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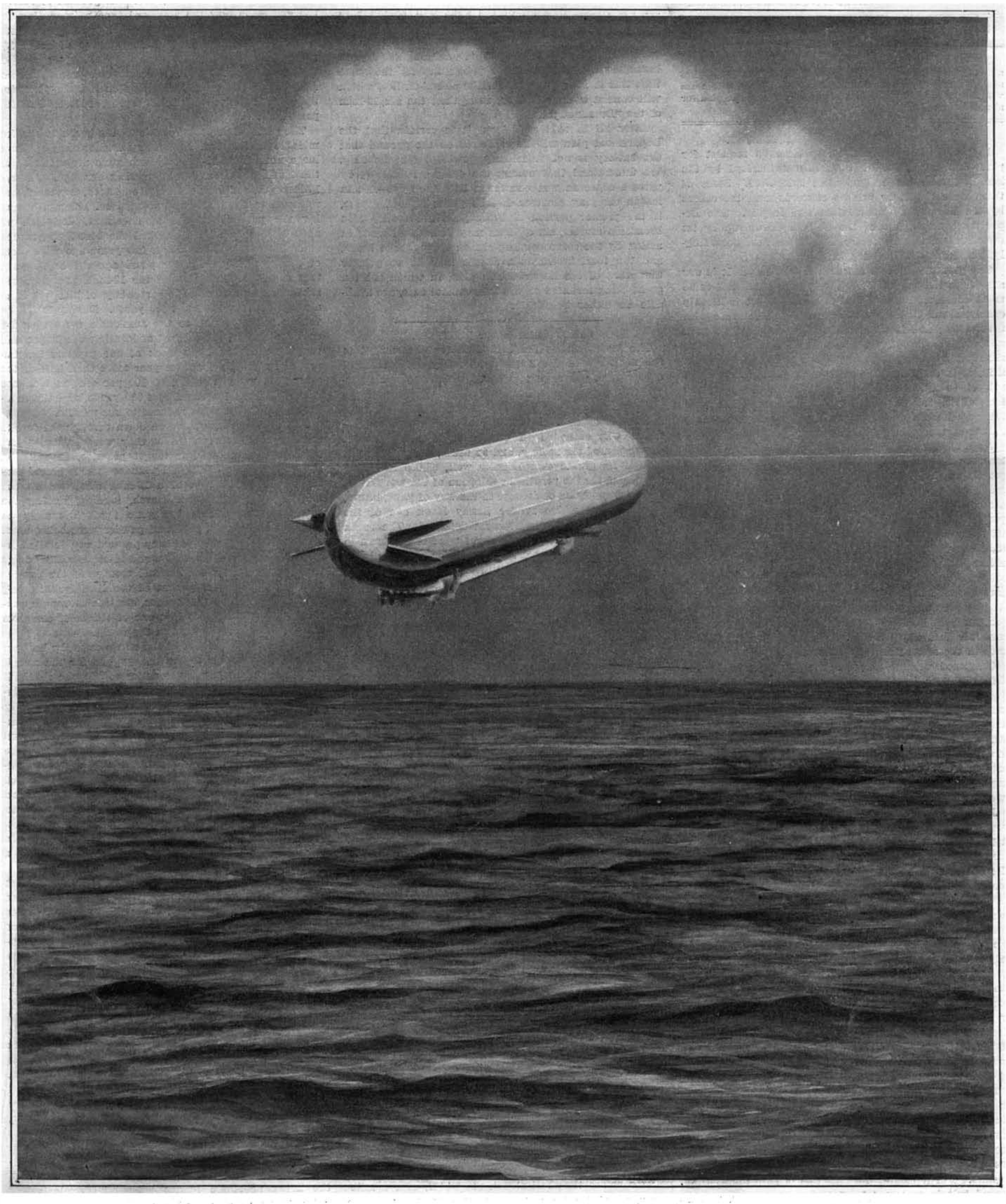

THE GREAT DIRIGIBLE AIRSHIP OF COUNT VON ZEPPELIN FLYING OVER LAKE CONSTANCE, SWITZERLAND.—[See page 470.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, DECEMBER 22, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PLANS OF OUR 20,000-TON BATTLESHIP.

In response to the Navy Department's request for plans for the 20,000-ton battleship authorized by the last Congress, ten designs were submitted. Some of them were drawn by private concerns, and the others by the Bureau of Construction and Repair. The Department favors one of the designs drawn up by its own bureau, and Secretary Bonaparte has, accordingly, recommended its adoption by Congress.

The greatest interest attaches to this ship. It is our answer to the "Dreadnought," a vessel which has come to be considered as the type ship for future battleship construction. Naturally, comparison will be made with that vessel; and in the absence of detailed information as to distribution of weights, and the thousand-and-one elements which go to make up the total efficiency of a ship, it is certain that the Department's plan will be subject to much unfavorable criticism. For, on the face of it, it will appear to the layman that with 2,000 tons more displacement, we are building a ship that is no more powerful than the "Dreadnought."

As a matter of fact, our new ship will be just 2,000 tons, or 11 per cent, more efficient than the British prototype. The same arguments with which, in a recent issue, we urged that the 18,000-ton "Dreadnought" must of necessity be superior to the 16,000-ton "Michigan," will now apply to the question of the relative efficiency of our 20,000-ton new battleship and the 18,000-ton "Dreadnought." Displacement means power, either for attack or defense, and if, as we shall see below, our new ship carries no more guns, and has no greater speed than the British ship, it must inevitably follow that those guns are better disposed, more amply protected, and the security of the whole ship more certainly assured, in the exact proportion of the difference in the size of the two vessels.

Compared with the "Dreadnought," our new battleship, 510 feet long, is 10 feet longer on the water line; has 3 feet more beam, or 85 feet; and is of 20,000 tons displacement, or 2,000 tons more than the "Dreadnought." Her coal bunker capacity is about 400 tons less, and her estimated speed the same. She carries the same armament of ten 12-inch guns; but her secondary battery for repelling torpedo attack is heavier, consisting of fourteen 5-inch rapid-fire guns, as against about twenty 3-inch rapid-firers.

Judging from the fact that the weights allotted to guns and motive power appear to be about the same, it follows that considerably more weight must have been allowed in our new ship to be the most important element of stability and protection. Although the belt armor of the two ships is the same in its maximum thickness, there is no doubt whatever that the Department design calls for a continuation of the maximum thickness of this armor over a greater length of the ship's hull amidships. The belt armor is 8 feet in width with a maximum thickness of 11 inches and its cross section is uniform throughout the length of the belt. Remembering how terribly effective was the heavy gun fire of the Japanese against the unarmored or lightly-armored ends of some of the Russian battleships, our designers are carrying the full thickness of the belt armor much farther forward and aft than has been usual in previous warships which, of course, adds greatly to its weight.

The side above the main belt armor is protected by an upper belt 7 feet 3 inches in width, and of a maximum thickness of 10 inches. This belt also carries its maximum thickness farther fore and aft than has been the usual practice, and serves to afford unusual protection to the substructure of the 12-inch gun mounts. Furthermore, the side of the ship above the second belt is protected by 5 inches of armor, which protects the base of the smoke pipes and the majority of the guns of the 5-inch battery. Particular attention has been paid to the subdivision of the ship, which has been so worked out that everywhere three separate walls of skin plating will intervene between an exploding mine or torpedo and the magazines.

The guiding principle in working out the hull and the armor plan has been the recognition of the necessity of making the modern battleship more secure against sinking or capsizing, and the larger part of the increased displacement of this ship has been spent in producing a hull that will stand up on an even keel under the prolonged and combined attack of the torpedo, the mine, and of 12-inch batteries of the modern battleship.

The announcement that the design calls for only ten 12-inch guns will produce disappointment among those people, lay and professional, who delight in the spectacular; but this battery will be more powerful, or, rather, more effective, than that of the "Dreadnought," for the reason that all of the guns will be mounted along the central axis of the ship, and will be available on either broadside. This will enable our new ship to oppose to a ship of the "Dreadnought" type a broadside 25 per cent more powerful. At the same time this is done at some sacrifice of end-on fire, which will consist of four 12-inch, as against the six 12-inch of the "Dreadnought."

After all is said and done, it is certain that the Department plan will be criticised on the ground that the battery is not sufficiently powerful for the ship. We understand that among the designs submitted by private concerns was one for a battleship 540 feet in length carrying fourteen 12-inch guns; but, of course, if the greater portion of these guns are mounted in broadside turrets, six of them may be masked when in action by the corresponding six on the opposite beam, and the total broadside available may be no greater than that of the Department's plan, in which the ten guns, being mounted on the longitudinal axis, are available on either broadside.

SANDY HOOK COAST DEFENSES.

The invitation by the United States government to the members of the American Society of Mechanical engineers to pay a visit to that most sacred of all government reservations, Sandy Hook, was a greatly appreciated courtesy to one of the most distinguished and influential technical bodies in this country. The invitation was extended in connection with the recent convention of the society, and as usual, the government treated its guests exceptionally well, $8,000 being appropriated for the practical exhibition of the working of the many elements of defense in the way of guns, mines, mortars, etc., which render Sandy Hook one of the most formidable of our seacoast defenses. The seven hundred guests of the government were taken down to Sandy Hook in a special train of ten cars, and the first stop was made at the southerly end of the Proving Grounds for the purpose of visiting the great 16-inch army gun, the largest and most powerful rifle in existence. This piece is still mounted on the temporary trial carriage on which it was proved some two or three years ago. The gun weighs 130 tons and fires a shell weighing 2,450 pounds with a velocity of slightly over 2,300 feet per second, and an energy of about 80,000 foot-tons, over 600 pounds of smokeless powder being necessary to secure these results. Although it is not likely that the gun will be re-duplicated, the piece will be permanently mounted at Sandy Hook, and will form a very valuable element in its defenses. It may be remarked in this connection, that the recent determination of the Ordnance Board to abandon the manufacture of guns of high velocity in favor of larger guns of low velocity, lends a new significance to the 16-inch gun, and if it should be decided to adopt for this piece the 2,000-foot-seconds velocity, which is to be the service velocity of the future, the 16-inch gun will become in a sense rejuvenated, and may be considered to have before it a long period of future usefulness. Two or three hundred yards to the east of the big gun, the visitors were shown two targets representing the side armor, backing, and framing of our latest armored cruisers and battleships, which have lately been erected for the purpose of testing their resisting power to the attack of modern shells. It was noticed that the targets, instead of facing the guns, have been built with their face at a sharp angle to the line of fire; and it was explained that this was done in order to test the resisting power of the armor when struck by shells delivered at an angle 20 degrees from the normal. As a matter of fact the majority of the projectiles which reach a ship strike her obliquely; comparatively few of them are delivered normal to the plate.

The visitors were next taken down to the massive concrete emplacements upon which the various guns which are submitted for proof are tried out. Here, two rounds were fired at a velocity of 3,000 feet per second from one of the latest type of 6-inch rapid fire guns mounted on a barbette carriage. The small interval of time before the shell struck the water, over a mile away, afforded a dramatic illustration of what is meant by a muzzle velocity of 3,000 feet per second. Then followed five rounds from a 15-pounder, semi-automatic, rapid-fire gun, and three rounds of shrapnel from a 3-inch field gun which were timed to explode above the water at about 1,000 yards range. As the shots were fired to leeward before a 35-mile gale, the sound of the exploding shells could not be heard, and the only evidence that the heavy rain of fragments was being duly scattered was the appearance above the water of a little white ball of smoke, looking for all the world like a puff ball hanging in mid-air. Other tests at this battery consisted of the firing of a 4.7-inch siege gun, mounted on a long recoil carriage; and a 2.38-inch field gun; and ten rounds from one of the famous 1-pounder pompom automatic guns. From the spectacular point of view, the most interesting exhibition was the firing, with full charge, of a 10-inch rifle mounted on one of the Buffington-Crozier disappearing carriages. This mount, whose design is chiefly due to Gen. Crozier, of the Board of Ordnance, who was present to receive the guests, is now the standard type of mounting for all the heavy guns of the United States coast defenses. The shell struck the water at a range of about 2½ miles, throwing high into the air a huge geyser of water. Ricocheting, it took another great leap of fully a mile and a half, when it struck again, throwing up another large column of spray, before it finally passed out of sight.

The party then passed on down the beach to the formidable fort known as Battery Richardson, where a large number of 12- and 10-inch guns are mounted on the Buffington-Crozier disappearing carriage. After a 12-inch gun had been raised into battery, traversed, and returned to the loading position, Gen. Murray, mounting the parapet of the emplacement, delivered an address in which he contrasted the best firing results obtained in target practice a few years ago with those of the present year. Five years ago the best results that could be obtained with the 12-inch gun were one shot in 3 minutes, and the percentage of hits was 50 at a range of from 4,000 to 4,500 yards. During the intervening years, thanks to the admirable system of fire control (that is, the method of locating the target, and ranging the guns), the work of our gunners has improved so greatly that last year more than half of the guns fired made a record of 100 per cent in hits, the range has been increased to 4,000 yards, and the average time between shots reduced to one minute.

The visitors then passed on down through the fort to another emplacement, where they were treated to an exhibition of sub-caliber target practice, in which a rifled tube, representing a 1-pounder gun, is placed centrally within the bore of a 10-inch rifle, and all the motions of unlocking a breech, loading, closing the breech, sighting, etc., are gone through exactly as though a full-weight shell and powder were being used.

Considerations of expediency prevent any detailed description of Fort Richardson, and it must suffice to say that the provisions for the safe storage of the powder and shells, the arrangement of the lifts for bringing the ammunition up to the guns, etc., are thoroughly up-to-date and render this fort one of the most complete and formidable of its kind in the world.

All systems of defense of the entrance to the harbors include, in addition to the heavy guns for the attack for armored vessels, provisions for sowing the channels with the deadly submarine mine. The submarine defenses of the Sandy Hook channels are particularly complete. They are arranged on the electrically-controlled system, and have been carried out on the lines which have been illustrated from time to time in the various issues of the Scientific American. By this system it is possible to discriminate in the treatment of friend and foe. When a ship strikes a floating mine, an electrical contact is made which gives notification to the operator within an armored casemate on the shore. If the ship be a friendly vessel, it is allowed to pass on; but if not, the operator immediately throws a switch and explodes the mine.

From the mining casemate the visitors were next taken to the hidden mortar batteries, from the crest of which they looked down 60 or 70 feet into a series of huge rectangular pits, at the bottom of each of which were four short, massive, rifled mortars, capable of throwing a 12-inch shell to the extreme range of 7 miles. For the benefit of the visitors, a salvo of four guns was fired with reduced charges, the guns having an elevation of about 50 degrees. At the word of command there was a reverberating crash, and instantly the eye was able to follow the skyward sweep of the four projectiles which, keeping the same relative four-square position in which they left the muzzle of the guns, could be seen soaring into the blue, drawing together under the effect of perspective, and diminishing until they were lost to sight. A few seconds later, after they had described a vast curve, whose highest point was a mile and a half above the earth, a cloud of spray thrown up from the ocean some three miles distant from the shore marked the point at which they fell. The exhibition closed with the firing of shells loaded with high explosive or with black powder, and the explosion of a powerful land mine. The latter lifted what appeared to be a veritable mountain of sand, earth, and broken timbers high into the air, and afforded a most impressive demonstration of the destructive power of this, the most formidable of all methods of attack.

NOTES ON RECHARGING OXYGEN GAS TANKS.

BY RANDOLPH BOLLING.

In laboratories situated in isolated districts like ours, the expense of getting oxygen tanks recharged is considerable, the express charges from Sydney, Nova Scotia, to New York city and back, plus customs duties amounting to about $15 on a small, 15 cubic feet capacity tank. This made it highly desirable to find some means of securing a supply of oxygen at something like reasonable prices. The idea of gas bags or gasometers occurred to the writer, but as these are at best cumbersome and rather obsolete methods of storing gas, and besides none being within a thousand miles of our laboratory, it was decided that we ourselves, should recharge our tank, which had recently become exhausted. The tank was one of those pressed-steel cylinders without seams and rivets, and guaranteed to stand a pressure of 600 pounds to the square inch, and to hold 15 cubic feet. In Hempel's "Methods of Gas Analysis," translation of E. L. Dennis, a chapter is devoted to the design of a calorimeter using oxygen under very high pressure, the gas being generated in a length of iron pipe with suitable couplings. This method of Hempel's appeared to be a simple arrangement and one easy to carry out, so the writer decided to use Hempel's apparatus, substituting the oxygen tank for the calorimeter bomb.

To set up the apparatus, a heavy brass coupling was screwed to the oxygen outlet of the tank, threaded to take an iron T pipe of ½ inch inside diameter. Into one opening of the T was screwed a pressure gage reading up to 200 pounds. The generator was made of a piece of double extra-heavy steel pipe, 2 feet long by 2 inches diameter, one end closed by a steel coupling and a heavy cast-iron plug. The other end had fitted to it a suitable reducing nipple and a piece of ½-inch pipe 6 feet long, threaded at the end. The mixture for generating oxygen was prepared by heating one kilo of manganese peroxide for about six hours on a thin steel plate over four Bunsen burners, in order to burn off all organic matter. I had the commercial article on hand, and it was far from pure, containing bits of sawdust, roots, and trash very intimately mixed, and not caring to risk an explosion, I took the precaution to get rid of the organic matter. After cooling the peroxide, it was all passed through a 40-mesh sieve and then mixed with one kilo of potassium chlorate, also ground to pass a 40-mesh sieve. The chlorate and the peroxide were carefully mixed together and 400 grammes weighed off. A small portion was then heated in a test tube to test its behavior, and although it sparkled somewhat freely, possibly due to a little organic matter still retained, I judged it was safe enough for use. The generator was then all ready to be connected up to the tank; but remembering the habit of pipe fitters in lavishly using lubricating oil in threading up pipe, I decided to heat the generator pipe and the connecting pipe to a red heat for a few minutes to get rid of the oil, which if mixed with potassium chlorate would cause a bad explosion. As I expected, a good deal of smoke issued forth, showing that this precaution was necessary. After the pipe cooled, a piece of brass gauze about 6 x 10 inches was rolled up loosely and rammed down the generator. This is recommended by Hempel as a good means of removing any traces of chlorine given off, and it also acted as a sort of porous plug to prevent the chlorate peroxide mixture from falling out when the generator was being charged. The apparatus now being all ready, the generating mixture of potassium chlorate and manganese peroxide was poured into the generator and the plug tightly screwed on, the pipe tapped to settle the powder at the end, and the tank with its pressure gage attached was taken out into a nearby field, so that if anything went wrong an explosion would cause no damage. The tank was stood upright on the ground, the pipe connecting the generator screwed on, and the needle valve to the tank opened. A lot of kindling wood piled around the generator was lighted, and then the operator retired to a safe distance to await results.

After about twenty minutes the fire burned out, and everything being apparently all right, I advanced to the apparatus and closed the needle valve on the tank. The gage showed 21 pounds pressure. This experiment showed that the charging could be done in this manner with perfect safety, and that a larger weight of reagents only was needed to get our tank properly charged. The generator was then disconnected from the tank, the plug taken out, and the hard, compact mass of potassium chloride and manganese peroxide dislodged by a chisel bar. The generator was then filled with 800 grammes and the same process repeated; this time the needle of the gage showed 65 pounds. The connections were examined for leaks under this pressure, and as several bad ones showed, the connections were then unscrewed and coated with a paste made of zinc oxide and zinc chloride, which I have found an excellent material for the purpose, and the charging was begun again until the gage showed 200 pounds. It was then decided to stop further charging, as this was sufficient gas to last for some time, and as we had no gage available reading up to 600 pounds. To secure this pressure of 200 pounds it required 2 kilos of potassium chlorate (commercial), worth about $1, and 2 kilos of manganese peroxide, worth about 40 cents. The material for fittings and labor cost about $1.50, but the generator is good for hundreds of chargings operations.

After one has the apparatus made, which is simple enough, a boy can charge a tank in two hours. This gas was used for carbon determinations in steel, for hastening the combustion of graphitic carbon in the determination of silicon in pig iron, and also used for burning off coke quickly in the determination of ash in coals for coke.

I find this method of charging oxygen tanks safe and economical. I have never used more than 800 grammes of the mixture for generating oxygen, not because I did not consider it safe, but on account of the size of the generator. No doubt one could calculate a charge that would fill a tank of a certain capacity up to any pressure that the fittings and connections would stand, but unless the apparatus is made of pipe known as the "extra heavy," the pressure could not be increased over 200 pounds with safety. In these notes I have given an account of my method of recharging oxygen tanks and it is hoped it may be useful to those chemists similarly situated in steel works laboratories.

LONG-DISTANCE OCEAN RACE FOR MOTOR BOATS.

CONDITIONS GOVERNING THE RACE FROM NEW YORK TO BERMUDA.

The conditions for the Long-Distance Ocean Motor Boat race from New York to Bermuda, to be held under the auspices of the Motor Boat Club of America and the Royal Bermuda Yacht Club, for the James Gordon Bennett Trophy have just been completed by the committee and are as follows:

Race.—To be from the station of the Motor Boat Club of America, on the Hudson River, New York City, to stake boat at Bermuda, placed by the Royal Bermuda Yacht Club.

Conditions.—Open to seaworthy motor boats of not less than 39 feet over all and not more than 60 feet over all. A seaworthy boat is a substantially-built, full-decked vessel, having motor power and living accommodations housed in and being equipped with all the tackles and appliances necessary to enable her to perform a long passage in open water.

Propelling Power.—Any form of internal combustion motor may be employed for propulsion purposes.

Fuel.—The committee comprehending that those entering the race have a thorough knowledge of the fuel necessary to make the passage, does not specify any quantity, but same must be sufficient to complete a distance of at least one and one-half times the distance between New York and Bermuda. No ingredient shall be used to increase the power of fuel.

Sails.—Boats must be equipped with suitable spars and rigging to carry sufficient sail to give them steerage way in a moderate breeze. This sail can be spread in any shape, but the total area of the canvas must not exceed 6 square feet for each foot of over all length. A steering sail and storm tri-sail may also be carried.

Stores and Water.—Stores and water sufficient for thirty days must be carried.

Crew.—No boat will be allowed to start with less than five men on board, one of whom shall be a practical navigator, one a practical engineer, and at least half of each crew must be amateurs. The committee earnestly recommends that no member of any crew shall be under 21 years of age, and that all members of the crew shall have had previous nautical experience.

Equipment.—A tender or life raft must be carried and a ring buoy or life jacket for each member of the crew. A full set of navigating instruments, a spare compass, sea anchor, oil bag and at least one gallon of crude petroleum or other oil, and fire extinguishers must be carried. Suitable arrangements for fitting an emergency tiller must be made. An assortment of spare parts and gear to the satisfaction of the committee must be carried.

Rating.—Will be calculated under the 1905 rules of the American Power Boat Association, except that the constant used in figuring the horse-power of the two-cycle motors shall be 850 instead of 750.

Time Allowance.—Shall be figured at 50 per cent of the American Power Boat Association time allowance table. The distance for computation for allowance to be on a basis of 650 miles.

Entries and Measurement.—Entries will be received up to twenty days before the start of the race, upon blanks which will be furnished by the Secretary of the Motor Boat Club of America, 314 Madison Avenue, New York City. All contestants must be measured by the club's measurer at least forty-eight hours before the start. An entrance fee of fifty dollars must accompany entry as a guarantee of good faith, same to be returned if boat starts.

Protests.—Protests covering the rating or eligibility of any boat must be made in writing within twenty-four hours after the finish of the race.

Inspection.—All contestants must report at the anchorage of the Motor Boat Club of America, or at such time and place as the Regatta Committee shall designate for the purpose of inspection and measurement.

Start.—The start shall be made from the station of the Motor Boat Club of America on Saturday, June 8, 1907, at 3 P. M.

The committee reserves the right to reject any entry if in their judgment the boat is unseaworthy or unsuitable for long distance racing, or is deficient in any particular. All entries will be accepted subject to inspection and approval by the regatta committee previous to the start.

The committee urges strict compliance with the letter and spirit of the conditions as above stated, and will be pleased at any time to inspect plans or boats under construction.

SCIENCE NOTES.

A remarkable collection of great archeological interest is to be disposed of in London. This comprises the extensive array of Egyptian curios collected by the well-known Egyptologist Mr. R. de Rustafjaell, and it is of a most complete description. The collection has been carefully classified and annotated and affords an informative and interesting history of this ancient country for a period of some 6,000 years, from the earliest time of the Egyptian nation 4,400 years B.C. to the present day. The pre-dynastic era is represented by an extensive array of flint implements; the dynastic period by sculpture, bronze, pottery, and fresco paintings; and the times nearer allied to the present by numerous personal ornaments, treasures, and trophies gathered from Egypt proper, the Sudan and surrounding tribes, including the famous praying board of the Mahdi found with the body of the Khalifa after the battle of Omdurman, and which is regarded with religious awe by the Dervishes, as it is popularly supposed to have been handed down to their chief through successive generations from the great Mahomed.

The technical professions now demand of their members for the higher planes of successful practise the same general educational preparation for professional study as that required by the best law and medical schools. Without entering into a discussion as to the relative merits of the educational work done by the small college and by that forming a subordinate member of the university, it is sufficient to say that this part of a well-rounded course of professional study harmonizes completely with the university system and is in fact an essential element of it. Both for technical efficiency, therefore, and for the broadest and best educational motives the technical school is bound to find its strongest development in an environment of universal study and investigation. The university has long since lost the character, if it ever properly had it, of a place where abstractions of learning, separated from the things which only give them life, are to be dispensed after the manner of instruction to men who are never to deal with the affairs of life. It has come to be an intensely practical working agent. It is effective and worthy of support only in so far as is makes itself felt in the real life of the community. If it is to be a true and real center of instruction it is imperative that it shall carry knowledge into every useful calling, governmental, corporate, or private. The time will soon come, if indeed it is not already reached, when it only can prepare men to administer and extend in a rational and moral way the great industrial activities which at the present time form the foundation of the material prosperity of the modern world.

OPENING OF THE NEW GRAND CENTRAL TEMPORARY STATION.

The opening of the temporary station, situated on the ground floor of the Grand Central Palace Building, corner of 43d Street and Lexington Avenue, in this city, occurred on Thursday, December 13.

From fifteen to sixteen additional tracks have been built in the large excavated area between 44th and 51st Streets, also between Fourth and Lexington Avenues, with a further sub-trackage of considerable dimensions. It was a novel sight to see the electric smokeless engines move about silently doing switching work. Owing to the delay in completion of signals, they will not run on the main line for a few days.

For the time being only the Harlem Division through and local trains will use the new depressed yard, which, it is thought will greatly simplify operations in the old yard. Ninety-seven trains daily will be accommodated on this division. The number of other trains run into and departing daily from the old station are one hundred and thirty-seven for the New York, New Haven & Hartford Railroad, and one hundred and twenty-six for the New York Central.

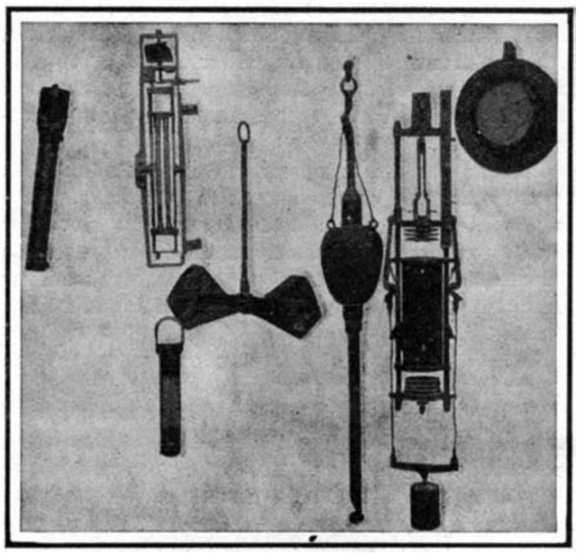
THE GERMAN MARINE RESEARCH BOAT "PLANET."

BY HERRMANN ALBRECHT.

His majesty's ship "Planet" started on her first cruise on January 21 of the present year. She is fitted out richly and most judiciously for her peaceful mission. This is to consist not merely of coast measurements in the South Sea; her commander has been given a great scientific programme of work to perform, which is to be carried into effect in part on the carefully-chosen outward passage to the South Sea. The ship's route lies by way of St. Helena, Capetown, Madagascar, Mauritius, Ceylon, and Batavia. Many of the instruments and methods of work to be used are among the most recent known.

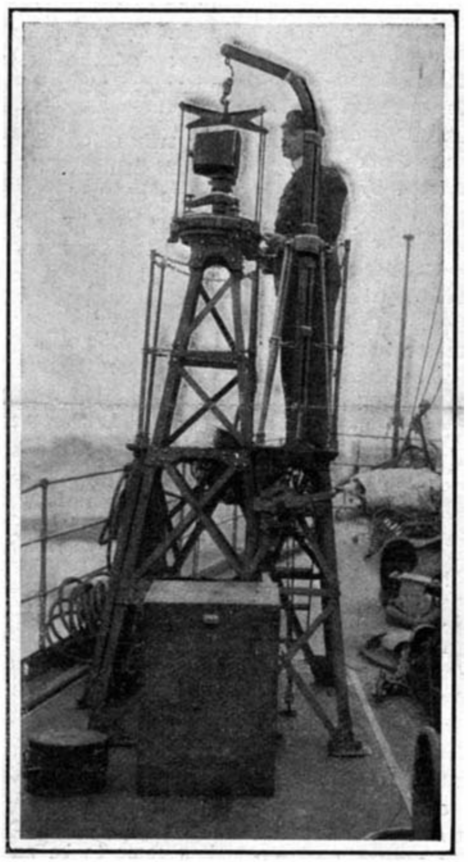
One task is to investigate the higher atmosphere over the ocean. The conditions prevalent here are known only through a few observations made in the North Atlantic, which go to show that these conditions are not as simple as theory has heretofore assumed. A number of kites fixed one above the other and attached by lines of fine piano wire are used. The movement of the ship alone is sufficient to raise the kites in an almost perfect calm, as was shown on board the gunboat "Sleipner." The top kite, which under favorable circumstances may reach a height of 20,000 feet, is provided with a meteograph, an instrument, weighing about 2 pounds, which during the rise and fall of the kite, registers the time, temperature, dew point, velocity of the wind and air pressure continuously, the last of these indicating, at what height each registration occurred. The meteograph may be carried still higher, to a distance of nearly 47,000 feet, by a system of two connected hydrogen balloons, one of which inflated more tensely than the other, bursts in the rarefied air at a determinate height, while the other balloon, acting as a parachute, carries the instrument carefully down until the float, which is attached to it below, touches the surface of the sea. The balloon remains in the air at a height of about 160 feet above the float and in this way indicates the whereabouts of the instrument to the ship. Then, finally, there are small balloons which are liberated without instruments and which give indications by their flight, of the direction and force of the wind. Since the "Planet" is to cross the region of the trade winds, monsoon, and calms, most manifold and interesting results are to be expected from the observations to be made.

Other researches lead down into the depths of the sea. The "Planet" is provided with the same deep sea sounding apparatus which was used on the German research boats "Valdivia" and "Gauss." Deep-sea measurements are to be made at specially interesting points, thus on the eastern boundary of the great bank which traverses the Atlantic Ocean in an S-shaped course, where the indentation of the sea bottom below the surface of the sea is greater in some spots than the height of the highest terrestrial mountains. Among the instruments of more recent construction carried by the "Planet" are a deep-sea manometer which determines the depth of the ocean from the pressure of the water at the bottom, a deep-sea water scoop, Richter's dip-thermometers, the mercury column of which breaks off on contact with the sea

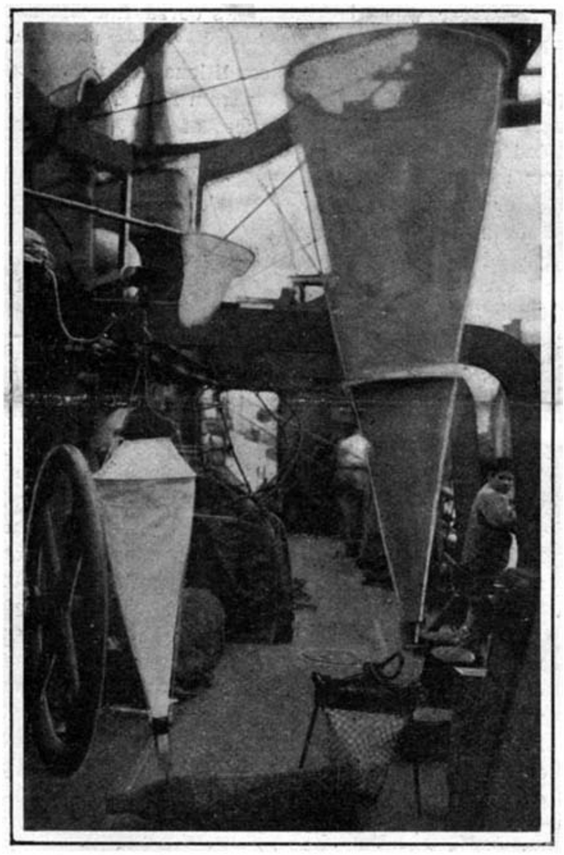


Various Instruments Used in Deep-Sea Observations.

bottom and thus allows the temperature which reigns here to be registered, and the scoop made according to the ideas of the Prince of Monaco, by means of which about a quart of the sea bottom material may be obtained. There are also instruments on board to determine the percentage of salts, the color and the transparency of sea water, others to determine the percentage of gases, phosphoric acid, silicic acid, and plankton, the finely-divided organic material which represents the primordial nourishment in the ocean.



A Phototheodolite for Measuring Wave Lengths and the Coast Line.



Deep-Sea Sounding Apparatus for Capturing Specimens of Deep-Sea Life.

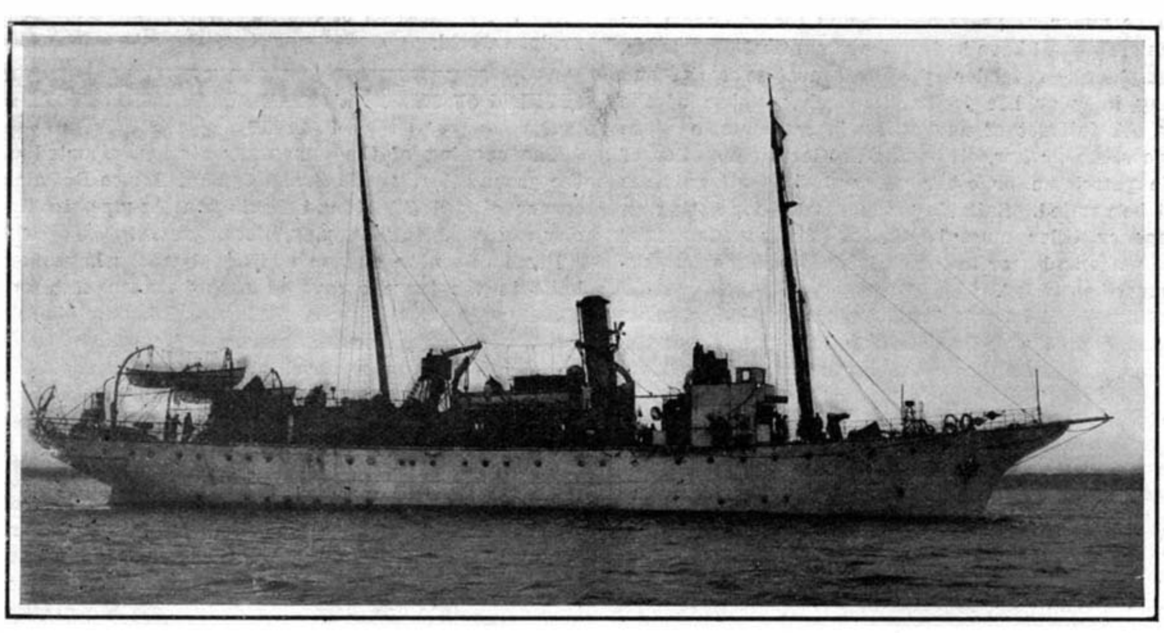
For the measurements themselves the new stereophotometric method developed chiefly by Dr. Pulfrich is to be employed. Two phototheodolites from the firm of C. Zeiss, in Jena, were mounted on board ship at a distance of 156 feet from each other. They are provided with two photographic cameras, the plates of which may be brought into exactly the same plane. The differences between the two pictures obtained at the same moment are noted by a special measuring instrument, the stereocomparer, which makes it possible to take measurements in all dimensions of the region photographed. According to the same method photographs and exact measurements of ocean waves are to be made on board of the "Planet."

In order that all the works on board ship may be facilitated to the utmost, especially in the tropics, she has been provided with large airy staterooms and working cabins. The doubts of the vessel's seaworthiness which her style of construction caused to be raised, were completely dispelled by her trial trips in the North and Baltic seas.

Formation of Fine Pearls.

Mons. Seurat has just returned from a mission in Oceanica, says L'Illustration, where he made a special study of the method of formation of fine pearls. His conclusions shed new light upon a question hitherto rather obscure, and seem to indicate the way to be taken for the artificial production of the natural pearl. While the Hindoo legend attributes the origin of the pearl to the fall of a drop of dew into the bosom of an oyster gaping in the sun, modern scientists have long believed that the pearl results from a secretion consequent upon the irritation produced upon the nerves of the mollusk by the introduction of a foreign substance, a grain of sand or other. For a long time the Chinese and the Japanese have thus manufactured so-called genuine pearls. They introduce into the very heart of the oyster small bodies, around which another gradually comes to model itself. Attempts of this sort have been made in France. But it seems to be admitted that the concretions thus obtained are not pearl, they are mere mother of pearl. According to another theory, a certain disease of the oyster determines the formation of *calculi* or "stones," which an equally morbid secretion envelops in pearl-matter. A good many pearls from Ceylon inclose a minute nucleus, the presence of which agrees with this theory. But all pearls do not present this phenomenon; the theory must therefore be discarded.

A parasitic origin appears today as good as demonstrated. Already Prof. Raphael DuBois had attributed the formation of pearls in the mold to the presence of a larva. During his stay in the Gambier Islands (1902-1904) Mons. Seurat decalcified pearls and he found at the heart a nucleus not formed by a "stone," but by the worm of the *tylocephalum*, which is a parasite of the oyster. At the same time it was noticed that the majority of pearls gathered *loose* in the oys-



The "Planet" Equipped for Meteorological Observations at Sea.

Balloon Used for Raising Instruments to High Altitudes.

THE GERMAN MARINE RESEARCH BOAT "PLANET."

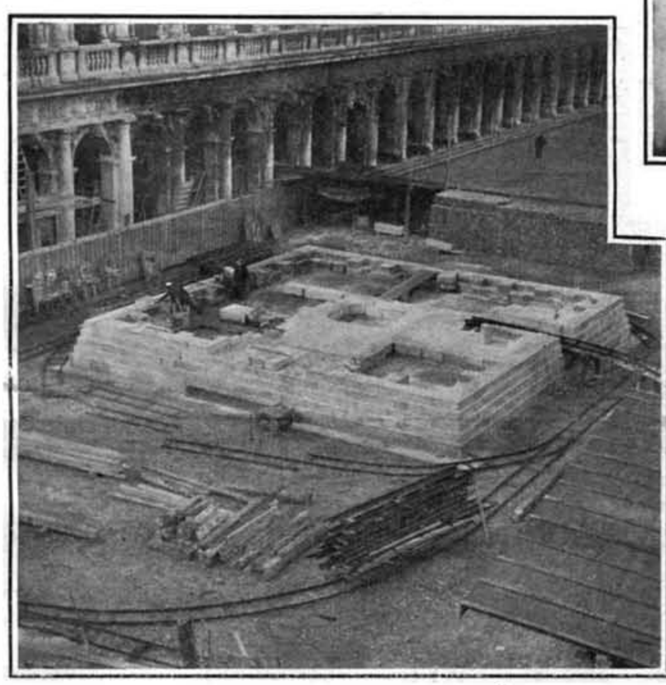
ters of Ceylon contained the remains of a worm. On the other hand, it is known that certain larvæ hatched in the cells of any given animal can continue their evolution only by passing into the stomach (if one may thus express oneself) of some other animal. The best known example of this phenomenon is furnished to us by tape-worms. Now in the present state of microbiological science it is accounted that this parasite of the oyster must accomplish its development in the eagle-ray, which pierces the oysters with its spine in order to imbibe the larvæ which prey upon it, and among these last the larvæ of the pearl. The knowledge of these facts therefore would allow contriving a process for supplying the oysters with the valuable larva while preserving them from the attacks of the eagle-ray. Mons. Seurat thinks it well to call attention to the fact that it is not the parasitic organism of the heart which causes the pearl to live and die. According to him the pearl tarnishes on contact with sweat and other secretions, with dirty or soapy water; it is restored by having the superficial layer dissolved in an acid, which constitutes a delicate operation. Gastric juice possesses for this purpose peculiar properties well known to California ladies who have their tarnished necklaces swallowed by hens whose digestion is carefully watched. These assertions of a scientist scarcely agree with the often-received idea that frequent contact with the skin of a pretty woman is required to preserve the "water" of pearls. We might at most "distinguish" and assume that certain shoulders possess the same properties as the stomach of hens.

More than eight years have elapsed since China granted to France a concession to build a railway from the Tonkin frontier to Yunnan Fu, the capital of the southwestern province, a distance of about 280 miles. Labor and climatic difficulties, as well as a change, in 1904, of the original *tracé* of the line, have had much to do with the delay, but work is now proceeding all along the new route, and it is expected that the railway will be open as far as Mengtzu in 1907, and be completed to Yunnan Fu, the terminus, in 1908.

THE REBUILDING OF THE CAMPANILE AT VENICE.

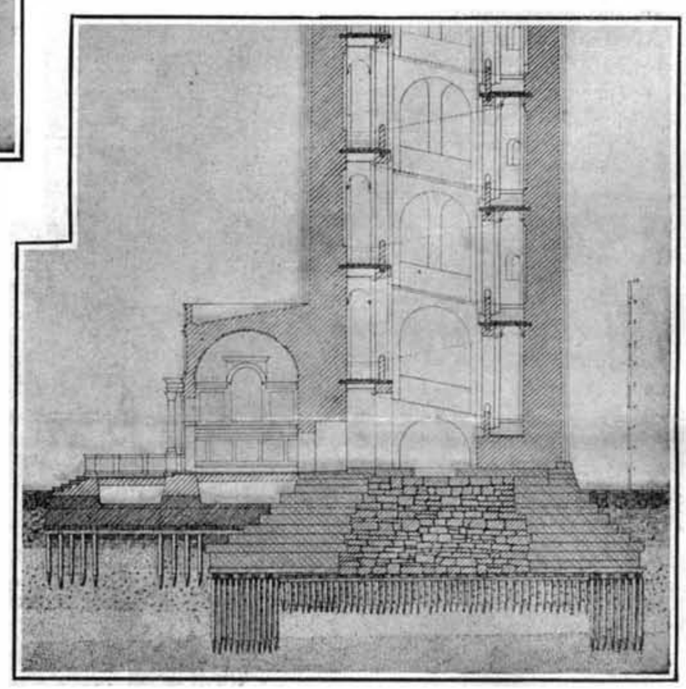
The group of photographs which we publish, showing the progress of the work of reconstructing the campanile at Venice, affords gratifying evidence of the fact that this most prominent feature in the best-known views of Venice is destined at an early date to lift once more its tall and stately beauty into the blue Venetian sky, as it had done for over one thousand years previously to the occurrence of its fall in 1902. It is gratifying to know that the reconstruction of the tower, at least as far as its external appearance is concerned, is to be entirely in accordance with its original lines and dimensions. The structure was 322 feet in height, and it was built on a foundation of closely-driven piles, upon which was laid a foundation of solid masonry some 15 or 16 feet in depth. When the campanile fell, this foundation masonry was not injured, and it will form the core or nucleus of the new foundations. That the substructure of the new tower will be absolutely secure against uneven settlement, and probably against any settlement whatever, will be evident from a consideration of the methods adopted to enlarge and solidify the foundation, all of which will be clear from a study of the accompanying vertical section through the foundations and the lower portion of the tower. In the first place, then, the total weight of the structure, because of the more modern method adopted in its construction, will be largely reduced, and at the same time the total area of the foundation has been about doubled. This has been effected by driving around the old piling, which was only 7 feet in length, several inclosing rows of piling, all of which will be 15 feet in depth. These piles have been put down in close contact with each other, each succeeding row being driven snugly against the one preceding it, the piles being driven from the outside toward the center, with the object of compacting the clay underlying the present foundation, and thus giving them additional support. In the square of new piling there are in all 3,000 piles. They were cut off at the same level as the old piles. The outside courses of the old foundation masonry were then removed for a certain distance inward over the old platform, and entirely new masonry has been built around this core, extending out over the whole area of the platform. It will be seen from this description that the question of future subsidence has, in all human probability, been entirely removed. Above the street level, the foundation is carried up in five steps to correspond with the five steps which, when the building was originally completed, showed above the level of the square. In building the walls of the tower, the original plans will be followed with great fidelity, and the internal spiral pathway will be retained; but for the convenience of the public an electric elevator will be built in the center of the tower. Fortunately, the authorities were able to recover from the mass of debris all the

Madonna and Child, Restored from 1,600 Fragments.

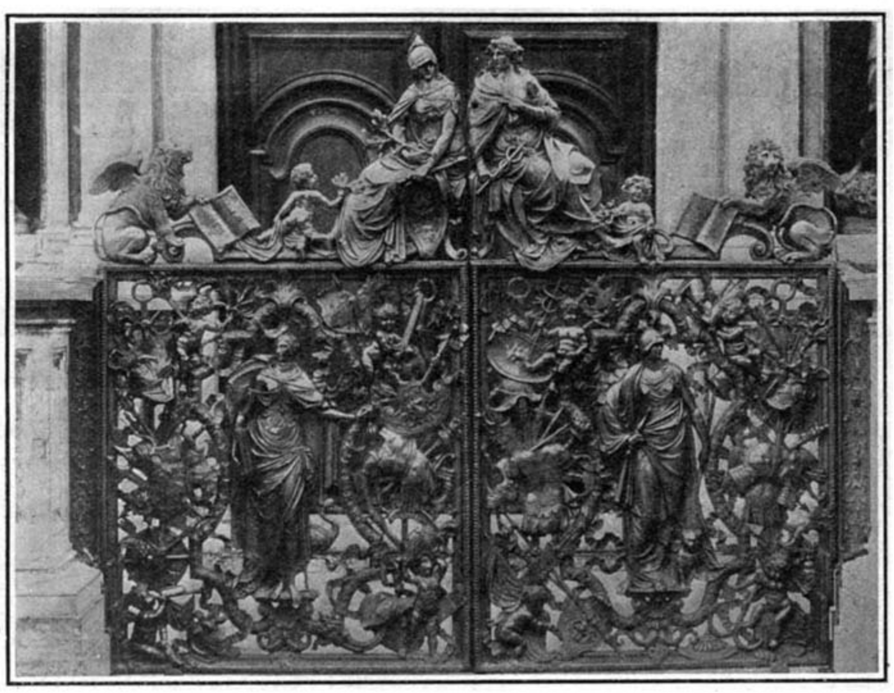


The Restored Foundations, Ready for the Erection of the Brickwork.

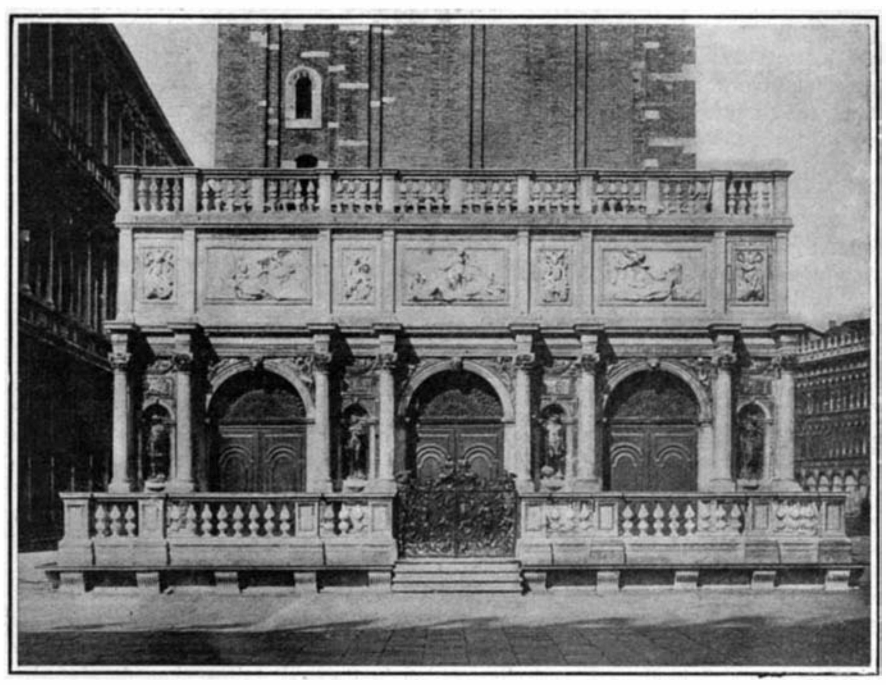
Three of the Statues from the Logetta; Now Restored.



Sectional View of the New Foundations, the Logetta and the Lower Portion of the Tower.*



The Fine Balustrade of Gai in the Logetta.



The Celebrated Logetta and the Base of the Campanile Before It Fell. Note the Cracks in the Wall.

THE REBUILDING OF THE CAMPANILE AT VENICE.

*The short piling is the original work; the longer piling and new masonry has been added during the reconstruction.

more valuable and essential fragments of the tower, including the remains of the ancient Loggetta, the golden angel which crowned the summit, and the bell. Fortunately, the statuary and the bronze gates were also recovered, and have been restored with great fidelity. The statue of the Madonna, which was broken into over sixteen hundred fragments, has been restored with such skill that it is impossible to believe that it could have been once so apparently hopelessly damaged.

Apart from the fact that the campanile is being subjected to such a faithful restoration, it is gratifying to know its fall has proved to be of widespread benefit in the note of warning which it has sounded and the careful investigation which it has produced as to the dangerous condition of many of the ancient and famous buildings of Europe. A large number of the more celebrated churches of Venice have been carefully examined as to the condition of their foundations; and their repair and strengthening is in the hands of competent architects and engineers. As an interesting instance we may quote that of the church of San Giovanni e Paulo, whose sinking foundations are being inclosed by a cofferdam of piling and concrete, which is being so put in as to inclose the clay beneath the church and prevent any further displacement. Another noteworthy work of preservation is that which has been done on the campanile of the church of San Stephano, which is 8 feet out of perpendicular in its total height of 203 feet. In this case a massive buttress carried on a foundation of screw piles was built; and it is not only preventing further displacement in the original direction, but is apparently having the effect of carrying the tower back to the perpendicular—a result which is probably due to the continued sinking of the older piling, while the more firmly-embedded screw piling refuses to yield, and tends to tilt the tower back to the vertical. Incidentally we would draw attention to the fact that the screw piling may now be carrying a much heavier load than was intended; unless indeed the contingency was provided for. For our photographs and much of our information we are indebted to A. Tivoli, of Venice.

Harnessing the Victoria Falls.

BY OUR ENGLISH CORRESPONDENT.

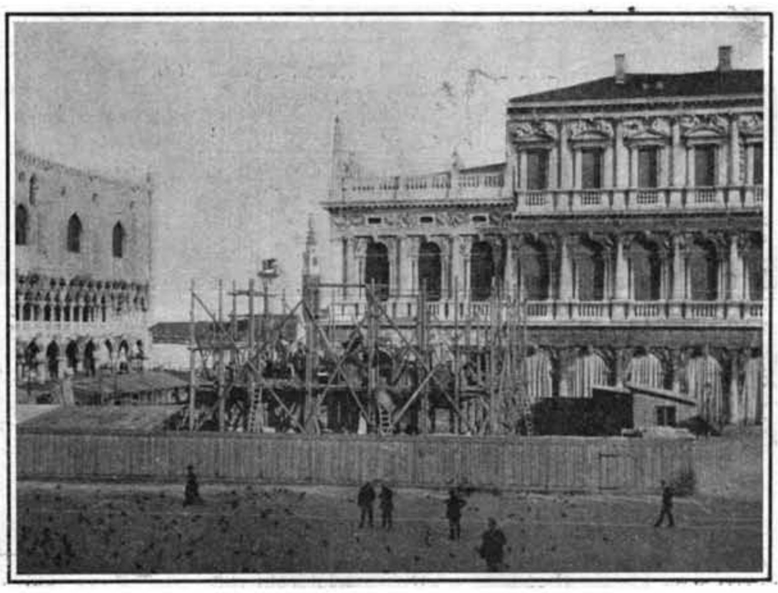
Some weeks ago we drew attention in the pages of the Scientific American to the scheme that had been formulated for harnessing the Victoria Falls on the River Zambesi for the purpose of supplying the Rand goldfields with a cheap supply of electricity in bulk for lighting and power purposes. At that time the project was somewhat nebulous, but now it has assumed definite form and preparations are being hastened forward for receiving the necessary powers from the South African government to permit the work to proceed without delay. When the project was first mooted it was realized that owing to its colossal nature it would have to be carried out upon absolutely new lines since the transmission of the electricity from the Falls to the Rand was over a greater distance than had ever before been attempted. Consequently in view of the various engineering and electrical problems and difficulties with which such a project would be confronted it was decided to form a powerful and cosmopolitan Commission for the purpose of investigating the idea in all its phases and details. This commission comprised Sir Douglas Fox & Partners and Sir Charles Metcalfe, the eminent engineers associated with the late Mr. Cecil Rhodes' various railroads; Mr. Ralph D. Merson, of New York, who has been associated with the Niagara power schemes; Prof. André Blondel, of Paris; Dr. Edouard Tissot; Monsieur Thury, of Geneva; Prof. Klingenberg, of Berlin; Mr. G. A. Hobson; Mr. Arthur Wright; and Mr. A. W. K. Pierce, who discussed the main problem, while the work of distribution at the Rand terminus of the line was investigated by the foremost engineers of the Allegemeine Electricitäts-Gesellschaft of Berlin, who have been intrusted with the contract.

In this undertaking the power is to be transmitted over a distance exceeding 600 miles. From a theoretical point of view there is no limit to the distance over which power can be transmitted, other than those of losses involved in the transmission, which in themselves constitute an important factor. But in the majority of cases, however, other considerations have to be taken into account, such as the configuration of the country and its obstruction to the erection of the cables; climatic conditions both normal and abnormal and their influence upon the maintenance of the line. In this instance the conditions prevailing are unique and conducive to the successful attainment of the project. Between the Falls and the Rand the country throughout the 600 miles is practically level, mostly uninhabited, and fairly open. There are no mountains to negotiate and no forests or swampy stretches to penetrate. The weather is remarkably equable, violent storms, blizzards, and other such natural visitations being quite unknown, while it is also immune from the effects of volcanic disturbance. In regard to the Falls themselves, the scheme has a more promising outlook than prevails at Niagara, where during the winter season and early spring numerous and severe troubles are caused by the presence of ice. The only fluctuations to which the Victoria Falls are subject are the differences in the river level and the attendant volume of water during the dry and rainy seasons respectively, but which in themselves do not offer any obstacle to the obtaining of an adequate supply for the purpose in view.

The power house in which the generating plant is to be installed is to be located at the foot of the Falls near the water's edge 350 feet below the ledge over which the river plunges. The intake will consist of a small canal deviating from the river a short distance above the Falls on the northern bank, and delivering at a convenient spot near the top of the gorge at the first or second bend of the river, since after tumbling over the gorge the river continues its course through a very zig-zag cañon for a considerable distance. The question as to what pressure the current shall be transmitted has not been definitely determined, but Mr. Mershon has suggested a potential of 150,000 volts. The cables themselves will be suspended upon steel towers placed at intervals of 1,000 feet to the outskirts of Johannesburg.

The question of possible failures in the supply arising from transmission breakdowns has been amply considered and adequate arrangements for guarding against inconvenience from this cause are to be made. Mr. Fox's solution of this problem is to construct a reserve or secondary hydraulic generating accumulator near the Rand which would have a twofold object. In the first place, in the event of the transmission line breaking down there would be immediately available a continuous supply of power which would be sufficient for all requirements during the time occupied in the repair of the failure, and secondly the conservation of energy during such periods as the full power is not taken by the various industrial concerns to which the supply is carried. This arrangement, it is pointed out, would possess many distinct advantages. It would enable the electrical working of such a long transmission as this to be made less difficult, as there would be a constant load factor imposed upon the line. Moreover, should the breakdown be more serious than anticipated, the supply from this accumulator would be in every way sufficient until the emergency steam-turbine generating plant situated in Johannesburg itself could be got to work. This steam-turbine generating station, the construction of which is to be commenced at once, is to have an initial capacity of 20,000 horse-power, extensions being easily possible as the supply develops. The utilization of the accumulator as a standby in case of accident to the main supply system from the Falls dispenses with the necessity of keeping this steam station constantly under steam, which would be a highly expensive matter, since the calls upon it might be few and far between. When intimation is received that a failure has developed in the main supply the reserve hydraulic accumulator would take over the supply until steam was raised in the Johannesburg station, which preparations would occupy about twelve hours. By means of this extensive power scheme it will be possible for the mines to obtain their requisite power at a saving of 40 per cent. At present there are only two small generating plants in Johannesburg of 4,000 and 4,700 horse-power respectively, the latter of which the promoters of this enterprise have already acquired. Nearly all the mines are at present operated by steam power the aggregate capacity of which is 281,099 horse-power. The greater part of this steam plant will be abandoned as many of the largest and wealthiest mining companies have signified their willingness to substitute electric power when the scheme is completed upon economic grounds, a consummation which has hitherto been impracticable owing to the high tariff at present prevailing on the Rand for electric energy.

The engineers of the undertaking point out that the conditions attending the supply of electric current to the Rand are unique. In the first place the load factor will be abnormally high as compared with that prevailing at power stations in other parts of the world. This is attributable to the fact that pumping and milling are carried out continuously without any cessation night and day.



Erecting the Brickwork of the Campanile. The Royal Palace at the Rear Has Been Completely Restored.

Bucknall's Long Balloon Voyage.

The longest balloon voyage of the year has just been accomplished by Mr. Leslie Bucknall, the well-known English aeronaut. Starting from London, he crossed the Channel, passed over France for a long distance, entered Switzerland and landed at Veney, on the shore of Lake Leman. About 472 miles is the estimated distance of the trip, the greatest covered during the present year. Accompanied by Mr. Spencer, he started on the 27th of November, at 9.30 A. M., from the Wandsworth gas works in the suburbs of London on board his new spherical balloon, "Vivienne IV.," which gages 2,615 cubic yards. He carried 500 kilos (1,120 lbs.) of sand on board. The wind blew strongly from the northwest, so the aeronauts were confident of being able to cross the Channel, and sailed first toward Folkestone, on the Channel coast, then crossed over at a good speed, coming over France at Touquet, and passing then over Amiens, Rheims, Chaumont and proceeding to the eastern frontier came to Switzerland and crossed the snow-covered Jura chain which lies at an altitude of 4,920 feet between Lakes Neuchatel and Leman. The balloon reached the shores of Lake Leman, and passed over this country during the night. At midnight Mr. Bucknall came over the lake and had before him the high peaks of the Bernese Alps, of which the Diablerets reaches an altitude of 10,660 feet, without much chance of passing by the Rhone valley by way of St. Maurice, so that he gave up the idea of crossing into Italy and landed on the shore of the lake at Veney at 1.30 A. M. This trip seems to be the best one which has yet been made from London, and as will be noticed, he made a very high speed. The new balloon of 2,615 cubic yards was built this year at Paris by Emile Carton, and this was its second trip only. It is one which Santos Dumont used on the occasion of the Gordon Bennett Cup race starting from Paris, and as will be remembered it was fitted with two horizontal propellers mounted on the basket and driven by a petrol motor. Santos Dumont caught his arm in the mechanism and was obliged to alight.

After the occurrence of this mishap he did not continue experiments in ballooning and turned over the "Two Americas," as it was called, to Mr. Bucknall, who baptized it "Vivienne IV.," this being the fourth balloon in the series he possesses, these gaging 1,560, 1,950, 2,015, and 2,615 cubic yards.

One Tunnel to Brooklyn Open.

The headings of the north tube of the pair of subway tunnels that are being built from the Battery to the foot of Joralemon Street, Brooklyn, came together near the middle of the East River at 2.35 o'clock on the afternoon of December 14, 1906, thus forming the first underground passage between the boroughs of Brooklyn and Manhattan.

For more than three years the two gangs at work on each end of the tunnel have been boring their way toward each other, through rock, sand and schist, and when they came together it was almost like the meeting of the rims of two tumblers held in a person's hand.

The men in the north tube had been working with might and main ever since December 8, when the engineers drove a 10-inch pipe through the 65 feet of earth that separated the two shields. That was done so that the levels might be checked, but even without that precaution the shields, it was said, would not have miscarried noticeably.

President Roosevelt Receives the Nobel Peace Prize.

The Nobel Peace Prize has been awarded by the Norwegian Parliament to President Roosevelt. In a short speech the President of the Parliament, Gunnar Knudsen, said what had especially attracted the attention of the world was President Roosevelt's efforts to end the war between Russia and Japan. The amount of the Nobel Peace Prize will be given to trustees to be used as a fund to be expended for the purpose of bringing together at Washington representatives of capital and labor to discuss industrial problems with a view to promoting a better understanding between employers and employees. The committee of six in charge of the fund will be called "The Industrial Peace Committee."

Correspondence.

Southern Storms.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of the 24th instant you print an interesting article on the great storm of September 26-27—the West Indian hurricane of that date. The enormous damage done at the same time to the timber, cotton, and other crops, as well as buildings in this State, was not due to this storm at all, but to another which blew from the opposite direction, i. e., northwest, as is shown by the thousands of trees broken, which all point to the southeast. There were two storms, one from southeast to northwest and the other from northwest to southeast, their edges meeting or overlapping about the eastern boundary of this State. Such occurrence must be very rare.

One result of the storm in this neighborhood has been the almost total extinction of the English sparrow, but unfortunately mocking birds, red birds, and others suffered in proportion. A large number of quail also have been killed. J. WILMOTH.

Wortham, Miss., November 25, 1906.

Brain Anatomy.

To the Editor of the SCIENTIFIC AMERICAN:

The article "Wanted, Brains to Dissect," over the signature of James M. Boady, states "that the school of anatomists who follow Spitzka have inaugurated a new era in brain anatomy by calling attention to the important function of the great bundle of transverse fibers—the corpus callosum—as an index to the intelligence of the race or individual."

"Salvarona," a professor of psychology and author of the "Wisdom of Passion" and other publications, member of the Society of Psychological Research, etc., says "that it is not gray, red, yellow, or pink matter that has to do with it at all, but the spiritual, mental, and psychological substances, forces, and motions which operate through the brain matter, as a condition."

That the "Rolando" suture is the locality of muscular motion he learned from Prof. James of Harvard ten years ago, and that the frontal lobes of the brain are concerned in the higher intellectuality has been taught for decades. Both Boady and Spitzka, as well as the old anatomists who cling to the "gray matter," miss the point. It is the spiritual, mental, and psychological substances, forces, and motion, which operate through brain matter. DR. JAMES B. CANDY.

Langhorne, Buck, Pa., November 12, 1906.

Roads for Automobiles.

To the Editor of the SCIENTIFIC AMERICAN:

Your recent editorial article on the subject of "Roads for Automobiles" was read with much interest and profit.

Here in Kentucky, in Fayette County, of which Lexington is the county seat, are some very fine roads for motoring. These roads are the old turnpikes reconstructed within the last three or four years with the steam roller, using broken limestone for material with a top dressing of the finer screenings. Crude oil from the Kentucky Ragland fields is then applied, making a road almost entirely free from mud or dust. When first put on, the oil sticks to vehicles and clothing and is quite disagreeable, but after a few days' sunshine the road becomes about as smooth and clean as asphalt, and further injury to vehicles or clothing cannot be discovered, and the road surface is bound so firmly and compactly together that the wear of motor traffic seems negligible. So tough is this material that the suction of motor tires has no effect on it. One application of oil a year is sufficient to keep the road in excellent condition.

I believe there are no finer motor roads in America, and no doubt they could be profitably studied by engineers interested in the construction of such roads. B. L. BANKS.

Richmond, Ky., November 7, 1906.

The Current Supplement.

In the effort to meet the present imperative demand for a satisfactory railway motor coach a rather large number of constructions have been developed. The latest of these, the Kobusch-Wagenhals steam motor coach is described in the opening article of the current SUPPLEMENT, No. 1616. The car is driven by steam. Count von Zeppelin, in a very thoughtful paper, gives his views on dirigible airships and enunciates the theory upon which the several craft which he has built have been designed. Major E. Stassano writes on the electro-thermal metallurgy of iron. Inasmuch as he is one of the foremost authorities on the subject, his essay will be read, no doubt, with interest. Mr. B. S. Bowdish contributes a pleasantly-worded article on the Weed Fields, in which he describes those wonders of our meadows which are commonly passed unnoticed. Mr. Willard L. Case's article on gas as a source of power, is concluded. The scientific control of boiler furnaces is a means of obtaining a high factor of efficiency and economy, is a necessity to which steam users are keenly alive. Although various devices have been designed for analyzing the gases in boiler flues to determine the quantity of CO_2 which they contain, none is more interesting than that which is described in the current SUPPLEMENT under the title "The Ados Automatic CO_2 Recorder." Sir Francis Galton writes on the measurement of resemblance and proposes a scientific apparatus for measuring the similarity between two human beings.

Thirty-six New Variable Stars.

In the course of the study, by Miss Leavitt, of the distribution of variable stars, the majority of the variables discovered have been fainter at maximum than the tenth magnitude. This is owing to the long exposure of the plates, taken with the 24-inch Bruce telescope, which have been used. Not only is the number of faint stars on these plates very great in proportion to that of stars brighter than the tenth magnitude, but the discovery of variations among the brighter stars is, perhaps, disproportionately small because their images are so large that only striking variations are noticeable. Since the beginning of this work, it has been felt that the plates taken with the one-inch Cooke lens, which cover a region of the sky 30 deg. square and show stars of the eleventh magnitude and brighter, would furnish a valuable means of discovering the brighter variables. In January, 1905, four of these plates, having centers in R.A. 16h., dec. 45 deg., were superposed. The positive used was very dense, and not well suited for the purpose of discovering variables, for which a thin positive is now always used. The six known variables RS Libræ, RU Libræ, RZ Scorpii, RS Scorpii, RR Scorpii, and RW Scorpii were rediscovered, however, together with the planet Uranus. No new variables were found, and owing to the pressure of other work, the examination of plates belonging to the map of the sky was only recently resumed. The region selected was that covered by a plate which has its center in RA. 12h., dec. 60 deg. The nebula in Carina and the "Coal-Sack," which had already been examined on Bruce plates of long exposure, are seen on these plates. Six photographs were compared, and thirty-six new variables were discovered, besides Nova Velorum, announced. The sixteen known variables, S. Carinæ, RX Carinæ, U Carinæ, RS Centauri, W Centauri, R Crucis, R Muscæ, S Crucis, RV Centauri, 131,360, 102,458, 103,260, 104,057a, 104,758, 105,160 and 125,564 were rediscovered, the last six having been originally found on Bruce plates and recently announced. In the entire region, within 15 deg. of the center of the plates, there are twenty-five known variables brighter, at maximum, than the tenth magnitude, omitting η Carinæ, the suspected variable T Carinæ, Nova (RS) Carinæ, Nova Velorum, and RT Carinæ which is too much involved in the nebula to be found by this method. The nine variables which might be found on these plates but were not rediscovered, are Z Carinæ, Y Carinæ, RZ Carinæ, S. Muscæ, T Crucis, U Centauri, 104,265, 130,656, and 130,763. It is believed that an examination of ten good plates of any region, suitably distributed as to time, may be regarded as thorough, though no examination can be exhaustive. It may be considered satisfactory, therefore, that on six plates, sixteen out of twenty-five known variables were rediscovered, while thirty-six new ones were found. This indicates that there may be from seventy to eighty variable stars in the region, which are brighter at maximum than the tenth magnitude.

To Our Subscribers.

We are at the close of another year—the sixty-first of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year. To those who are not familiar with the SUPPLEMENT, a word may not be out of place. The SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

Dr. William Brooks Honored.

Dr. William R. Brooks, director of the Smith Observatory and professor of astronomy at Hobart College, has been awarded a medal and diploma by the Astronomical Society of Mexico for his discoveries of twenty-five comets. Besides many other prizes, this is the twelfth medal conferred upon Prof. Brooks. Among these were medals from the Astronomical Society of the Pacific, a special gold medal from the International Jury of the Columbian Exposition, and the Lalande prize medal from the Paris Academy of Sciences, bestowed, in the words of the award, "for numerous and brilliant astronomical discoveries."

CONTROLLING THE COLORADO RIVER AND SALTON SEA.

The recent announcement that the engineers had succeeded in November in damming up the break in the banks of the Colorado River, and the more recent dispatches from the west stating that the river has again broken through its banks and was flowing into the Imperial Valley, have concentrated public attention once more upon the stupendous struggle between the forces of nature and ingenuity and resourcefulness of man which the Salton Sea catastrophe has produced. The huge gap, several thousand feet wide, through which the Colorado for many months has been emptying its waters into the depression of the Salton sink, has finally been closed by a dam, whose construction and the methods adopted to facilitate rapidity in its erection form a story of the greatest interest.

The readers of the SCIENTIFIC AMERICAN have been made familiar with the conditions of the Salton Sea disaster in a series of articles which appeared in the spring of the present year. We now present some photographs, taken during and after the completion of the dam, which, with the accompanying diagrams, will serve to make the situation perfectly clear.

The great natural depression, known as the Salton sink, once formed a portion of the ocean bed. Proof of this is found in the vast deposits of salt, the harvesting of which forms, or did form before the present inundation, an important industry. The term "sink" has been given to all that portion of the Colorado desert which lies below sea level; the Salton Sea is that portion of the sink which is at present covered with water. Within a recent period, measured geologically, the sink formed a portion of the Gulf of California; but the Colorado River, which brings down annually enormous quantities of silt, in the course of time so greatly broadened and raised the delta at its mouth, that the Salton basin was eventually cut off from the sea by a mass of silt, which now extends to a height, in places, of 40 feet above sea level. With the shutting out of the sea the inclosed waters of the Salton Sink gradually evaporated, until, in the course of ages, it had been reduced to its present dimensions, or rather the dimensions it had before the recent inundations commenced.

The alluvial deposits of the Imperial Valley are found to be, when irrigated, exceedingly fertile, and the present trouble has grown out of the efforts which were made to lead a portion of the waters of the Colorado River into the Imperial Valley for purposes of irrigation. In 1901 these operations were started by the dredging out of about ten miles of the channel of the Alamo River, which is shown on the accompanying map of the district, as running from the main stream of the Colorado in a general westerly direction. The canals and its waterways embrace about 100,000 acres of land; and so productive have the irrigated lands proved to be that there are at present about 12,000 people residing in the district, which is covered with prosperous farms. The mouth of the diversion channel, however, became so choked up in the course of time by silt brought down by the Colorado River, that, in preference to dredging out the canal, the irrigating company excavated a new channel from the river to the canal at the point marked on the accompanying map "Intake No. 3." This work was completed in November, 1904. The original ditch was about 50 feet in width, but the rush of waters due to a flood of the Colorado quickly cut a wider and deeper channel, with the result that more water flowed into the canal than could be used in the irrigation system, and the surplus, following the Alamo channel, flowed on into the Salton sink, which began to rise and spread out over the adjacent country. At times the increase in the depth of the Salton Sea has been as high as 3 inches in twenty-four hours. The salt industry has been practically ruined, and the irrigated district threatened with overflow. The maximum depth of water in the sink has been about 78 feet, but the basin would have to be filled to a maximum depth of about 150 feet before the water would cover the farms of the Imperial Valley.

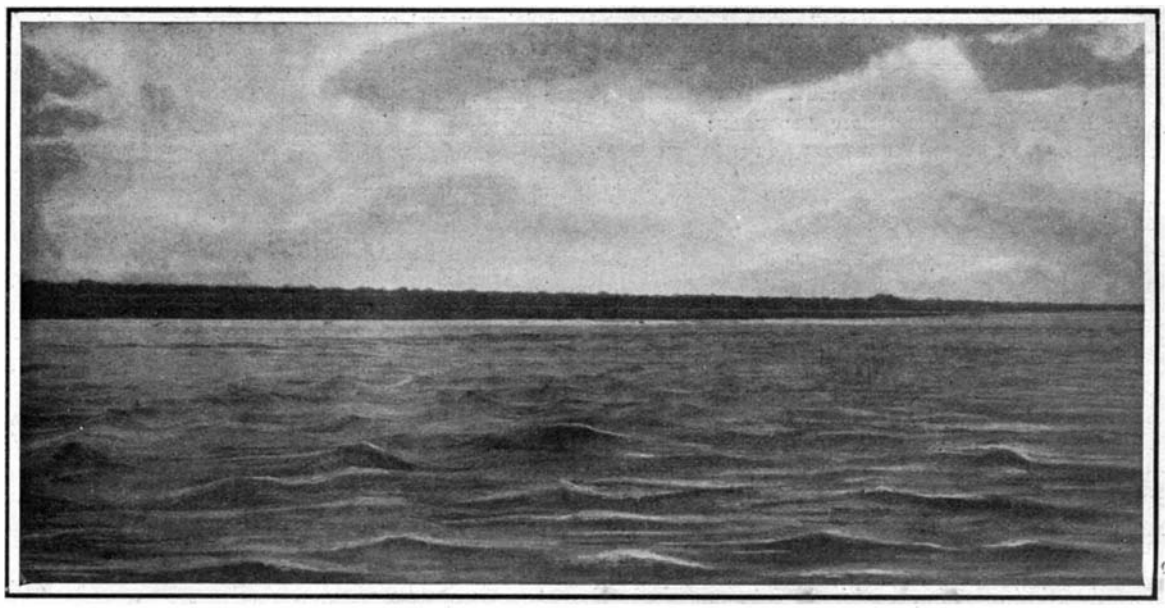
Referring again to the accompanying diagrams, intake No. 1 represents the point at which the original channel led out from the Colorado River. No. 2 was cut on the Mexican side of the boundary to conform with a provision of the Mexican charter to the irrigation company, and very little use has been made of it. Intake No. 3 is the emergency cut referred to above. In May, 1905, channel No. 3 was about 100 feet in width, but when the flood waters subsided, it was found to have widened out to 800 feet and that the enormous quantity of 14,000 cubic feet of water per second was flowing through the gap, which, at one point had been cut out to a depth of 24 feet.

Among the emergency measures aiming to throw the river back into its proper channel, may be mentioned the following: First, an attempt was made by means of a light jetty of piling and brush reaching from *A* to *B* (diagram No. 1) to form a sand bar and divert the flow of the river to the eastern channel of the island. This proved to be a failure. Then the

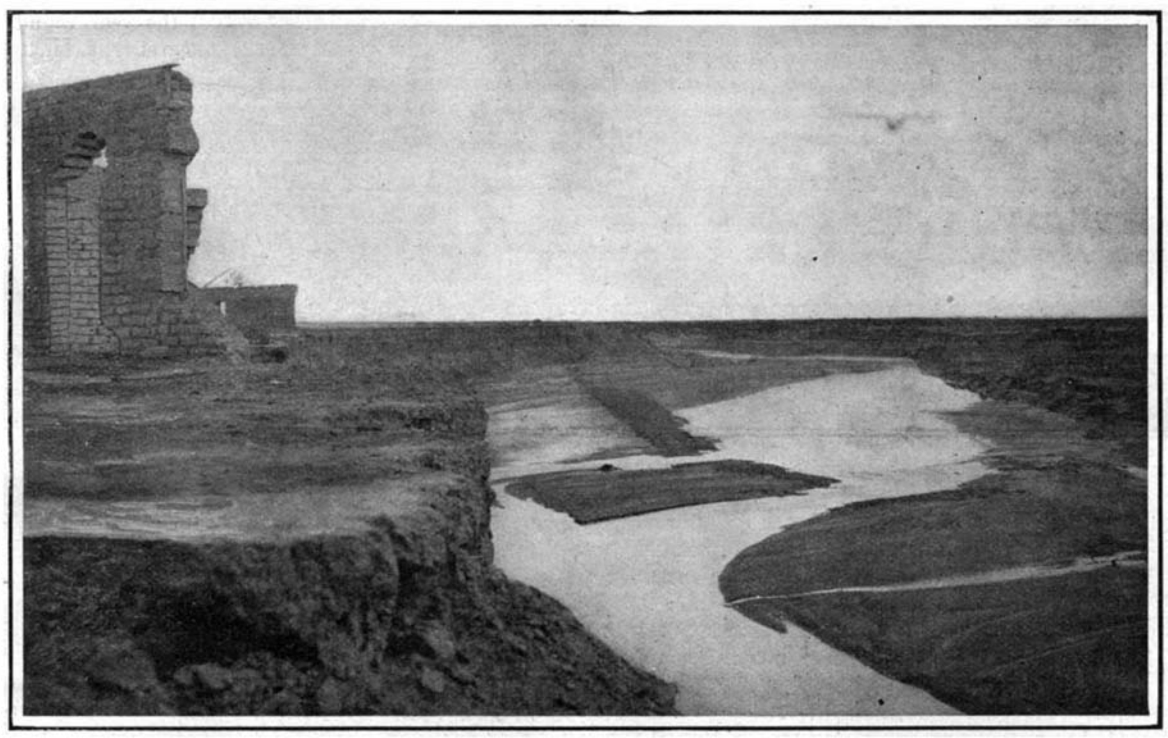
Southern Pacific engineers attempted to construct a pile dam across the west channel at point No. 6, diagram No. 2; but at high water the brush mats were undermined, the head of the island was washed away, and the work that had been done completely wrecked.

Finally, it was determined to concentrate an exceptionally large force of men, engines, flat cars, and material near the mouth of the new channel that had been cut through at the site of intake No. 3, throw a massive rock and gravel dam across the channel at a point halfway between points No. 2 and No. 5 (diagram 2), and so divert the river back to its original channel. The successful completion of the dam is due to the earnest co-operation of the Southern Pacific Railroad Company, 40 or 50 miles of whose tracks are endangered, of the United States Reclamation Service, and of the engineers of the irrigation company.

The first step was to lay a branch railroad from the main line of the Southern Pacific Railroad to the break in the river bank. This done, a series of side tracks was laid down for the storage of rock and other materials for the dam, the underlying idea being to attack the torrent of the river with a large force of men and abundant materials, and throw the dam across the breach with the greatest possible rapidity. For the construction of the dam there were assembled 1,100 piles, 2,200 cords of willows for mattresses, 40 miles of ⅝-inch steel cable, and 70,000 tons of rock. In addition to the rock, half a million cubic yards of earth had to be dumped into place, if the roaring torrent was to be thrown back into its proper channel. For constructing the dam, hauling the material into place, etc., there were assembled eight locomotives, an army of mules and horses, and over 1,000 laborers. The problem was complicated by the nature of the bottom over which the torrent was flowing; for it consisted of soft silt of unknown depth. The first step taken was to drive a row of piles across the torrent. To each of these was fastened a length of ⅝-inch braided steel wire cable. Meanwhile a vast pile of tall, slender willows had been gathered on the shore adjacent to a large flat boat. This was anchored to the piles upstream by cables, whose lengths were such as to allow the barge to float over the site on which the dam was to be built. Twelve "dead men" logs were buried deep in the banks of the stream, and to each was fastened one end of a cable which led to a huge spool of cable on the boat. There were twelve of these spools spaced about 8 feet apart. Large skids or launching ways were built upon the deck of the boat, and upon these the work of constructing the mattresses was begun. Many cords of willows were laid on the launching ways, and hundreds of men bound them with wire into fascines or bundles 25 inches in diameter and 90 feet in length. Twelve cables were then twisted around each bundle in double loops, and many thousands were thus bound together. The cables formed the warp and the fascines of willows the woof of what was actually a huge leafy carpet.



A View Taken on the Salton Sea, Which is Growing Steadily, Fed by the Escaping Waters of the Colorado.

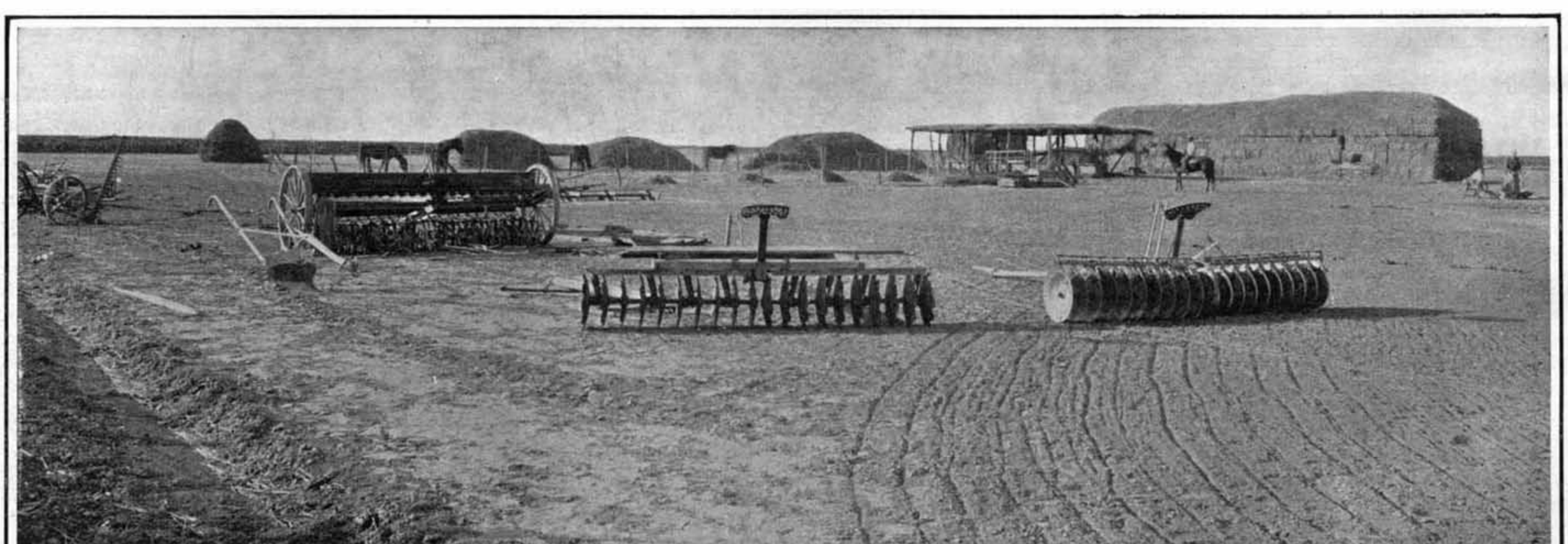


Ruins of Mexicali, a Mexican Town, Four-fifths of Which Has Been Washed Away by the Escaped Waters of the Colorado. Note the Depth to Which the Flood Has Cut Down Through the Alluvial Soil.

When the launching ways had been covered a steamer pulled the barge into the river; the spools turned; the cables unwound; and the huge carpet, 90 feet wide and 3,000 feet long, fell over the side of the boat into the water and sank to the bottom, where it was held in place by the cables leading from the row of upstream piles before mentioned. The silt at once began to settle in between the leaves and the twigs of the mattress. The barge was followed by a floating pile driver, which pinned the mattress (nailed the carpet, if you will) down, with piles 40 to 60 feet in length. In the deepest part of the stream three strips were laid superposed.

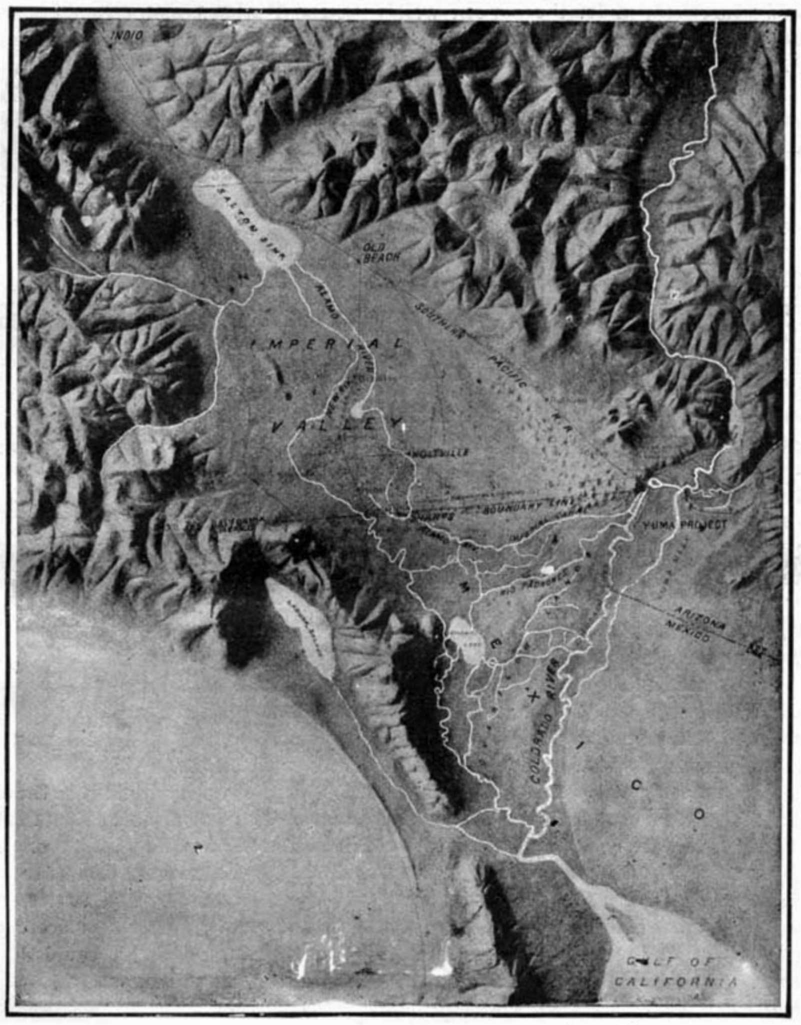
The next step was to drive a strong pile railroad trestle 3,000 feet in length across the axis of the mattress, from shore to shore, with a side track at the center provided with switches for the passage of trains. When the preparatory work was finally completed, the task of building the rock and gravel dam was commenced, and rushed through with the greatest possible speed, night and day, until the breach was closed, and the river thrown back into its proper channel. The dam was advanced from both banks simultaneously. Long trains of gravel and rock were drawn out over the trestle, and their contents dumped as quickly as the men could pry the rock off the cars into the rushing torrent. As the ends of the two portions of the dam approached each other, the water increased in height and rushed with increasing velocity through the narrowing channel. All through the night of November 3, the men redoubled their efforts and by noon of November 4, after working for many hours unloading at the rate of five minutes to each carload, the final closure was made, and the mighty Colorado River, which drains some 230,000 square miles, was thrust back into its original bed, and again flowed down to the Gulf of California.

Estimates of the damage done by the inundation include: the washing of 30,000 acres of rich land into the Salton Sea, and the injury of as much more by the formation of gullies or small canyons; and the destruction of four-fifths of the town of Mexicali, in Mexico; while some 50 miles of the Southern Pacific Railway track have been rebuilt at successively higher



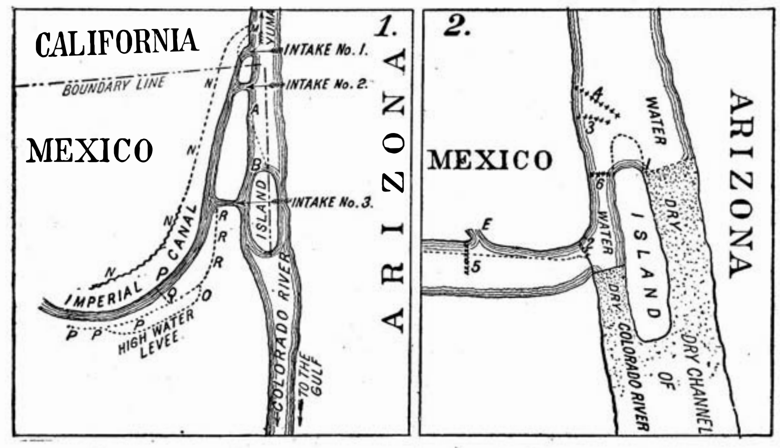
A Typical Farm in the Imperial Valley.

CONTROLLING THE COLORADO RIVER AND SALTON SEA.

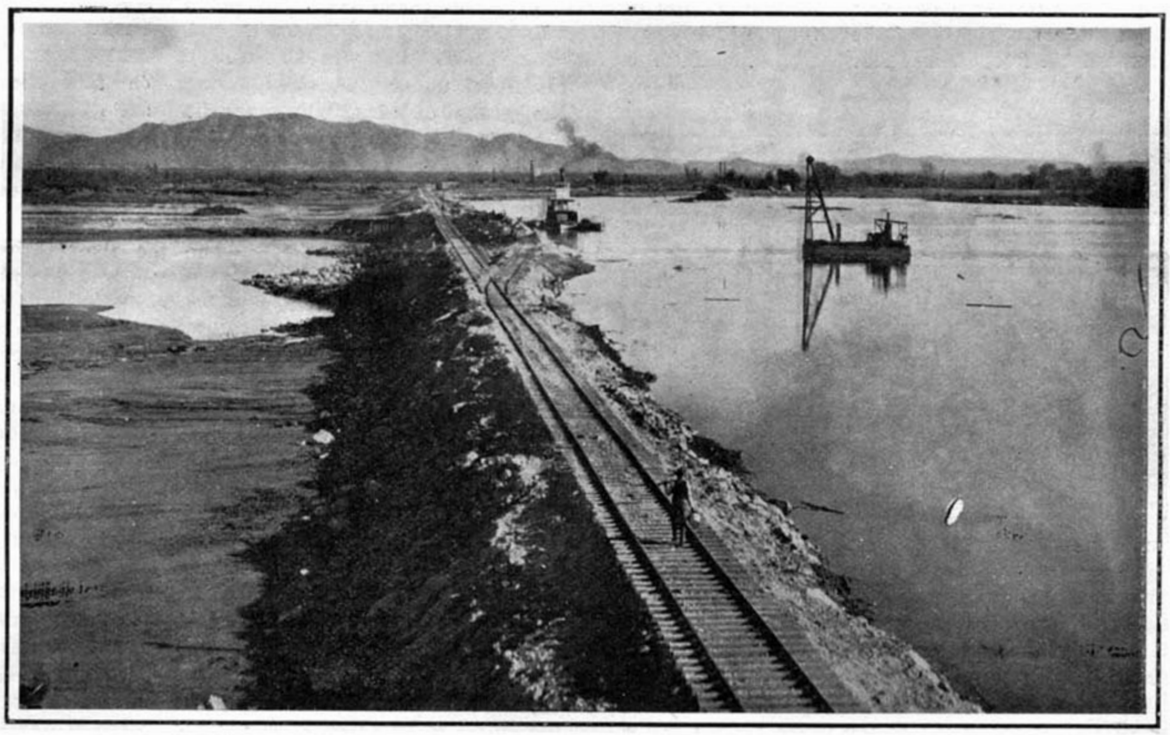


The Imperial Valley, the Colorado River, and the Inundated Country.

levels to avoid the encroaching sea. Furthermore, millions of tons of the salt which formed such a profitable industry have been covered by the silt at the bottom of the Salton Sea. At the present writing the area of the Salton Sea is about 500 square miles, and its greatest depth 78 feet. Had the Colorado River not been turned back to the Gulf, not only would the entire Imperial Valley, with all its improvements, have been jeopardized, but the vast United States Government Laguna Project Weir, and the land which it was to have irrigated, would also have been threatened. The average annual evaporation of still water at Yuma, Arizona, is 7 feet; consequently the enlarged Salton Sea will be visible in the ancient sink for some time to come. In view of the prodigious efforts expended on the construction of the dam just completed, there is a positive element of the tragic in the announcement that the Colorado has again broken through its banks, this time at a point about a mile below the old break at intake No. 3. The Southern Pacific Company has voted $2,500,000 to grapple with the new disaster and the people of the Imperial Valley have agreed to add another $1,000,000 to this. The task must be accomplished and it will be; but just what it will cost or where the trouble will end it is difficult at this time to foretell.



The New Dam Has Been Built Between 2 and 5 (Diagram 2). The River, Since Completion of Dam, Has Broken Through Its Banks a Mile Below the First Break at 2.



The Great Dam of Gravel and Rock, 3,000 Feet in Length, Recently Built Across the Channel Through Which the Colorado River Was Flowing into the Salton Sea.

Thousands of Tons of Clay Were Unloaded from Cars Upon the Upstream Side of the Dam, and Broken Up and Washed Into the Interstices of the Broken Rock by the Use of Hydraulic Jets.

Curious Appearance of the Silt Left by the Flood and Subsequently Dried Out and Cracked by the Action of the Sun.

CONTROLLING THE COLORADO RIVER AND SALTON SEA.

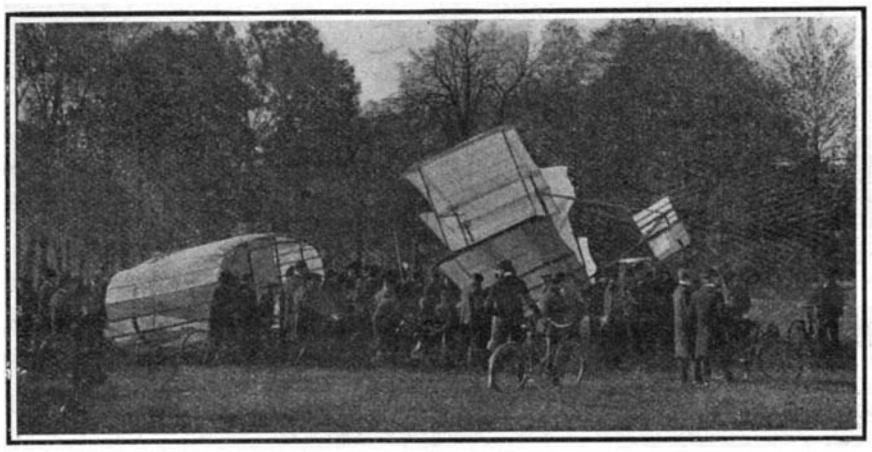
The Argentine Republic is one of our strongest competitors in the food markets of the world. In many respects it resembles the United States, being in nearly the same zone, on the other side of the equator, and having a large, fertile, level country, admirably adapted to agriculture and stock raising. Almost everything that can be raised in the United States can be raised more cheaply and equally well in Argentina. The country has a total area of 1,135,840 English square miles, equal to all the United States east of the Mississippi, with both the Dakotas, Minnesota, and Iowa added. About 25,000,000 acres are under cultivation, nearly half of which is in wheat. With the wheat she raises, Argentina can supply bread for her own 5,000,000 people and for 16,000,000 to 22,000,000 persons in other countries, calculated on the United States basis of 4 2-3 bushels per capita. The mild climate of the country gives farmers and stock raisers many advantages, for in the farming country the temperature rarely falls much below the freezing point, and grass grows the year round. The country extends through 34 degrees of latitude, or about 2,300 miles, from north to south, while the limits of the United States cover only about 24 degrees, or 700 miles less. The northern boundary of Argentina is 200 miles nearer the equator than the most southerly point of Florida, and the southern boundary of continental Argentina is 400 miles nearer the south pole than the United States (excepting Alaska) is to the north pole. The country is 800 miles wide at the widest point and tapers at the south to the narrow point of Patagonia, as it used to be called.

According to newspaper dispatches the German Society of Wireless Telegraphy has succeeded in holding wireless telephonic communication between Berlin and Nauen, twenty-four miles away. The conversation was carried on partly by Herr Von Sydow, Under Secretary of the State Postal Department, who, it is claimed, succeeded in receiving perfectly intelligible repetitions to his questions.

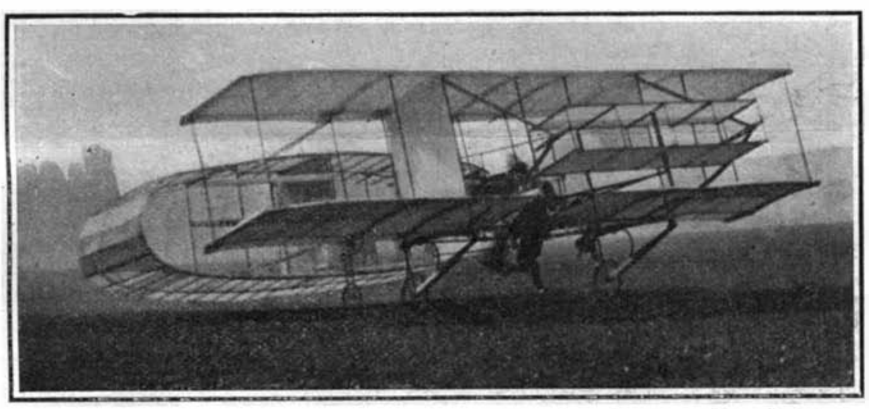
RECENT AIRSHIP AND AEROPLANE EXPERIMENTS IN EUROPE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The new Lebaudy airship "La Patrie" is making its first flights. The craft is the second airship of the fleet which the French War Department is having built and which will be located permanently at certain fortified posts, especially near the eastern frontier, where they can be at once called upon for service in case of an invasion. Designed somewhat on the same general lines as the "Lebaudy," which is the first airship of the series built by the Lebaudy brothers, it differs from it in some particulars. The shape of the balloon body is about the same, following engineer Julliot's designs for the long body with the beak-like prow and tail, also keeping the flat, oval, canvas-covered frame, which is attached directly to the gas bag and serves as an aeroplane. In the present airship the form approaches more nearly the cigar shape, the rear end being rounded off to a greater extent and provided with canvas frames placed at right angles so as to keep the craft in proper longitudinal trim. As will be noticed, the design of the rudder is considerably different from the former plan. One of the views shows a rear view of the car, which is of the characteristic form. What is remarkable is the small size of the car in proportion to the gas bag, for it measures not much over one-tenth of its length. The propellers are attached by a frame of steel rods to the car. There are two propellers, one on each side, the bearing being supported at the outer end of the frame, while the motor shaft passes out at the sides of the car and is connected to the propeller through bevel gears. Below the car is a tapered frame of steel tubes which serves to support the whole airship on the ground or to take up the shocks when the balloon alights. In this frame is mounted a gasoline tank of large capacity. A large exhaust pipe runs from the motor and curves below the car, where it ends in a muffler. In the present airship the flat plane which forms part of the under side of the balloon is placed much nearer the front end, and the car is not suspended from the middle of this frame, but rather toward its rear. Under the flat frame is mounted a keel-like vertical web which serves to give steadiness. Back of the frame is a rudder of elaborate design. It consists of a fixed canvas-covered part which is attached under the balloon by cords and has a cross-shaped section. At the end of this frame is attached a vertical movable rudder which is pivoted near the center and can be worked from the car cords. The two sets of steadying frames under the balloon and the set at the end of the body no doubt account for the airship's stability.



The Bleriot Aeroplane After the Accident.



The Bleriot Aeroplane Running Along the Ground Before the Accident.

Among the minor improvements with which the "Patrie" is equipped we may mention an electric bell which rings whenever the gas pressure in the bag reaches the maximum. The envelope has been reinforced to obtain greater impermeability, with the result that the bag will remain inflated for ninety days. The maximum effective lifting capacity is 1,260 kilos (2,772 pounds), so that the airship, besides fuel for ten hours, can carry a crew of three and about 850 kilos (1,870 pounds) of ballast, or a crew of seven and 550 kilos (1,210 pounds) of ballast.

The "Patrie" made its first flight on the 16th of November over the flat ground, around the shed, under the direction of Georges Juchmès, who piloted the first "Lebaudy" so successfully. At 8:20 A. M. the airship was taken out of the shed and brought to the starting point by the corps of military aeronautic aids. The weather was fine, with a light breeze blowing. In the nacelle were Capt. Voyer, delegated by the Minister; Lieut. Bois, who is to pilot the airship when it enters the army service; the mechanic Deguffroy, besides the pilot Juchmès, his mechanic, Rey, and the aid Debrul. Set free at 9:20 A. M., the airship passed to a point near the Seine and then turned about by a fine maneuver, coming back to the plain, running at high speed and in a straight line, and after different evolutions it stopped at 10 o'clock at the starting point, after which the aids returned it to the shed. An altitude of 600 feet was maintained.

The next trial took place on the 22d of November. In spite of the unfavorable weather with a rather stiff breeze and fine rain, the army commission who were to test and receive the airship decided to make a trip on that day over the plain of Moisson. The result was a great success. The aeronauts' report of the trip is as follows: "Cloudy weather, with wind from the southwest which was strong in the air but light near the ground. Starting from the shed at 8 o'clock A. M., tests were made of the motor and propellers at different speeds from 8:50 to 9:10. The balloon was brought by hand to the usual starting point on the plain. It had six men in the nacelle, the same crew as above, with the mechanic Landrin replacing Capt. Voyer. Let loose at 9:32, the airship rose up and came to a balance at a height of 250 feet. As soon as the propellers were started, it headed against the wind and succeeded in traveling very well in this manner. Evolutions were made during thirty minutes under the direction of Lieut. Bois, who now piloted for the first time. From Lavacourt to La Roche-Guyon and from Mousseau to Moisson the steering was perfect. It came back under good control above the group of aids, who drew it down to the ground by the ropes, and it was returned to the shed without any trouble." The balance and steadiness of the airship are said to be excellent and it is much superior to the "Lebaudy" in this respect, owing to the free use of the flat frames. In the afternoon it made a second trip which lasted until nightfall. At 2 o'clock it started off with Lieut. Bois at the helm, and made a number of runs to show the high speed of which it is capable, making also several evolutions at some 300 or 350 feet from the ground. Owing to the use of the planes, it was found that during all the trip only 22 pounds of ballast was used. This is remarkable, inasmuch as the airship stayed in the air nearly until sunset.

The 70-horse-power Panhard-Levassor motor was worked at about two-thirds of its power, running at 650 revolutions per minute instead of the standard speed of 1,000 revolutions. Sometimes exceeding the speed of 30 miles an hour, the huge airship made an average speed of 22 miles, which is a high figure.

The "Patrie" made its fourth flight on the 24th of November and this was as successful as the former trips. Starting from the balloon shed at Moisson at 9 o'clock in the morning, it sailed above the village and the surrounding forest, amid a heavy fog, but this did not prevent the aeronauts from continuing the evolutions. Everything went well with the Panhard motor in good order and the airship kept a fine balance in the air. After a flight of one hour the "Patrie" was brought back to the starting point. On board were Capt. Voyer, Lieut. Bois, the mechanic Scheffer of the Panhard firm, and the mechanics Rey and Deguffroy. During the trip it faced a wind of 20 miles an hour, although the motor was not run at a higher speed than 650 revolutions per minute. The airship carried 750 pounds of ballast, of which only 198 pounds were used.

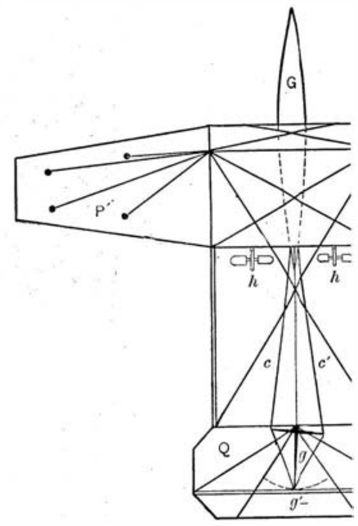
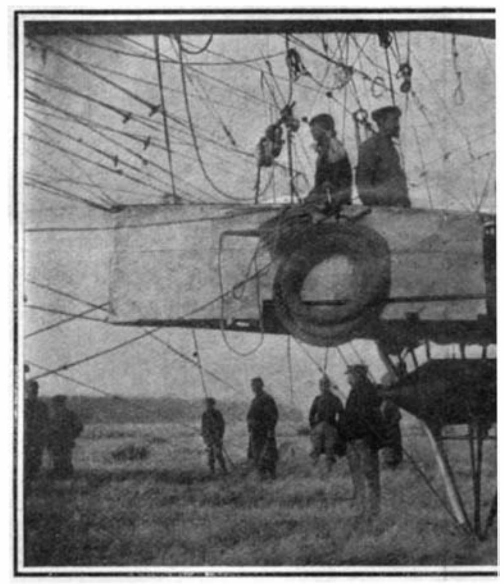


Diagram of Count De la Va

On Nov. 26, the sixth and most remarkable trip of all was made, as the airship sailed 2 hours and 12 minutes, and covered a distance of 57¾ miles.

The start took place at 9:25 A. M., with Capt. Voyer at the helm and others in the car. With the 70-horse-power motor in fine shape and all working well, the airship made evolutions about the region of the Seine near Mantes and Vernon and could be steered with great ease. Several times it disappeared from view in the fog. It came back to the balloon shed at 11:37. Capt. Voyer showed remarkable skill in handling the airship on this occasion. As a result of this performance, the War Department's commission which had been detailed to watch the results of the trials, consisting of prominent officers of the army, decided that it had showed what it could do in the most satisfactory and conclusive manner, so that the airship was formally accepted by the War Department and will be made the second unit of the proposed fleet, together with the "Lebaudy," which is now used for training the special aeronautic corps at the army balloon grounds of Chalais-Meudon, near Paris. On the next trip, made on the 28th, seeing that the airship now belonged to the army, the crew was made up exclusively of members of the Aerostatic Corps. Starting at 10:18 A. M., the airship was again piloted by Capt. Voyer, and he was aided by Lieut. Bois. The remainder of the crew consisted of Commandant Aron, of the Military Aerostatic Corps, Capt. Dorant, and two mechanics. Lasting for one hour and five minutes the trip finished at 11:23 A. M. at the shed, with fine weather prevailing, and a rather strong southwest wind. The airship made a good speed toward Freneuse and Bonnières, then returned, passing above the grounds and dropping a mock projectile with news of the trip, then continued sailing over Mericourt and Rolleboise, along the Seine.



The Car of the "Patrie," Ready to Start

On this, which was the sixth ascension, the airship covered about 93 kilometers (57¾ miles) in two hours and returned without accident to its shed. The average speed was therefore about 26¼ miles per hour. Inasmuch

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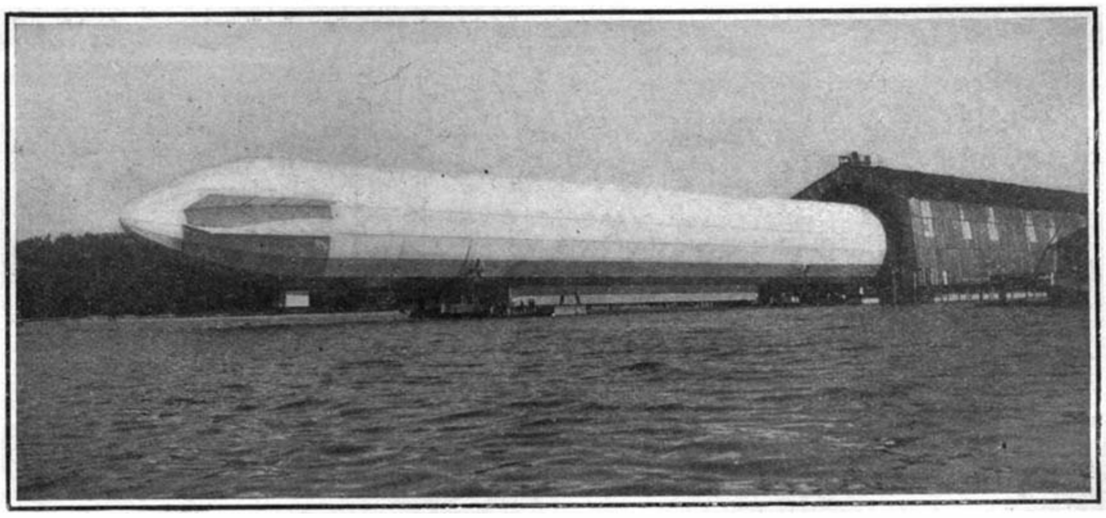
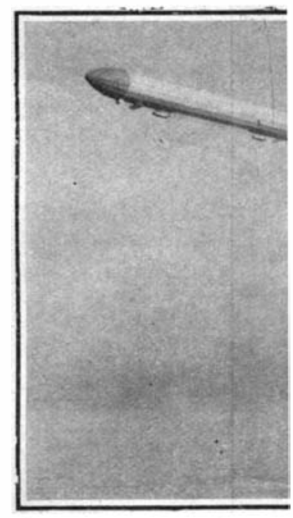


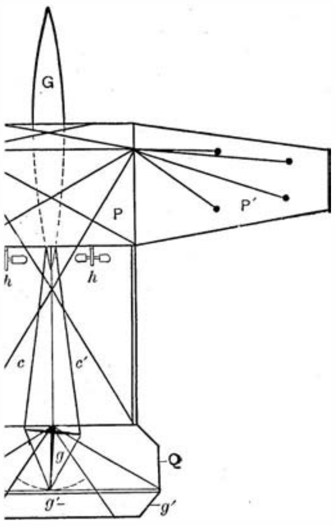


This Airship, which is 38 feet in diameter by 410 feet in length and which has a capacity of 367,120 cubic feet, held itself stationary against a 33½-mile-an-hour wind on Jan radius of 3,000 miles at 31 miles an hour. The latest French Airship, "La Patrie," is 33¾ feet in diameter by 196 feet long and has a capacity of 111,195 cubic fe

Count Von Zeppelin's Airship—The Largest and Fastest Thus Far Constructed—Coming

SOME OF THE MOST RECENTLY-CONSTRUCTED AEROPLANES AND AIRSHI as time is lost in getting up speed and in slowing down at the end of its journey, the average running speed was doubtless somewhat higher.

The fleet of airships which the French army is to have will be three in number, for the present at least. It will be remembered that after the remarkable success of the "Lebaudy," in which figures the trip from Moisson to Paris, it was turned over to the government, who thereupon decided to have built the present airship "Patrie." Later the Minister arranged to have a third airship built in 1907 on the same general plan, and it will be known as the "République." Engineer Julliot's designs are used in all cases. The "Lebaudy" is now in service in the military aerostatic park of Meudon, in the suburbs of Paris, where a special army corps is being trained so as to handle the airships in the future. As to the "Patrie," it is to be used at the military quarters of Verdun, near the frontier.



De la Vaulx's Aeroplane.

We have already given some of the leading details about the new airship which M. Henri Deutsch has had constructed after the designs of Aeronaut Surcouf. It was taken out and put through its first evolutions in the air a few weeks ago, and while on the whole it will no doubt be a success, an accident to the carbureter prevented it from showing what it could do, and moreover when it came to earth the car received a shock, through the negligence of the workmen, which caused it to break in two by its own weight, so that the new airship has been somewhat unfortunate in its first experiments, through no fault in the design. It is to be hoped that it will be in running order before long, but considerable work will have to be done in repairing the nacelle.

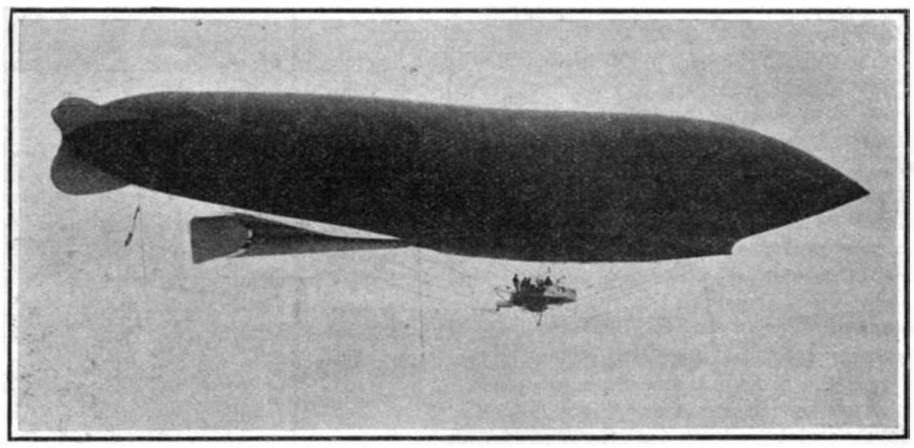
to Start on the Flight of Nov. 23, 1906.

It made its first trip on the 11th of November, commencing to operate with the guide rope at 10 o'clock. The crew was made up of four persons in the car, the constructor, Ed. Surcouf, at the helm, Henry Kapferer, engineer Cormon, and the mechanic Paulhan. Rising then above the Seine, the propeller started and the airship went through a series of evolutions which showed that it could be controlled with ease. But soon afterward the motor had to be stopped owing to the freezing of the carbureter. This rather unusual accident was caused by the fact that the exhaust was cooled by means of a water jacket which was designed to diminish the fire risks and prevent sparks from flying. But this was a disadvantage for the carbureter, as the exhaust could no longer be made to heat it to the proper point. The strong draft caused by the airship's movement gave a still further cooling effect when going at any great speed, so that the aeronauts were obliged to stop every three minutes or so on the flight. Under these conditions, M. Surcouf decided not to continue that day, but to alight near the Seine on the plain of Chambourcy. While in the air, however, it was observed that the airship was remarkably steady. When alighting, the men on the ground made a false maneuver for which there seems to be no excuse, and, as has been stated, the car was allowed to break by its own weight, so that some weeks will be needed for repairs. It appears that the water circulation and carbureter can be arranged to work in a simpler way. The system of cylindrical gas bags is thought to be preferable to a set of canvas frames for steadying the craft, and in fact when in the air the airship was very stable.

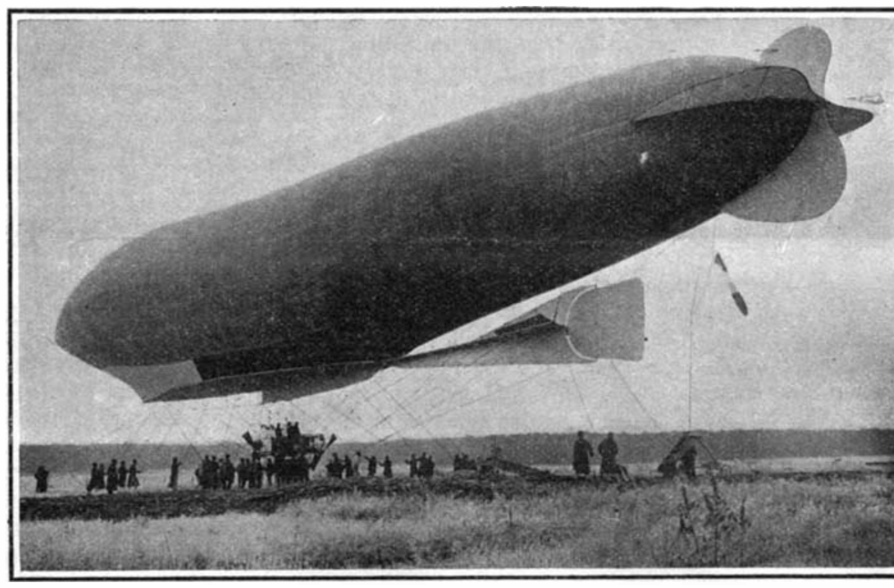
The Bleriot aeroplane was recently tried in Paris, mounted by M. Lemétayer. Its form remains about the same as described heretofore, except that in place of one of the two elliptical frames a regular aeroplane structure consisting of two horizontal superposed surfaces is employed. The aeroplane rolled out on the ground at full speed upon its wheels, but was prevented from rising in the air, for when it ran over a ditch the carriage broke.

Following the movement which has taken place lately in Paris in favor of aeroplanes, Count De La Vaulx is to build a flyer upon a new design. In order to make experiments with aeroplanes, he is designing one which will be built under the direction of aeronautic engineer Tatin, and Maurice Mallet, the well-known constructor of Paris, at the latter's establishment in the suburbs. It will, no doubt, be finished within a few months. Some details have been made known as to the general features of the new aeroplane. It will not be built according to the box plan such as Santos Dumont accepted, but on the contrary is designed on the lines of a body with outstretched wings resembling a soaring bird. As will be noticed in the diagram, there are two propellers turning in opposite directions. The propellers are worked by a 50-horse-power gasoline motor of the Antoinette type, built by Levavasseur, which is meeting with much favor on account of its extra light weight. The motor is placed together with the pilot in the car *C*, which forms the main body of the apparatus and is composed of a frame of light wood strips covered with canvas. It will have a rectangular section ending in curved points at each end. Above the car are fixed the main wings *P′ P′*, forming plane surfaces with the body *P*. Back of these is mounted a fixed tail *Q* having a rather large flat surface, hinged to which in the rear is a frame *g′* which serves as a horizontal rudder. Below the tail *Q* is placed a vertical rudder *g* which is mounted on a pivot and can be worked from the nacelle by cords *c c′* with the end moving as shown by the dotted line. In the present design it is desired to reduce to a minimum the opposing resistances and to obtain the highest speed possible for the aeroplane, which will allow of cutting down the area of the flying surface and the size of the apparatus. It is expected to secure a speed of 45 miles an hour with the 50-horse-power motor.

Santos Dumont is engaged in designing a new aeroplane upon somewhat different lines from the present one, and expects to have it finished so as to begin trying it early next year. He considers the aeroplane which he used up to now as simply an experimental apparatus in order to obtain some data for a more complete one, and the flyer which he will build according to his experience will be quite different in many respects, as he found that the design had to be modified considerably in order to secure the best results. He says that the wings of the present aeroplane were built much larger than was needed to secure a good effect in the preliminary work. The new flyer will be equipped with a 100-horse-power motor which is now building at the shops of the Levavasseur firm near Paris, and will have sixteen cylinders mounted as before in V-shape, being probably the lightest existing motor for that power. It will enable him to reach a much higher speed than before, and he expects to reach 75 miles an hour. He is engaged in building a small model of the new aeroplane and will no doubt have it finished within a week or so. In the meantime, he is overhauling his motor, and expects to go on with the trials of his present machine before long, seeing that the weather is somewhat favorable at times.



The French Military Dirigible, "Patrie," in Flight.

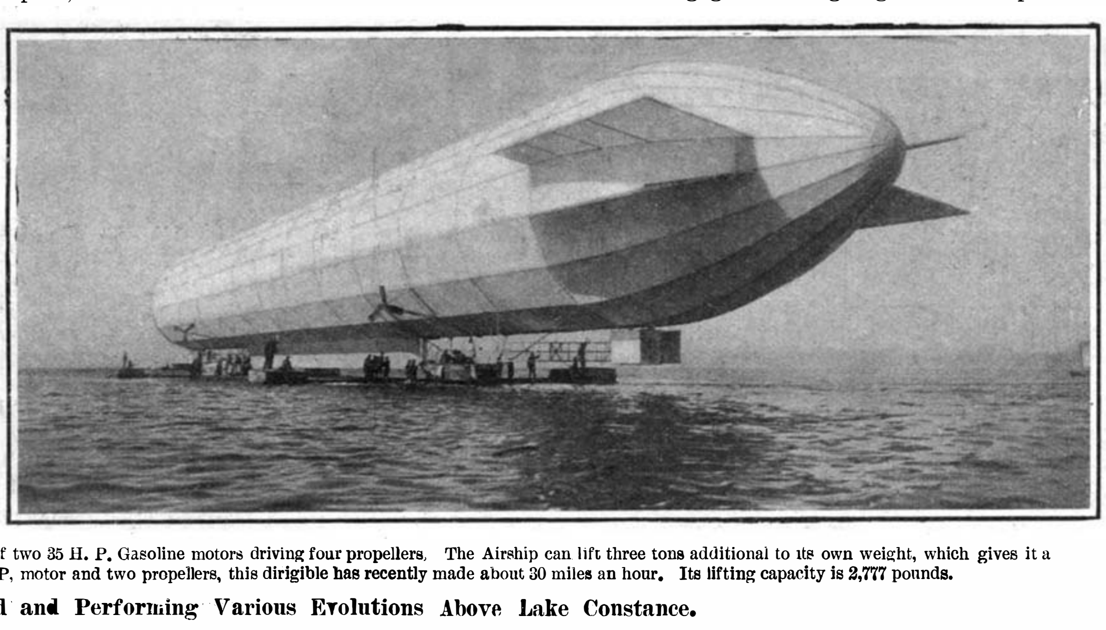


The New French Dirigible "Patrie."

A new aeroplane which is to enter the field in France is to be built by the Antoinette Company, which has been formed for constructing the Levavasseur light-weight motor, used by Santos Dumont and others. The designs of the new flyer are to be drawn up conjointly by Capt. Ferber and M. Levávasseur. As Capt. Ferber is one of the pioneers in aeroplane work in France and has already built and made experiments with a flyer, and given the experience which M. Lavavasseur has had in motor work for the last five years, there is no doubt that the new aeroplane will be one of the foremost in the field. It is to be known as "Antoinette No. 1," and will be piloted by Capt. Ferber, also taking one other person, so that no doubt it will be of a large size and high power.

In the history of navigation of the airship the efforts which have been spent by the famous German officer, Gen. Count Von Zeppelin, form one of the most interesting chapters. Count Von Zeppelin, has devoted a considerable portion of his life and expended one fortune in attempting to solve this problem. The latest cable advices indicate that he has at last succeeded and that the airship which he has designed and constructed can be classed among those which are practical.

The readers of the Scientific American are aware that his experiments have extended through several years. The first airship he built which attracted the attention of scientists and others was the one tested on Lake Constance in 1900. Although but three flights in all were made at that time, the performance of the airship was such as to encourage the belief that with certain alterations it would be successful. But for a series of unfortunate accidents, all of the tests would probably have resulted successfully. As it was, the craft was propelled against a breeze calcu-



wind on January 17 last, by means of two 35 H. P. Gasoline motors driving four propellers. The Airship can lift three tons additional to its own weight, which gives it a 1,195 cubic feet. Driven by a 70 H. P. motor and two propellers, this dirigible has recently made about 30 miles an hour. Its lifting capacity is 2,777 pounds.

—Coming Out of Its Shed and Performing Various Evolutions Above Lake Constance.

D AIRSHIPS THAT ARE NOW BEING EXPERIMENTED WITH IN EUROPE lated by the experts to be blowing at the rate of 12 miles an hour, yet it maintained a speed of nearly 18 miles an hour. During one flight it remained in the air an hour and twenty minutes, although the steering gear was caught in the skeleton framework and became partly unmanageable. The attempts proved also that the airship was dirigible in spite of its great size, as several complete circles were made while in the air. The expense of designing and building a craft of such proportions and the outlay for the balloon house and necessary machinery exhausted Count Von Zeppelin's resources and further development of his design was given up until November, 1905, when again accidents occurred which prevented the trial from being a practical success. The demonstrations showed, however, that the air ship could carry five men and sustain them aloft in addition to the double equipment of motors. The accident in 1905 was again caused by trouble with the steering apparatus located on the forward portion of the craft, partly submerging it in the water of the lake, although the after part of the car was sustained in the air by the gas and one motor.

During the trials which were held in the latter part of 1906 the airship at one time was aloft for a period of over two hours and reached a height of 1,000 feet above the lake. It was under perfect control during the entire period, being steered readily in various directions, describing circles, and performing other maneuvers. These demonstrations were witnessed by a number of experts in aerial navigation.

The immense proportions of the Zeppelin design form its most notable feature. The craft utilized in 1900 was about 420 feet in length. The one which made the last ascent is but ten feet shorter, while its diameter has been somewhat increased, giving it a capacity of about 370,000 cubic feet of gas. This is 32,000 feet more than the former type. The total weight of the present air ship, however, is 2,200 pounds less than the original design, being 19,800 pounds with ballast and equipment. The theory of the designer in favor of liquid ballast is still adhered to, the water being held in bags which can be opened by means of valves operated by wires leading from the controlling station. The gas bag is divided into six compartments supplied with suitable valves under the control of the engineer.

The engines form an excellent illustration of the wonderful progress which has been made in motor invention. The experiments in 1900 were made with an engine of but 30 horse-power. At the present time the two motors employed represent a maximum horse-power of 170 more than five times the capacity of the original motor—yet their total weight of 880 pounds is but 11 pounds more than the 1900 type. One engine is placed forward and the other aft beneath the bag in order to distribute the weight as equally as possible. The steering-apparatus is also in duplicate, but so arranged that one man can control both the forward and rear rudders. A high grade of gasoline is used as fuel, and the reservoirs attached to the air ship contain a sufficient supply to permit it to remain aloft a period of several hours.

It has been questioned why Lake Constance was selected by Count Von Zeppelin for the scene of what will be his life work. It is understood that he preferred this locality partly because of its suitability for the maneuvering of an air ship of such proportions, and also because of the favorable wind currents. As shown by the accompanying photographs the building for housing the airship is so arranged that when the craft is to be used, it can be drawn out by one of the small steam boats in service upon the lake. It usually rests upon floats built to support it until the engines are started and it gets under way. Despite the enormous size of the gas bag, the arrangements for filling it are such that it can be completely inflated in about six hours.

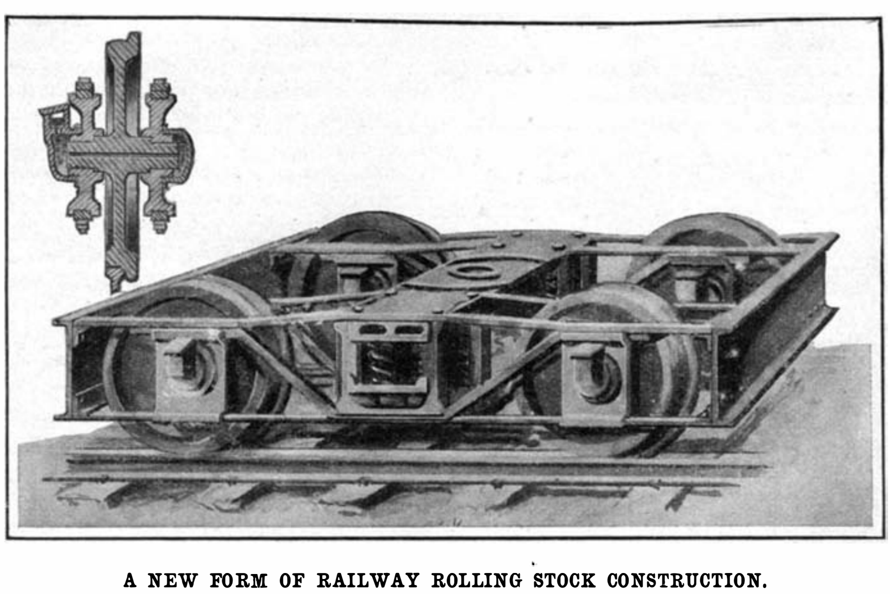
A NEW HAND-PROPELLED AUTOMOBILE FOR CHILDREN.

The accompanying illustration shows a new kind of toy automobile recently invented and placed on the market. The machine is known as the Exer-ketch, and it differs from most toy autos in that it is hand-driven by levers instead of being propelled by the feet. It consists of a U-shaped iron frame carrying at its rear end a large spur gear that meshes with a pinion of about half its size mounted upon the rear axle. The shaft of the gear carries a crank on one end and a sector having three holes on the other. The crank and sector are attached by connecting rods to the two levers pivoted near the front end of the frame. By placing the connecting rod in different holes in the sector, the levers can be made to work together or in opposition. The levers can be pivoted at three different points in the frame in order to adjust them to the length of reach of the operator, who sits as shown and steers with his feet by turning the pivoted front axle. A special form of clutch locks one of the rear wheels to the revolving rear axle for the purpose of driving the machine. The seat is of sufficient length to accommodate two children readily. Besides being a good chest and arm developer, this new form of auto will doubtless be found a favorite by all children on account of its method of propulsion being similar to that of a hand car and because of the comparatively fast speed they can attain with it.

A NEW TYPE OF TOY AUTOMOBILE.

A NEW FORM OF RAILWAY ROLLING STOCK CONSTRUCTION.

We had occasion recently to call attention to the evils of the present practice of rigidly attaching opposite car wheels to a common axle. When rounding curves the outer wheel should travel faster than the inner one; but this it cannot do owing to the rigid connection of the two wheels. Consequently, one or both of the wheels must slip, grinding and wearing away the tread surfaces of the wheel and rail. Aside from the fact that the load is thus increased at curves there is constantly the danger of breaking a flange or of a wheel climbing the rail and thus derailing the car. To overcome these evils, Mr. Emilio Mujica Canto, of 116 Broad Street, New York, N. Y., has invented the construction illustrated in the accompanying engraving. It will be observed that each wheel of the truck is formed with a separate short axle mounted independently in its own bearings. Thus each wheel can adapt itself to its own peculiar requirements irrespective of the movements of its fellow. The new construction is best shown in the section view of one of the wheels, and it will be evident that it is as strong as the usual construction. A journal box is provided at each end of the axle to supply oil to the two bearings. If desired, the inner box may be sealed as shown in the section view, and it may be filled by feeding the oil from the outer box through a central bore in the axle. Aside from overcoming the defects mentioned above, it is claimed for the new truck that the life of the wheels is materially increased, it will round curves of smaller radius, it is more flexible on uneven roadbeds, and allows of a more uniform distribution of the weight of the car. By using two journal boxes with a connecting oil passage the danger of a hot box is materially reduced, for, if the oil of one box is exhausted, it will renew its supply through this passage from the other journal box.



A NEW FORM OF RAILWAY ROLLING STOCK CONSTRUCTION.

An Elastic Roadbed.

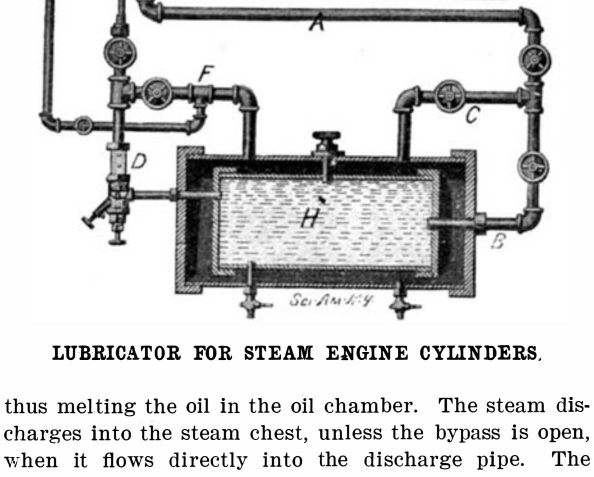
Consul-General Richard Guenther quotes the correspondence in a Frankfort paper from Zurich, Switzerland, stating that trials were recently made there with an elastic road covering invented by Street Superintendent Aeberli.

A section of Hohlstreet was covered with Aeberli material. Many persons witnessed the trial, among them representatives of the municipal and cantonal authorities, who showed great interest. Two steam rollers were employed to smooth the road covered with the new macadam. Trials with a six-horse wagon loaded with ten long tons gave a satisfactory result after the macadam had been sufficiently rolled. The macadam is prepared of gravel of a fineness of from 30 to 50 millimeters (1.181 to 1.968 of an inch) in diameter, and is freed of all earthy matter. This gravel is first heated in a specially constructed machine, and from a revolving drum is subjected to the action of liquid tar, so that each particle of gravel becomes covered with a coating of tar.

This tarred gravel is then put up in heaps, covered, and allowed to remain so from eight to ten weeks. It is asserted that during that period fermentation occurs which causes the tar to penetrate into the pores of the gravel and in this way lessens the formation of dust. In covering the road with this material the most painstaking cleanliness must be observed and dry weather must be awaited. No foreign matter must become mixed with the macadam. In rolling it no water must be used. The cost of preparing this macadam is small, 44 pounds of tar being sufficient for 1 cubic meter (35.3 cu. ft.) of dry gravel; or if limestone is used, 55 pounds. The machine is operated by four laborers and furnishes from 10 to 15 cubic meters (353 to 530 cubic feet) per day.

LUBRICATOR FOR STEAM ENGINE CYLINDERS.

Lubricators of steam engines intended for use in the open, such as traction engines, and the like, are liable to become clogged in cold weather. To obviate this difficulty a recent invention provides a steam jacketed oil chamber which prevents the oil from freezing; furthermore, the oil is forced from the oil chamber into the cylinder by means of live steam. The flow of oil is regulated by a needle valve through a sight feed which is constantly under the eye of the engineer. The apparatus is clearly illustrated in the accompanying engraving. From the main steam pipe a pipe *A* leads through the jacket *B* into the oil chamber *H*. A branch *C* from this pipe opens into the jacket *B*. From the oil chamber *H* a pipe leads to the regulating valve *D* which is formed with a glass tube section through which the engineer may watch the flow. Thence a tube *E* leads to the steam chest. The tube *E* is connected by pipe *F* with the jacket *B* and a bypass connects the pipe *F* with the exhaust pipe of the engine. In use if the oil is frozen, the valves of pipes *C* and *F* are open to permit a flow of steam through the jacket, thus melting the oil in the oil chamber. The steam discharges into the steam chest, unless the bypass is open, when it flows directly into the discharge pipe. The oil in the chamber *H* is forced, drop by drop, through the valve *D* by steam from the pipe *A*, and is injected with the steam through the pipe *E* into the steam chest. The inventors of this improved lubricator are Messrs. Charles L. Grayber, and Edward R. Kerrigan, of Deer Lodge, Mont.



LUBRICATOR FOR STEAM ENGINE CYLINDERS.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

INSULATOR.—L. STEINBERGER, New York, N. Y. The essential features of Mr. Steinberger's invention comprise an insulator provided with a body portion having a large superficial insulating-surface, great strength, and improved and novel means for securing it in position upon a switchboard, wall, floor, or other supporting member. It relates to insulators for electric conductors of the type especially adapted for supporting conductors carrying high-tension currents.

ELECTRIC MOTOR. — D. MENDELSON, Brooklyn, N. Y. The invention is in the nature of an electric motor of the vibrating type, designed chiefly to be used in small installations for advertising purposes, but applicable also to other uses; and it consists in the novel construction and arrangement of the motor parts, with special reference to securing a large effective power and freedom from polarization and residual magnetism.

SELF-RESTORING TROLLEY.—J. T. ANDREW, Montgomery, Ala. In this instance the invention pertains to trolleys, the more particular object being to enable the trolley-wheel or other analogous member to be readily replaced upon the conductor when dislodged therefrom. By merely pulling the trolley-pole downwardly so as to place the trolley-harp beneath the conductor and then releasing the pole, the operator is enabled to start the car under conditions where he need pay no further attention to the trolley.

Of Interest to Farmers.

MILK AND CREAM SEPARATOR.—F. H. REID, Sioux City, Iowa. This improvement is in centrifugal separators in which a so-called "liner," comprising a series of metal shells of approximately conical form, are arranged within a drum and the whole mounted upon a rotatable shaft, the full-milk from which the cream is to be separated being admitted at the center of the cones and distributed radially between them, the separation of cream being effected by centrifugal action and the two liquids being drawn off from the drum at separate orifices or spouts.

Of General Interest.

HAIR-WAVER.—A. SCHÄRER, New York, N. Y. The purpose in this case is to provide a device for imparting a decided and uniform wave to the hair and to so construct the device that it will not tend to break the hair and that can be conveniently applied, and also to provide a construction which will be of a simple nature, the comb portion, or that which remains in place upon the head for a period of time being made very light.

BOOT AND SHOE.—C. RADOTINSKY, Kirkwood, Mo. The purpose of the improvement is to provide a construction of welt boots and shoes wherein they will not require lasting in the assemblage and attachment of the upper to the welt and the welt to the outer sole and wherein no insole is employed, the welt being attached directly to the upper and then to the sole.

VULCANIZING PROCESS.—H. W. MORGAN, Cleveland, Ohio. The more particular object here is to apply the vulcanizing material to comparatively pliable substances such as would ordinarily be destroyed by the heat of vulcanization. The inventor desires especially to apply a plastic material to particles of wood, paper, and the like, and so vulcanize the plastic materials as to avoid injury upon the objects to which they are thus applied.

TOOTH-BRUSH AND DENTIFRICE BRACKET.—L. W. MCCONNELL and W. V. GAGE, McCook, Neb. The object of this invention is to provide a device which may be attached to any convenient support, and by means of which the brush as well as the dentifrice may be supported in such manner that they are always within easy reach of the user. Means are provided that will facilitate the drying of the brush after its use.

DISTILLING AND RECTIFYING APPARATUS.—U. LORENTZ, Cristobal, Canal Zone, Panama. In carrying out his invention Mr. Lorentz makes use of lightly-burnt clay diaphragms or partitions and also other media formed of the same material for distributing and diffusing the mash or mash liquor in the still-column, the porosity and rough surface of these parts being highly effective in producing the desired separation of the aqueous and alcoholic elements.

BURIAL-CASE.—E. A. KNODLE, Springfield, Ill. In the present patent the object of the invention is the provision of a new and improved burial-case which is simple and durable in construction, cheap to manufacture, and arranged to permit hermetical sealing, and thus prevent escape of all noxious or mephitic gases and germs of diseases.

STERILIZED ERECTED POLE.—H. P. FOLSOM and H. JONES, Circleville, Ohio. The invention relates to the sterilizing of poles which from their erection in the ground become infected by bacteria and fungi and attacked by insects, resulting in the decay and destruction of a portion of the poles. The invention aims to obviate difficulties developed by antiseptic treatment and to secure and maintain a sterile condition of poles for long periods.

COMBINED NEEDLE AND THREAD CASE. —C. J. EKBERG, San Francisco, Cal. In this instance the invention has reference to cases, and more particularly to those adapted to hold a needle and thread for traveling and like use. The device combines in an extremely small compass a holder for a needle, different kinds of thread, and a threading device for the needle.

BOTTLE AND BOTTLE-CLOSURE. — A. EIMER, New York, N. Y. Mr. Eimer's invention relates to bottles and bottle-closures, and the object of the improvement is the provision of efficient means for effecting the closure of bottles, especially in connection with those containing chemicals. The means employed will overcome the defects arising from the use of cork, rubber, and ground-glass stoppers.

LABEL-PASTING BOARD.—G. N. BYL, Jersey City, N. J. One purpose here is to construct a board upon which labels may be laid in regular order to receive a coating of an adhesive material and to provide means whereby the labels in any row or series may be instantly raised at one of their ends from the board without soiling the hands, the labels occupying the position at that time which enables the operator to quickly remove them with the least inconvenience and without danger of lacerating or soiling the labels.

HOSE-COUPLING.—J. H. BIERY and J. H. ZWANGER, Alliance, Neb. The improvements made by these inventors are intended more especially for use in firmly connecting together adjacent end portions of hose-sections—such, for instance, as are employed between locomotive-engines and their tenders—although such improvements are equally adapted to analogous purposes in the arts.

MOISTURE-PROOF JOINT.—W. I. AIMS, New York, N. Y. This invention relates to tunnels and like structures securing moisture-proof joints at the sections; and its object is to provide a new and improved joint arranged to render the abutting flanges of the sections moisture proof at the bolts connecting the flanges with each other.

Hardware.

PIPE-CUTTER.—J. J. DELEHANT, Chicago, Ill. The aim of this inventor is, primarily, to provide a tool by means of which the tool may be held in engagement with the pipe during the cutting operation and by means independent of the handle of the tool, and also a tool in which the knife may be easily and widely adjusted adapting it to the particular work on hand, so as to increase the efficiency of the tool and the duration of its parts.

Heating and Lighting.

AUTOMATIC IGNITING AND EXTINGUISHING APPLIANCE FOR GAS-BURNERS.—J. HOROWITZ, 45 Rue Servan, Paris, France. The apparatus is constructed so as to control alternately and automatically from a point situated at a greater or less distance the ignition and substantial extinction of any desired number of gas-burners, illuminating-signals, advertisements, transparencies, and generally speaking, signs of all kinds serving for advertising purposes or as luminous signals. It serves for public lighting, railway-stations, theaters, cafes, etc.

BOILER.—G. KINGSLEY, New York, N. Y. Two water-walls are arranged, respectively, at the sides of the furnace and each having short inwardly-projecting water-tubes and having an arrangement with respect to the walls and grate, so that the gases of combustion are caused to circulate between the walls and around the tubes, thus producing a boiler having a great heating-surface and great steam-making qualities, and one in which the dangers of explosion will be reduced to a minimum.

FITTING FOR WATER-HEATING SYSTEMS.—J. O'NEILL, New York, N. Y. The present invention relates to a fitting in which the return from the radiator enters in a line parallel with the course of the water through the system. It relates to an improvement over the heating systems set forth in Mr. O'Neill's formerly filed application for a patent on a heating system.

Household Utilities.

COFFEE-COOKER.—M. M. HERRERA, Caracas, Venezuela. The more particular object in this case is to provide a vessel to be used in connection with a coffee-pot in such manner that the ground coffee is subjected to the action of steam and allowed to become softened and also to permit the hot water used to percolate through the ground coffee into the coffee-pot.

INDICATOR. — H. S. ELLIS, Greenville, Texas. A plate is made of any material and having its edges provided with notches which are arranged opposite peripheral spaces bearing the names of groceries or other articles and a series of knobs, buttons, or other devices having shanks adapted to enter such notches and wires or equivalent means for holding the said devices in such manner that they may be turned over the edge of the plate, and by their position on the front or back of the same to indicate particular articles to order.

Machines and Mechanical Devices.

GRINDING-MACHINE.—G. PEISELER, Charlottenburg, Prussia, Germany. The machine differs from those which have hitherto been known by the surfaces to be ground of the article operated upon being brought into contact with the grindstone by imparting a rolling motion to the article. This is attained by a work-holder or holding-arm carrying the article being revolubly mounted on a pin and being pressed against the grindstone under the action of a load, the pin carrying the holder being moved according to the nature of the object to be ground.

SPRING-MOTOR.—H. S. ESCH, New York, N. Y. The object of the invention is to provide a motor capable of running for a considerable length of time without requiring rewinding of the springs and arranged to permit storing and desired amount of power for future use by the employment of a plurality of springs adapted to be thrown automatically and successively into action relative to the part to be rotated at a uniform power and speed.

Prime Movers and Their Accessories.

LUBRICATOR.—F. W. KNOTT, Madison, Wis. In this patent the improvement refers to force-feed lubricators; and its object is to provide a lubricator arranged to automatically and periodically force the desired quantity of the lubricant to the bearing, cylinder, or other part or parts to be lubricated.

Railways and Their Accessories.

RAILROAD - SIGNAL. — E. C. LOMBARD, Peoria, Ill. A train may pass freely along the track without affecting the signal in any way; but should two trains get within the same section the torpedo is immediately placed, and when either train gets within a short distance of said torpedo it is exploded to warn the engineer of impending danger. The signal is automatic. Means are employed to enable electric lights to operate simultaneously with torpedo placing and exploding device, and serve as an additianal signal.

SEAL-LOCK.—T. E. VAN DERWERKEN, Green Island, N. Y. The principal objects here are to provide means whereby a destructible seal can be applied to a lock in such a manner that the opening of the lock will cause the destruction of the seal, to provide means whereby the car can be locked with an ordinary wired seal either when the seals which are intended to go with the lock are absent or even when the door is not fully closed, also to provide means for holding the seal and for destroying it.

Pertaining to Recreation.

MECHANICAL TOY.—H. C. MURRAY, Gulfport, Miss. One purpose of the invention is the provision of a mechanical toy adapted to be pushed over a surface and wherein as the toy is moved backward and forward the head of the object carried by the toy will be automatically turned from side to side.

NOTE.—Copies of any of these **patents** will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this **paper**.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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Marine Iron Works. Chicago. Catalogue free.

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Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

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WANTED.—Copies of our "Manufacturers' Index" issued some eight years ago. State price. Munn & Co., 361 Broadway, New York.

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Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods, Dies and Metal Stampings our Specialty. 43-47 S. Canal Street, Chicago.

Inquiry No. 8541.—Wanted, manufacturers of portable firewood saws.

The celebrated "Hornsby-Akroyd" safety oil engine. Koerting gas engine and producer. Ice machines. Built by De La Vergne Mch. Co., Ft. E. 138th St. N. Y. C.

Inquiry No. 8542.—Wanted, the addresses of the Birkeland E. Y. de Process, also the apparatus for the artificial production of nitrates.

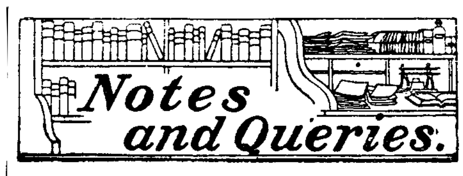
Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8543.—Wanted, machinery for carding, spinning and making twine, rope and plaited cord, from cotton, mohair and Angora goat hair.

Inquiry No. 8544.—Wanted, rotary engine for oil or alcohol.

Inquiry No. 8545.—Wanted, makers of typewriter ribbons.

Inquiry No. 8546.—Wanted, manufacturers of devices controlling valves by electricity.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of **price.**

Minerals sent for examination should be distinctly marked or labeled.

(10254) G. L. M. asks: 1. Please give me the difference between Eastern, Central, and Western standard time and where it is changed. A. Eastern time has the 75th meridian west of Greenwich as its central line and is 5 hours behind Greenwich time. Central time has the 90th, Mountain time the 105th, and Pacific time the 120th meridian as its center. Theoretically the meridians half way between those above named are the lines where the change of time is made, and each is one hour earlier than the next to the east. Practically the convenience of the railroads controls the matter in the United States. Thus, the change of time is made at Buffalo on roads starting from that place, east or west. It is made at Pittsburg for roads having that as a center. This is better than changing the running time an hour at some small way station. The line north and south along which the time changes is not a straight line. 2. Also the difference between Eastern, Central, and Western sun time and where it is changed. A. Sun time is the time at the particular place. It is noon by the sun when the sun is exactly south of one, and clocks which are set to sun time are said to keep *local time*. This is not called eastern or western. It is the time of that meridian only. It is the same local time upon a line due north or south over the earth. For a change of one degree of longitude the local time changes four minutes, being four minutes earlier for each degree to the west, and later by the same amount for each degree to the east of any place. This is the time that was kept everywhere in the world before standard time was introduced. Now nearly the whole civilized world has standard time based upon the meridian of Greenwich.

(10255) B. C. B. asks: Can you furnish me a book of instruction on the wiring of an electric light plant that explains fully the testing of lines for breaks, that explains the arc lamps, the incandescent lamps, the transformers and everything about an electric light plant? A. There is no single book which covers the range of topics upon which you desire information. We can furnish the following: Crocker's "Electric Lighting," Vol. 1, "The Generating Plant," price \$3; Vol. 2, "Distributing System and Lamps," \$3.

(10256) P. S. writes: 1. Can commercial calcium sulphide be used for phosphorescent paint or light? A. No. 2. If it cannot, what are its uses? A. It has some use in medicine. It may be used for the preparation of sulphureted hydrogen. 3. What is the chemical action of a secondary battery made of copper, zinc, and lye? A. In general, zinc is taken from the solution while charging and deposited upon the zinc plate; oxygen is evolved, which attacks the copper and forms copper oxide upon the positive plate. In the discharge the opposite changes take place. 4. If two pieces of annunciator wire about ten or more feet in length are laid parallel with the insulations touching and with the terminals at one end not connected and those at the other end connected through a telephone receiver and secondary of a medical coil in series, or one terminal to the platinum-pointed screw of a buzzer through the receiver and the other terminal at the same end connected to the vibrating contact, is the sound produced in the receiver caused by leakage, induction between the wires or do the wires act as a condenser? (This also takes place to an extent when the ground is used instead of either wire.) A. We scarcely understand your arrangement from the description, but, if there is a sound produced upon an open circuit, it is by means of waves transmitted across the space separating the wires, as is frequently the case by induction in the working of the telephone. 5. Are the use of the magneto, the galvanometer and similar instruments the only ways for testing for leaks? A. For methods of testing wires and cables, see the book on that subject by Webb, price \$1; or Kempe's "Electrical Testing," price \$7.25. Latest editions. 6. What is the average or extremes of resistance in woods? A. Dry wood is an insulator and wet wood may have any resistance according to its wetness.

(10257) O. F. N. writes: In your answer to question No. 10210 you state that the moon rotates on its axis. Permit me to express my opinion that said rotation cannot be understood so that the moon has its own axis to rotate on. It seems to me that it would be more correct to say that the moon rotates on the earth's axis. "The moon rotates on its axis once while it revolves around the earth once." It might be true in one sense, but not in the common way we have the idea of rotating bodies. We are all revolving around the earth, but it would not do, I suppose, to state that we are all rotating on our own axes. We must, I think, have the idea that we are all rotating and revolving on and round the axis of the earth. If we suppose that the moon is a solid ring round the earth, would it then be correct to state that every part in length, as the thickness of that ring, were rotating on its axis? Certainly not. The ring was rotating on its center, the common center for all the parts of the ring. That is to say, every part of the ring would rotate on the center of the ring. Consequently, therefore, as the moon can be considered as a part of the ring, the moon has no axis of its own but is rotating on the axis of the earth. A. Two knights are said to have disputed once whether a certain shield were silver or gold. After nearly killing each other they found that both were right, because one side was silver and the other was gold. So with the discussion of our correspondent; he stands on the earth and sees the same face of the moon all the time, and declares that it does not rotate at all, but has the same axis as the earth. Astronomers viewing the moon as if from some point of external space see the moon present all sides of its orb to them every revolution, and say that it rotates once on its axis in every revolution around the earth, its central planet. We agree with the astronomers, but do not expect to convince any one who takes the opposite view. One's opinion often depends upon one's point of view.

(10258) C. M. C. writes: May I trouble you with a request for information on the following phenomenon, to me curious, and as to which so far I have been unable to find any explanation? An ordinary incandescent electric-light bulb after the current is cut off exhibits for some hours a peculiar phosphorescent glow, emitted apparently from the inner surface of the glass and quite strong enough to enable a coarse print to be read if placed close to the bulb. This glow or phosphorescence becomes dimmer and stronger in pulsations of about three seconds. It becomes stronger when the hand is brought close to the glass, say within half an inch, and concentrates at the point of the bulb nearest the hand. Perhaps I should say it becomes brighter at such point, as there is no diminution of the light in other parts of the glass. The light is pale and green. It more nearly corresponds to a phosphorescent appearance than any other kind of luminosity. It does not seem to be traceable to leakage of electricity. The filament or carbon of the bulb exhibits no light whatever. A. This phenomenon can be produced in most lamps by holding them near the pole of the secondary of an induction coil. We suspect that this is the same thing and that the circuit is an alternating one, so that the alternations of the E. M. F. produce the fluorescence in the bulb, which lasts long enough after the current is turned off to be visible in the dark. It may be that the lamp, too, is exhausted just to the degree that makes this possible. Another lamp in the same place may not show the same effect.

(10259) E. K. asks: What is the difference in the meaning of the terms "mass" and "weight" as applied in physics? Text-books are indefinite, some giving mass as the weight divided by gravity, others that they are used synonymously. A. Mass is the quantity of matter a body contains; the weight of that body is the measure of the attraction of the earth upon that mass. The mass of a body will be the same everywhere, so long as the quantity of matter it contains does not change. Its weight changes as it may be moved about on, above, or down in the earth. If we divide the weight of a body at any place by the intensity of gravity at that place, the quotient is always the same for that body. This quotient is therefore the mass of the body, since as we have said the mass of a body does not change.

(10260) H. A. M. asks: In one of our largest engineering plants a discussion has been carried on for several months past, and which is apparently likely to continue for many months longer unless it is settled by a recognized authority. The question is, "Does the inner rail or the outer rail support the weight of a locomotive or car when it is passing around a curve?" Kindly settle the argument through the columns of Notes and Queries. A. Each rail of the railway track usually bears a part of the weight of a locomotive. We have heard of locomotives taking a curve at so high a speed as to lift the inner wheels clear of the rail, but we never saw such an occurrence. In building a track the outer rail is raised on a curve enough to throw the locomotive toward the inside of the curve sufficiently to counterbalance the centrifugal force, which would throw the engine over outward. In this case an engine going at the calculated speed would round the curve in exactly the same way that it would run on a level, and half the weight would be borne by the inner rail and half by the outer rail.

(10261) W. I. asks: Would you kindly tell me, through your paper, what would be the apparent size or diameter of our sun, if an observer viewed it with the unaided eye from the planet Jupiter? A. The apparent diameter of the sun as seen from the earth is about 32 seconds of arc; as seen from the planet Jupiter it would be reduced in the ratio of the distances of the earth and Jupiter, or 92,300,000 to 483,300,000 miles, approximately one-fifth as large in diameter.

(10262) F. M. asks: Please describe in your Notes and Queries column the building of a spark coil suitable for electric gas lighting, the size of wire to be used, how to insulate it, and if the spark could be regulated by a movable core. How many sal-ammoniac batteries would be necessary? Could it be connected on batteries used for bell work? A. For a gas-lighting coil make a core of No. 16 B. and S. iron wire, 10 inches long and 1½ inches in diameter. We see no advantage in having the core movable, still it may be made to slide out of desired. In this case a spool must be used for winding the coil upon, otherwise the coil may be wound directly upon the core, insulated with paper. Wind the coil 8 inches long and have 13 layers of No. 16 B. and S. double cotton-covered copper magnet wire. A battery of four sal-ammoniac cells should be sufficient for a line around a house; if not, add more cells to the battery. The same battery can be used for ringing bells, if the wires for the two services are separate and each has a separate connection to the battery; that is, the two wirings are to be in multiple on the battery.

(10263) J. J. S. S. asks: Kindly inform me whether a Sprengel air pump is a draw or force pump. There has been a dispute among some students as to which was right. I thought it a draw pump. A. The Sprengel pump acts by the expansion of the air in the reservoir, from which the air is to be removed into the tube of the pump, where the air pressure is less than in the reservoir. In this way it may be called a "draw" pump, although the term is not an exact one as applied to the action in question.

(10264) W. T. R. asks: A floating vessel displaces its own weight of water—does it? Well, suppose we take a plaster cast of the vessel's bottom, and so arrange that she will have, say one-fourth of an inch of water all round her (below the water line, of course), won't she float? In that case she does not displace her own weight! Question: Will the earth's attraction overcome the thin layer of water, and cause the vessel to bump the bottom of mold? A. The statement that a floating body displaces its own weight of water means that if the space in the water which is occupied by the vessel were filled with water, that water would weigh the same as the vessel weighs. This is not difficult of experimental proof, and has been known for many centuries. It was discovered by Archimedes. If the mold you propose were filled full of water, the vessel when placed in the mold would displace a volume of water whose weight is just equal to that of the vessel. If the mold were never filled with water, the effect is just the same. The volume of water equal to that of the vessel below the water line on the mold weighs the same as the vessel weighs. The earth cannot make such a vessel bump the bottom of the mold. The water sustains the weight of the vessel, even if it weigh many tons. This is the case with a large ship in a drydock before the water is pumped out. It floats just clear of the bottom of the dock. We confess we do not understand your difficulty.

(10265) J. E. D. asks: 1. Please inform me a complete formula of the construction of an up-to-date dry cell. A. You will find complete instructions for making a dry cell as good as any in our SUPPLEMENT, Nos. 1383 and 1387, price ten cents each. 2. What salt or chemical can be added to a dry cell to increase the voltage, the solution used in same being sal-ammoniac and zinc chloride? A. The voltage of a dry cell is 1.4 volts. This is due to zinc, sal-ammoniac, and carbon. It cannot be increased. 3. What is the direct cause of sal-ammoniac crystals forming on the zinc element of a dry cell, the saturated solution consisting of one to three parts? A. If sal-ammoniac crystals form on the zinc in a cell, the solution has too much sal-ammoniac in it, and requires more water or less sal-ammoniac. If you refer to the crystals which often are to be seen on the zincs of sal-ammoniac cells, these are not sal-ammoniac, but a very complicated compound, and are not soluble in water to any extent. They are soluble in hydrochloric acid, and it is possible that you may have had reference to this in your second question. These crystals are a double chloride of zinc and ammonium. They increase the internal resistance of a cell, and reduce the E. M. F. also.

(10266) F. W. G. asks: I have a camera with two 1¼-inch diameter 7-inch or 7½-inch focus meniscus lenses, as illustrated on page 334, "Experimental Science," Fig. 2. I want to place a plano-concave lens between the meniscus lenses, same as Fig. 12. Of what focus must the plano-concave lens be? A. To adapt your lenses to portrait work after the manner described in "Experimental Science," page 334, Fig. 12, you will need a concave lens slightly stronger than 16 inches focus. A 14-inch lens should enlarge the image sufficiently for portrait work. The difference between a lens with 7½-inch focus and one of 8-inch focus is very slight.

(10267) J. W. E. writes for instructions for tinning cast iron. A. To be successful in coating cast iron with tin the castings must be absolutely clean and free from sand or oxide. The greater the care in cleaning at the outset the better the resulting work. Before the castings can receive a coating of tin it is necessary to remove the coating of scale or oxide, so the clean metal will be exposed to the tin. The castings are usually partly cleaned by means of a "rattler," which removes much of the scale. They are then to be placed in a pickle of dilute muriatic acid until a clean surface is the result. If the pickle is warmed by means of a steam jet the operation will be hastened. The castings can be examined occasionally while in the pickle and any sand or black spots removed by means of a scraper or wire brush. The castings can then be washed, and if desired kept for a length of time by being placed under clean water. As long as they are covered with water they are not subject to oxidation. For a flux the castings are dipped in a mixture composed of 4 parts of a saturated solution of sal ammoniac and 1 part of muriatic acid. "Boiled" acid, as that combined with zinc is sometimes called, is not to be used. For tinning the best block tin is required, and this should be melted in an iron pot, care being taken that it is not burned or overheated in melting. After the tin is melted it can be cleaned of impurities by taking a piece of green or wet wood secured to a pointed iron rod, and fastening same so the wood will be kept at the bottom of the pot of melted metal for one or two hours, depending on the amount of impurity in the metal. The surface of the metal is to be skimmed occasionally by means of a perforated iron skimmer. To protect the surface of the metal from oxidation it can be covered with sal ammoniac. There is nothing to be added to the tin. Another method is to cover the surface of the tin with tallow or palm oil. The casting is taken up by means of suitable tongs, dipped in the flux and then immersed in the melted tin and held for a sufficient time to allow the surface to be tinned. The tin should not be so hot as to discolor when casting is removed. If desired the casting can be held for a time in another pot, which is to be partly filled with tallow or palm oil and kept at a temperature that will melt tin. This bath of grease will allow the casting to retain an even coating of tin, and allow any superfluous metal to drain off. The castings may be cleaned from the grease by first rubbing in sawdust and then in bran.

(10268) E. B. C. asks for a good non-corrosive, easy-flowing jet black ink. A. An exceedingly fine ink is said to be produced by the following recipe: 11 parts galls, 2 parts green vitriol, 1-7 part indigo solution and 33 parts of water. Here the relatively larger quantity makes the gum unnecessary, while the indigo solution makes the brilliant black seem still deeper. Writing executed with this ink may, it is true, be removed by means of dilute acids, but it may be rendered visible again by chemical means.

(10269) M. E. H. writes: I would like a formula for oil paint such as used for painting photographic backgrounds, and would like to ask if you could help me to secure such a receipt. A. The following retains sufficient flexibility to enable the sheet to be rolled: Soft soap, 2 ounces, boiling water, 12 ounces. Dissolve and work well into usual oil paint, 6 pounds.

(10270) G. L. asks: I have an induction coil guaranteed to give a 1-inch spark. What amount of current will be required to make the 1-inch spark, and what number of 1900 dry cells or Bunsen's batteries will operate it? A. Two or three Bunsen, or twice as many dry cells will probably run the coil to its full efficiency. We should not advise the use of the Bunsen cells with nitric acid. The fumes in the house will corrode all metal-work. Better use chromic acid solution.

(10271) A. C. asks: A farmer in plowing around a square field, having plowed a strip ten rods wide, finds that he has one-fourth of his field plowed. How many acres in the field? A. The problem you send is not an arithmetical problem, but requires for its solution an equation of the second degree in algebra. The solution is as follows:

Let x = one side of the field, then will
$x - 20$ = the side of the square piece left after the strip is plowed around the outside.
x^2 = the area of the field, and
$x^2 - 40x + 400$ = the area of the square piece.

This area is three-quarters of the area of the entire field. Therefore,

$$\tfrac{3}{4}x^2 = x^2 - 40x + 400$$

Solving this equation, we obtain for the side of the field, 149.2 rods; and for the area of the field, 139.3 acres.

(10272) J. M. L. asks: 1. Will you please give me the two laws of thermo-dynamics? 1. The first law of thermo-dynamics is: "Whenever work is performed by the agency of heat, an amount of heat disappears equivalent to the work performed; and whenever mechanical work is spent in generating heat, the heat generated is equivalent to the work thus spent." (Deschanel.) The formula is $W = JH$. W is the work in foot-pounds, if English measures are used; H the degrees which one pound of water would be raised in temperature by the heat; and J, Joule's equivalent, 772 foot-pounds, as determined by Joule, or 773 foot-pounds as re-determined lately by Rowland. The second law is variously stated by different authors. Perhaps the simplest form of the law is: "It is impossible for a self-acting machine, unaided by any external agency, to convert heat from one body to another of a higher temperature." (Clausius.) Another form is: "The efficiency of a completely reversible engine is independent of the nature of the working substance, and depends only on the temperature at which the engine takes in and gives out heat; and the efficiency of such an engine is the limit of possible efficiency for any engine." (Deschanel.) 2. If the specific heat of gold is 0.03244, what weight of it at 470 degs. C. will raise 1 kilogramme of water from 12.3 degs. to 15.7 degs. C.? A. The water is to be raised 3.4 deg. C. 1,000 grammes require 1,000 calories per degree of rise of temperature, and for 3.4 deg. rise require 3,400 calories. The gold is to lose 470 deg. —15.7 deg., or 454.3 deg. One gramme of gold gives out 0.03244 calorie for each degree of loss of temperature, and for 454.3 deg. will give off $0.03244 \times 454.3 = 14.737$ calories. As many grammes of gold will be required as 3,400 contains 14,737, which is 230.7 grammes of gold.

(10273) T. A. says: The following method is given in "Cyclopedia of Receipts" for deodorizing petroleum: Mix chloride of lime with petroleum in the proportion of three ounces to each gallon of the liquid to be purified. It is then introduced into a cask. Some muriatic acid is added and the mixture is well agitated, so as to bring the whole of the liquid into intimate contact with the chlorine gas. Finally the petroleum is passed into another vessel containing slaked lime, which absorbs the free chlorine and leaves the oil sufficiently deodorized and purified. Can you suggest the quantities required of muriatic acid and slaked lime? Also if the cask should have one end open or agitated with the bung in? Is there any danger attending this process? A. The quantities of muriatic acid and slaked lime to be used in deodorizing petroleum are not important. If an excess of acid were used, it would disappear when the liquid is passed through the lime. Probably 3 fluid ounces per gallon will be sufficient to furnish enough chlorine for the process. Similarly, the bung may be in or out of the cask. There will not be excessive pressure in the operation; yet if the cask is open, the escape of chlorine will not be very annoying in the open air. The only danger we can see in the work is the inhaling of chlorine gas. This would be disagreeable, and if a large quantity were taken into the lungs, it would be dangerous.

(10274) E. J. asks: Does liquid when boiling give off air, in the shape of bubbles which pass to the surface? If this is the case, why does mercury do so if this metal is always used to extract air from tubes, etc.? Or is it only the vapor of Hg that bubles? A. When a liquid is boiling it is giving off its own vapor into the air, if it has been heated for a time sufficient to drive off the contained air. Even mercury contains air under ordinary conditions. Only after it has been heated is the air driven out. In filling a barometer tube the mercury is boiled to get rid of its contained air which would injure the vacuum.

(10275) W. C. P. asks: Some few years ago I saw on sale a self-lighting gas-tip which I believe was referred to as a platinum sponge. Have you any publications which treat on this subject, its principle and method of construction? A. Self-lighting gas jets are made by placing a lump of spongy platinum so that the gas will strike it. The absorbing power of the sponge is very great, and the absorbed gas becomes so hot that the sponge is heated to a red heat and ignites the gas. Platinum sponge can be obtained from dealers in chemicals. It is simply the Doebereiner's lamp or philosopher's lamp, as it was called, which was used for lighting lamps, etc., before the invention of the friction match. The sponge for some reason soon loses its efficiency.

(10276) D. E. asks: Please let me know if there is a cheap and simple way to change 110-volt 1 1-5 ampere alternating current to a steady current? A. A rotary transformer is the only practical way to change an alternating to a direct current. This is a motor run by the alternating current and having a winding leading to a commutator, by which the direct current is taken off at the other end of the shaft of the machine.

(10277) J. D. S. asks for a stove blacking or varnish that will give a black gloss and not burn off. Brunswick black gives the gloss but burns off when applied to top of stove. A. Take plumbago, make into a thin paste with sodium silicate or water glass. This makes an excellent stove polish and should be brushed thoroughly.

(10278) H. B. says: 1. I have a closed-circuit battery in which there are two plates of carbon and one plate of zinc. What would be the solution I could use in this battery to best advantage? A. Use a bichromate solution of a chromic acid solution. 2. In winding the field magnet and the armature core of an electric motor, is it absolutely necessary that the same gage wire be used? That is, must the wire on the field be the same size as the wire on the core? A. No. The gage of wire is determined by calculation, and one may be either larger, the same size, or smaller than the other.

NEW BOOKS, ETC.

SELF-PROPELLED VEHICLES. By James E. Homans, A.M. New York: Theodore Audel Company, 1907. 8vo.; pp. 598. Price, $2.

Mr. Homans's excellent work hardly needs recommendation after the success which attended the first edition. Few books upon this subject are provided with illustrations which so excellently supplement the text in the discussion of the comprehensive questions arising in the theory, construction, operation, care, and management of the automobile. The author has covered the subject with great thoroughness, and few indeed are the points which have not received due attention. It is difficult to discuss this book in detail, because of its comprehensive nature; but among the illustrations Plate I, a cross-sectional diagram of a four-cylinder touring car, giving the names of the principal parts, will appeal to every non-technical person interested in the automobile.

AUTOMOBILE CATECHISM. By Forrest R. Jones, M.E. New York: The Class Journal Company, 1906. 16mo.; pp. 134. Price, $2.

The author has successfully attempted to provide a brief and concise manual upon the automobile for the use of owners and drivers of cars possessing internal-combustion motors. The book, which is provided with a number of illustrations to supplement the text, is in the convenient question and answer form, and is provided with a careful index and a small but useful list of "Don'ts" and facts to be remembered. Every part of the engine is given due weight, and numerous troubles liable to be encountered by the driver are explained and their remedies are given.

THE AMERICAN ANNUAL PHOTOGRAPHER AND PHOTOGRAPHIC TIMES ALMANAC FOR 1907. New York: George Murphy, Inc. 8vo.; pp. 354. Price, paper, 75 cents; cloth, $1.25.

The twenty-first volume of the American Annual comes to us this year as well printed and as well illustrated as ever. Among the special articles which deserve mention, we would enumerate Mr. Wilson Bentley's snow and ice crystal photography; D. G. Archibald's "Developing for Certain Results"; W. W. Lakin's "Carbon Printing for the Beginner"; Maximillian Toch's "Photomicrography as an Aid to Chemistry"; C. H. Claudy's "Advanced Photography as a Recreation"; J. A. Anderson's "Apertures"; and Richard Hines's "A Simple Dark Room Light." The illustrations this year, lavish as usual in their number, are characterized for the most part by excellent artistic taste on the part of the photographer. It must be confessed, however, that the half-tone process does not always lend itself to the reproduction of the soft effects obtained on rough papers. In the appendix will be found the customary collection of photographic formulas.

PRACTICAL LETTERING. With Original System for Spacing, Complete Spacing Guide, Analysis, etc. By Thomas F. Meinhardt. New York: The Norman W. Henley Publishing Company. 1906. Oblong, paper cover. Fully illustrated. Pp. 15. Price, 60 cents.

THE STRANGE CASE OF DR. BRUNO. By F. E. Daniel, M.D. New York: Guarantee Publishing Company, 1906. 12mo.; pp. 235; 14 illustrations by J. L. Brooks. Price, $1.50.

EXPORTERS' ENCYCLOPEDIA. Containing Full and Authentic Information Relative to Shipments for Every Country in the World. New York: Published by the Exporters' Encyclopedia Company, 1907. 12mo.; pp. 633. Price, $5.

UNIVERSAL DICTIONARY OF MECHANICAL DRAWING. By George H. Follows. First Edition, First Thousand. New York: The Engineering News Publishing Company, 1906. Oblong, pp. 60. Price, $1.

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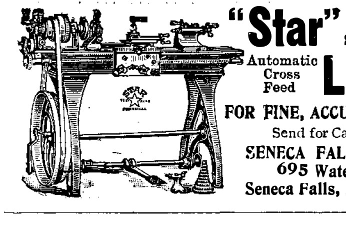

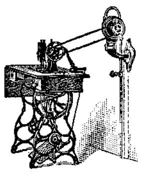

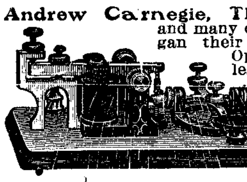

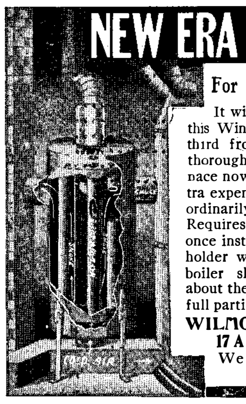

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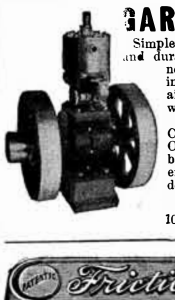

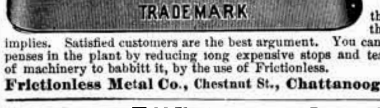

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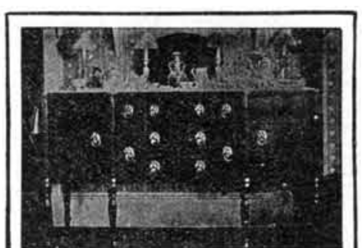

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