

have been so arranged that about half the total supply of ammunition will be carried at each end of the vessel, and four ammunition hoists driven by constant-speed electric motors will deliver ammunition to the guns. Battle order and range indicators will be fitted in accordance with the usual naval practice.

The engines are Curtis marine turbines, 120 inches diameter, 7-stage reversible, located in separate compartments, of a combined brake horse-power of 16,000, arranged for outboard turning propellers when going ahead. The steam pressure at throttle valve is 250 pounds, and maximum revolutions at full power about 350 per minute. The necessary auxiliaries and accessories will be provided in accordance with the practice of the Bureau of Steam Engineering.

There are twelve watertube boilers of the Fore River "Express" type, placed in three watertight compartments, with a total grate surface of 693 square feet, and a total heating surface of 37,080 square feet. The working pressure is 275 pounds per square inch. The steaming capacity will be such that all the steam machinery can be run at full power with an average air pressure in the firerooms of 5 inches of water. The "Salem" carries four smokepipes, each 75 feet high above the base.

The arrangement of the quarters provides accommodation for a commanding officer, twelve wardroom officers, five warrant officers, and 340 men. The quarters for the officers are located in the after portion of the vessel, with the usual staterooms, messrooms, etc., as customary in the naval service. The amidship and forward portions of the vessel are given up to the crew, with the usual lavatories, dispensary, sick bay, etc. Quarters for the chief petty officers are provided on the orlop deck forward. For our illustrations and particulars we are indebted to Mr. Francis T. Bowles, President of the Fore River Company, and formerly Chief Constructor of the United States Navy.

Silk from Spiders.

Because of the external resemblance between silk and spiders' webs, it seemed likely that both consist of similar materials. As, however, most spiders' webs are entangled with insects, dust, and other foreign objects, it has so far been impossible to collect a sufficient quantity pure enough for chemical analysis. At the recent French Colonial Exhibition held at Marseilles there was exhibited an interesting silk-like product, which was derived from a big spider living in Madagascar, and which will possibly be manufactured in the near future as a substitute for ordinary silk. In fact, a French Jesuit father, M. Camboué, has installed at Tananarivo a testing plant, in which the spiders are reared in order to be artificially deprived of their webs. Each spider will yield 150 to 600 meters of silk thread at a time, and will die after being emptied five to six times in a month. These webs are of a very beautiful orange-yellow hue.

Prof. E. Fischer, of Berlin, recently succeeded in obtaining a sufficient amount of this substance to carry out a thoroughly scientific analysis, the results of which are given in a paper read before the Berlin Academy of Sciences.

The main component of ordinary silk, viz., a substance called silk fibroin, is a protein which is remarkable for the simple amino-acids that it contains. Spiders' silk was found to be of a quite similar composition, but for the absence of any component soluble in water (glue) and the presence of glutamino-acids. Its beautiful orange color is another distinctive feature.

Because of this remarkable affinity between the two substances, their external resemblance cannot be considered fortuitous. Both substances are known to be produced from the liquid secretion of glands, which on issuing from the animal's body immediately coagulates, acquiring a surprising mechanical strength. This process calls to mind the coagulation of blood. It is true to say that the spinnerets giving off the spider's web, from a morphological point of view, are markedly different from the glands of the silk worm, which supply the material for the silk thread, and which are considered by zoologists as modified salivary glands. The chemical similarity of secretions from organs so dissimilar will be found the more remarkable.

Simple Silvering Process by Dipping.

Roselein has invented a process of silvering without the use of the electric current, and which is specially applicable to small articles of brass or copper, as buttons, screws, hooks, etc. The bath is composed of 22.5 liters of water, 0.906 kilogramme potassium cyanide, and 225 grammes of silver nitrate. Although the cyanide and the nitrate can be dissolved together in water, it is better to dissolve them separately and mix the solutions. Both should be used hot; the best temperature being 50 deg. to 60 deg. C. (122 deg. to 140 deg. F.). The articles to be plated, after having been cleaned, are placed in baskets or attached to wires, and hung in the bath. The silver is deposited almost immediately. If the surface of the articles to be plated is polished, that coating will also be pol-

ished; while on matt articles the coating will be matt.

The solution is not to be strengthened from time to time, but used up; and when no more silver is deposited, the bath is to be thrown away. Adding new silver does not improve the work; on the contrary. This is probably because there is a gradual addition of copper or brass, from articles to be plated, to the bath.

A HOME-MADE AIR THERMOMETER.

BY BAKER BROWNELL.

Among the various instruments which have been devised for the measurement of temperature, the air thermometer has the distinction of being the first form of any value. It was invented probably by Galileo about the year 1593, and was used to a considerable extent by physicians; but its readings were deceptive, for at that time the influence of atmospheric pressure was unknown. Galileo invented the alcohol thermometer eighteen years later, and this more accurate and at the same time more simple instrument almost entirely superseded the older form.

In some ways, however, the air thermometer is more efficient than either the mercury or alcohol thermometer. Since it is based on the principle of expansion of a gas, the air thermometer is very sensitive, and offers a large register for a small change in temperature. The reason for this greater susceptibility to heat is evident from the following data. The coefficient of expansion of air is 0.003665, or approximately 1-273 of the volume; the coefficient of mercury is 0.0001815, or 1-5510. Thus, a cubic centimeter of air, upon the application of one degree Centigrade of heat, will expand about twenty times as much as an equal volume of mercury. Besides this, a greater quantity of air than mercury can be conveniently utilized for expanding.

A simple air thermometer can easily be made. The materials needed are a thin, hollow sphere or bulb of glass, about two inches in diameter, having as an outlet a glass stem from eight to twelve inches long, of about one-eighth inch inside diameter. A bottle of considerable weight, about three inches in diameter and from three to five inches high, is necessary. (Any ordinary rather small bottle will do.) This should be half filled with eosin solution or otherwise colored water. A cork stopper for the bottle, having a hole through it large enough to admit the glass stem. The stem must now be partially filled with the eosin solution. This can be done by warming the sphere with the hand, and holding the end of the stem under the surface of the liquid. Some of the expanded air is expelled, and when the hand is removed from the bulb, the eosin solution rises gradually in the tube to fill the vacant space caused by the contraction of the cooling air. If temperature changes not far from the normal are to be registered, the eosin should stand finally at somewhat over half way up the tube. It is rather difficult to reach a satisfactory result sometimes, and several trials may be necessary. They are easily repeated, of course, for the liquid already in the tube can be driven out by warming the bulb again.

Two grooves, running lengthwise, should be cut into the sides of the stopper to provide for free communication between the air in the bottle and the outside atmosphere. It is essential that the bottle should not be corked air-tight, since this condition would cause a counter pressure of the air in the bottle whenever the air in the bulb is expanded. When the cork stopper has been put in, and the stem of the glass sphere inserted so that the end of the tube is under the surface of the liquid, the air thermometer is complete. A scale of degrees marked on cardboard may be put back of the tube, or the gradations may be scratched on the glass itself, but the readings will be inaccurate, for they will vary with every barometric variation, since the air pressure on the liquid in the bottle fluctuates. In only a much modified and rather complex form can the air thermometer be relied upon for exact measurement.

The delicacy in action of the air thermometer makes it very useful in detecting sudden local changes in temperature. Interesting experiments can be performed with it; for instance, if a piece of filter paper saturated with ether is placed on the bulb, the eosin

quickly rises because of the heat absorbed in evaporation. Because of its inconsistencies in readings, however, it is wrongly named as a definite measurer of temperature, for it is really only a thermoscope.

A German Military Airship.

During the course of the last few months decisive alterations have been made in the scope and service of the German Aeronautical Battalion, the merely tactical exercises so far carried out on ordinary free balloons being supplemented by experiments on steerable airships. At the same time the barracks provided for this battalion in the neighborhood of Tegel have been enlarged, and a special corps of engineers organized to design and build a really practicable motor-driven airship for military purposes.

The new airship, according to a recent notice in the Berliner Tageblatt, is designed on similar plans to the Parseval airship, and after having been constructed and tested in perfect secrecy, has performed with satisfactory results a first four hours' trial run. The airship would navigate at a height of 1,500 meters (nearly a mile) with a speed of 45 to 50 kilometers per hour, showing remarkable stability. It is of spindle shape, and is kept horizontal on the escape of gas by two ballonets arranged behind one another, and into which atmospheric air or gas is pumped.

The platform affords accommodation for six persons, and can be armed with guns. Equilibrium is maintained by weights running along bars, which readily compensate any readjustment in weight due to movement or the consumption of ammunition. The experience gained in connection with both the Zeppelin and Parseval airships thus seems to have been utilized to the best advantage.

Dynamos for supplying current to the propellers have been provided, and this airship promises to be a reliable factor for military operations, if its mobility proves to be as perfect as the first trials indicate.

From the Alps to the North Sea in an Airship.

Owing to the special attention which is now being paid to the airship problem on both sides of the ocean, and the recent successful trial trips of French aeronauts, it will be of interest to give some details of a scheme worked out by Count Zeppelin, the well-known German airship constructor.

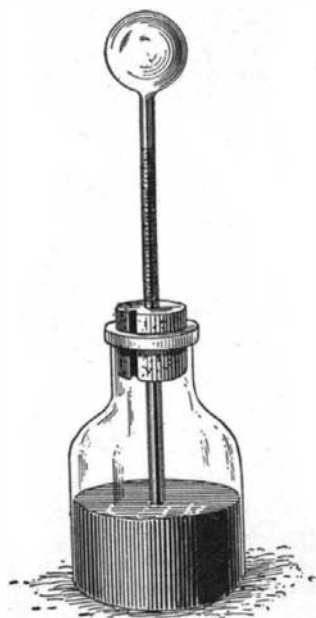
Zeppelin intends shortly to start on a flight from Friedrichshafen, on the Lake of Constance, to Emden, on the North Sea, and back on the same way, thus twice crossing the whole of Germany.

According to reports in the German daily press, this scheme will be quite practicable from the theoretical point of view, Zeppelin's airship being large enough to store the material required for operation. The distance to be covered on its way would be about 1,600 kilometers (1,000 miles); and supposing the balloon to traverse 60 kilometers (37½ miles) per hour, the whole flight would be completed within 27 hours. When allowing, for the sake of safety, for a journey of forty-eight hours, the flight would still be possible, the amount of benzine carried by the balloon being sufficient for fifty hours.

As regards the practical part of the problem, the maximum journey so far recorded by Zeppelin's airship lasted two hours, while even Lebaudy so far has not completed any flights lasting more than three hours. Some difficulty would be experienced in recharging the balloon if this proved necessary. The direction of the wind would likewise be an important factor to be reckoned with, and even if the wind on starting were specially favorable, it would be the less favorable on the return journey. Finally, there has not so far been a flight without incidents, and these on such a long flight would obviously be the more frequent.

Another factor to be considered is, that the enormous consumption of benzine, as entailed by such extensive flights, would be equivalent to an automatic throwing of ballast, the airship rising ever higher. In order to counteract this, Zeppelin would have to let out gas; and this again would have to be compensated for by throwing out ballast. The resulting alternative rising and falling of the balloon would doubtless put the motor to a severe test. Whether the aeronaut will be able to counteract this phenomenon by dynamical means, keeping his airship at the required height, will have to be ascertained by practice.

Another interesting scheme has been enunciated by Major von Parseval. This aeronaut intends gradually to extend the range of his airship by circular tours of ever-increasing extension, and to begin by a flight round Berlin. This flight will involve a distance of about 60 kilometers (37½ miles) to be traversed, and as this could be done in one and one-half hours, this scheme, while being far more modest than the one above described, would have the undoubted advantage of being considerably more practicable.



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