SCIENTIFIC AMERICAN

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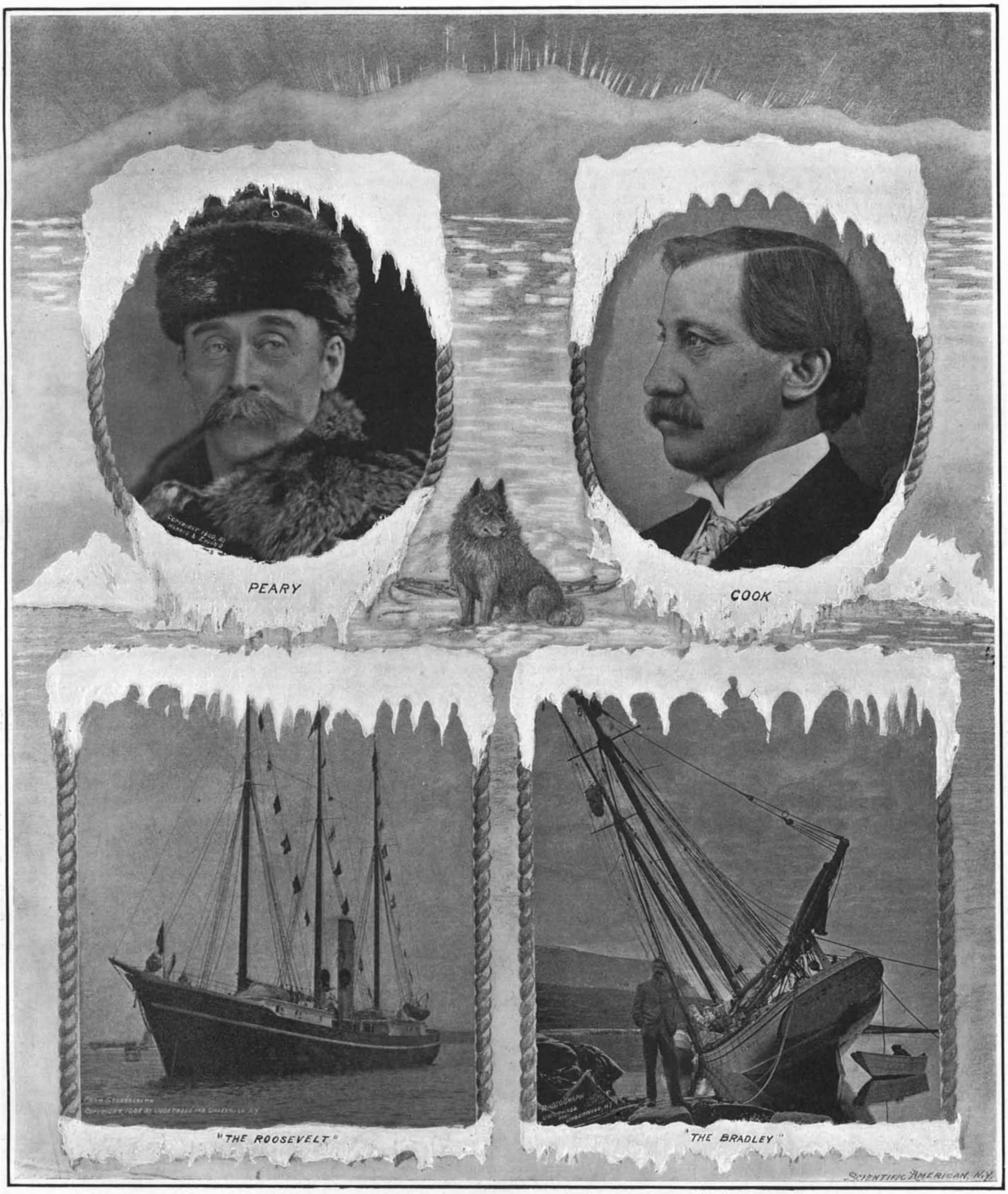

OUR ARCTIC EXPLORERS.—[See page 196.]

The greater length of time required by Cook to reach the Pole may be explained in part by comparing the Arctic steamer "Roosevelt" of the Peary expedition with the fishing schooner in which Cook reached the Arctic regions.

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NEW YORK, SATURDAY, SEPTEMBER 18th, 1909.

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.

HONOR TO WHOM HONOR IS DUE.

Within the last two weeks announcement has been made of one of the most romantic and interesting achievements connected with the history of exploration since the day of Columbus. The announcement of the discovery of the North Pole was one which fired the imagination of the most torpid and stimulated the enthusiasm not only of scientific men, but the whole civilized world.

The knowledge that this elusive goal, which has baffled the energies of man for so many generations, had at last been reached, naturally led to universal rejoicings and much national pride.

Within a few days the announcement of this discovery was followed by news that another American explorer had reached the same goal.

This natural feeling of exultation was, however, quickly dimmed by the criticisms and accusations which followed the first cable dispatches, which made it patent to all that the claim of one of the explorers was to be disputed by his rival, and that the public was to be treated to a long-drawn-out and tiresome controversy.

It is unfortunate that the daily press, in its eagerness for news items and for "copy," controversial and sensational in character, should have seized upon these exceptional circumstances, with a view of fomenting a bad feeling which was regretted by all, and that, in many cases, it should have taken sides, not with the view so much of reaching the truth as to become partisans in a controversy, with a view of stimulating circulation and private gain. This deplorable attitude is not confined to this country, as the same journalistic policy is noticeable in the foreign press. This is a mere condition of the times.

The truth in regard to both these explorations must and will be known. Honor must be given where it belongs.

It is a somewhat unusual precedent to doubt the statements of discoverers, especially when they had been connected with any particular line of exploration for a period of many years. It is most fortunate, however, that the two parties to the controversy should both be Americans, and that there is no danger of the dispute assuming an international aspect.

Those who are in a position to judge of these matters—the scientific men who have interviewed the explorers—are many of them of the opinion, at the time we are going to press, that the description of the exploration of Commander Peary tends to confirm the conditions as described by Dr. Cook.

Of all fields of human endeavor, there is none to which the world has been ready to accord greater respect than that of geographical research; and, because of the multiplied dangers and hardships of Arctic travel, the men who have pushed out farthest in the quest of the North Pole have been especially favored with national attention and municipal honors.

With a unanimity out of all proportion to the results to be obtained, it has come to be recognized that the most valued prize of the few that remained to be won by the explorer was reserved for him who should first set his foot upon that point which forms the northern extremity of the earth's axis. With the slow passage of the centuries, each bearing away its roll of men who have sacrificed their lives in the effort to solve the secrets that lie within the Arctic Circle, the quest for the North Pole had come to take on, moreover, a certain color of romance, which detracted nothing from its dignity as a serious scientific problem; and the record of unwearied patience, heroic courage, and sublime self-sacrifice which has marked these centuries of polar exploration, has served to place both the men and their mission upon a very high plane of human regard.

Therefore, we look upon it as most regrettable that the almost simultaneous announcement by two American explorers that they had reached the North Pole should have set on foot an undignified controversy of world-wide notoriety. For here we have no mere difference of opinion between two private individuals. One of the disputants, at least, by virtue of the fact of his bearing a high commission in his country's service, and each of them as having but recently planted the flag of his country at the very peak of the world, must necessarily speak and act as a distinguished representative, for the time being, of his native land. Whatever of disappointment, or of fancied or actual wrong, may have been felt by the sender of that accusing dispatch from Labrador, consideration of the dignity of the navy and the nation should have sealed his lips.

REPORT OF THE CHIEF OF ORDNANCE.

For the average civilian, the most interesting section of the last report of the Chief of Ordnance of the United States army will be that which deals with the new 14-inch gun, which for the future will constitute the principal weapon in our scheme of coast defense. Of the five guns of this type provided for by Congress, four are to be built of concentric cylinders assembled by shrinkage in accordance with the system heretofore in use, and the fifth is to be of the wire-wound type. The manufacture of two built-up and one wire-wound gun is well under way, and the construction of the other two built-up guns will be undertaken as soon as the forgings can be procured.

The motive for the design of the 14-inch gun was the desire to produce a weapon that would not be subject to the destructive erosion of the bore that characterizes the present 12-inch guns of high velocity, which is so severe that the 12-inch piece, with a muzzle velocity of about 2,500 feet per second, is so badly worn away in the rifling after firing less than 100 rounds that the projectile fails to bite on the rifling and leaves the muzzle of the gun with insufficient speed of rotation. As a consequence the axis of the projectile fails to remain true to the line of flight, or trajectory, and the projectile itself begins to turn end over end and fails to strike the target head on. The rapid wear of the interior of the bore is supposed to be due to the extremely high temperature which accompanies the high powder pressures that are necessary to give high velocity. Since the striking energy of a projectile is equal to the product of its weight and the square of its velocity, it is possible, by increasing the weight of the projectile, to decrease the velocity without a loss of striking energy. This is what has been done in the case of the 14-inch gun, which, as compared with the 12-inch gun, firing a 1,000-pound shell at 2,500 feet per second, will fire a 1,600-pound shell at about 2,100 feet per second and with a much lower powder pressure and temperature. The decrease in the erosion is expected to give the 14-inch gun more than double the accuracy life of the 12-inch gun.

The report tells us that in the design of the 14-inch gun the question has arisen as to which of the two methods of construction gives the longer life to the gun, the use of a relatively large or of a relatively small powder chamber and propelling charge. Under the former set of conditions the maximum pressure corresponding to the prescribed muzzle velocity will be appreciably less than under the latter conditions, but the powder charge will be correspondingly greater; and experience has indicated that erosion is affected not only by the maximum pressure of the powder gases but also by the weight of the propelling charge in guns of the same caliber. To determine which method to follow, tests have been made of two 2.5-inch guns, whose ballistic data are exactly similar to those proposed for the 14-inch guns, in accordance with the two systems above described. These firings will be continued until it has been definitely ascertained under which of the two sets of conditions the accuracy life of the gun is the longer.

A new 6-inch, wire-wrapped rifle, with ballistics identical with the 6-inch rifle of the model of 1897, is to be built, in which the use of a superior quality of steel in the tube and the substitution of a wire envelope for the steel jacket will not only greatly increase the elastic strength of the gun but will reduce the weight about 25 per cent and will somewhat reduce the cost. A new design for a 12-inch wire-wrapped mortar, of the same power but weighing 30 per cent less than the 12-inch mortars now in our fortifications, has recently been completed. The question of erosion is the most serious one confronting the Board of Ordnance. Extensive tests with the 0.30-caliber rifle have shown very clearly that the erosion is three or four times as rapid with a propelling charge of nitroglycerin powder as with one of nitrocellulose powder; and that the temperature has a great deal to do with the erosion is suggested by the fact that, while the temperature of combustion of nitroglycerin powder is about 3,200 deg. C., that of nitrocellulose powder is only about 2,500 deg. C. It is the opinion of the Board that, if it were practicable to so modify the composition of our smokeless powders as to reduce the temperature of combustion, erosion would become a much less serious factor. Here is a problem for the chemist, the solution of which would win for him one of the richest prizes in all the history of military and naval inventions.

Experiments have been carried on with the object of extending the accuracy life of cannon by the use of a rotating band on the projectiles, considerably wider than that now employed. We gather from the report that the ordnance experts expect that the wider band will merely insure better rotation of the projectile when the rifling is worn, but that they do not anticipate that it will prevent erosion.

The Scientific American has for many years been of the opinion that erosion is largely due to the abrading effect of the rush of gases at high velocity past the projectile, and that if this were prevented by a more perfect obturation, or closing up of all interstices between the shell and the gun, the erosion would be greatly, if not altogether, eliminated. Although the report makes no mention of the fact, we understand that experiments with a new form of rifling band acting in conjunction with a packing material at the base of the shell, have shown most encouraging results, regarding which we hope to give further information at a later date.

THE COMPOSITION OF THE UPPER ATMOSPHERE.

The composition of the air at great altitudes has long attracted the interest of meteorologists. In the earliest ascensions of unmanned registering balloons, twelve or fourteen years ago, attempts were made to secure specimens of air from the upper strata of the atmosphere. In one case half a gallon of air was thus collected. Its analysis showed a composition identical with that of air near the earth's surface. The system of monthly ascensions which was subsequently instituted revealed the remarkable phenomenon of the "permanent inversion layer." The diminution of temperature with increase of elevation, which was observed at all lower levels, was found to cease at a height of about 10,000 meters (33,000 feet), above which level the temperature was found to rise, slightly but regularly, with increase of elevation. This upper warm stratum has been found everywhere, in the tropical and temperate zones, near the Arctic circle, and over the Atlantic Ocean.

The discovery of this singular reversal of the temperature gradient suggested a possible difference in the composition of the atmosphere at high and low levels. The French meteorologist Teisserenc de Bort, although he did not share this opinion, undertook an experimental investigation of the subject. He suspended from a sounding balloon a glass tube closed at both ends and with one end drawn out to a fine point, which was sealed in a flame after the tube had been completely emptied of air. At a certain height an electrically driven hammer broke off the fine end of the tube and admitted air. The tube was then sealed again by the heating of a platinum wire by current from a small storage battery. The electrical contacts required to effect these operations were made either by the barometer at a prescribed elevation or by the clockwork of the meteorograph. The glass tube was suspended at a distance below the balloon which prevented the entrance of a trace of escaping hydrogen.

In this way specimens of air were collected at various heights in July, 1907. Another series of experiments was made on the Atlantic Ocean, from the "Otaria," but the salt contained in the sea air made the electrical contacts unreliable.

The specimens collected were too small for ordinary chemical analysis, but they were tested, by special methods, for argon, neon, and helium. Argon and neon were found at all heights, from 26,000 to 46,000 feet. The characteristic yellow line of helium appeared in the spectrum of most of the specimens, but no trace of helium was found at the highest level (46,000 feet).

For the year 1911 there is being organized in Italy, under the patronage of King Victor Emmanuel, a celebration in honor of Amadeo Avogadro, this being the centenary of the publication of his celebrated memoir concerning the molecular state of gases and the well-known law which bears his name as to the change of volume of gases with temperature. His researches laid the foundation for chemical as well as physical theory. A committee has been formed under the direction of the Royal Academy of Sciences of Turin and it is taking measures to publish a memorial volume containing his most important researches. Besides, there is to be erected a monument to Avogadro at Turin, in which city he was born and was professor of sciences. An appeal for funds is made to all who are interested in the movement, the committee being headed by Senator S. Cannizzaro.

ENGINEERING.

The total length of railway under construction or immediately projected in India is 3,222 miles, of which about one-third is by the British government and the rest by private companies. The estimated cost is over twelve million dollars.

The replica of the "Half Moon," built to the plans of the late Heer C. L. Loder of the Dutch navy and recently brought over for the Hudson-Fulton Celebration, is now being rigged at the Brooklyn navy yard under the supervision of Heer E. J. Bentham, constructor to the royal navy, who built her.

The torpedo-boat destroyer "Flusser," built by the Bath Iron Works of Bath, Me., for the U. S. navy, has recently completed the first of her official acceptance trials over the measured knot course off Rockland, Me. The average of her five top-speed runs was 32.7 knots, while one run was made in 1 minute 46 4/5 seconds, or at the rate of 33.7 miles an hour. The latter is nearly three knots faster than the best speed of any boat in the American navy.

The Montreux-Berne-Oberland electric railway in Switzerland has installed automatic gates at its grade crossings. When the bow trolley of the car comes in contact with an auxiliary wire run close and parallel to the main trolley wire, the current passes through the auxiliary and operates a motor mounted on brackets on the iron gate post, swinging down the gate and at the same time lighting lamps and ringing a bell. When the car has passed, the gate automatically returns to the vertical position.

The Panama Canal authorities have approved the purchase of a 20-inch pipe-line suction dredge, made to order for use elsewhere by the Ellicott Machine Company of Baltimore, but never used. This is expected to be in use before the end of the present year on the hydraulic fill for the Gatun dam, making the fourth suction dredger engaged in that work, while a fifth will probably be added next year. When the dam is nearly complete, some of the dredges will be removed to the central division, as the water in Gatun Lake rises sufficiently to permit dredging. It is estimated that some 4,000,000 tons of material can be more economically removed than by steam shovels.

Except for a few short distances, totaling 127 miles, automatic block signals now extend from the Atlantic to the Pacific Ocean. According to the Railroad Age Gazette, of the distance unprotected by this system, 93.4 miles on the Southern Pacific in the Sierra Nevada Mountains uses the electric train staff. The next longest gap, 20 miles in length, occurs where a change of line is about to be made. The remaining gaps are due to bridges and points where changes are in progress. The line thus operated by the block system extends from Jersey City on the Atlantic to Oakland on the Pacific, over a total distance of 3,245 miles; and it includes the Lehigh Valley Railway to Buffalo, the Lake Shore & Michigan Southern to Chicago, the Chicago & Northwestern to Council Bluffs, the Union Pacific Railway to Ogden, and the Southern Pacific Railway to Oakland.

A very remarkable demonstration of the possibilities of producer-gas engines for small boats requiring less than 500 horse-power has recently been made by Mr. H. L. Aldrich in a boat built for the purpose, the results being described in International Marine Engineering for August. The boat is 40 feet long over all, 9 feet beam, and 3.5 feet mean draft, and is driven by a four-cylinder four-stroke cycle engine of 35 horse-power, and can cover between 800 and 900 miles at an average speed of 8 to 9 miles an hour on one ton of pea anthracite. Such a plant can be conveniently and safely installed on coastwise schooners in the lumber and coal trades, fishing and oyster boats, and the like; and in addition to the greater safety, with anthracite at $4 a ton the cost of operation is about one-tenth that of a gasoline engine of equivalent power with gasoline at 15 cents a gallon.

A train ferry service between Sassnitz in Germany and Trelleborg in Sweden has recently been opened, conveying trains across 65 miles of open sea, by means of which through train service from Berlin to Stockholm is now possible. The ferryboats, two of which are owned by the German government and two by the Swedish State Railways, are superior in size, speed, and accommodations to any in the world, and carry a full train of eight cars on two parallel tracks, the balance being maintained while loading and unloading by special trimming tanks. There is almost no tide at that part of the Baltic, but the height of the water varies with the wind, so a double-jointed steel ferry bridge is provided, 160 feet long, with a large bolt in the seaward end fitting a hole in the stern of the ferryboat, to insure alignment of the tracks. When the cars are on the ferry, they are bolted down to the deck by special shackles, the car springs being relieved by screw jacks. Provision is also made for bracing them in heavy weather from the overhead girders of the vessel. The boats have complete and luxurious restaurant and sleeping accommodation for 150 passengers, in addition to the car space.

ELECTRICITY.

Conversation by a wireless telephone, the invention of two lieutenants of the French navy, is said to have been carried on between Toulon and Port Vendres, a distance of 155 miles.

The electric process iron smelter at Herould on the Pitt River has recently delivered a carload of pig iron, produced by the electric process, at $25 a ton—cheaper than it could be bought at tidewater. It is pronounced to be of the finest quality for casting purposes.

The electric power station of the government buildings at Washington is nearing completion. It is located in Garfield Park, near the Capitol, and connected with the legislative buildings by 7,000 feet of tunnels through which cables and steam pipes run. The tunnels are large enough for a man to walk through comfortably, so that breaks and other troubles can be quickly located and repaired.

A transformer was short-circuited by lightning during a terrific storm at the village of Olginate, near Lecco, in northern Italy, on August 18th, subjecting the low-pressure distribution system to a voltage of 3,000. Attempts to switch off the current by the residents, alarmed by the blowing of fuses, caused the death of several persons and a number of serious burns.

At the Winnipeg meeting of the British Association for the Advancement of Science a model was exhibited by Mr. S. H. Schneider, which he claims will revolutionize the generation of electricity. It consists of a collapsible airtight box, which when closed sinks in water by its own weight. On reaching the bottom it is expanded by a magnet, when, being lighter than the water displaced, it rises to the surface, where it again folds up and sinks. The inventor states that a full-sized "generator," weighing 600,000 pounds and displacing 10,000 cubic feet, would generate 50,000 horse-power at practically no cost of operation.

Electric-car motormen in Berlin are subjected to three weeks' training, comprising 20 hours in the classroom and 40 on the cars in each week. The course comprises the usual practice on a dummy platform, and study of every detail of car equipment, as well as sufficient instruction in overhead and track equipment to enable the motormen intelligently to report accidents. After the recruit has completed the course, he must pass separate examinations by the car engineer and the district traffic inspector. Candidates receive half pay during instruction, but to cover the cost of training each must deposit $16, which is refunded in full after one year's employment.

Judgment has just been rendered in two suits of the Union Carbide Company against the American Carbide Company for infringements of the Willson product patent of 1895 and process patent of 1896. The patents are upheld as valid, but no infringement is found. Since the defendant company is exculpated of infringement partly on the ground that it manufactures carbide by means of what is strictly a resistance furnace, and not an arc, and the complainant company has also long relinquished the arc for resistance heating of the carbide materials, it will be interesting to see what further steps are taken by the latter.

The economical importance of maintaining uniform load factor is well shown by comparison of the records of the Appleton, Minn., Electric Company for last year and for 1905, prior to the installation of storage batteries. In the latter part of 1905 it was found desirable to maintain a 24-hour service, but cost of continuous operation of the generating unit appeared to be prohibitive. Chloride accumulators were therefore installed, to store the surplus power when the plant was run at maximum capacity during the night, and capable of giving out a third of that maximum for eight hours during the day. The gross receipts of the company increased by 14 per cent in the following year, in spite of which the fuel consumption for 1906 was actually less than for 1905; and making due allowance for interest and depreciation, the net return on the storage battery investment was 14 per cent.

The diary of a traveler from New York to Chicago by interurban "trolley" lines, published in the Electric Railway Journal of August 28th, shows that the limitation of electric-car lines to cities and suburban districts is a thing of the past, and that such systems are no longer installed to supply purely local needs or to feed railways. The first 115 miles was covered not strictly speaking on a trolley car, although most of it could have been, but by the electrified New York Central Railroad to Hudson, N. Y., as a matter of convenience. Thence to Chicago all but 72 of the 1,143 miles was traveled on trolley lines, in a running time of 45 hours and 24 minutes at a cost of $19.67. The author describes his journey as most pleasant and comfortable, revealing many attractive parts of the country unseen by the steam-railway travelers, and intends to repeat the trip, finding that the running time can be reduced by over 10 hours.

SCIENCE.

Gréhant has studied the disturbances of respiration of various animals confined in an atmosphere in which acetylene was substituted for nitrogen, the mixture containing 79 volumes of acetylene and 21 volumes of oxygen. A pigeon died in 30 minutes, a rabbit in 40 minutes, while no effect was produced on a tortoise. The respiration of frogs was arrested, but when the asphyxiated frogs were brought into the open air they soon recovered their normal condition. It appears from these experiments that acetylene is far less poisonous than carbon monoxide, but it should be remembered that poisonous gases act very differently on different animals.

In a recent number of the Scottish Geographical Magazine a claim is made on behalf of the British government to the island groups of South Georgia, South Orkney, South Shetland, South Sandwich, and Graham Land, all in that part of the Antarctic continent nearest to America. These islands are declared to be a dependency of the Falkland Islands. Hereafter no whalers will be allowed to fish in those coastal waters or to make use of the harbors, without buying an annual license at the Falkland Islands. This is the first serious attempt to take possession of any considerable Antarctic area. The Antarctic country is now the scene of a large reviving whaling trade.

Time is a curious freak at the earth's poles, and when Dr. Cook says that he reached there at 7 o'clock in the morning of Tuesday, April 21st, 1908, his statement is without certain meaning. Presumably he carried Greenwich time, in which tables for navigation are calculated. So at the time of his discovery it was 2 in the morning at New York. As this meridian runs to the North Pole as well as that of Greenwich its time also applies. So does the time of every other meridian, and in consequence at the same instant it was also 7 o'clock Monday afternoon and every hour, minute, and second in between until 7 o'clock Tuesday afternoon. At both the North and the South Pole it is always two days at once, and every day lasts for forty-eight hours.

The observed acceleration of the mean motion of Encke's comet was at first attributed to the effect of a resisting medium, but subsequent changes in the comet's motion have made this hypothesis untenable. Prof. Hackenberg has made a preliminary research which appears to indicate that the observed changes may be produced by the action of dense swarms of large meteors. Biela's comet is known to have been affected by a swarm or current of meteors, which doubtless caused the division of the comet into two parts. In 1906, Charlier published an elaborate investigation of the accelerations of the motions of comets which is in harmony with Hackenberg's theory. Hackenberg promises soon to apply Charlier's results to the motion of Encke's comet.

A German inventor, Otto Nicolai, claims to have invented a new method of welding aluminium, using a specially-prepared metal paste with different ingredients. At a certain heat there is formed a mixture of aluminium oxide and the paste which gives rise to a chemical compound whose nature is not yet determined. Excellent welding is obtained for the metal or nearly all of its alloys, without any special precautions. For aluminium bronzes such as are used for German torpedo manufacture, which contain 90 per cent copper and 10 per cent aluminium, it is required to add finely divided aluminium powder to the paste. This latter must be used in all cases in presence of a great excess of the metal so as to form the above-mentioned compound, to secure the proper welding He also solders aluminium to other metals such as copper, iron, nickel, etc. In this work he uses large pieces of metal or again thin sheet metal or wires, with good results.

More than once it has been asserted, in good faith but erroneously, that diamonds had been produced in blast furnaces. In 1896 J. Frank treated various products of the blast furnace with acids and obtained a residue composed of titanium cyano-nitride, mixed with brilliant crystals, all of which, except one, were very minute. The crystals were not affected by mixed nitric and hydrofluoric acids, which dissolved the titanium. They showed no facets and were very fragile, but as they were not attacked by any acid, Frank assumed them to be diamonds. Nothing further was heard of these crystals until recently, when the subject was re-examined by Johanssen in the course of a study of the incrustations formed in two blast furnaces, of which one had been in operation 14 years and the other 4 years. Johanssen endeavored to obtain titanium cyano-nitride, and he succeeded, but found that compound mixed with fine sandy particles, which were not attacked by hydrofluoric acid and were altogether similar to Frank's crystals. But the particles refused to burn in oxygen, fused to an opaque mass in the oxyhydrogen flame and dissolved completely in fused borax. Analysis proved them to consist almost entirely of alumina.

AN AUTOMATIC ELECTRIC FOG-SIGNALING APPARATUS FOR RAILROADS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

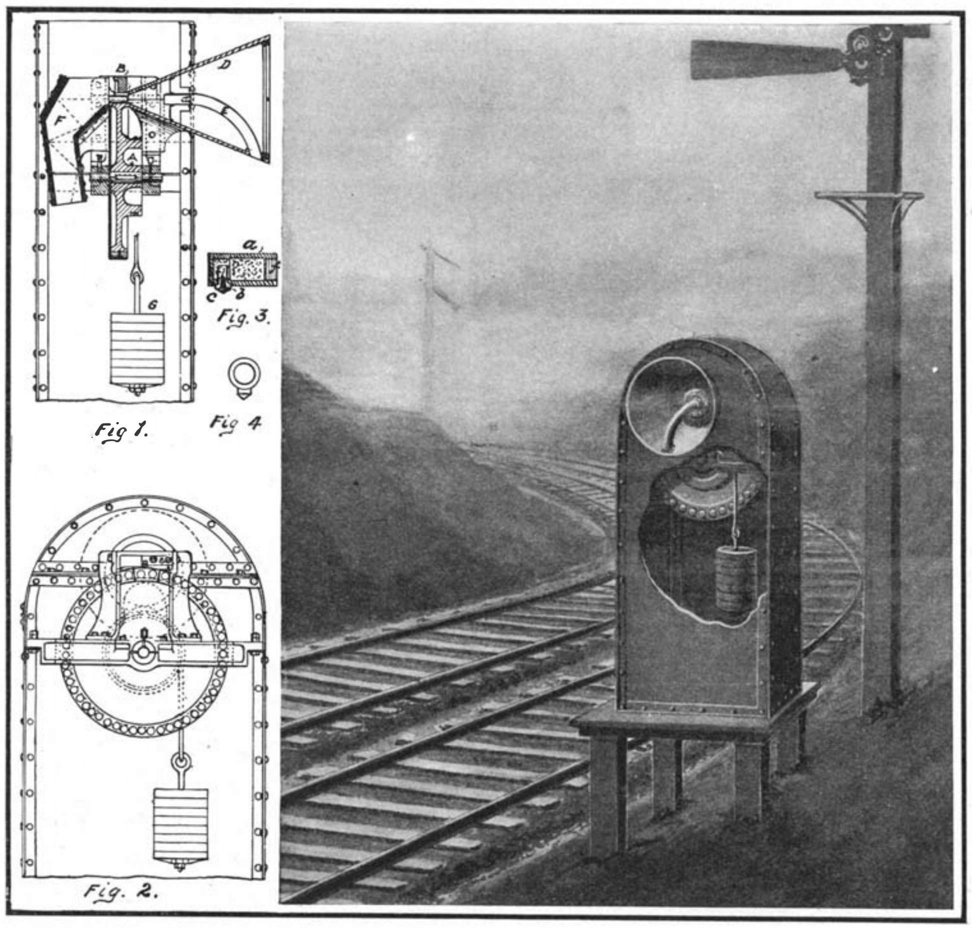
Interesting experiments have been carried out upon the Belgian State Railroads with a new system of signaling in fogs, a system which is the invention of Mr. W. de Ruyter van Steveninck, a late officer of the Holland navy, now resident in Brussels. The important feature of this device is that it is absolutely automatic in its operation, the detonators being electrically fired by the train itself, and in such a manner that a powerful acoustic signal is given beside the track. The signal is entirely independent of the operator, though operative in conjunction with a visual signal, and always gives an adverse signal should there be any breakdown in any part of the apparatus.

The detonator signal is retained, because it affords the most striking and certain means of warning the crew of a passing train, and cannot by any possibility be misunderstood. An accident would therefore be directly attributable to willful negligence on the part of the engineer.

The apparatus comprises a small waterproof pillar box mounted beside the track, fitted with a trumpet facing the direction of the approaching train, this trumpet being placed on a level with the engineer in the cab of the locomotive. In this box is mounted a large wheel, provided with a peripheral magazine capable of holding fifty cartridges in grooved sockets. The forward action of this wheel is controlled by a pulley and counterweight, which is wound up like the weights of a clock, and which will make one revolution of the wheel clockwise. This wheel thrusts forward one cartridge at a time, the cartridge being brought to rest in a small space in the neck of the trumpet by a spring buffer.

The detonator (Figs. 3 and 4) comprises a cartridge case *a*, to the outside of which is screwed a small metal cap *b*. In this cap is inserted a screw *c*, insulated from the cap itself by a small tube of ebonite, which tube also carries a short length of platinum wire, one end of which is soldered to the point of the screw and the other to the cap *b*, which is filled with guncotton. The cartridge itself is loaded with common black powder, and is closed at its outer end by a wad *f*. The insulated screw in the cap is connected with one terminal of the battery, and the cartridge cap itself with the other terminal, the circuit being broken at the rail. The approaching train as it passes the apparatus closes the circuit, either by means of rail contacts or a treadle placed in the track; and immediately the circuit is established, the platinum wire in the cartridge cap becomes incandescent and fires the guncotton, which in turn detonates the cartridge. The sound of the explosion is deflected through the trumpet, as well as the gases of ignition, while the wad of the cartridge is blown to the ground through the curved tube *F* (Fig. 1). Under the force of the recoil the cartridge case itself is ejected from its socket in the magazine wheel, and falls into a box (Fig. 1), whence it can be easily recovered. Immediately after the explosion the magazine wheel, under the influence of the counterbalance weight, commences to revolve, bringing the next cartridge into the firing position in the neck of the trumpet, the extent of its travel being arrested by the buffer already mentioned, which insures its coming into the correct firing position. This brings the apparatus into firing position again. The empty cases can be collected, and may be recharged, which serves to reduce the working cost of the system. The rail contact can be placed either alongside the detonating apparatus or some distance in advance thereof, according to the prevailing conditions. Although the circuit is established and the detonation is produced as the front wheel of the engine passes over the contact, and the apparatus immediately resets itself, subsequent firing by each successive vehicle of the train is avoided by means of a relay, which cuts out the whole circuit until the last wheel of the train has passed completely by. The relay then opens instantly, and sets everything in readiness for the next train. In this way useless expenditure of the cartridges is avoided, only one being fired for each train.

Should the line be clear, the apparatus is cut out of action, and no signal is given. A detonator is fired only when the signal arm is at danger, or when the signaling arrangement breaks down.



AN AUTOMATIC FOG-SIGNALING APPARATUS FOR RAILROADS.

It is obvious that the apparatus may be set at some distance from the signaling operator's cabin, the occupant of which, through not hearing the explosion, may not know whether the signal is fired or not. This event is ingeniously guarded against by means of an alarm to the operator's cabin, which gives indication that the explosion warning has been communicated to the engineer of the train. Directly the detonator is fired, a contact is closed and a circuit established with an electric alarm bell placed in the signal cabin. This bell continues ringing until the operator acknowledges the intimation by breaking the bell circuit by the movement of a switch. Similarly, intimation of the cartridge exhaustion of the magazine wheel is conveyed to the signal operator. When the magazine has been so depleted that only five cartridges are the wheel, this alarm bell in the signal cabin commences ringing, and cannot be arrested until the apparatus is recharged. Should the operator ignore this warning, and the last cartridge be fired, the whole of the signaling arrangements are interrupted by locking the apparatus automatically, and their normal working cannot be restored and trains pass by until the apparatus is recharged with cartridges, unless the train engineer willfully ignores the stop signal.

The Belgian experiments, which were of a searching nature, conclusively established the efficiency and reliability of this ingenious system.

RAT DESTRUCTION BY ELECTRIC CURRENT.

Besides being harmful parasites, liable to work considerable damage wherever they take up their abode, rats are known to be the dangerous agents of propagation of infectious diseases, especially bubonic plague. Invading freely any vessel lying at anchor in harbors where that terrible scourge exists, they will carry contagion with them to any port touched by the ship, and accordingly present a most dreadful danger which it is hard to fight.

Many methods have, it is true, been suggested during the last few years for the destruction of rats, but none of these has proved free from serious drawbacks. "Smoking" by means of sulphurous acid gas is, for instance, liable to harm the cargo, while evicting the rats with illuminating gas is not free from some danger to the crew. As it is, none of these methods lends itself to general use at any place infested by the fearful rodent.

A Viennese engineer, Herr von Florentin, Baron of Biederheim, has recently performed, in the presence of representatives of several administrative bodies, the Imperial Navy Office, etc., at the Charlottenburg Municipal Electricity Works, some interesting tests on an extremely original device, by which the rats (or any other vermin) are literally electrocuted.

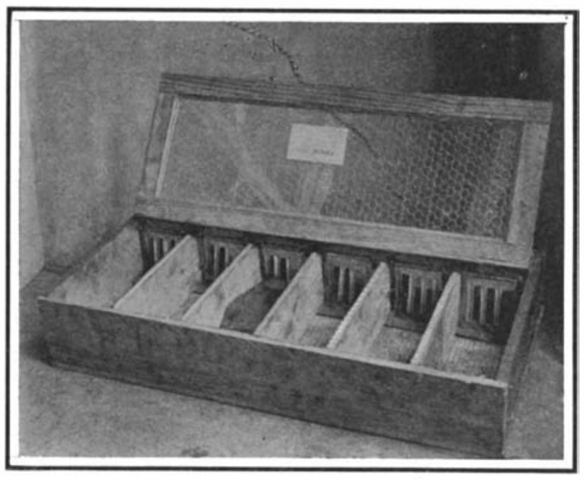
This patented apparatus takes advantage very ingeniously of all peculiarities of the rodent. Attracted by curiosity toward an electric lamp or by gluttony toward an appetizing morsel, the animal itself closes the current bound to kill it in a maximum of 50 to 60 seconds. Access to the apparatus is always free, even after this has been filled with several electrocuted animals, and, as shown by experiment, no rat caught by the electric trap succeeds in escaping its fate.

One of the most interesting features of this scheme is that continuous, alternating, or three-phase currents of low tension, e. g., 110 to 120 volts, are quite sufficient to electrocute the animals. Such currents are available at present nearly everywhere, and especially on board ship. Should no electric installation be available, it would be sufficient to provide a small accumulator battery, which in spite of its lower tension would produce quite similar effects.

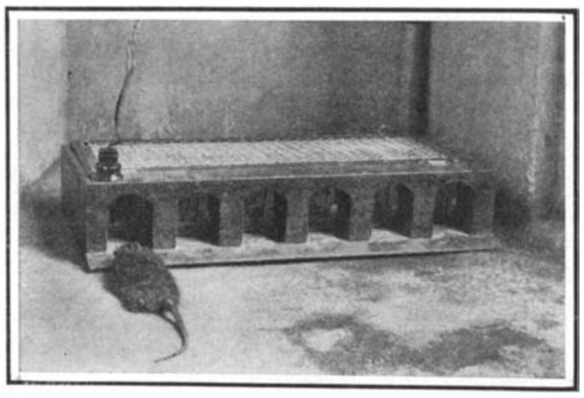
The apparatus can be so arranged that the electrocuted animal itself signals its execution to any desired place, advising the watchman by an electric bell, or the lighting of a red incandescent lamp, that there are some killed animals to be removed. The low tension of the current excludes any danger to men, and prevents any accidental electrocution of domestic animals.

The photograph reproduced in Fig. 1 shows the moment the rat prepares itself to enter one of the pigeonholes of the apparatus. Fig. 2 represents the electric trap open, with an electrocuted rat.

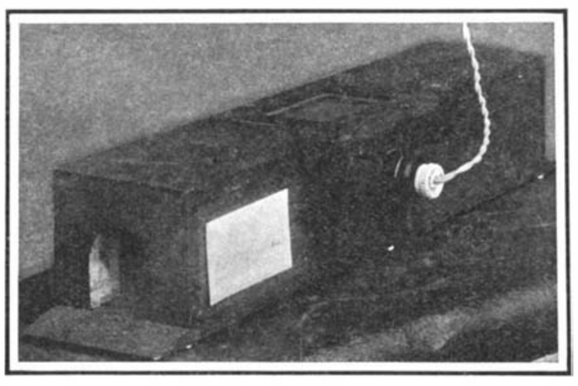
This invention is exploited by a company in Charlottenburg.



Top view of trap with lid raised, showing electrocuted rat.



Entrance side of trap with rat about to enter.



Smaller form of trap with single entrance.

RAT DESTRUCTION BY ELECTRIC CURRENT.

H. R. Weersma has attempted a new determination of the solar apex, or the point toward which the sun and planets are moving. He finds, for the apex, the co-ordinates: right ascension 267.7 deg., declination +31.41 deg. The point thus defined is in the constellation Hercules, near the star Nu Herculis.

.BLE OUTLOOKS FOR ARTILLERY TRAINS.

BY DR. ALFRED GRADENWITZ.

A novel type of portable outlook for artillery trains has been recently designed by a German firm, the object being to allow men to note the effect of their own fire.

As shown in Fig. 1, the limber-pole of a field gun may be used as an observing station. The cartridges are carried in the limber case. The pole is hinged so that it can swing vertically. A special foot supports it on the ground.

Before erecting the pole a rope ladder with a shield is fixed in place. The rope ladder is tightened automatically as the pole is swung into position. The protective shield, when not in use, is carried in front on the gun limber arms and on the case frame, and at the same time serves as a foot rest for the men seated on the limber. All the instruments used for observation are carried in receptacles below the foot rest as well as in the limber case itself.

The operator is equipped with a strap and hook, by means of which he attaches himself to the pole. The rope ladder may be fitted at the top with an additional seat consisting of two rope ends and a transverse beam on which the operator may seat himself (see Fig. 2). Instead of a rope ladder, the pole may be provided with lateral rungs which, when out of use, are folded and received in recesses, thus eliminating any risk of injuring the horses.

Fig. 2 represents the limber of a 15-centimeter howitzer. The observing station is similar to the one shown in Fig. 1, with the exception that it is made up of two poles fastened end to end.

In Fig. 3 an ammunition caisson is represented for individually located field guns. These can be turned up so that the bottom constitutes the front of the shield. The armor is thicker in front than on the sides and roof. Below the bottom is located the box containing the observation ladder, which is likewise armored. The ladder is of the telescopic type, and can be extended and collapsed by means of a tackle. It is equipped with a top seat, telescope support and map table, all foldable.

Fig. 4 represents a three-section observation car. The observation ladder is swung up by means of a winch and tackle. Because of its height, the ladder is held by guy wires. All the necessary instruments such as telephones, etc., are installed in the driver's box.

It may be said that observation wagons are by no means new. In fact they have been used as far back as in the fifteenth century for scaling the walls of fortresses. Later they were used in fighting fire, and now we find them restored to their military dignity.

Fig. 4.—Three-section observation ladder.

Fig. 1.—Single-section ladder and shield.

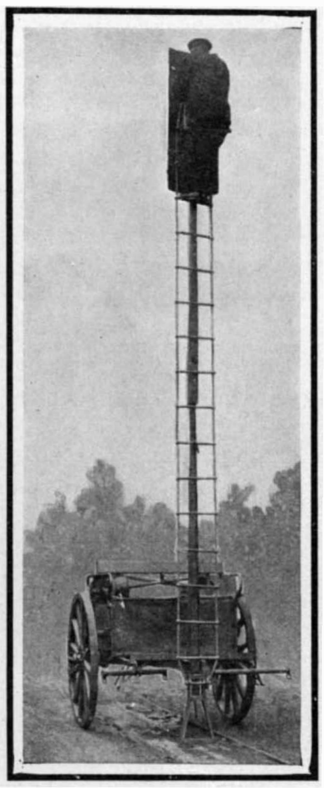


Fig. 2.—Two-section ladder.

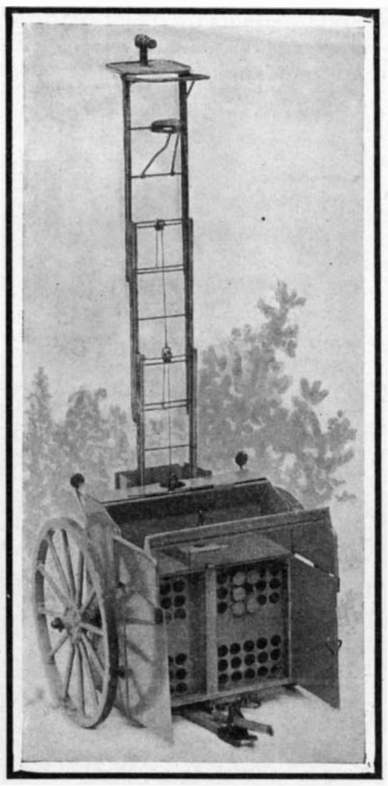


Fig. 3.—Telescoping ladder.

PORTABLE OUTLOOKS FOR ARTILLERY TRAINS.

Cinematophthalmia.

The illusion produced by the cinematograph is explained by the persistence of luminous impressions on the retina. The duration of the impression varies according to the intensity of illumination, the frequency of interruption, and various other conditions. Its average value is 2/45 second. In order that the moving scene shall be reproduced in a lifelike manner before our eyes, the pictures must move before the lens and follow each other at intervals a little smaller than 2/45 second, so that one impression still remains when its successor arrives, and thus the pictures blend together, to a certain degree.

This series of rapid and brief excitations produces, in time, a certain fatigue of the eyes and more or less persistent ocular troubles. A French physician, Dr. Ginestous, has studied these troubles and given the name of cinematophthalmia to affections of this character. These troubles are fortunately not very serious. Dr. Ginestous describes several forms. The first form is essentially temporary, and consists chiefly in lachrymation and photophobia, which compels the patient to close his eyes. The trouble begins with the passage of the first picture across the screen. In most cases the closure of the eyes for a few seconds is all that is required. The spectator appears to accustom himself, and adapt his retina to the new task which is imposed upon it. In a second and more lasting form of the malady, this retinal adaptation is impossible. As soon as the eyes are reopened, the symptoms reappear. Some watering of the eyes and slight redness of the conjunctiva persist after leaving the hall, but in most cases the symptoms rapidly disappear. In a third and still more prolonged type, a true conjunctivitis persists for two, three, or four days. It is usually accompanied with redness, burning and itching, lachrymation and photophobia, but without aggulutination of the eyelids. Finally, in rare cases, there are troubles of accommodation, accompanied by headache and great difficulty in reading, writing, and seeing near objects.

Ophthalmias of this sort are not usually alarming. In most cases they heal rapidly, even without any treatment, and the most obstinate cases yield to very mild treatment. The best remedies are rest and mild eye-washes containing cocaine and adrenaline. The principal causes of the difficulty must be sought in the operation of the cinematograph.

I. Defects in sharpness of the pictures or in focusing the projecting apparatus make the seeing of moving pictures difficult and painful. The negatives should be as sharp as possible, for the corresponding positives are magnified in projection to nearly one hundred thousand times their area, and the defects of sharpness are magnified in the same proportion.

II. Place of the spectator. Charpentier has proved that the persistence of impressions on the retina depends upon the size of the retinal image, and that the persistence is less for near than for distant objects. Consequently, in a moving picture hall, the seats nearest the screen are not the best.

III. Fatigue is caused by luminous impressions which are too strong or too weak. According to Charpentier's researches, the persistence of luminous impressions diminishes as the illumination increases, and conversely. This law is confirmed by the phenomena of moving pictures. Bright and strongly-illuminated images are more fatiguing than others, and most fatiguing of all is the abrupt transition from black to white, or from dark to bright.

IV. According to the theory of the cinematograph, it is necessary to produce a regular and rapid alternation of images and eclipses. In order to obtain these results, the edges of the moving film are perforated with holes 4/5 inch apart, into which mechanical fingers enter and thus regulate the movement of the film and hold it during the necessary period. But in time these perforations become worn and a certain amount of play results, which causes vibration and blurring of the images. This fault, apparently trivial, is increased in direct proportion to the magnification of the projected image.

V. In order to prolong the spectacle, some operators move their films with the minimum speed physiologically necessary to produce the persistence of the retinal images. Hence the eye is compelled to make an effort to retain and superpose the successive pictures, and this effort necessarily causes retinal fatigue. The wearing of blue glasses has been recommended, in order to avert these inconveniences. The director of the Pathé establishment at Bordeaux suggests moving the hand, with the fingers separated so as to form a perforated screen, before the eyes. Dr. Ginestous rightly remarks that this device is not very practical.

The evil is not very great; it suffices to recognize its existence. Those persons whose eyes are fatigued by viewing moving pictures, have always the recourse of giving up this form of amusement. There are many worse privations.—Cosmos.

Seeing by Telephone.

To allow people conversing by telephone to see one another is known to be the ultimate goal of those inventors to whose labor we are indebted for the evolution of telephotographic apparatus. As the problem did not so far admit of any practical solution, inventors have, in fact, been satisfied with transmitting, by wire, photographic pictures, diagrams, handwriting, and the like. According to reports just received from Denmark, a satisfactory solution is now offered. In fact, two young Danes (the brothers Andersen) recently called at the offices of Politiken, the well-known Copenhagen daily, in order to submit to the editor the principle of their idea, particulars of which cannot yet be given out. Unlike the Korn apparatus, optical transmission, according to their scheme, is not effected by means of any material sensitive to light, such as selenium, nor is a picture produced by photographic or mechanical means as in all the apparatus so far suggested. Transmission, in fact, takes place simultaneously, so as to reproduce any objects situated at the sending station in their natural colors and motions, their dimensions, however, being reduced.

The apparatus is connected by a contact with the telephone wire, when the acoustic or optical currents can be thrown alternately through the line. The operator is thus able at will to show himself, or to bring before the eyes of the person at the other end any objects he may like to show him. As the apparatus, so far from being necessarily located immediately beside the telephone, can be used within a considerable range, provided the contact be obtained, the possibilities of this invention are obviously many. Further details will be awaited with interest.

Fake Discoveries.

BY A. F. KUNBERGER.

In the January, 1909, number of the Journal of Industrial and Engineering Chemistry appeared an editorial, its contents being given here in part:

"The agitation against so-called patent medicines, which culminated in the National Food and Drug Act of 1907, also has served to awaken the public to the many deceptions which are being practised, and the many worthless preparations for general domestic use which are on the market. The results of this movement have been, first, to force a great many of the more palpable frauds to be withdrawn from the market; and, second, to provide for the correct labeling of all others, so that the purchaser may be in a position to buy intelligently. Only those materials, however, which may be classified under the head of food and drugs for the human system come within the scope of this legislation."

The writer mentions fake remedies offered in the market for the treatment of hard water for boilers and other products used in quantity in the industries. He concludes with an appeal to the chemical profession to take measures to suppress these chemical fakes, both by legislative and educational means. It is hard to see why people are so easily led into believing statements made in advertising literature, even if indorsed by those in positions of importance, who either out of ignorance or indifference have failed to investigate tests made in their presence before going on record as having witnessed them.

Some years ago a sample of a chemical supposed to render wood fireproof was submitted to us for analysis. A careful examination proved it to be common table salt, for which a price of 25 cents a package (about one pound) was asked, and undoubtedly was paid by scores of buyers. We know, of course, that salt acts to a certain extent as a protection; but by no means does it make wood fireproof, and at the best it is worth less than 1 cent a pound. Some time later two samples, one a pink and the other a blue chemical, were submitted to us for examination. A circular stated that the blue chemical added to gasoline would render it non-explosive; the same was claimed for the pink chemical if added to kerosene or coal oil. The circular also contained a number of testimonials from persons whom one would expect should know better, but undoubtedly they were not thinking deeply enough to consider what harm could grow out of their indorsement. One of the testers, the chief of the fire department of one of our large eastern cities, stated that in his presence the chemical was placed in a can containing gasoline, the fluid being ignited in the can and poured into another containing gasoline without exploding either of them. We wish to state that the oil termed gasoline is not explosive, and if ignited in an open can will burn with a smoky flame, so there was no merit in the material added. It is entirely different if gasoline which has been kept in a partly empty can for some time, is brought in contact with a lighted match or candle, or if the can should be opened near a flame or light of any kind, as an explosion will be the result of such carelessness. The explosion is due to the gases formed in the can, and these mixed with air are highly explosive; but nothing known at present will prevent this except precaution. And if there were a remedy, it would naturally have to destroy the qualities of the gasoline which make it valuable; that is, its ability to vaporize rapidly and at a low temperature. We made an analysis of both chemicals, which were offered at 50 cents a bottle containing less than an ounce of material, and found them to be common table salt, dyed the colors above mentioned. What attracts the attention of the general public at present is a material supposed to make ashes burn. It is sold, and to our personal knowledge was bought, at very fancy prices. We took the trouble to analyze a package, and found that it contained powdered calcium carbide with 30 per cent of free lime and coal dust. Whether these impurities were purposely mixed or their presence was due to an inferior grade of carbide, we did not consider sufficiently important to investigate. Any person of average intelligence ought to know that ash is a mineral admixture of coal and is non-combustible. All statements made by careless investigators to the effect that the addition of any of these compounds to their coal increased the calorific or heating power are ridiculous, and the good results exist only in the imagination of the user. The efficient way to obtain all the heating value contained in the fuel is to have proper grates and draft facilities, and to keep them clean. Clinker and ash should be removed by frequent raking, since too hard raking carries a large quantity of unburnt coal into the ash. There are hundreds of other compounds of a similar nature, which flourish long enough to fill the pockets of the "discoverer," and we cannot caution the reader too emphatically to stop to consider the feasibility of a so-called discovery before buying it and recommending it without having seriously investigated its merits.

A Remarkable Nile Fish.

A very peculiar fish (*Tetrodon fahaka*), which is called "fahak" by the Arabs, is found in large numbers in the Nile at high water. The fahak belongs to the group of globe fishes. In its normal condition it is ten or twelve inches long and of elongated shape. A thick mucus covers its entire body, with the exception of the abdomen, which bears numerous spines. The fish has a thick head, with a broad forehead and protruding eyes. The dorsal and anal fins are small, circular, and transparent; the caudal fin is larger, and of orange yellow color. In general, the colors of the fahak are bright and harmonious. The back is very dark blue, the sides are striped blue and orange, the abdomen is yellow, and the throat snow white. The mouth is of peculiar shape, each jaw being divided in the middle, so as to produce the appearance of four large teeth, whence the name *Tetrodon*, meaning four-toothed.

The most interesting peculiarity of the fahak is its power of inflating itself like a balloon, by drawing in a large quantity of air. Usually it swims in the manner of other fishes, but when danger threatens it rises quickly to the surface of the water and begins to pump air into an extension of the gullet. By this means the abdomen of the fish soon becomes so greatly distended that it exceeds the rest of the body in size. The fish loses its equilibrium, turns over, and floats on its back, and at the same time the spines of the abdomen are erected. By this transformation the fahak is protected against the attacks of its enemies. If one of these seizes it, the aggressor is wounded by the spines and thenceforth leaves the unpleasant creature alone. If the inflated fish is grasped by the hand it endeavors to draw in still more air, as if it were well aware of the importance of this action to its safety. When the danger is past, the air escapes with a slight hissing noise, and the fish gradually resumes its normal form.

The fahak is found in many streams of West Africa, but most abundantly in the Nile, which it ascends from the Mediterranean. It penetrates into the irrigating canals and ditches, and there lays its eggs. When the flood subsides, great numbers of the fish are left stranded and become the prey of birds of all sorts. They are also eaten by the peasants. Occasionally the use of the fish as food appears to cause poisoning. There is a story of two American sailors who died soon after eating the liver of the fahak. Such cases, however, appear to be very rare, and they are perhaps to be attributed to the use of decomposed fish. On the other hand, the *fugu* fishes, or Japanese species of *Tetrodon*, are extremely poisonous. As in the case of the European barbel, the muscular flesh is harmless, but certain other parts, especially the roe, liver, milt, but also the skin, abdominal wall, and intestines, are so poisonous that they have been used in Japan as a means of suicide and murder from time immemorial. In the Asiatic seas fugu poisoning often occurs among sailors and natives, and in Japan the sale of all species of *Tetrodon* is forbidden by law. The fahak is a great source of delight to the Egyptian children, who drive the inflated fish around and harry them until they literally burst. The children also inflate the dried fish and make handballs of them. The fahak is often found in curiosity shops, where it is bought by travelers as a memento of the land of the Pyramids. The fahak was known to the ancient Egyptians. Its representation occurs twice on the walls of a temple at Deir-el-Bahari.

Photographic Dyeing.

Sunlight, which destroys many organic coloring matters, also converts some colorless and soluble inorganic compounds into insoluble colored substances, which may thus be fixed in the interior of tissues. Many experiments in dyeing fibers and fabrics by the agency of sunlight have been made, especially by Persoz and Grueve. The following are some of the results obtained:

Sixty parts by weight of sulphuric acid were added to a solution of 120 parts of potassium bichromate in 1,000 parts of water. White wool and silk fabrics were dipped in this solution, dried in a dark room and exposed to sunlight. A beautiful light shade of brown was produced by from 10 to 20 minutes' exposure.

Prussiate of potash gives a medium shade of blue. If white cloth impregnated with this salt is exposed to sunlight under thick paper bearing a cut-out pattern, the design is reproduced in blue on the cloth, which is then rinsed in water to remove the unaltered prussiate from the parts which were covered by the paper.

Grueve found that very permanent shades of buff, blue, green, and gray can be obtained from ferrocyanides, and brownish violet, black and olive from chromates. For blue, the fabric is dipped in a solution containing 60 parts by weight of potassium ferrocyanide, 80 parts of tartaric acid and 24 parts of ammoniacal perchloride of tin, with more or less water, according to the shade desired. A short exposure to sunlight develops the blue color.

For green, sulphuric acid and an ammoniacal salt are used in connection with the ferrocyanide or yellow prussiate of potash. Buff shades are obtained by producing blue, as above, and treating the dyed fabric with caustic alkali, which converts the blue compound into yellow ferric oxide.

Gray and "mode" tints are produced by treating buff (obtained as described above) with an infusion of nut galls or Campeachy wood. Silk fabrics can be dyed in various shades of brown by impregnating them with copper chromate and exposing to sunlight.

The experiments prove that a certain quantity of moisture is required to produce brilliant colors with short exposure. Probably many substances which are employed in photography would produce desirable results in dyeing, but they are too expensive to be used for that purpose.

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1759, is devoted to a very exhaustive discussion of the wonderful aeronautical meeting at Rheims, France. Some splendid pictures of the more prominent aeroplanes in flight are presented. One of these photographs shows no less than three flying machines in the air. One of the most remarkable papers read before the Winnipeg meeting of the British Association for the Advancement of Science was that of Prof. Ernest Rutherford. In this paper he explains very lucidly how the modern scientist measures the atom. The electrolytic rusting of iron is discussed by Alfred P Morgan. N. W. Greenway writes on the comparative weights of reciprocating and turbine machinery for marine work. The most notable project for irrigation yet undertaken by the United States Reclamation Service has at last been completed, and will be thrown open to the public on September 23rd, for which reason Albert Wilhelm's excellent illustrated article on the subject of the Gunnison project (the project in question) should be read with some interest. Prof. Albert F. Ganz of the Stevens Institute of Technology writes thoughtfully on the progress in electric current development in the artificial lighting field. A good practical article which will be read with profit by the amateur is Clarence Biggs's "Fitting Electric Bells." Dr. D. T. Macdougal of the Carnegie Institution, one of our greatest biologists, writes on aridity and evolution. Prof. T. J. J. See has the distinction of being what may be called an astronomical revolutionist. In a paper entitled "The Origin of the Satellites" he sets forth his theory that satellites are in reality captured bodies, and that they did not spring from parent planets as we now suppose.

Official Meteorological Summary, New York, N. Y., August, 1909.

Atmospheric pressure: Highest, 30.36; lowest, 29.50; mean, 30.01. Temperature: Highest, 93, date, 9th; lowest, 58; date, 4th; mean of warmest day, 83; date, 9th; coldest day, 62; date, 17th; mean of maximum for the month, 78.7; mean of minimum, 64.5; absolute mean, 71.6; normal, 72.6; deficiency compared with mean of 39 years, 1.0. Warmest mean temperature of August, 77 in 1900; coldest mean, 69 in 1903. Absolute maximum and minimum of August for 39 years, 96 and 51. Average daily excess since January 1st, 1.3. Precipitation: 7.94; greatest in 24 hours, 5.05; date 16th-17th; average for August for 39 years, 4.64. Accumulated excess since January 1st, 1.15. Greatest precipitation, 10.42, in 1875; least 1.18, in 1886. Wind: Prevailing direction, northwest; total movement, 7,610 miles; average hourly velocity, 10.2; maximum velocity, 40 miles per hour. Weather: Clear days, 13; partly cloudy, 10; cloudy, 8; on which 0.01 inch or more of precipitation occurred, 9. Thunderstorms: 13th, 20th. Mean temperature of the summer, 71.83; normal, 71.90. Deficiency, 0.07. Precipitation, 13.09; normal, 12.17. Excess, 0.92.

The "Panflex" spring wheel, invented by Hon. R. C. Parsons, of turbine fame, shown in operation at the recent *conversazione* of the Royal Society, is an invention which has for its object the easy motion of a vehicle when run at low or high speeds. This ease of motion is due to the springs being capable of deflection in every direction. The wheel is exceedingly reliable, according to its distinguished inventor, and not subject to bursts or punctures, prevalent in the case of wheels fitted with pneumatic tires. The wear and tear are small, and should a spring break, which is seldom the case in practice, another can be inserted in a few minutes at a very small cost.

Correspondence.

A SLIGHT ERROR CORRECTED.

To the Editor of the Scientific American:

On page 125 of the Scientific American of August 21st is an article headed "A Record Cross-Country Motor-Boat Trip," in which you place the location of dam No. 6 at Rochester, Pa. Dam No. 6 is located about five or six miles below Rochester; while dam No. 5 is located at Freedom, about one and one-half miles above Rochester, and twenty-four miles below Pittsburg. This is a small error, and perhaps need not be corrected. My only excuse is that I am an interested reader of your paper and have a few moments time to spare. Dewitt Howe.

Freedom, Pa.

A HEAT PARADOX.

To the Editor of the Scientific American:

The fact can be discovered by the physical experiment, that if a conducting rod is heated, and then partly cooled very rapidly, the quick cooling will increase the temperature of the still hot adjacent section.

Therefore, a paradoxical phenomenon of heat being directly generated by cold can be demonstrated, which depends on the conductivity of the rod and the proportion of the part cooled.

The degree of this increase of temperature is directly proportional to the heat of the rod and the degree and the quickness of the cooling.

Force used by the heating, in expansion, is retransformed into heat, of rapid contraction, by quick cooling, and is conducted along the rod faster than the cold, it being yet partly hot, and increases it in temperature that can be measured, which proves that force from the rapid contraction caused by the quick cooling is conducted along the rod as heat.

Lucerne. A. F. Wood Chenoweth.

EARLY SUGGESTIONS OF INVADING ENGLAND BY BALLOON.

To the Editor of the Scientific American:

The recent crossing of the English Channel by M. Blériot has aroused worldwide attention. It may be interesting to know that in June, 1803, Boulard and Le Campion, two French cartoonists, predicted the invasion of England by a balloon. Boulard's drawing is entitled "La Thilorière or the Descent on England. Design for a Montgolfière (balloon) capable of carrying 3,000 men and which will cost only 300,000 francs. There will be fixed to it a lamp which will give out a volume of flame sufficient to prevent its cooling. Extracted from the Publiciste of Thursday, 13 Prairial of the year XI. [2 June, 1803.] Paris, chez Boulard, No. 175 Rue St. Denis, etc." Campion's picture, designed and engraved by Echard, is called "The Tower of Calais, new aerostatic machine constructed by M. Romain by order of the government, to cross from France to England in conjunction with M. Pilatre de Rozier." A third and still more curious plate shows the invasion of England as carried out by the combined operations of warships, flat-bottomed boats, and balloons of all shapes and sizes, while cavalry and artillery approach Dover through a subterranean passage. A glance at these cartoons, which are reproduced in Messrs. Wheeler and Broadley's interesting work entitled "Napoleon and the Invasion of England," shows that the Frenchmen of that period had some gift of prophecy, fanciful though it was. Although no airships have been built to carry 3,000 men, still Zeppelin's exploits come close to realizing the dream of the French artist. Gerald Ellis Cronin.

Brooklyn, N. Y.

SHEET LIGHTNING.

To the Editor of the Scientific American:

In connection with Mr. A. A. Graham's letter in the issue of August 28th, 1909, I would like to say that the facts at our disposal at the present time would seem to indicate that sheet lightning is to be expected at high altitudes.

First. The atmosphere is very rare.

Second. It is probable that the atmospheric dust, if not wholly lacking, is present in but small quantities, of the lightest material.

Third. The temperature is low and the clouds are very apt to consist of minute ice crystals.

If it is correct to reason from the laws governing the discharge of an induction coil, we may draw the following conclusions:

Likening the chain lightning to the so-called spark of the coil, we can safely say that such a discharge is unable, owing to the lack of dust, to form an incandescent path.

If the sheet lightning is compared with the brush discharge of the coil, the following facts are brought out:

The thinness of the air would tend to produce sheet lightning.

The clouds of ice crystals, having insulating properties, would perhaps act in much the same way as a piece of varnished cambric placed between the terminals of a coil.

Such discharges would be noiseless.

In conclusion, I would like to ask if any of your readers have satisfactory explanations of the coloring (violet to yellow) of lightning flashes.

Pinebur, Miss. W. H. Dunn.

LATIN-AMERICAN TRADE.

To the Editor of the Scientific American:

Do you know that the total foreign trade, exports and imports, of the twenty-one republics, including the United States, in 1907 was $5,500,000,000?

Do you know that of this, the share of the twenty Latin-American republics was $2,077,000,000?

Do you know that these figures show that Latin America does more than one-third of the total commerce of the American republics, divided as follows:

Exports to foreign lands........$1,072,000,000
Imports from foreign lands...... 1,005,000,000

Do you know that further analysis of these figures shows a total foreign trade between Latin America and the United States of $558,000,000?

Do you know that this total represents only about one-fourth of the total foreign trade of the sister republics of the United States, divided as follows:

Exports to the United States.....$318,000,000
Imports from the United States.. 240,000,000

Do you know that these figures show a balance of trade against the United States of approximately $78,000,000 a year?

Do you know that the Latin-American countries bought last year from other nations than the United States $756,000,000?

Do you know that from the United States these countries purchased only $240,000,000?

Do you know that Latin America purchased more than three times as much from other countries as she did from the United States?

This demonstrates the great possibilities of trade development for the United States in Latin America.

John Barrett, in a speech before the Trans-Mississippi Commercial Congress in San Francisco, October 6th, 1908, said:

"Without unwarranted enthusiasm, let me point out to you my confident belief that the next ten years will be a Latin-American decade—that all the world will be then studying and watching Latin America as it now does Japan and the Orient, and that a material, economic, intellectual, and political advancement will be witnessed in Latin America which will rival what has been accomplished in the United States. Were it not for the lamentable ignorance which prevails throughout the United States in regard to the peoples, institutions, resources, and governments of this section of America, this statement would not seem in the least surprising. Those of us who have traveled from Cuba to Chili and from Brazil to Bolivia are keenly aware that this great onward movement has already begun, and that Latin America has entered upon a new era of splendid activity and world-wide influence.

"Twenty republics varying in size from the area of Brazil, which is larger than that of the United States proper by 200,000 square miles, to Salvador, the smallest, which would take in Rhode Island six times over, having a combined population of nearly seventy millions, and a foreign commerce valued at more than $2,000,000,000 per annum, are going ahead so rapidly that no man can safely prophesy the limit of what they will accomplish during the next ten years. Gifted with a variety of climates and of resources, blessed with a marvelous intermingling of cool plateaus and tropical lowlands, provided with vast navigable river systems and long extent of accessible coast line, supplying numerous important products which the rest of the world must purchase, and possessing great mineral wealth and a people of deep sympathies and high intellectuality based on an old and worthy civilization, they all challenge our best study and keenest appreciation."

I am indebted to the International Bureau of American Republics for the above data.

New York, N. Y. Alfred J. Thompson.

TREES AS WITNESSES IN EARLY SURVEYING.

To the Editor of the Scientific American:

Your very interesting account of "Making a Tree to Speak," in the issue of the Scientific American of August 14th, is rendered more complex in Pennsylvania than in the West for two reasons: First, by the system of surveys, or rather the lack of system in the early surveys; and second, by the fact that they are much older, and consequently much harder for a surveyor to determine. Throughout northern and eastern Pennsylvania the surveys were made at dates varying from 1749 to 1804. The earliest surveys were isolated tracts, usually taken up by settlers, and surveyed by authority of warrants granted by the Proprietors to the applicants, and executed by a deputy surveyor, to whom the warrant was directed. About 1767 explorations were made by agents of the Proprietors of the river valleys, and in 1769 large areas were sold to settlers, and the lines run and marked upon the ground by what Mr. Cooke calls the "blazed line," or by chopping off a small slice of bark from the opposite sides of the trees which the surveyor passed. The corners of the surveys were usually marked by cutting three notches in the corner tree in the direction from which the surveyor approached it and on the side from which he left it. Besides this corner tree the surveyor marked other trees standing near by, with three notches on the side facing the corner tree, and called witnesses. These surveys of 1769 were located in the river valleys, and generally at the mouth of some stream of considerable size, affording abundant water power as it came to the river. In 1772 the surveys were extended up the smaller streams, sometimes for long distances, taking the land which was deemed tillable, and this plan was followed until 1789. At this date there arose a great demand for the lands, and large bodies were sold by warrants to the applicants, who had them surveyed; and frequently the surveyor had no regard for the previous surveys, and laid the new warrants on top of the older ones. In the year 1793 a company known as the Holland Land Company took warrants for thousands of acres located in the northern part of the State, and sent surveyors to make the location. Again these surveyors paid no attention to any of the former surveys, and used the same style of marking as had previously been used by the older surveyors. In 1802 to 1804 the surveyors from the State of Connecticut, claiming under the original charter granted by the King of England, "extending from the Atlantic to the Pacific," came into the State and began their surveys, and again used the same system of marking, paying no attention to any of the former surveys. This act led to what is termed in history the Pennimite and Yankee war, which later, by the decree of Trenton, decided that the Connecticut settlers should hold seventeen townships in Luzerne County, but that the State of Connecticut should release all its claim to other parts of the State of Pennsylvania.

Now, after the lapse of from one hundred and seven to one hundred and sixty years the surveyor finds difficulty, with the full meaning of the word, in determining how these old surveys were located. The timber in many places was removed before the lines were fully settled, and where it remains it requires a great amount of skill on the part of the surveyor to detect the traces of the ax-marks in the bark of the trees, and still more skill to count the rings, to determine to which set of surveys the mark belongs. This difficulty is increased by the fact that the old surveyors were careless in their locations, and occasionally the marks are found as much as two miles from where they purport to be, and the courts hold that the monuments on the ground are the controlling factor in making the location.

To show the importance of "making a tree speak" to determine a location, a surveyor recently had occasion to retrace the lines of a survey made sixty years ago. The corners were all obliterated. Some had been trees, some were called "stones," and one was called a "pine knot." A dispute arose over the location of the pine knot. A surveyor was called, and after trying in vain to locate the pine knot from the other corners as called for, came upon a marked line tree bearing the date of this particular survey, and traced it out until he came to a point where tradition said the other line of the survey came to the pine knot. Making search, he found a marked tree on that line, and bringing the two lines to an intersection on the bearings called for, was preparing to set a permanent monument, when a workman dug up a piece of wood. On examination this proved to be the pine knot in question. By removing the accumulation of decayed wood and dirt, the notches with which it had been marked were so clearly discernible that the location was settled.

Different kinds of timber show a variety of ways of healing over the cut, and some become so overgrown in a few years that they are more difficult to determine than some other species after a much longer period. The various species of pine lose the marks in a few years, where they are of rapid growth, because the bark shells off. Some species of oak and the hemlock will hold a mark for a long time, and frequently it is found that the marks show very plainly after a lapse of over one hundred years. In the Connecticut survey above referred to, some corners were trees on which Roman numerals were cut, and yet after a lapse of over one hundred years the letters can be found in the old wood of the tree by cutting away the new growth, which has closed over the flattened surface where the numerals were cut. So, taking it all, the trees do speak, and tell an indisputable story, and stand as silent witnesses to the hardships of the surveyors of that early day in climbing over the mountains and leaving their trail in the timber to be found by future generations.

Millville, Pa. Boyd Trescott.

COMMANDER PEARY'S DISCOVERY OF THE NORTH POLE.

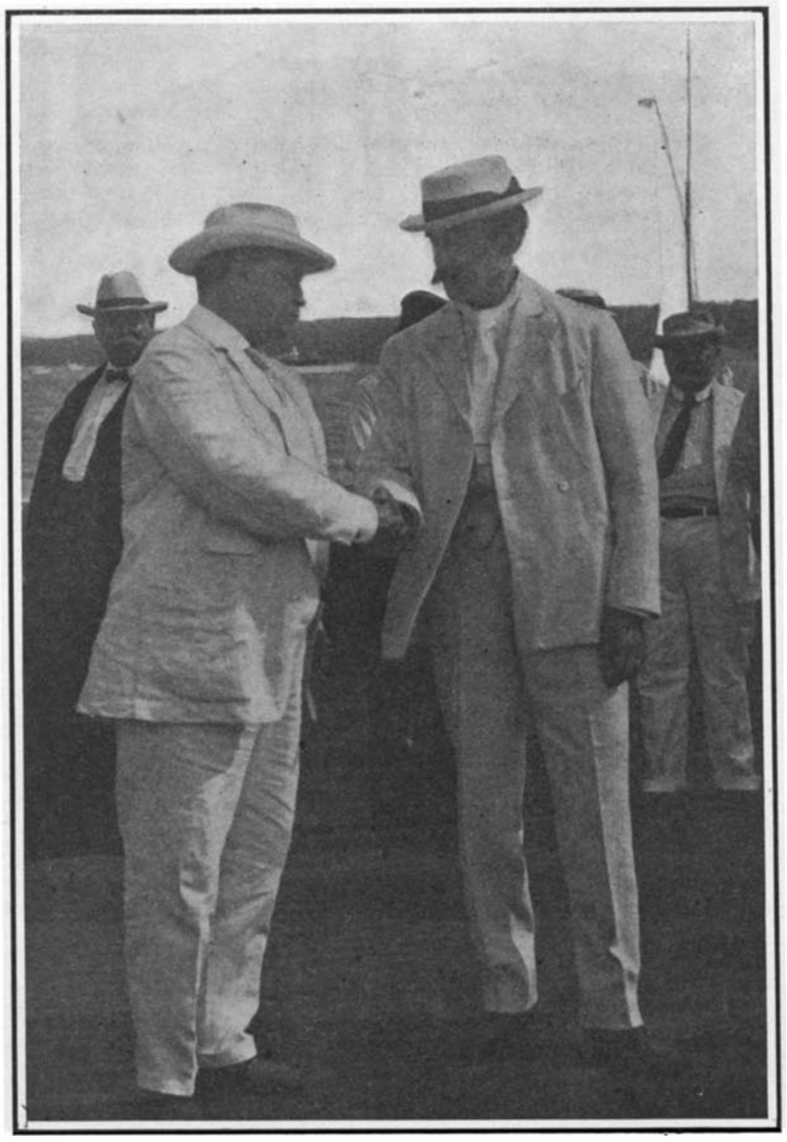
The amazing coincidence of the report by two independent explorers of their location of the North Pole within a year of each other, after the hardship, privation, and expense of life and funds endured in vain in the effort to find it for over three hundred years, makes any comparison of the probability of the reports or the value of the results obtained difficult if not unprofitable with the limited particulars hitherto available.

We prefer, therefore, to await the verdict of the investigation, which will undoubtedly be made by the highest scientific authorities upon presentation of the complete evidence on either side; and expressing no opinion, briefly to summarize Mr. Peary's report of his achievement as we did that of Mr. Cook.

The origin and early history of polar exploration was sufficiently outlined in last week's SCIENTIFIC AMERICAN, which also compared the reported achievement of Cook with the earlier work of Peary. After the latter's expedition of 1906, when he reached 87 deg. 6 min. N. lat., then the "farthest north," he determined to make one more effort to reach the Pole, and the "Roosevelt" was accordingly equipped by the Peary Arctic Club with all the material and scientific instruments which have been proved to be most essential in polar exploration by Commander Peary's twenty-three years of experience.

The "Roosevelt," with Peary and his party on board, left New York on July 6th, 1908, called at Sydney, near Cape Breton, Nova Scotia, leaving there July 17th, and proceeded east round Newfoundland and then straight north through Davis Strait and Baffin's Bay to Cape York, Greenland, at the southern end of Smith Sound. Leaving there August 1st, the ship proceeded *via* Etah, farther up the sound, navigating laboriously through floating ice, often densely packed, to Cape Sheridan in Grant Land, the northern end of Ellesmere Land, on the other side of the sound, arriving there September 1st, and there the expedition passed the winter. The farther progress of the explorers has been reported by Commander Peary exclusively to the New York Times, by whose courtesy we are permitted to give the following abstract.

Peary's full report describes greater difficulty in making the point selected for winter quarters than was at first suggested. An actual landing at Cape Sheridan was not made until several days after arrival there, strong northeasterly winds and the drift of the ice repeatedly forcing the ship back and twice driving her aground, and it was only on September 5th, after zigzagging through leads in the ice for several days, that the "Roosevelt" succeeded in rounding Cape Sheridan into open water, and lying up in an opening in the floe at the mouth of the Sheridan River.



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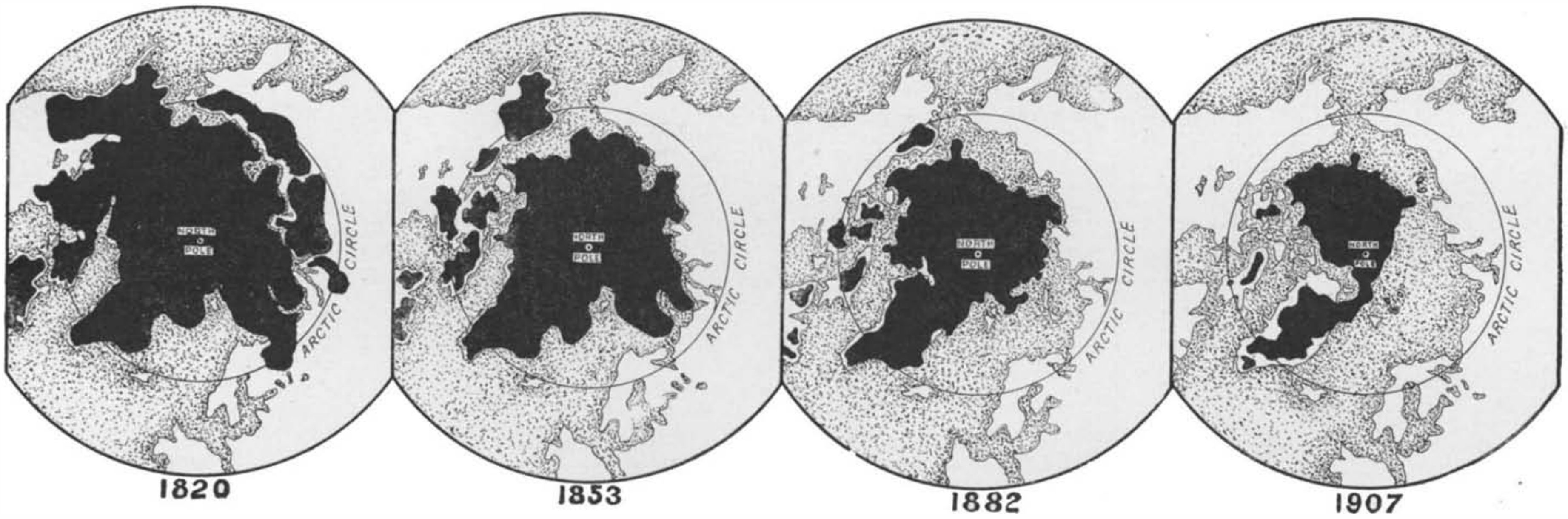
Ex-President Roosevelt bidding Commander Peary God-speed on his successful polar expedition.

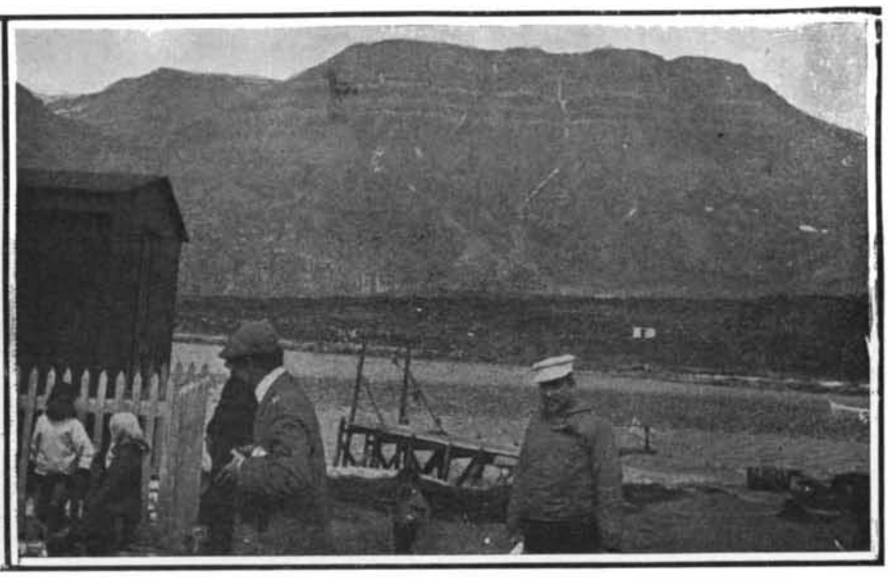
Supplies and equipment were immediately transferred across the ice to a clapboard house and storeroom hastily built on shore, and on September 15th the work of transporting supplies was begun, several sledge expeditions depositing provisions at various points along the coast from Cape Sheridan to Cape Columbia, so that the sledge party on its spring dash for the Pole might travel as light as possible and pick them up *en route*. This work was carried on continuously until November 5th, and was mingled and followed by hunting expeditions, tidal and other observations by various parties, lasting until February.

The sledge expedition for the Pole left the "Roosevelt" in three divisions on February 15th, 21st, and 22nd under Capt. Bartlett, Prof. Marvin, and Com. Peary respectively, the total of all divisions being 7 whites and 59 Esquimaux, with 23 sledges drawn by 140 dogs.

All of the divisions appear to have assembled at Cape Columbia, such of the supplies as were required being brought up from the other depots on the route, the dogs rested, and the equipment thoroughly overhauled by February 27th. In the meantime, apparently, Bartlett's pioneer division had been hewing a way north through jagged ice to the "big lead," a stream of open water, which he crossed on the first of March and got away north over the ice, the remainder of the party following soon after, but being stopped on their second day's march by open water formed by a breach of the ice by strong wind after Bartlett's division had passed the spot. Two sledges were smashed beyond repair in the first march, the teams going back to Cape Columbia for reserve sledges. At the end of the fourth



Four stages in Arctic discovery. The black areas indicate the unexplored portions in the respective years.



Photographs by Underwood and Underwood.

Dr. Cook in conversation with Etah Esquimaux. Some of these tribesmen accompanied him on his successful expedition.

Mr. Thiegaard Jansen, Danish inspector of North Greenland, the first to receive the news of Cook's success. He is the man with the white cap.

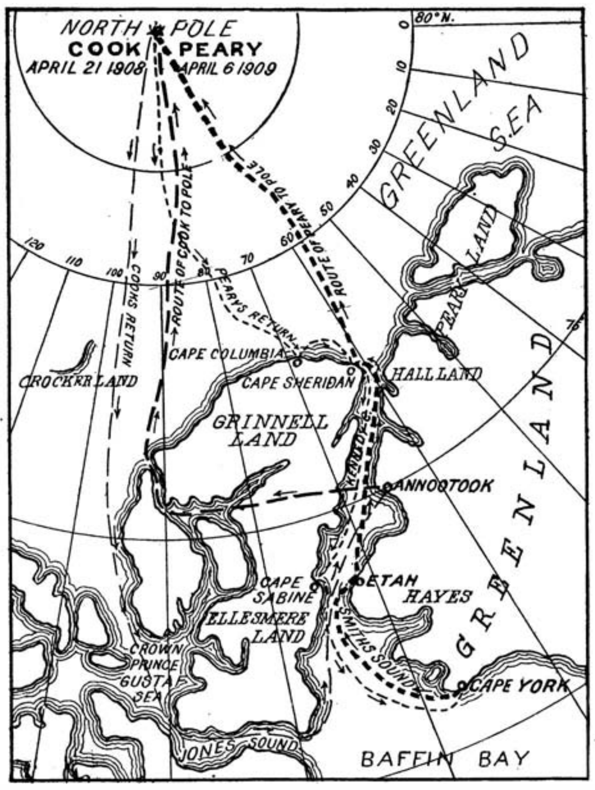
SCENES ON THE COOK AND PEARY EXPEDITIONS.

day the rest of the expedition caught up Bartlett, who had been stopped by open water, which delayed the entire party till March 11th.

On the 5th of March the sun appeared for a few minutes at noon for the first time after the long winter night. On March 11th the lead was sufficiently frozen over to be crossed, and another start was made. Borup and Marvin, who had gone back for alcohol and oil from Bartlett's third camp, had not yet come up with the expedition in spite of the delay, causing some anxiety, but a note was left for them, and three days later they caught up the main party at the end of its sixth march. The latter in the meantime had been traversing alternately floating solid ice and newly-frozen leads, and had just crossed the 84th parallel. From that camp Dr. Goodsell turned back by prearrangement, and McMillan accompanied him reluctantly, owing to a badly-frozen foot, which he had been concealing for three days, much to the regret of Peary, who had counted on his enthusiasm and physical powers.

The best dogs and sledges were selected for the northward journey, the party now consisting of 16 men, 12 sledges, and 100 dogs. At the end of the tenth march, at latitude 85 deg. 23 min., Borup turned back in charge of the second supporting party. The traveling rather improved, and Commander Peary and Marvin waited twenty hours after the start of the advance party, in order to overtake them as they broke camp after the next halt, thus using the same camp and keeping in touch with the advance party once in every twenty-four hours. After two more marches the sun began to get high enough for observations to be made, 85 deg. 48 min. being recorded, and, the going continuing to improve, 50 minutes was covered in the next three marches, including 20 miles on the third day, bringing the party to 86 deg. 38 min. At this point Marvin turned back with the third supporting party. The next day's march was good, but after that came the deepest snow encountered, accompanied by haze which made a short and exhausting journey. At the end of the succeeding day the ice parted exactly where the party was encamped, nearly causing the loss of dogs and sledges, but after an exciting period dashing from one moving floe to another, better going was reached. Then came Capt. Bartlett's last day, another long march with fair going, camp being made at 87 deg. 48 min., as shown by observation of the sun next day. The sturdy navigator of the "Roosevelt," who had borne the brunt of the pioneering work, walked several miles north in the morning to be sure that he crossed the 88th parallel, and then turned reluctantly back with the two Esquimaux of the last supporting party, the provisions carried being insufficient to last more than 6 men and 40 dogs for the week or more estimated to be required to reach the Pole as well as for the return journey.

Peary then determined to try and reach the Pole in five forced marches, allowing less than a day for each, extending the last one, if necessary, to complete the distance lacking. His cabled narrative speaks of "five marches of fifteen miles each"; but as he was then south of the 88th parallel, this is an obvious mistake for 25 miles, to which distance he refers as having accomplished his intention on his next, the twenty-first, march. After a few hours' sleep good going was found, and twenty miles were covered on the twenty-second march before an open lead delayed the journey. Another brief



Map showing the routes taken by Peary and Cook on their expeditions.

halt and even better weather and smoother ice enabled another twenty miles to be made on the next march, including a dash across 100 yards of ice newly formed over a lead, which buckled under the sledges and broke as the last one left it. Again a short sleep, and twenty-five miles were made on the twenty-fourth march. Although the temperature was not so low as had been experienced, even the Esquimaux complained of the bitter cold. Much-needed sleep was taken for a little longer, and then the party dashed forward, dreading that each rise in the ice marked an open lead, but always finding continued going. The haze was thicker, but an observation was possible at noon, showing 89 deg. 25 m. A rise in temperature to 15 deg. below zero encouraged the dogs, and forty miles was covered in twelve hours. An observation at noon on April 6th, at the end of the twenty-sixth march, showed latitude 89 deg. 57 m. to have been reached, only three minutes or a little over three miles from the Pole, so the remaining distance was apparently covered before a rest was taken.

The first thirty hours at the Pole was spent in making observations and taking photographs. Ten hours after arrival the weather cleared, and the afternoon of April 7th was cloudless. A crack in the ice five miles from the Pole was found, and a sounding was made, 1,500 fathoms of wire finding no bottom, and the wire being broken and lost in withdrawing it.

Speed was just as urgent on the return as on the upward journey, every day gained lessening the chance of a gale opening leads and destroying the track. Every march back lessened the chance of provisions running short before the base was reached, so the equipment could be lightened to facilitate speed. Peary therefore determined, in spite of the records for Arctic travel made on the advance, to try to *double* the daily journey on the return, covering two of the northward marches on each march south, and making use of the same "igloos"—the ice huts made in camping—and so saving time at each halt. This he very nearly accomplished, regularly covering five outward marches in each three of the return journey. He was singularly fortunate in escaping open leads in the ice, which had delayed the return of the supporting parties, down to lat. 85 deg. 23 m., the camp at the end of the tenth outward march, where a lead five miles wide was encountered. By good luck Bartlett's trail was found again at the other side, and by continued rapid traveling Cape Columbia was reached on the 23rd of April after fifteen marches. The "Roosevelt" was reached in two more marches, and found unharmed. Nearly two months were spent in additional geodetic observations and in bringing back remaining supplies from the outlying *cachés* until on July 18th the ice was sufficiently open for the ship to be removed from her berth. She fought her way south to Cape Sabine by August 8th, picked up Whitney and the stores at Etah, coaled from the "Jeanie," and cleared from Cape York August 26th, and reached Indian Harbor September 5th to send the now historic telegram: "Stars and Stripes nailed to North Pole."

How the sextant is manipulated in measuring the sun's altitude.

HOW COOK MADE HIS LATITUDE OBSERVATIONS.

So much doubt seems to have been engendered in the public mind by a certain portion of the press, regarding the validity of Dr. Cook's observations, that it may not be amiss to describe briefly the methods which, in common with every other explorer, he would necessarily adopt in determining his latitude. The actual determination of latitude, although it is one of the most important practical questions in astronomy, is also one of the most elementary, for which reason we fail to understand why so much ado should have been made.

For the purposes of astronomical measurement, the celestial sphere is divided as indicated in Fig. 1. Assuming that the observer is placed at *O*, his celestial horizon will be *H E S W*. The axis of the heavens will be *P p*, *P* being the elevated pole, and *p* the depressed pole; *Z* will be the zenith of the observer, and *N* his

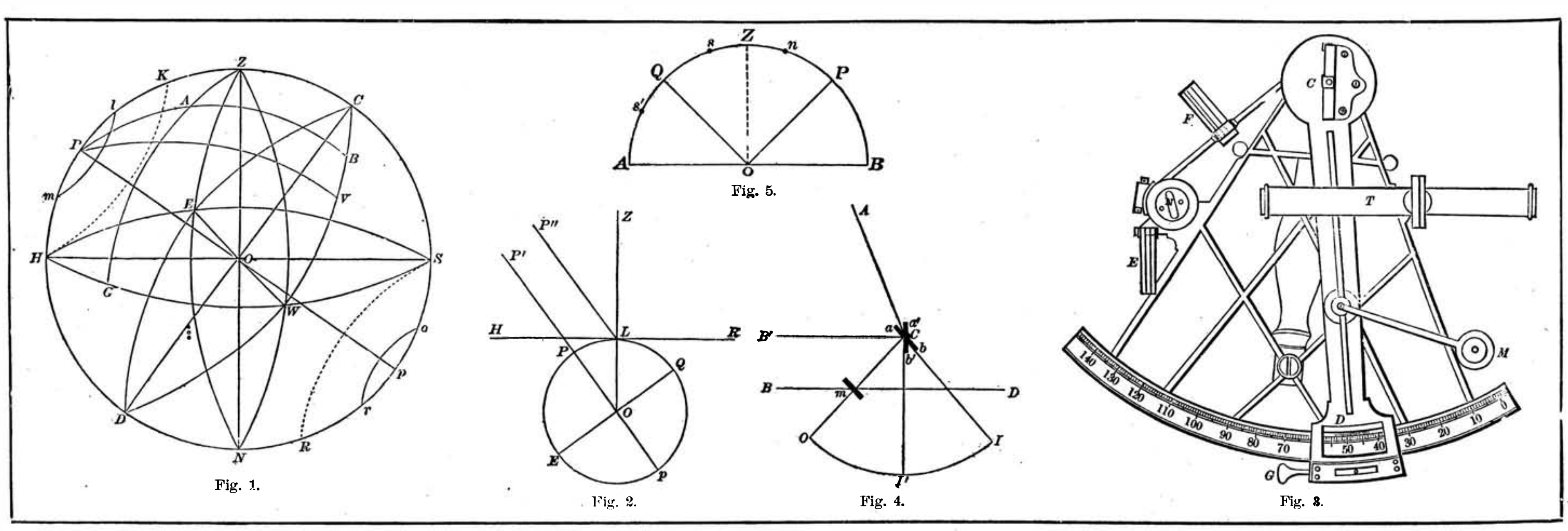


Diagram showing the principle of the sextant and the manner of its use in determining the altitudes of celestial bodies.

HOW COOK MADE HIS LATITUDE OBSERVATIONS.

nadir. The great circle $HZSN$ will be the observer's celestial meridian; like all great circles passing through the celestial poles, it is an hour circle or circle of declination. The circle $ECWD$ is the equinoctial (the celestial equator), and the circle $EZWN$ perpendicular to the meridian is the prime vertical, cutting the horizon at E and W, respectively the east and west points. The north pole of the heavens is P, and is marked by the Pole Star or North Star.

The latitude of any place on the earth is equal to the altitude of the elevated pole at that place. Hence by measuring the altitude of the Pole Star, the north latitude of a place above the equator is directly obtained. This follows from a consideration of Fig. 2, in which $P p$ is the earth's axis, and $E Q$ the equator. The line $H R$ tangent to the earth's surface at L is the horizon, and the point Z the zenith of L. Assume that the earth's axis and the line $L P''$ parallel to the earth's axis to be both indefinitely prolonged. Because of the immensity of the celestial sphere as compared with the earth, these two lines will sensibly meet at a common point on the surface of the celestial sphere, and this common point is the elevated pole. To an observer L this elevated pole will therefore lie in the direction $L P''$, and $P'' L H$ will be its altitude. From Euclidian geometry we know that the angle $H L Z$ is equal to the angle $P\ O\ Q$, and the angle $Z\ L\ P''$ equal to $Z O P'$. Hence the angle $P'' L H$ (the altitude of the pole) is equal to $L\ O\ Q$, the observer's latitude.

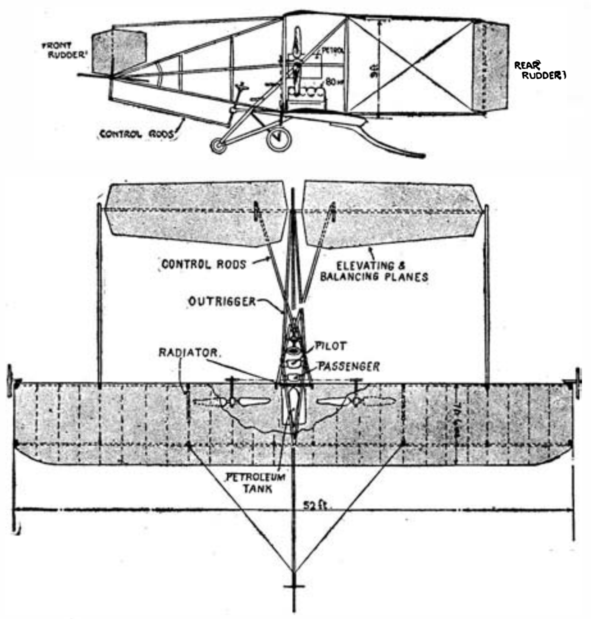
The latitude of a place on the earth is also equal to the declination of the zenith at that place. The declination of a body or point is its angular distance from the plane of the celestial equator, and hence $Z O Q$ in Fig. 2 is the declination of the zenith or latitude of L in Fig. 2.

In order to calculate his latitude, the navigator or explorer employs a sextant, which is an instrument by means of which the angular distance between two visible objects can be measured. Since Pole Star observations cannot always be taken, because the horizon is not always visible at dusk or at night time, the navigator is generally compelled to measure the sun's altitude, and to use that as the basis of latitude calculations. As shown in Fig. 3, the sextant is a sector of a circle, whose arc measures 60 deg. A movable radius, called the index bar, $C D$, revolves about the center of the sector. At its lower extremity the bar carries a vernier D. At the upper extremity of the index bar is a silvered mirror C, the surface of which is perpendicular to the plane of the instrument. Another glass N, called the horizon glass, is rigidly attached to the frame of the instrument, the upper half of which glass is transparent and the lower half silvered. The surface of the horizon glass must also be perpendicular to the plane of the instrument. A telescope T is directed toward the horizon glass, with its optical axis parallel to the plane of the instrument. Two sets of colored glasses F and E are usually provided for the protection of the eye when the sun is observed. The sextant is constructed on the principle that the angle between the first and last direction of a ray which has been reflected twice in the same plane is equal to twice the angle which the two reflecting surfaces make with each other.

Suppose that we wish to measure the angular distance between the sun A and some distant object B on the horizon (Fig. 4). The object B is distinctly visible at D in the telescope through the upper, transparent half of the horizon glass m. The object B is so distant that the rays $B' C$ and $B M$ coming from it may be regarded as sensibly parallel. If $a b$ and $C I$ are the positions of the index glass and index bar when both glasses are parallel, the ray $B' C$ will be reflected by the two glasses in a direction parallel to itself, and the observer, whose eye is at D, will see both the direct and the reflected image of B in coincidence. If the index bar be moved to some new position $C I'$, so that the ray from the sun, A, is finally reflected in the direction $m D$, then the observer will see the direct image of B and the reflected image of A in coincidence. The angular distance between the two bodies is evidently equal to the angle between the first and the last direction of the ray $A C$, which angle is equal to twice the angle made by the two glasses with each other, or twice the angle $I C I'$. If then we know the point I on the gradient arc at which the index bar stands when the glasses are parallel, twice the difference between the reading of that point and that of the point I' will be the angular distance of the two bodies. To avoid this doubling of the angle, every half degree on the arc is marked as a whole degree.

The sun is the body generally used by navigators in determining latitude. The time of noon being approximately known, the observer begins to measure the altitude of the lower limb of the sun a few minutes before noon, and continues to measure it until the sun ceases to rise, or "dips," as it is called. The greatest altitude attained by the sun is taken as the meridian altitude. Corrections are made for index error, dip, atmospheric refraction, parallax, and semidiameter, and the result is the sun's true meridian altitude. Taking this from 90 deg. we obtain the sun's zenith distance. Looking in the Ephemeris or Nautical Almanac we find the sun's declination given for Greenwich (or Washington) noon of every day, with the hourly change, so that we can easily deduce the exact declination at the moment of observation. Then the observer's latitude is obtained, because the latitude of the observer equals the sun's zenith distance plus the sun's declination. This is apparent from a consideration of Fig. 5, in which the circle $A Q P B$ is the meridian, Q and P the equator and the pole, and Z the zenith. $Q Z$ is the declination of the zenith, or the latitude of the observer. If the sun is observed at s, south of the zenith as it crosses the meridian, then $Z s$ is its zenith distance and $Q s$ its declination, which is known. Then $Q Z$ equals $Q s + s Z$; in other words, the latitude equals the declination of the sun plus its zenith distance.

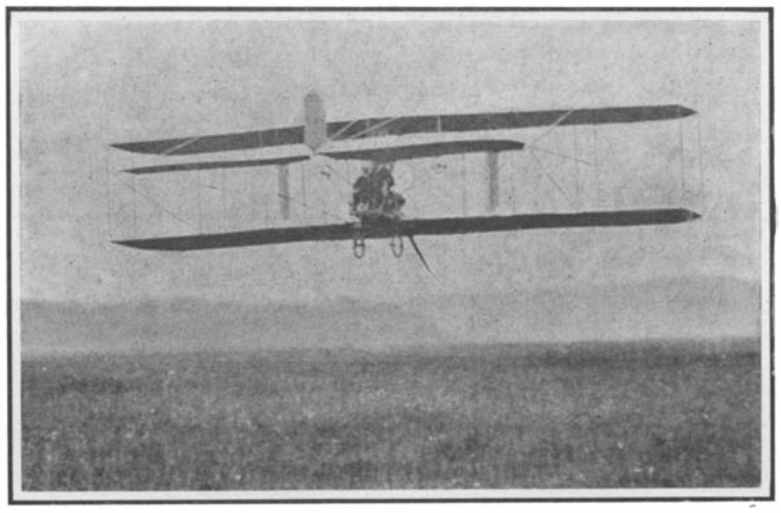
The handling of the sextant is so simple a matter, and the application of corrections to its readings so easy, that we fail to understand how anyone can seriously doubt Dr. Cook's accuracy.



Plan and side elevation of Capt. Cody's biplane.

CAPT. CODY'S BRITISH ARMY AEROPLANE.

Following close upon the great exhibition of flying which was given recently at Rheims, Capt. S. F. Cody, who has been working for a number of years in the interests of the British government, has met with complete success with his aeroplane, and has succeeded in accomplishing a cross-country flight of one hour and three minutes' duration, in the course of which he rose to a height of about 400 feet, circled a church steeple, and traveled altogether about 47 miles. This is the first flight demonstration of any account which has been given in England, and the fact that it has been accomplished by an American after persistent experimenting puts another aviation record to the credit of the United States.



Capt. Cody in flight in his latest biplane.

CAPT. CODY'S BRITISH ARMY AEROPLANE.

Capt. Cody has made a few minor changes in his machine since it was illustrated by us in our issue of January 30th last. Chief among these is the dividing of the single-surface horizontal rudder in front of the machine into two separate planes, or wings, placed side by side, and arranged so they can be worked together or separately and in opposite directions. This division of the horizontal rudder into two parts has been substituted for the separate wing tips, or balancing planes, which were formerly placed at each end of the single surface. By inclining the two wings of the present rudder in opposite directions, the machine can be righted when it tips to one side or the other, and this movement of the wings can also be used in steering the aeroplane to the right or the left. Steering in a horizontal plane is accomplished chiefly by means of two vertical rudders—one in front above the horizontal rudder, and one some distance at the rear of the planes.

The Cody biplane is mounted upon three wheels and one skid. Two of the wheels, which are about 2 feet in diameter, are placed side by side just under the front edge of the lower plane, while the third one is located in advance of the other two, and at the intersection of two pairs of heavy inclined uprights extending downward from the rear longitudinal of the upper plane and from beneath the bed of the motor respectively. The former pair of inclined uprights carries seats for the aviator and his passenger, the latter seat being a foot or more above the aviator's seat and just in front of a radiator consisting of long thin tubes extending upward to the front edge of the top plane. A single skid extends backward from the rear edge of the lower plane on the center fore-and-aft line of the machine. Most of the weight of the aeroplane is carried upon the two large wheels placed beneath its front edge. Coiled-spring shock absorbers surround the upright rods extending from the axle of these wheels to the lower edge of the front plane. If the machine tips downward in front when running along the ground, the weight is taken by the small wheel in front, while if it tips upward the skid at the rear touches the ground. This skid also acts as a brake when alighting. The use of the inclined uprights extending out in front, and also the use of bamboo to support the rudders, makes Capt. Cody's biplane somewhat similar in construction to that of his fellow countryman, Mr. Curtiss.

The main planes of Capt. Cody's machine are 52 feet long by 7½ feet in a fore-and-aft direction. They are spaced 9 feet apart at the center, this distance gradually diminishing to 8 feet at the ends. Both planes are arched slightly in a transverse direction, the upper one being curved downward somewhat more than the lower one, in order to bring it nearer to the latter at the ends. The ends of both planes, moreover, are almost flat, although the other parts of the surfaces have the usual parabolic curve. In arching these surfaces downward, Capt. Cody has followed the idea of the Wright brothers, who claim that a slight downward curvature of the ends of the planes is preferable to an upward curvature of them. In the "June Bug" biplane of the Aerial Experiment Association, it will be remembered that the upper plane had its ends curved downward, while the ends of the lower plane were curved upward. This arching of the surfaces in opposite directions was, we believe, the idea of Lieut. Selfridge, and it was found to work very well.

The wings of the horizontal rudder are also arched slightly in a similar manner to the main planes. These are operated by a horizontal steering wheel mounted upon the end of a universally pivoted lever. Swaying the wheel from left to right or *vice versa* sets the wings of the horizontal rudder so as to right the machine when it tips, while turning the wheel moves the vertical rudders in front and behind and also inclines the wings of the horizontal rudder slightly in opposite directions, in order to tip the machine downward as it makes a turn; pushing forward the steering wheel or pulling it backward causes the two wings of the horizontal rudder to move together, and inclines them downward or upward, in order to direct the machine in either of these two directions. Capt. Cody has also provided for auxiliary balancing planes at the ends of the main planes. These can be attached to the uprights half way between the planes, if they are found necessary, in order to tip the machine in making abrupt turns. The inventor has also provided for warping the main surfaces if he finds this necessary. He has employed a system of warping the wing extensions of box kites for some time past with the man-lifting kites with which he has experimented. If it was found that the kite was not riding properly, by hauling it down and warping the wing extensions of the main box the trouble could be remedied.

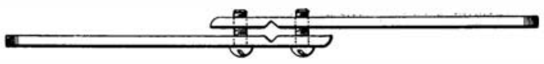
The power plant of the Cody machine now consists of an 8-cylinder E. N. V. gasoline motor capable of developing about 80 horse-power. This motor has replaced the 50-horse-power Antoinette which he used early in the year. It has been moved slightly back from the front edge of the lower plane, instead of being placed forward of the front edge as heretofore. In other words, the positions of the motor and the aviator have simply been reversed. The motor drives two

(*Continued on page 200.*)

A HANDY TAP WRENCH.

BY EDWARD J. TIEDE.

A wrench for holding machine taps or reamers and the like can be easily made of a piece of flat steel and two machine screws; if steel is not handy, iron can be used. Take a piece of stock of about ⅜ x ¼ inch, and cut off two lengths of 5 inches each. Near the end of



A HANDY TAP WRENCH.

these pieces and about 1 inch apart, drill two holes; ¼-inch tap holes in one and clearance holes in the other. Centrally between the holes file V-shaped grooves about 1/16 inch deep. Tap out the holes, and assemble the parts, using round-head screws of ¾ inch length. The ends of the wrench should be rounded for convenient handling. The dimensions herein given can of course be varied at will. Any size from the smallest to the largest can be made in this way.

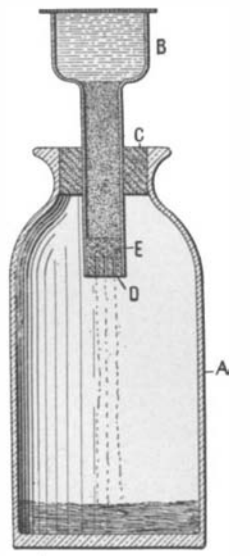
THE COLD PROCESS OF MAKING SIRUP.

BY THALEON BLAKE, C.E.

The customary way of preparing table sirup is to pour boiling water on sugar, or set a pan of water on the stove to boil, with sufficient sugar to sweeten and give body to the water. Sirup for canning is almost invariably made by one of these methods, although neither one enables the housewife to obtain a finely-flavored, clear fluid.

Sugar when put in boiling water, or in cold water that is raised to the boiling point, seems to lose its delicate flavor; the resulting sirup is frequently stained, rather faintly yellowish or bluish, according to the composition of the vessel in which it is prepared. This stain may be due to the chemical salts in the water, which are made active to color sugar by being subjected to heat; or the stain comes from the tinned or glazed material of the vessel, given off when hot, in the presence of water and sugar. It may, of course, originate from the chemical reactions set up in the water only when the water is in vessels of certain composition; and the stain may be unnoticeable when vessels of other composition are used. But where a stain in the sirup cannot be detected, there will always be found a gritty sediment in the sirup pitcher after cooling. This is due to the impurities of commercial sugar.

There is another and better method of making sirup than by the aid of heat; it is the cold process. By this simple method, the sirup resulting has a body that is of crystal purity, free from stain, and with the sediment filtered out. And what is of more importance, perhaps, to one who has a discerning palate, the sirup has a flavor superior to that produced by cooking, or by the application of heat, however moderately.



THE COLD PROCESS OF MAKING SIRUP.

My father was a druggist and chemist of near thirty years' practice. He began to make all his sirups very early in his career, and obtained quite a reputation among physicians in his locality for the quality of them. I have depicted his method, which makes the sirup and filters it all in one operation, using instead of the chemist's apparatus, such articles as almost any housewife can find in her kitchen, and can assemble easily.

The parts required in this home-made apparatus are a bottle *A* of about a quart or more capacity; an Argand lamp chimney, *B*; two corks, *C* and *D*; and a bit of cotton, *E*, for a filter. A large-mouthed bottle, having a well-fitting cork, is preferable to a glass can or Mason jar, as the cork *C* is already fitted to it. This cork *C* is placed on a board or table; the circumference of the Argand chimney is marked on its upper surface, and a hole is cut through the cork, a trifle less than the mark indicates. Care must be taken to cut this hole so that the chimney will fit in it snugly; for cutting which, a sharp penknife will do, although a wood-carving chisel, having a curved cutting edge, is a better tool to use. The smaller cork, *D*, is fitted within the Argand chimney, and one or more small holes are bored through it; the holes may be burned by means of a red-hot wire.

If a funnel be substituted for the Argand chimney, the large cork *C* may be dispensed with; and if a bottle is used having a neck that will admit the Argand chimney's long cylindrical tube, but not its funnel-shaped base, no cork need be used with the chimney either; but the use of a cork is preferred, as it prevents the dust from getting in, and keeps the water in the sirup from evaporating. In use, the parts are assembled as shown in the drawing, and pure granulated sugar is poured into the chimney until the tube part is filled. Over this filtered water is poured; and the top is then covered to exclude dust.

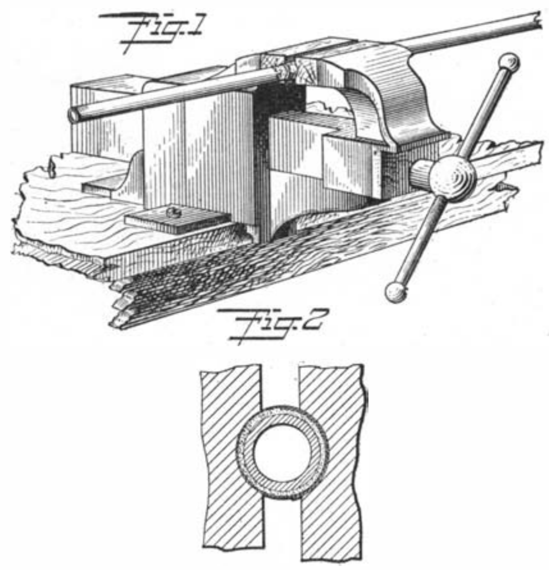
Immediately the manufacture of sirup begins. The process must not be hurried. The rate at which the sirup drops into the bottle must be regulated by the size of the hole through the cork *D*, also the thickness of the cotton *E*, and the density it is packed home against the cork. If the sirup is made too rapidly, it drops down diluted. By regulating the filter, the control of manufacture is assured. Filter paper of suitable texture for filtering sirups may be substituted for the cotton; a rapid filter paper and cotton would make an ideal strainer to clarify the liquid as it forms and seeks to escape.

The sirup made by filtration—as a chemist would call the process—has a taste of rock candy. By suspending threads in the sirup, crystals of sugar will grow upon them, popularly known as "rock candy." These crystals, by the way, are better than ordinary sugar to sweeten a teacup, in the opinion of some connoisseurs. As a medium in which to preserve cherries, peaches, plums, in fact, any whole fruit, to use when serving liquors, it is immeasurably superior to "boiled" sirup. Cherries, hard-cooked and suspended in it, may be incased in solid crystals of "rock candy." With thought and ingenuity, many novelties may be devised with it as one of the ingredients.

VISE FOR POLISHED PIPE.

BY A. V. SEARING, JR.

A very good way to hold pipe or rods that have a polished surface, is to sprinkle dry plaster of Paris on heavy paper and roll the article to be held in the



VISE FOR POLISHED PIPE.

paper, taking care that there is plenty of the plaster between the paper and the pipe or rod. Place the roll between blocks of wood having a hollow face, and clamp firmly in an ordinary bench vise. If upon removing the paper the plaster is found to adhere to the pipe in hard cakes, do not try to scrape it off, but wash the pipe in clean water, which will loosen the plaster and leave the surface in a perfect condition. Another method is to place the pipe between pieces of lead sprinkled with plaster, and use a pipe vise for a clamp.

TEMPORARY REPAIRS TO BROKEN SPRINGS.

A spring is most apt to break in the center, as in Fig. 1. The spring clips *A A* will probably hold it together after a fashion, but the ends will sag and put a dangerous strain on the clips. A hard-wood board *B*, from 1 inch to 2 inches thick, should be procured,

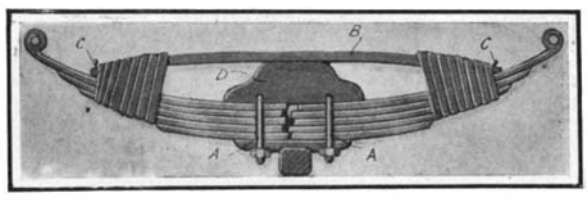


Fig. 1.—REPAIRING A SPRING BROKEN AT THE CENTER.

and the sides trimmed down so that it will be about 5 inches wide in the center and 2 or 3 inches wide at the ends. Drive nails *CC* in the ends of the board, jack up the frame of the car to take the weight off the spring, put the center of the board on the rubber bumper *D*, or, if there is no bumper, on a suitable block of wood, and bind the ends down tightly to the spring with leather straps or clothesline.

In case the breakage is toward one end, a block *E*, Fig. 2, should be nailed to the board over the break. The remainder of the operation is substantially as

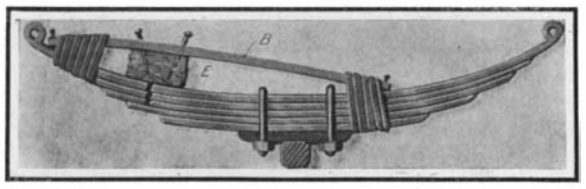


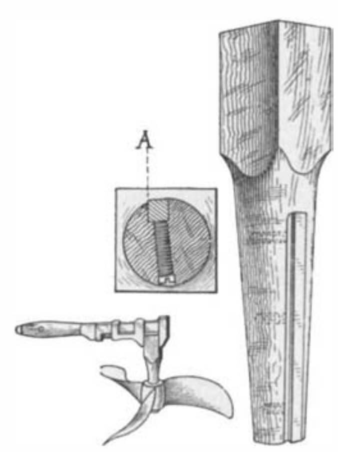
Fig. 2.—REPAIRING A BREAK AT ONE END OF THE SPRING.

shown in Fig. 1. When clothesline is used, the winding should start at the end of the board, the short end of the rope being tied in a single knot, and led along the board and covered by the subsequent turns.

SIMPLE TAPERED REAMER.

BY ALBERT F. BISHOP.

A simple tapered reamer for fitting a propeller wheel to a shaft that might have an odd taper may be made out of a tough piece of hickory turned in a lathe to the same taper and size of the shaft. Leave a square end on the hickory piece, as shown in the illustration. Cut a quarter-inch groove full length in the tapered part, snugly inserting a quarter-inch square piece of steel in the groove. Self-hardening steel is perhaps obtainable. Be sure to bevel the cutting edge, which is marked *A* in the illustration, to prevent the cutter from digging in. The steel is backed up with three set screws which may be turned with a screw driver to slightly adjust the taper and make a perfect fit. Use a fair-sized monkey wrench in rotating the reamer. The writer fitted a propeller wheel in a few minutes with this device.

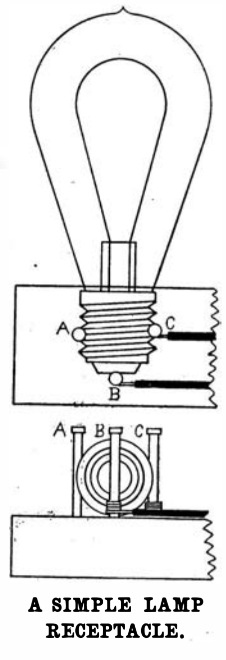


A SIMPLE TAPERED REAMER

A CHEAP LAMP RHEOSTAT.

BY F. P. M'DERMOTT, JR.

A lamp rheostat is sometimes required for experimental purposes when receptacles for the lamps are not available. Where they are watched sufficiently to avoid any danger from fire, Edison base lamps may be held in place by nails, thereby overcoming the need of receptacles. The illustration shows such an arrangement, in which a lamp is held in place on a board by three nails, *A*, *B*, *C*. No dimensions are given for the location of the nails, as their proper position is very readily obtained by using a lamp as a gage. The edge of the board should be about at the junction of the base to the globe, as shown. See that the nails for holding the various lamps are so located that the globes do not crowd one another. The wires are connected to the nail *B* and to either *A* or *C*. They are twisted around the nails and may be soldered thereto if desired. When in use the board should be laid on a table somewhat larger than itself, and with the lamps in a horizontal position. In case a lamp accidentally becomes loose, the table will catch it and prevent its being broken. The lamps are inserted by pushing them downward between the nails *A* and *C*, and screwing them up until contact is made with the nail *B*. Notice that, with certain connections, a short-circuit will result if the shell of the base touch the nail *B* at the same time that it touches *C*.



A SIMPLE LAMP RECEPTACLE.

CAPT. CODY'S BRITISH ARMY AEROPLANE.

(Concluded from page 198.)

two-bladed propellers in opposite directions by means of sprockets and chain. These propellers, as noted in our former article, have blades which taper toward the tips, the widest part of the blade being at the hub. Another interesting point about these blades (which are made of aluminium) is that the arms which carry them are fastened to the rear or pressure side of the blades. These arms are inclosed by a false face, in order to avoid sharp angles, but there is a high ridge down the face of the blade, which is so great that the blade has in reality a triple curved face. From the cutting edge to the center the camber increases the pitch; then comes the reversal of the curve, where the false face rounds the arm; and finally a renewal of the sharp camber, where the false face runs off into the trailing edge. The propellers are said to give a thrust of over 20 pounds to the horse-power.

The weight of the Cody biplane complete with the aviator is about 2,000 pounds. Despite the fact that it is such a large machine, it has been designed with a view to ready portability. The main planes each divide into three sections, consisting of a central portion 20 feet in length, and two end portions each of 16 feet in length. The poles which support the rear rudder fold back against the planes, and the front rudder bamboos can be readily dismounted. The chassis also comes apart, and thus the whole machine can be easily and quickly dismounted for transport. Although no test has been made of its speed, this machine because of its powerful motor and efficient propellers, and, especially, because Capt. Cody has attempted to reduce all head resistance to a minimum, is undoubtedly a very fast one. It is probable that it will compete with the Bleriot and Antoinette monoplanes which are to race in England for a $25,000 purse next month.

For the details and drawings of the Cody biplane published in this article, we are indebted to the English weekly Flight.

Aviation Abroad.

The second foreign aviation meeting, which was held last week at Brescia, Italy, was by no means as successful as the first event at Rheims. The field was very rough, which made landing without breakage difficult, and in addition to this the weather was not always propitious. M. Lefebvre, the daring French aviator who piloted a Wright biplane at Rheims, was killed at Juvissy on September 7th when his machine plunged to the ground. This is the second fatal accident which has occurred with a Wright aeroplane. Lieut. Calderara, of the Italian army, who also had a bad fall in his Wright machine a couple of months ago, again came to grief when he took Lefebvre's place at Brescia on September 8th, the first day of the meeting. Just after starting the aeroplane tipped so badly that one runner struck the ground and was demolished. M. Bleriot struck a tree and broke his propeller. Anzani's propeller also broke while he was attempting to make a test flight. Both the latter accidents were attributed to the unevenness of the ground. Curtiss and Bleriot crossed the startling line every day in the 31-mile race for the Grand Prix, according to the regulations, but no extended flights were made up to the time of our going to press. It was much too windy on the 10th instant for any flight to be made. At Berlin Orville Wright continued to make daily flights. On September 7th he flew for 52 minutes, and on the 9th he made two flights for Crown Prince Frederick. He is teaching Capt. Englehardt to operate the machine. At Scarborough Beach, near Toronto, Can., Mr. C. F. Willard last week made two excellent flights out over Lake Ontario with the Curtiss biplane of the Aeronautic Society. Each time he started by running down an incline on the shore of the lake, and made a circle from one to two miles in circumference, landing in the water successfully upon floats fitted to the aeroplane. This is the first time a motor-driven aeroplane has been fitted with floats and made to alight without damage upon water.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

SHIRT-COLLAR.—J. Dorf, New York, N. Y. The collar is of the turn-down type, arranged to permit the wearer to conveniently slide the necktie in the collar to the desired position, the necktie not coming in contact with the rear collar button but passing over a flap overlying the collar button and forming an integral part of the turn-down portion; permitting the wearer to draw the collar tight in front by the necktie, causing the collar to appear with a lock front and keeping the top edges close together.

Electrical Devices.

BATTERY-COVERING.—G. E. Andrews, Providence, R. I. The more particular purpose of the inventor is to provide a two-part covering made of rubber, and provided with means for rendering a battery cell so completely watertight that the cell may be effectively employed where moisture is excessive, or even be totally submerged under the surface of water.

SWITCH-HOOK-CONTROLLING DEVICE.—M. M. Kahn, Louisville, Ky. In operation, the weighted arm normally rests upon the hook of weight. When, however, the telephone is in use, the arm is thrown backwardly into position, and may be secured in this position by means of the set screw. After the telephone has been used, the arm is again turned forwardly into engagement with the hook.

Of Interest to Farmers.

PLANT-PROTECTOR.—E. R. Drake, De Land, Fla. In growing some vegetables, and particularly tomatoes, and especially in southern latitudes, great care is necessary in controlling access of the sun's rays to the plants so as to graduate their effect to a certain non-injurious degree. The north side requires no such protection as the others, but being open, it allows free access for setting the plants and for weeding, and otherwise tending them while growing.

BEET-HARVESTER.—M. J. Ely, Oxnard, Cal. An object here is to provide a device in which the plow can be raised or lowered and locked in either position so that when the digger is being used and the plow is locked in its lowered position, it cannot be lifted therefrom without lifting the entire weight of the whole frame of the machine together with the wheels and the weight of the driver.

THRESHING-MACHINE. — T. S. Haynes, Bay City, Texas. The invention has in view a rigid frame arranged at one side of the harvester and adjustable to different elevations above the ground, the frame carrying the harvesting mechanism and braced intermediate its length by the frame of a downwardly and outwardly-inclined elevator.

Of General Interest.

CARD-INDEX CASE.—E. A. Yungel, New York, N. Y. In this index case it will be impossible to place a card out of its correct position, and the invention may be broadly defined as consisting of a card-holding receptacle, with the bottom thereof having card-engaging members located in relatively different positions for each card or set of cards the case is to contain and without interruption between adjacent members.

EYE-SHADE.—G. E. Henry, Philadelphia, Pa. This improvement has reference to eye shades of the kind mounted upon spectacles, the more particular purpose being to support the shade upon the end portions of the spectacles, and also to produce certain changes in construction of the shade and its support, thereby increasing the general efficiency of the device.

Hardware.

SELF-HEATING SOLDERING-IRON. — A. Husson, Oshkosh, Wis. The object of the invention is to produce an iron which will operate effectively to produce a thorough vaporization of the liquid as it is admitted to the burner. The invention relates especially to the types of irons which are heated by liquid fuel.

WIRE-STRETCHER.—F. Stanlake, Owosso, Mich. This invention pertains to improvements in stretchers, and more particularly to that type in which there are employed a ratchet member and a pivoted lever member having dogs in engagement with the ratchet member and having its pivot movable longitudinally of the ratchet.

Heating and Lighting.

HOT-WATER HEATER.—E. B. Sadtler, Richmond, Va. In the present patent the invention is an improvement in hot water heaters and it has for its object the provision of a simple and effective structure which will be durable in operation, and which will not easily get out of order or leak and will produce a maximum heating effect in operation.

BOILER.—C. E. Chapman, Fort Edward, N. Y. A purpose here is to provide a stationary flash boiler in which the steam dome and water column are removed from and are practically independent of the boiler proper, and wherein the amount of water conducted to the boiler from the water column by excess air pressure in the water column over and above the boiler pressure is under complete control.

GAS-LIGHTER.—W. D. C. Wright, Philadelphia, Pa. A spark coil and battery cells are disposed in a casing, to which is attached a hollow standard, at the top of which there is a stationary electrode and also a spring electrode, the latter being attached to an electrical conductive rod held in bearings in the hollow stem. The casing is of conductive metal and the rod is in electrical communication with the casing. Means provide for completing the circuits.

Household Utilities.

LIQUID - STRAINER. — M. Arruebarrena, Cienfuegos, Cuba. The principal object the patent has in view, is to provide a continuously acting filter for sugar syrup, which may be operated with the minimum of power and readily cleaned. Throughout the whole of the construction, the material used is perforated, and therefore filtration is not arrested at any point.

Machines and Mechanical Devices.

CLUTCH.—J. Schneider, Ann Arbor, Mich. In the present patent the invention relates to clutches, and it has for one of its objects the provision of one which will permit of the ready engagement of the drive and driven shafts, with automatic means which will more securely connect the two shafts should there be any slip from the wearing of the parts after the clutch has been thrown into operative position.

CARD-EXHIBITING DEVICE. — A. J. Thomas, Roubaix, S. D. Means are here provided for conspicuously displaying illustrated postal cards, or cards whereon fancy buttons or like merchandise are placed. The invention affords an apparatus of great capacity and extremely well adapted for the exhibition of cards in large number and of different design, that are brought into view by manual operation of the machine.

POT-FEEDER FOR TYPE-CASTING MACHINES.—L. A. Sengele, Victoria, Texas. In this instance the invention relates to type-setting and type-casting machines, and more particularly to such machines as are employed to cast slugs provided with impression characters, each slug representing the line, or its equivalent, to be printed.

CENTRIFUGAL BOLTING-MACHINE. — G. Cusson, Chateauroux, Indre, France. The invention has reference to an apparatus suitable for use in a flour mill as a flour extractor for the different grindings of wheat, as an extractor of semolina, oatmeal, or groats, as a meal-sifter, and capable also of being used in various industries.

Prime Movers and Their Accessories.

BOILER-FLUE CLEANER.—J. Wiechmann, Albany, N. Y. In this case the object of the inventor is to provide a new and improved boiler flue cleaner, arranged to insure a thorough removal of scale and to provide the desired flexibility of the cleaner to readily pass through bent or curved tubes, flues, or pipes.

INDICATOR.—C. W. Snyder, Hudson, N. Y. The improvements are in indicators adapted for use in connection with engines, for making indicator cards to show the variations in the pressure in the cylinder during the movement of the piston. It is especially adapted for use with internal combustion engines.

Railways and Their Accessories.

GRAIN-CAR DOOR.—P. J. A. Schnoor, Holstein, Iowa. This door is intended to meet the several requirements in loading or unloading grain and can be conveniently manipulated to form openings of more or less extent according to the use to which the car is to be put. It may readily be attached to the door of an ordinary car.

DUMPING CAR.—T. Lawson, New York, N. Y. This invention pertains to dumping cars admitting of general use, and particularly railway cars of the general type described in a former patent granted to G. I. King and T. Lawson. The object of the present invention is to improve the general construction of the car, and especially of the means for tilting the box and opening the doors thereof.

MAIL-BAG CATCHER.—D. W. Council, Rutherfordton, N. C. The object of this patent is to provide a device which may be applied to the car without any changes in the same, which will take the bags from the crane or support already in use, and hold it until it is removed from the holder, and which will deliver the outgoing bag, at the time it receives the incoming one.

Pertaining to Vehicles.

VEHICLE-SPRING.—J. N. Brewster, New York, N. Y. The invention refers to carriages, road wagons, trucks and like vehicles, and its object is to provide a spring, arranged to yieldingly support the vehicle body and to readily compensate for the variation of the load, without danger of breaking the springs and without requiring the heavy multiple leaf springs now generally employed.

HARNESS.—D. F. Balentine, Greenville, S. C. An object in this case is to provide simple harness for detachably securing a draft animal to a vehicle, by means of which the horse or other draft animal can be firmly secured to the vehicle, and which permits the horse to be instantly released in case of necessity without the driver leaving his position in the vehicle.

CARBURETER FOR INTERNAL-COMBUSTION ENGINES.—P. J. Grouvelle and E. H. Arquembourg, 71 Rue du Moulin Vert, Paris, France. The object of the inventors is to obtain an additional supply of air in a carbureter which is automatically operated by the vacuum which is created in the carbureter by the suction of the motor and to permit of varying the proportions of air and of carbureting fluid according to requirements by using the vacuum itself.

Designs.

DESIGN FOR A BADGE.—J. W. Green, Los Angeles, Cal. The badge has the shield form with a beaded border. Inside of this the flat surface is ornamented with a clock face at the top placed between the outspread antlers of a deer on whose collar are the capital letters B. P. O. E. A small flower is on each side of the animal's head at the lower corners.

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.

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending August 31, 1909,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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