the direction of mathematical experts, and all under the disciplined organization of the Navy Department, ready to undertake the work almost immediately.

I anticipate that, by the introduction of aviation in the navy, we will be able to develop substantial improvements in certain necessary instruments such as the aeroplane compass, for example, and that we

will be able to add something of value to the science of meteorology. Those of us who were brought up in sailing ships realize that our dependence on the wind and weather sharpened our weather instincts. Aerial navigation will doubtless develop in our future naval airmen a yet keener appreciation of weather indications, through their greater dependence on them, and the meteorological observations of these men will doubtless be recorded systematically.

Advanced Study in Electrical Engineering at the Massachusetts Institute of Technology

THE year just completed at the Massachusetts Institute of Technology has found the graduate study which is provided in electrical engineering with an increasing number of students. Prof. Jackson's lectures on the Organization and Administration of Public Service Companies were attended by a class of twelve graduate students and Prof. Pender's lectures on Advanced Alternating Currents and the Transmission of Power were attended by an even larger number of graduate students. Prof. Wickenden's advanced course in the Design of Central Stations and Distribution Systems has also been in demand.

Besides graduating the largest class from the undergraduate course which the Institute of Technology has heretofore graduated in electrical engineering, one degree of Doctor of Engineering and four degrees of Master of Science were conferred on men taking their major work in electrical engineering.

The applicants for permission to become candidates for advanced degrees in electrical engineering are already more numerous than they were last year, and particularly is this true in respect to graduate students who intend to study the problems of electric railroads, electric transmission of power and the organization and management of public service companies.

The Electrical Engineering Department of the Institute of Technology received an appropriation of \$3,000 from the Edison Electric Illuminating Company of Boston to be used in an investigation of the relative operating reliability and cost of electric trucks, gasoline trucks and horse trucking, for the purpose of determining to what degree electric trucks are adapted to compete with gas and horse trucks in the city of Boston. This investigation will cover the cost of delivery of goods in the different ways. It will include all questions which concern electric trucks, including the influence of the different kinds of city pavements on cost of delivering goods, and the effects of different routings of the vehicles. The investigation will be partly theoretical but it will be planned to determine practically what it ordinarily costs to deliver goods under city conditions. This part of the investigation will be accompanied by actual observations extended over a period of many months. At least a year will be occupied in this work, and Mr. H. F. Thomson has been appointed Research Associate to carry on the work under the direction of Prof. Pender.

The Current Supplement

CITY life presents pressing and peculiar biological problems. One of the most important is the removing of the city's wastes. By the modern methods of sanitary science, these wastes can be purified and rendered harmless. It is with such methods of protecting the purity of inland and seaboard waters that the opening article of the current SUPPLEMENT, No. 1853, deals.—Prof. Henry S. Jacoby, of Cornell University, writes of recent bridge construction in America.—Dr. L. A. Bauer continues his discussion of Ocean Magnetic Work.—Electric energy is sold to consumers either by contract or at a rate proportionate to the current consumed. In the latter case the current is measured by meters. The various meters employed are described and illustrated.—The fifth of Sir J. J. Thomson's Royal Institution lectures on Radiant Energy and Matter is presented.—Major George D. Squier's paper on Multiplex Telephony and Telegraphy, by Electric Waves Guided by Wires, passes to its second installment.

The Microphone and Hidden Water

THE French inventor Dienert has contrived an application of the microphone to the discovery of underground water. One end of a tube is inserted in the ground, the upper end being attached to the microphone. The sounds of flowing or dropping water are conveyed to the ear from great depths.

In the Marne valley two springs were discovered with this apparatus at a depth of about fifty feet below the surface of the ground. It is believed that the apparatus will be of great service in mining operations both for indicating the location of concealed springs and for communicating with imprisoned miners.

Correspondence

The Forthcoming Merchant Marine Number

To the Editor of the SCIENTIFIC AMERICAN:

One of the most noteworthy announcements made recently in your paper is the one telling its readers of the forthcoming (July 15th next) issue devoted to the "American Merchant Marine."

When I read this, a thrill goes through my heart; I feel a disgrace, a humiliation, a sense of shame, never felt before. When I was a boy, in Missouri, some great statesmen told us in school, out of school, and in the press, how the American clipperships were once seen on every sheet of water of the earth, while now we are suffering as a nation after the civil war, but every American heart should hope: *that the future would remedy all this.*

Most of these men, as I now realize, were the old school protectionists, who delighted to believe their own stories and who were then, as their followers are now, disciples of Baron Münchhausen.

Yes, Mr. Editor! your July 15th number should prove an awakening, not only among the scientific men of the country, but among all true Americans.

Will this number reveal the actual facts? Or will the facts be colored through Pennsylvania glasses? I hope not! Mr. Munn always stood for the truth and nothing but the truth; such as I have known him for forty-six years. It is the real mission of the SCIENTIFIC AMERICAN to smash the system which caused the destruction of our merchant marine. Every schoolboy, every citizen should learn to detect the fallacies which have been saddled upon this great nation in connection with the merchant marine.

I hope July 15th will be a red-letter day in the history of the American nation. We shall see!

MAX JÄGERHUBER.

Turner, Orange County, New York.

Aeroplane Stability

To the Editor of the SCIENTIFIC AMERICAN:

I anxiously looked forward to the publication of your May 13th or "Aviation Number," and have read your admirable production with great pleasure. Being in the profession of civil engineering, and having had the privilege of lecturing on "Mechanical Flight" at numerous occasions, dating from 1904 to the present year, I have watched closely all articles that deal with the stability and adaptability of the flying machine, as these have been the principal lines of my studies.

Your editorial rightly mentions that the most important element in the flying machine is stability, with the conclusion that we shall ultimately come to a type of a machine which possesses inherent stability independent of devices requiring equilibristic skill of the operator.

Particular attention is given to the late Octave Chanute, his constant endeavors and his advocacy of automatic stability, but to my knowledge he never even offered a theoretical solution for stability.

In Mr. Marius C. Krarup's article, he refers correctly to the present flying machine as "in part a flying machine, and in part a death trap;" and says that "It is without the addition of a single new fundamental idea to supplement or correct its original design." He asks, "What does the engineer say, the man whose profession it is to compare the creations of inventive genius with the data of applied science?" He further states, "Suppose we recommend that inventors work a little harder, and invite imitators to retire from their pernicious activity."

In Mr. Marius C. Krarup's article, he refers correctly to "Stability of the Flying Machine," he says that "the common dihedral angle of the two halves of the main planes to each other, and of the main planes to the keel or tail, give a measure of automatic stability that is now widely understood."

Using the above extracts for the basis of this letter, as an engineer I desire to strongly advocate the necessity of serious study by the inventor and engineer for the accomplishment of stability and adaptability of the flying machine, if the universal use of the same is desired. I agree thoroughly with your statements that it is time to stop imitations, and to work on lines that are founded on better engineering principles.

In the first place, the construction of the machine itself undoubtedly can be greatly improved, by following the well-known forms of truss construction, whereby diverging struts should supplement vertical struts as in the present machine, thereby doing away with the cross chords that tie the present structure together, and in a measure hold their separate parts in rigid relationship to each other. The modern tubular steel is admirably adapted for the construction of the flying machine, and to my mind may be used to the exclusion of wooden braces, with their weak joints and connections.

My studies on mechanical flight have led me to design a machine, whereby automatic stability is theoretically obtained by constructing the wings of either side as separate structures, and pivoting them on the central longitudinal line. The wings of the machine during propelled flight would be mechanically held in a horizontal position as with the present machine, having a very slight, if any dihedral angle; but in case of loss of forward propelled motion or stability, the wings would be automatically raised, as in natural flight, leaving the weight of the body and central portion of the machine below the upraised sustaining areas. This would bring the machine to earth in an upright position, with retarded motion. This proposition is of the simplest construction, the shaft of the engine, being the pivotal axis of the wings.

Together with this theoretical solution for automatic stability, I have furthermore advocated the necessity of adaptability, whereby a machine may alight and travel on the water as would a motor-boat, or alight on and travel over land, as would an automobile. This may be accomplished by simply attaching below the sustaining areas spherical or cylindrical rotating hollow floats, further eased and made buoyant by being encircled with modern pneumatic tires.

In promoting the art of mechanical flight, an engineer or inventor is handicapped in the development of his ideas, unless he is endowed with the necessary finances for constructing the same; and I find that publications, as well as individuals, make it very hard for one to develop meritorious propositions of this kind, by insisting upon the inventor or engineer proving his theories before the necessary financial assistance is given.

In reference to your list of the \$1,000,000 in prizes being offered, I find no prize available for the development of stability and adaptability in the flying machine.

A prize of \$25,000, to be handled by the SCIENTIFIC AMERICAN, in the development of that part of the art, would do more for the advancement of the flying machine toward universal use than the entire \$1,000,000 offered, as recounted in your issue.

In these experiments calling for construction and practical demonstrations of the theoretical propositions a good rule to follow would be that unless the theoretical proposition could be eliminated by the judges handling the fund, it should receive the assistance of the fund in the construction and demonstration of the machine.

J. EMERY HARRIMAN, JR., C. E.

Boston, Mass.

Waterspouts in Nantucket Sound

To the Editor of the SCIENTIFIC AMERICAN:

In the current issue of the SCIENTIFIC AMERICAN I read with much interest the article on "Waterspouts." Nantucket whalers, returning from long voyages, frequently related thrilling experiences with waterspouts in the tropical zone, but it was not until the summer of 1896 that the islanders themselves had the privilege of viewing one of these phenomena, for it is rarely that a waterspout has been seen in northern waters. In fact, the spout which made its appearance in Nantucket Sound in 1896 is said to be the farthest north of any on record.

This waterspout appeared in the Sound midway between the islands of Nantucket and Marthas Vineyard, near the Cross Rip lightship, on the afternoon of August 19th, 1896, and I have an excellent photograph of it in my possession. The waterspout accompanied an ordinary thunderstorm, and its progress was noted by the Weather Bureau officials on both islands, the data being on record at the Nantucket station. It first made its appearance at 12:40 P. M., when a tongue shot down from a dense black cloud, rising and falling a number of times. Suddenly a second tongue seemed to leap out of the water and joined that hanging down from the cloud. Twice the waterspout parted, but it joined together again almost instantly, the phenomenon continuing in plain sight of the residents of Nantucket and Marthas Vineyard islands for half an hour.

The spout apparently had no side motion, and it was surrounded by a flat calm, extending over a radius of several miles. A small schooner and a catboat were becalmed within a mile of its base, and those on board the vessels stated that the heat experienced was very oppressive. When the spout broke a cool summer breeze sprung up in the Sound, and the surrounding waters seemed to be full of cross currents and "eddies."

Nantucket sea captains who witnessed this phenomenon stated that the spout was the most pronounced of any they had seen, even in the warmer climes. This is the only time a waterspout is known to have made its appearance in Nantucket Sound.

Nantucket, Mass.

HARRY B. TURNER.