erable excess in weight, the craft will be fit for operation as long as the driving mechanism is operative and there is a sufficient supply of fuel.

The Parseval airship has a radius of action of ten hours, which period may, however, be lengthened considerably, if the ballast consists entirely of gasoline.

The speed is placed at 45 kilometers per hour (27.9 miles), thus insuring a range of 225 kilometers (139 miles) in the case of a ten hours' operation in calm air. A few hours are required to get the craft into working order. A large two-horse wagon is sufficient to transport the airship when deflated.

Ship Elevators.

In a paper read before the Austrian Engineers' and Architects' Society, and reported in the official organ, the Zeitschrift des Oesterreichischen Ingenieur und Architekten Vereines, Dr. A. Riedler—speaking more particularly of the competition for designs for the projected ship lift at Preran—pointed out that the results of such competitions can never possess any widespread applicability, owing to the preponderance of local conditions influencing the design in every case. The two essential considerations, however, in the mechanical part are reliability in working and reasonable prime cost, and to these may be added as subordinate, though important, conditions, simplicity, ease of supervision, and accessibility and interchangeability of parts. So far as the engineering part of these projects is concerned, it cannot be determined beforehand with the same degree of accuracy as is possible with the machinery, but is largely dependent on subordinate circumstances, all foundations and underground construction being influenced by the nature of the ground. Nevertheless, it is possible to fix as a standard for underground construction a limit that will be seldom reached in practice, and thereby insure absolute reliability in working, by reducing the pressure, set up on the site by the structural work, to the natural pressure. This ideal cannot be realized in the case of lifts where concentric loads, deep foundations, high supporting walls, etc., are in question, at least not without great expense. On the other hand, in the case of inclined plane lifts, this broad condition can be easily fulfilled by adopting a suitable form of construction, the reliability of working being far greater than is attainable in engineering works as a rule.

The inclined plane system is also the only one that can be constructed at a low cost, but it is essential that only a single and sufficiently high speed should be used, and that the dry-haulage method should be adopted in order to save the weight of the water trough. All the plans hitherto proposed for affording an elastic support to ships when out of the water are based on an erroneous idea, and calculated to defeat their own purpose, the only reliable way being to recognize the fact that all ships undergo deformation when loaded and afloat, and to adapt the supports to the actual form of the vessel and then fix them in a perfectly rigid manner. The hydraulic press forms the best method of carrying out this idea in practice, a number of such presses being so arranged on a truck that they can be applied to vessels of different build, and the press heads covered with a ring of hemp, which is forced against the hull by a pressure of two and one-half atmospheres, the pressure at the contact surface being about one-tenth atmosphere. Then, as the truck is drawn out of the water, the weight of the ship gradually acts on the rings, and the press valves must be closed. If the presses are mounted six feet apart, the pressure in each cylinder will not exceed forty atmospheres. Each press must be operated independently, so far as closing the valves is concerned, in order that the weight may be distributed uniformly; otherwise there is the danger of bending the hull plates where the internal pressure is low, and no guarantee that the more heavily loaded parts will not bulge to a dangerous extent. No difficulty will be encountered in packing the press plungers quite tightly, leather being a perfectly reliable material.

In distributing the pressure, the plan recommended is to mount every eight presses in two double rows on a separate truck, all the trucks being attached to a through girder. Wheels running in ball bearings are indispensable, the frictional resistance being only about one-third that of roller or plain bearings. The tractive force is preferably applied by rack and pinion, the strains being less than those in the ordinary mountain railway of this type and the movement freer from jolting. Low speed electro-motors would furnish the motive power, two pairs of cogwheels being sufficient for the reducing gear. Springs on the truck wheels are not essential, the hull and track being sufficiently elastic to take up the slight irregularities in the rails, joints, etc.; and in this system no duplication of the lifting plant is necessary, since the rate of haulage can be increased to 10 feet per second, owing to the low dead weight and absence of water.

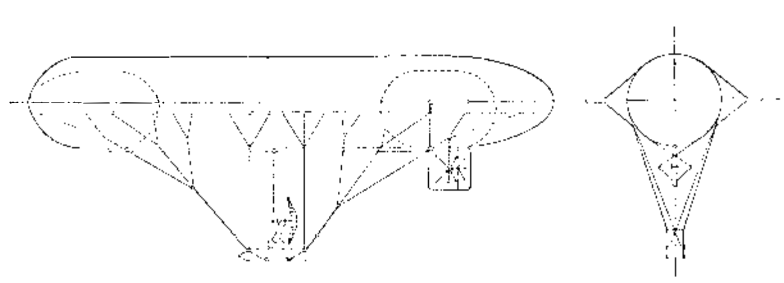
The plant for discharging the ship into the high level water may be greatly simplified by providing a turntable (turning through an angle of 16 deg.) of the same gradient as the rest of the track, so that the train of trucks and their load can be run down into the water without change of gradient, only the direction of movement being reversed. The turntable can be operated by a couple of electro-motors at opposite sides. This arrangement dispenses with the necessity for any protecting wall at the high level, and no extensive masonry is required anywhere, the pressure on the site being no greater than the natural pressure.

Official Meteorological Summary, New York, N. Y. October, 1906.

Atmospheric pressure: Highest, 30.59; date, 13th; lowest, 29.36; date, 6th; mean, 30.06. Temperature: Highest, 74; date, 9th; lowest, 37; date, 12th; mean of warmest day, 66; date, 5th; mean of coldest day, 43; date, 11th; mean of maximum for the month, 61.8; mean of minimum, 50.4; absolute mean, 56.1; normal is 55.5; average daily excess compared with mean of 36 years, +0.6. Warmest mean temperature for October, 61 in 1900; coldest mean, 50 in 1876. Absolute maximum and minimum for this month for 36 years, 88 and 31. Precipitation, 4.30; greatest in 24 hours, 1.21; date, 19th and 20th; average for this month for 36 years, 3.70; excess, +0.60; greatest precipitation, 11.55, in 1903; least, 0.58, in 1879. Snow: Trace. Wind: Prevailing direction N.E.; total movement, 10.490 miles; average hourly velocity, 14.1 miles; maximum velocity, 58 miles per hour. Weather: Clear days, 5; partly cloudy, 10; cloudy, 16. Thunderstorms: Date, 9th. Frost: Date, 11th, 12th, 13th. Fog: Dense, date, 20th.

Automobile Omnibus Lines in Paris.

The first of the automobile omnibus lines commenced running in Paris not long ago. Experiments had been made for a long time past, and the public became accustomed to seeing the omnibuses pass along the streets, but the system was not put in actual operation until the first week in June, when the line known as the Montmartre—St.Germain des Près was started, and the eleven automobiles were used to replace eighteen



Side and Bow Elevations of the Parseval Airship.

of the old form of omnibuses requiring 194 horses in all. The time which is needed to make the trip across town, which was about 45 minutes, is now reduced to 25 minutes. These cars have been furnished by the well-known automobile firm the Société Brillié, after a sharp competition between many of the leading firms. The Omnibus Company of Paris has now ordered as many as 90 new cars, which are to be used upon six lines in the city to replace the horse vehicles. These lines will be put in service from month to month so that they will all be in operation at the end of this year. It is proposed to start up soon the second line, running from the city hall to the Neuilly gate. All the cars are built after the general lines of the company's standard double-decked omnibus.

A Bricklaying Feat.

In the erection of the House of Representatives office building, adjacent to the United States Capitol at Washington, an interesting fact has developed in connection with the brick masonry work. The first brick was laid at the site on the afternoon of July 5, 1905, and on July 3, 1906, there had been laid in the walls 11,000,000 bricks. This is believed to be the greatest number of brick laid on any building in one year in the United States, and probably in the world. One of the causes conducing to this record-breaking feat was the remarkably "open" winter of 1905-06. In those winter months the work continued almost without interruption from either snow or cold, and not more than twelve or fifteen days were lost during the entire winter by reason of weather conditions.

Water-proof glue is manufactured of gum shellac three parts and India-rubber one part by weight, these constituents being dissolved in separate vessels in ether, free from alcohol, subject to a gentle heat. When thoroughly dissolved, the two solutions are mixed, and kept for some time in a vessel tightly sealed. This glue resists the action of water, both hot and cold, as well as most acids and alkalis. If the glue is thinned by the admixture of ether, and applied as a varnish to leather along the seams where this has been sewn together, it renders the joint or seam water-tight, and almost impossible to separate.

THE STORY OF THE DISCOVERY OF THE FIRST ANILINE DYE.

BY SIR WILLIAM HENRY PERKIN.

My father was a builder. In early childhood I began to think about the choice of an occupation, and as I took an interest in everything that went on about me, I thought I should probably follow in my father's footsteps, and I busied myself with practical carpentry at every possible opportunity. I remember also that I took a lively interest in the applications of the lever, the screw, and the wedge, of which I occasionally saw practical examples. The reading of some descriptions of steam engines and the like awakened an interest in machine construction, and I spent much time in making drawings and wooden models. I was also very much interested in painting, and even had, for a short time, the foolish idea that I should like to become an artist. I believe that the practical knowledge of mechanics which I thus acquired in early youth has exerted a lasting influence upon me, and I never lost the appreciation of its value.

Shortly before my thirteenth birthday something occurred which was destined to determine my final choice of an occupation. A young friend who had a cabinet of chemical apparatus showed me some experiments of a very elementary sort, including the crystallization of soda and alum, and these experiments seemed to me so wonderful (and indeed every formation of crystals appears wonderful to me to this day) that I saw that chemistry was something far higher than anything that I had yet met with, and my ambition to become a chemist was awakened. I thought that I should be happy if I were apprenticed to an apothecary, for I could make experiments at odd times; but circumstances intervened which led to a still better result. Until that time I had attended a private school in the neighborhood, but I now left it and, at the age of thirteen, entered the City of London School. In this public school lectures on chemistry and physics were given, very strangely, during the noon recess. It was the only school in the country in which these subjects were taught. I had not been there long before the teacher, Thomas Hall, B.A., observed my great interest in the lectures, and permitted me to assist in preparing the lecture experiments. This raised me to the highest pitch of enthusiasm. I often went without my luncheon in order to find time for my work in the dreadful place that in that school was called "the laboratory."

Hall had heard a few lectures by Dr. Hofmann, and had worked with him for a short time in the Royal College of Chemistry in Oxford Street. When I was fifteen years old he had several conversations with my father, and the result was that I went to Dr. Hofmann, to study chemistry under his direction. (I am afraid that my father, although he said nothing, was displeased at the time, for I know that in accordance with his wish I should have become an architect.) I soon finished my course of qualitative and quantitative analysis, and took up research work. Strangely enough, the first subject that Dr. Hofmann selected for me was anthracene. The raw material was obtained from Mr. Cliff (the manager of Bethel's tar works). Unfortunately, Laurent had assigned to this hydrocarbon an erroneous formula ($C_{15}H_{12}$), and although I had prepared and analyzed anthrachinone (Laurent's anthracenuse) and other derivatives, the figures I obtained would not fit any possible derivative of $C_{15}H_{12}$. Notwithstanding this, the experience thus acquired and the material and derived products obtained all became useful to me when I began to work on alizarine many years afterward. Dr. Hofmann next gave me as a subject the action of cyanogen chloride upon naphthylamine, and after I had purified naphthaline and made from it nitronaphthaline and then naphthylamine—operations which one had to do for one's self in those days—the remaining part of the investigation was soon finished, though it was not published until some time afterward. I was now about seventeen years old, and became an assistant in Dr. Hofmann's experimental laboratory. Before I go on I must here give expression to my profound feeling of indebtedness and gratitude to Dr. Hofmann for his brilliant method of teaching, for his stimulating enthusiasm in scientific investigation, and for the interest which he took in me during my studies.

I now come to the period connected with "mauve." As Dr. Hofmann's assistant I was occupied all day with his researches (which at that time were concerned chiefly with the phosphor bases). I therefore carried on my own work in the evening and at other spare times at home in my scantily furnished laboratory, and there it was that, in the Easter vacation of 1856, when I was just eighteen years old, I discovered "mauve." As is known, I was led thereto by an attempt to produce quinine artificially from allyltoluidine, which caused me to study next the oxidation of aniline. Now, when in experimenting with the dyestuff thus obtained I found that it was a very stable body that produced on silk a beautiful violet, exceedingly resistant to light—being in this respect very different from archil, which was then employed in silk dyeing—it appeared to me that it would be a useful dye if it could be produced in large quantities. But its probable cost of production made this seem almost hopeless, and such would indeed have been the case had it not possessed so strikingly intense a dyeing power. I quietly continued my investigations, sought to determine the formula for the dyestuff, etc., and at the same time I obtained an introduction to Messrs. Pullar, of Perth, who gave a favorable opinion of the specimens of dyed silk submitted to them. When the summer vacation came and I had more time at my disposal, I undertook, with my brother's assistance, technical experiments on a very small scale, in which one or two ounces of the dyestuff were produced. Then, on August 26, 1856, the process was patented. Soon afterward, during a visit to the dyeworks of Messrs. Pullar in Perth, I made experiments, in conjunction with them, in dyeing cotton and other materials. They were also good enough to take me to some print works at Mary Hill near Glasgow, where experiments in printing were begun. As the results, so far, were satisfactory and the opinion of the dye was favorable, it was decided to undertake its manufacture. Consequently, I did not return to the Royal College of Chemistry at the end of the vacation. I must confess that, after taking this step, I experienced considerable apprehension that the undertaking might prove a failure, and I was also worried by the thought that my technical work would put an end to my scientific researches.

As sufficient knowledge concerning the practical operation of the process of manufacture was yet lacking, and as the dye had also not been fully tested on large quantities of material, it was not possible to begin the manufacture on a very large scale. My father had confidence in me and in the invention, found the required capital, and joined with me and my brother in the enterprise, under the firm name of "Perkin and Sons."

After the necessary land had been acquired, the erection of the factory was commenced about the end of May or the beginning of June, 1857. As my father was an architect, the buildings were quickly erected, and by the end of the year a sufficient plant was ready for operation to enable us to begin making the dyestuff and delivering it to silk dyers. This was in December, 1857.

In an article of mine, "On the History of Alizarine," may be found the print of a hasty pencil sketch of the factory, which I made early in 1858, or less than a year after the commencement of building.*

But much yet remains to be told of the difficulties which were connected with the first commercial production of the dye, and which continued for some time longer before they were gradually overcome. At the time when we set the factory going I had no knowledge of chemical factories except what I had learned from a few books, and I had only once been, for a few minutes, inside a chemical factory, and that an alum factory. Had I, however, seen the apparatus then commonly employed in chemical manufactures, this would have been of but little value to me, because the new industry required its own peculiar appliances. As the materials were more costly and the methods more refined than those of other chemical factories, the apparatus also necessarily had to be of a far higher class and more carefully constructed. And not only this, but it had to be newly invented, and practical directions for its manufacture had to be given to the makers, for it was astonishing how little the practical men of those days could help one with suggestions of their own. The waste of valuable time caused by the delays in their work, and their imperfect understanding of the directions given them, were at times very discouraging. Luckily, I had a little practical knowledge of machine construction and mechanics, and this was invaluable to me at that time. Fortunately, also, very little, if any, of the apparatus designed failed of its intended purpose.

In the chemical part, also, many difficulties had to be overcome. The manufacture of aniline, which could then be found in but very few laboratories, was no simple matter. Benzol was not made in large quantities, and when it was obtained it was of very variable composition, so that it had to be purified. Its conversion into nitro-benzol at moderate cost likewise proved difficult. Strong nitric acid was not manufactured except in very small quantities and at exorbitant prices, and as we did not wish to engage in its manufacture, we tried a mixture of soda, saltpeter, and sulphuric acid, and in this way produced large quantities of nitro-benzol, an operation which, however, required great care. The extraction of the dye and its purification also presented many difficulties.

On looking back at all the difficulties of the infant industry, many of them appear, in the light of our present knowledge, so insignificant as scarcely to be worth mentioning. Yet they had a very real existence in their time.

But the production of the dye was not all that there was to do. The methods of using it also had to be developed. In those days dyers were accustomed to the use of vegetable dyes only, and they did not know what to do with basic dyes like "mauve." I had to become, to a certain extent, a dyer and calico printer, and I spent much time, first in London and Macclesfield in silk dyeing, then in Scotland in calico printing, and next in Bradford in finding out how to dye half-woolen mixture with "mauve." I could not well spare this time from my own factory, but it had to be.

Verily, this dye was a pioneer, and it made the way clear for all that came after it! And what a change has come about in dye works and print works! Instead of, as formerly, jealously guarding their own secret processes, the heads of factories now expect that, on the appearance of a new dye, the chemists shall teach them how to use it.

* Journal Society of Arts, 1879.

Utilization of the Entire Cotton Plant.

According to the chemical investigations of Dr. Robert R. Roberts, of Washington, D. C., the entire cotton plant is a fiber that can be utilized. Dr. Roberts has been quietly employed on cotton fiber work for the past five years, and has just reached the stage of his investigations which would justify him in announcing the results of his discovery. He can delint cottonseed in five minutes, handing out a handful of seed that will rattle like shelled corn. This is done without injuring the germinating qualities of the seed, nor does it affect the value of the manufacture of oil. In this delinting process Dr. Roberts claims a saving of 75 per cent of seed waste in planting, eliminating defective seed, which will enable the Southern cotton planter to use the drill machine in planting, obviating, in a manner, the enormous expense of chopping out the surplus cotton stalks. He claims furthermore that his delinting process will effectively destroy the boll weevil, whether the eggs or larvæ are laid in the germinating point of the seed or hibernating in the form of a beetle in the loose cottonseed. The seed can be delinted, he says, for about $6 per ton. Cotton stalks, after the ordinary process of reduction to a pulp, become by the new process in thirty-four hours a fine fiber, not as long as cotton itself, but similar in texture. This fiber, he claims, will make the finest paper in the world.

Peary's New Polar Record.

Commander Robert E. Peary has sent a message stating that he succeeded reaching latitude 87 degrees 6 minutes. This is higher than the point reached by the Duke of the Abruzzi, who held the record. Peary suffered terrible privation and hardship, battling incessantly with ice, storms, and headwinds. No deaths or illness, however, occurred in the expedition.

Peary wintered on the north coast of Grant Land and then traveled by sledge northward. Gales broke up the ice, destroyed his caches, and cut off communication with his supporting bodies. Drifting steadily eastward, however, he reached the point mentioned. On the return his party had to eat eight dogs.

THE IONA NAVAL MAGAZINE.—II.

BY WALTER L. BEASLEY.

(*Concluded from page 326.*)

The heart and activities of the Iona naval magazine are centered around the storage and manipulation of smokeless powder into charges for the large and small size guns of the navy, and the black for bursting charges for the shells. Some of the more important places, therefore, are the powder filling houses, four of which are in operation, situated at widely different points. These are all small, one-story, wooden structures, designed to be unpretentious and isolated owing to the possibility of an explosion. One of the accompanying pictures shows the interior of the main filling house, which presents about one of the most animated and interesting sights to be seen on the island. The men are required to wear long white serge suits and moccasins; no metal or other articles are allowed in the pockets which might in any way cause friction. All the tools, funnels, measures, cups, scales, and other appliances used are made of copper. Here the delicate and somewhat dangerous business of weighing out the various smokeless powder charges is done. Even one or two grammes difference in weight is carefully observed. At the Indian Head, Md., proving grounds the naval ordnance experts, by tests, determine the powder charge best adapted for the various guns. Also at the annual target practice similar results as to range and velocities are recorded. With the advent of new guns and the slight chemical change in the powder, the charges are subject to constant revision. This keeps the filling-house men constantly employed. Each morning the day's supply of powder is brought from the magazine in the lead-colored wooden boxes. These are zinc-lined, air-tight, and hold 100 pounds. The government pays seventy cents per pound for powder, and furnishes the alcohol to the manufacturers. The output of the naval powder factory at Indian Head, which is about 2,000 pounds per day, is mainly used for experimental purposes on the proving grounds. Owing to the careful process of manufacture, particularly in the final washing of the pulp, the powder is said to be equal, if not a bit superior, to that obtained from the manufacturers. The boxes of powder are emptied into a long wooden trough, and with a copper scoop it is dipped out, accurately weighed, and tied up in quarter, half, and full charges, in white bags of muslin. These bags have several wide streamers for fastening attached, and each is tagged with the date of filling and the amount of powder it contains. A small ignition charge of quick-burning black powder, to set off the smokeless, is stowed in the bottom of each bag.

They are then placed in large copper cans and returned to the magazines, where they are held in readiness to go aboard the ships. At the time of the writer's visit the big charges, 220 pounds for the 13-inch guns, were being put up. These are arranged in four quarter charges of 55 pounds each. The bags when piled on top of one another reach to the top of a man's head, and present a formidable sight of bottled-up destruction. The heaviest charge used in the navy is for the new 45-caliber, 12-inch, breech-loading rifles installed on the "Connecticut" and "Louisiana," which is 310 to 330 pounds. As the smokeless powder, owing to various atmospheric pressures and different temperatures, absorbs moisture and undergoes a slight chemical change, all the smokeless powder is sent to the naval storage depot at Dover, N. J. Here has been established a redrying house, where the smokeless powder is placed in a series of bins or draws where, at a steady temperature, it is kept for a regular time. Three hundred thousand pounds of smokeless powder were redried here last year. No ammunition is put up at this point, it being reserved entirely for the storage of powder and high explosives. It has an ideal location for this purpose, being seven miles inland and entirely isolated.

Nearly all the powder consumed at Iona Island is sent direct from this depot.

To furnish the great number of bags for the powder charges, an extensive sewing plant is constantly kept going on the second floor of one of the ordnance buildings in the Brooklyn navy yard. Here, with an electric cutter, 50 to 100 thicknesses of muslin are cut up at a time into various sized patterns. A series of steel dies, at a single operation, cut out great quantities of the round bottoms for the bags. Thirty different sizes are made for the bursting and propelling charges, ranging from the 3-pounder to the 13-inch gun. The sewing is all done by skilled men operators, a motor being attached to each machine. The making of the large 12 and 13-inch bags, with a half-dozen wide streamers, requires an extraordinary amount of intricate sewing and manipulation. Each is deftly turned and twisted several hundred times before completion. Besides the regu-

One of the Powder Filling Houses Charging 3-Inch Shells.

A red flag is flown while this operation is in progress.

THE IONA NAVAL MAGAZINE.—II.