SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. **Editors and Proprietors**

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico........$3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS

Scientific American (Established 1845) ....$3.00 a year
Scientific American Supplement (Established 1876)................ 5.00 "
American Homes and Gardens........................... 3.00 "
Scientific American Export Edition (Established 1878)........... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, NOVEMBER 3, 1906.

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

THE LATEST MARINE TURBINE SUCCESS.

The satisfactory completion of the trials of the turbine machinery of the "Dreadnought" has a wider significance than that of establishing the high speed of this battleship; for it marks a decided step forward in the development of the marine turbine. In the first place, the horse-power developed is considerably greater than that hitherto secured in a steamship, the largest turbine installation previous to the appearance of the "Dreadnought" being that on the Cunard liner "Carmania." Moreover, the fact that the turbines ran ahead of the contract requirements of 23,000 horse-power by an additional development of 5,000 horse-power, with a proportional increase in the speed, indicates that the serious difficulties which arose in the Allan Line steamers, and were not altogether eliminated in the "Carmania," have been now fairly well mastered. These trials, moreover, must come with a very welcome assurance to those who are responsible for the turbine engines of the "Lusitania" and "Mauretania"; for the equipment of the "Dreadnought," in which four turbines are employed on four shafts, is broadly identical with that of the new Cunard fliers, whose horse-power, however, will be three times greater. The "Dreadnought" turbines were designed to give a speed of 21 knots with 23,000 horse-power; but they actually developed 28,000 horse-power and drove the ship at a mean speed of 21½ knots, with occasional bursts of speed of 22¼ knots. The turbines of the "Lusitania" and "Mauretania" are designed to drive the vessels at 25¼ knots with 68,000 horse-power. If they exceed requirements in the same proportion as the turbines of the "Dreadnought," they should drive the new ships at a speed of from 25¾ to 26½ knots, and develop between 80,000 and 90,000 horse-power.

"CALIBER" AND "BORE."

It will be remembered that in a recent issue we explained the various uses of the term "caliber" as applied to ordnance. A correspondent now asks if we will make a similar explanation of the word "bore" as applied to shotguns; and more particularly when it is used in conjunction with a numeral, as in speaking of a 10-bore, 12-bore, or 16-bore shotgun. At the first reading, anyone who is familiar with modern rifles and heavy ordnance might think that the word "bore" here was used as a unit of length, as when we say that a 50-caliber, 6-inch, rifle is a rifle 25 feet, or fifty times the caliber (diameter of the bore), in length. But as a matter of fact, the term "bore," when applied to shotguns, is never used to indicate length, but always refers to the diameter of the bore. There is, by the way, quite an interesting scrap of history attached to the use of the term, which carries us back to an early period in the use of firearms.

In the days of our forefathers, when rifle balls were spherical, and long, cylindrical, conical-headed bullets and rifled barrels were undreamed of, the gunsmith adopted a curious but convenient method of designating the gage or diameter of the bore. He expressed it by stating how many bullets, of a size that would fit a particular musket, would go to make a pound. Thus, a 10-bore musket would be one of such a bore than ten of its bullets would go to make a pound weight; a 16-bore gun would be one whose bullets would run sixteen to the pound, and so on. Hence we get the anomaly, that the larger denomination musket has the smaller bore. Although the day of the spherical bullet has long passed away, and the only smooth-bore remaining is the shotgun, the old method of designation has been retained.

THE CARNEGIE INSTITUTION MAGNETIC SURVEY.

About twelve months have elapsed since we announced that the yacht "Galilee" of the Carnegie Institution had sailed for Hawaii, to commence her task of making a magnetic survey of the northern part of the Pacific Ocean. At the close of last year she completed her first cruise, which included the Hawaiian Islands and some of the islands which lie beyond the archipelago. On March 2 she started on a longer cruise, of some 20,000 miles of sailing, and secured the necessary magnetic observations on a voyage which included Fanning Island, the Samoan Islands, the Fiji and Marshall groups, Guam, Yokohama, and San Diego, at which port the cruise was concluded. The data thus secured is sufficient to enable the Institution to revise the existing magnetic charts of the North Pacific Ocean. It constitutes an invaluable contribution to that worldwide system of surveys by which it is hoped some day to determine the complicated laws which govern terrestrial magnetism, and thus relieve the art of navigation of one of its present sources of perplexity.

The scope of the work outlined by the Institution includes the collection of data sufficient for the revision of the magnetic charts of all the other oceans; and the yacht will shortly be dispatched on a voyage around the world, in which she will call at Valparaiso, Rio Janeiro, and Washington; cross the Atlantic to the Cape of Good Hope; and return to the Pacific by way of the Indian Ocean and the Philippines. With the elaborate observations thus secured, the Institution will be able to prepare new charts of magnetic declination embracing the complete circuit of the globe. The Institution aims at securing the necessary magnetic data in those localities where there is at present no organization engaged in surveys of this character; and as an instance of the work done by Dr. Bauer, director of the Department of Terrestrial Magnetism of the Institution, it may be mentioned that during last summer his assistants secured the needed observations at seventy stations in Canada in latitudes where hitherto few magnetic observations have been made. As the result of this work the magnetic maps of this country extend up into Canada and reach entirely across the continent.

ROADS FOR AUTOMOBILES.

The day of the much-to-be-desired special automobile roadway would seem to have come at last, for it is authoritatively announced that a company has been formed to build a special automobile course on Long Island, to be used in the annual international contest for the Vanderbilt cup, and also as a special driveway for automobilists throughout the year. The fact that the donor of the Vanderbilt cup is president of the company, and that it is promoted by some of the leading automobilists and automobile interests in the country, is a guarantee that this road will be built, possibly in time for next year's contest. Over and above the convenience and safety both of the drivers and the public which will result from the construction of such a course, this enterprise will prove to be of inestimable advantage in promoting the automobile interests of this country. When the racecourse is completed, it will be unique; for there is nothing of the kind in existence, or projected, even in Europe. Consequently, the annual Vanderbilt race will assume even greater importance than it now possesses, and the entries both for the elimination races for home manufacturers, and also of foreign contestants, will undoubtedly be larger and more representative than ever. To everyone who followed closely the races of this year, it was evident that the poor showing of the American cars was due largely to insufficient trying-out in preparation for the race; and no doubt the limited amount of trial practice was occasioned by the lack of suitable roads on which high speed could be safely maintained.

Of greater importance, however, than the construction of special racecourses is the provision of public roads suitable to the trying demands of general motor traffic. For it must be admitted that the surface of the present roads has shown itself to be quite unable to stand up under the severe usage imposed by automobiles and motor cars. In fact, the provision of suitable motor roads may be considered one of the most pressing problems of the present day. As far as the general public and, indeed, the automobilists themselves are concerned, the most serious difficulty is that of the abominable dust from which there seems at present to be absolutely no escape. As matters now stand, the only way in which to avoid dust-raising is to reduce speed to a point considerably below the present speed limit; and this is out of the question. The automobile has come to stay. It is an industry too vast, a sport too noble to be subjected to any restrictions which would ultimately kill its popularity.

Therefore, if the automobile may not be brought down to the road, the road must be brought up to the automobile, and some way found by which the dust horror may be mitigated, if not entirely removed.

So serious was the problem considered to be in England, that a royal commission on motor cars was appointed, which has recently presented a characteristically thorough and comprehensive report. It states that on the great main roads within a radius of 30 or 40 miles out of London, dust raised by motor cars "causes material damage, discomfort, and annoyance to users of, and dwellers by, the highways." Many instances of the depreciation of property are given. A real-estate agent testified that herbage, within fifty yards of the highway hedges, was absolutely useless, either for feeding cattle or harvesting. In one case, near Windsor, a house that was bought for $25,000 could not be used because of the dust, and was sold for $10,000. The person who bought it, thinking to make money by the bargain, could not sell the house at any price. A farmer stated that hay and grain crops were rendered injurious to live stock, and that cattle would seldom graze on pasture near the road.

Since the reduction of the speed of automobiles to that of horse-drawn vehicles (at which speed the dust nuisance would vanish) is out of the question, Lord Selby's commission set itself to find some means of holding the top dressing down upon the roads and preventing dust. In his report, an ample digest of which will be found in the current issue of the SUPPLEMENT, the attempts which have been made and are now in progress to find a suitable form of dust-preventer for motor traffic are outlined, and the merits of the various systems of roadbuilding are discussed.

The report favors the best type of macadam roads for both heavy and light motor cars. Though such roads are not dustless, they are more nearly so than the roads composed of various local stone, which is liable to be of a friable character. For roads carrying unusually heavy traffic, a special and more costly type of construction should be used, and a system of "armoring" the road with stone blocks, which is known as the Kleinpflaster and is used with success in northern Germany, is recommended. It consists of a foundation of large inverted pyramidal stones, between and above which is laid 4 or 5 inches of small broken stone. Above this is one inch of sand, and above the sand are placed carefully selected broken stones, about 3½ or 4 inches square. These are placed with a one-half inch spacing, and compacted with a lime-sand binding of heavy consistency. This road is of great strength; is practically dustless; and its life is from twenty-five to thirty years. It costs about $18,000 per mile for an 18-foot road. Outside of this, and the paved roads laid on sand foundations as used in France, the remedy for dustlessness at present seems to consist in the use of some form of liquid tar or oil; but the serious objection to oiling is that when the dust begins to fly, as it ultimately will, it is exceedingly injurious to the clothing; while the oiled surface adheres to the feet and is carried into the home, where it is destructive to rugs, carpets, etc.

According to the report, none of the various devices employed as dust-preventers has proved to be a permanent and unqualified success, although a mixture of blast furnace slag and tar, or "tarmac," is spoken of hopefully. The hope is expressed that the government, realizing that the dust problem is of national importance, will appropriate a sum of money for experimental work.

SUCCESSFUL FLIGHT OF SANTOS DUMONT'S AEROPLANE.

On October 23, after one unsuccessful trial in the morning, Santos Dumont finally, in the afternoon, drove his aeroplane through the air a distance of 150 feet at an elevation of about 20 feet from the ground. The experiment took place near Paris, and was witnessed by a crowd of people, including representatives of the Aero Club of France. When Santos Dumont shut off the power, his machine came down so heavily on its four wheels that it demolished them. Twice the distance necessary to win the Archdeacon prize was covered. This prize, a cup, was offered for the first aeroplane which flew a distance of 25 meters (82 feet). The $10,000 prize for the first flight of a kilometer in a circle has yet to be won. Complete descriptions of Santos Dumont's aeroplane and its performance were published in our issues of August 18 and October 6 last. Fitted with a 50-horse-power, eight-cylinder motor, which drives the air propeller direct at a speed of 1,500 R.P.M., a thrust of over 300 pounds was developed. This was sufficient to drive the machine and its operator—a combined weight of over 500 pounds—forward through the air at a speed of about 25 miles per hour. According to the cabled account, the stability of the machine appeared to be good, though what it will do when flown a longer distance and in a circle yet remains to be seen. At any rate, this is the first flight of a motor-driven, man-carrying aeroplane that has been witnessed by a considerable number of people. We hope, in the near future, to be able to publish a photograph showing the aeroplane in the air. In comparing the results of Santos Dumont's experiment with those which the Wright brothers claim to have attained, there is one striking fact, viz., the young Brazilian, although having an apparatus of the same general type as that used by the American experimenters, but of about one-half its weight, found that a 50-horse-power motor was necessary to drive his flier up into the air and forward through it at a speed of 25 miles per hour; while the Wrights, with a machine of twice the weight and half the power, claim to have made nearly double the speed (38 miles per hour).

In the experiment just described, Santos Dumont's machine lifted only about 10 pounds to the horse-power, while the Wright brothers' aeroplane, it is claimed, lifted 60, and Maxim found that it is possible to lift 133, although, in reality, with his huge machine weighing 8,000 pounds, provided with two 18-foot propellers and steam engines developing 461 horse-power, he only succeeded in lifting 20 pounds per horse-power at speeds of about 40 miles an hour. When the fact is noted that the new aeroplane has a total surface of 645 square feet (the superposed planes being 39.37 feet long by 8.2 feet wide) as against about 480 square feet of sustaining surface carried by the Wright machine (the planes in this machine are said to have been 40 feet long by 6 feet wide), if we concede the correctness of the Wrights' results, we must immediately conclude that the Dumont machine is exceedingly inefficient. The only essential features wherein it differs from the Wright flier are the use of a small, high-speed propeller (necessitated by the mounting of it on the engine shaft) and the setting of the planes at a dihedral angle. Therefore, it would appear that both these arrangements are quite inefficient.

THE INTERNATIONAL WIRELESS CONFERENCE.

BY A. FREDERICK COLLINS.

Delegates representing the governments of nearly thirty countries, convening for the purpose of drawing up regulations for the control of wireless telegraphy in times of peace and war, have been in secret session in Berlin.

This is the second international wireless telegraph congress that has convened at the suggestion of Germany. The first, it will be remembered, was held in Berlin in 1903, when it was resolved that "coast stations should be obliged to receive and forward all telegrams from vessels at sea by whatever system they might be dispatched." In order to facilitate communication between vessels and coast stations, technical explanations of the working of the apparatus are to be published.

Telegrams referring to wrecks and attempts to render assistance to vessels at sea are to be forwarded before all others. The rates for telegrams forwarded into the interior from a coast station will be those of the ordinary telegraph service plus a special charge for the use of the wireless apparatus, and will be paid for on receipt. Telegrams sent to a vessel will be paid for on board the vessel at the rates usually charged by the nation under whose flag the vessel sails. Stations are to be arranged so as to interfere with one another as little as possible, and arrangements will be made to insure correspondence in a number of technical details. Provision is made for other states besides those which sent representatives to the preliminary conference so that they may be parties to any arrangements which may finally be made for the regulation of wireless telegraphy. The most important of these resolutions is the one referring to the duty of coaling stations to receive all messages without distinction relatively to the system used. This resolution was incorporated in a protocol which was signed by the representatives of Germany, Austria-Hungary, Russia, France, Spain, and the United States. The representatives of England and Italy did not sign, for the chief reason that the navies of these countries have long-term contracts to use the Marconi apparatus exclusively, which is also true of Lloyds.

To those who so persistently clamor for the "open door" policy in wireless telegraphy, i. e., the interchange of messages between ship and shore stations equipped with whatever system, it is pointed out that Marconi secured letters patent on the fundamental principles underlying wireless telegraphy as it is practised to-day, in 1896, and further that at the very outset of the successful application of electric waves to the transmission of intelligence without wires by him, Dr. Slaby, of Charlottenburg, Germany, went to England and through the influence of the emperor witnessed the experiments.

A little later Dr. Slaby devised a system of wireless telegraphy, collaborating with Count Arco, and this and Prof. Braun's system, also a German production, were finally merged into what is now known as the Telefunken system. In every country from this time on inventors assiduously attacked the problem, presumably from the viewpoint of effecting selectivity, and the result has been an abundance of systems differing from one another and from the original in detail but not in principle.

As a matter of fact there have been only two marked improvements made in the design of wireless telegraph apparatus since it came into existence, and these are the resonance circuits devised by Lodge, and the liquid barretter invented by Fessenden. All others are merely modifications and some of them are infringements. This being true, it follows that if there is any merit in protecting inventions by letters patent, and if such protection is valid, then certainly Marconi is entitled to the fruits of his genius and his industry, which should give him a monopoly for a period, at least in this country, of seventeen years, ten of which have already expired.

It is urged that the ether is free to anyone who may care to use it. But this is beside the question. That it is free is self-evident. The interchange of messages, which is put forth so strenuously by some of the representatives, is of lesser importance. The vital point that is menacing the safety of the public is the evasion of the laws, and none are more difficult to uphold than those relating to patents.

Fortunately neither the breaking of laws nor the making of regulations can compel an inventor or his assigns to handle a competitor's products, and it is not clear how any rule can be framed that can justly compel the Marconi company to receive and re-transmit messages sent by other companies unless they choose to do so, unless indeed the wireless companies now in the field are to be considered as common carriers by their respective countries.

Last spring the daily papers reported an incident which they stated "as emphasizing the danger of giving one company a monopoly of the wireless telegraphy business, and of permitting those operating any one system to refuse to interchange intelligence with shore stations or ships equipped with another system." A recent cablegram says that the British delegates individually favor the "open door" policy if the regulations are not too rigid. Until the priority of wireless telegraph inventions can be sifted through the courts it would be well to have the opposing interests abide by a regulation that should provide merely for a compulsory interchange of messages where there is danger involving the lives of passengers on the high seas, but it need go no further.

The matter of tuning naval and mercantile marine vessels to different frequencies and the location of shore stations to avoid interference, in so far as possible, are necessary, but these are secondary questions over which no time will be lost in the present conference. No effort will be spared to induce the British and Italian representatives to agree on an unlimited interchange of messages between ship and shore stations no matter what the system installed may be, for this is the primary object of the promoters of the congress.

AERONAUTICAL NOTES.

On the 22d ultimo there was inaugurated at Pittsfield, Mass., the first balloon chase held in America. Two balloons, the "Orient" and the "Centaur," carrying two and three men respectively, ascended at 10:20 A. M. and sailed northward at a slow speed. The "Centaur" landed 30 miles away in the outskirts of Bennington, Vt., at 1:11 P. M., while the "Orient" kept in the air till 4:30 P. M. and finally landed at Jamaica, Vt., some 57 miles from the starting point. The winning balloon was piloted by Leo Stevens and carried Capt. Homer W. Hedge, president of the Aero Club of America, as passenger. Charles T. Walsh, the pilot of the "Centaur," was accompanied by Major Samuel Reber and Capt. Charles F. Chandler of the Signal Corps of the U. S. A. The "Orient" beat the "Centaur" not only in distance traversed, but also in altitude reached as well, for this aerostat ascended to a height of 8,000 feet, as against the 6,888 reached by its opponent. Contrary to what is usual in the upper air, the aeronauts found the strata unusually hot, the thermometer on the "Centaur" at one time registering 74 deg. and that on the "Orient" 106 deg. A northeast wind was blowing near the surface of the earth, and the weather was damp and chilly. After the balloons had ascended some distance a gentle air current from the southwest was encountered. This caused the balloons to change their direction and travel northward. The three automobiles which pursued them had an exciting chase. C. F. Bishop in his 45-horse-power Panhard, suffered a breakage of a driving chain and was passed by Floyd Knight in a 35-horse-power Berkshire car. The latter reached the spot where the "Centaur" landed nearly two hours after that aerostat came down. The second car to arrive at the landing place of the "Centaur" was a 16-horse-power Pope-Hartford machine, which reached the spot but 12 minutes behind the Berkshire, having consumed 4 hours and 53 minutes in chasing the balloon, the flight of which lasted but 2 hours and 50 minutes. Mr. Bishop's Panhard was 5 hours and 20 minutes in completing the pursuit. Great difficulty was found in following the balloons, as they were continually disappearing among the hills or in the clouds. The men in the "Orient" witnessed the descent of the "Centaur" at Woodford, some three miles east of Bennington, and dropped a note as they passed over the latter place, telling where the larger balloon had landed. It was this information that made it possible for the pursuers to locate the aerostat, after they had all but given up the search upon arriving at Bennington at 2:30. The army officers who went up in the "Centaur" obtained considerable valuable data which they expect to turn in to the chiefs of their departments, with the hope that the War Department may experiment with balloons and airships for its own use, as is done by the war departments of most of the foreign powers.

Besides the successful experiment of Santos Dumont with his aeroplane on the 22d ultimo, we have to record some further experiments made by M. Vuia at Issy-les-Moulineaux, France, on the 7th of October. M. Vuia's machine, which was illustrated and described in our issue of March 24, consists of two large wings having a spread of 215¼ square feet. These wings, which can be folded up, are held rigid when in use by steel ribbons. They are slightly concave, and have a purely geometrical shape. They are mounted upon a framework, which is carried on pneumatic-tired wire wheels, forming a quadricycle. The apparatus is propelled by a special carbonic-acid gas motor, which is nothing more nor less than an ordinary Serpollet engine, and is run on the heated vapor from the liquid carbonic acid. The heating of the gas keeps it from congealing, due to its own expansion, and also increases its pressure by superheating it. By combining the heating of the gas with the admission of the same to the cylinders, the experimenter has a double means of varying the pressure on the pistons, and hence the power of the motor. The cylinder contains 22 pounds of liquid carbonic acid, which is sufficient to run the motor at its full capacity (25 horse-power) for five minutes. The propeller, which has a diameter of 7.21 feet and a pitch of 7.71 feet, is mounted directly on the end of the shaft, and gives a thrust of 130 kilogrammes (286 pounds) when the engine is making 900 R. P. M., and the apparatus is held stationary. To develop this speed the engine requires a pressure of 143 pounds to the square inch. The total weight of the apparatus and operator is about 550 pounds. On the date mentioned, M. Vuia, in the presence of the officials of the Aero Club of France and a considerable crowd of onlookers, succeeded in getting his machine to rise in the air by bounds of about two-fifths of a second duration.

Experiments have also been carried on recently in France by M. Cornu with a helicopter, which consists essentially of two propellers on a vertical axis. These raise the apparatus and advance it by blowing the air which they displace against suitably disposed aeroplanes. The model tested was fitted with a 2-horse-power Buchet motor, which revolved propellers of 2.25 meters (7.38 feet) diameter. The weight of the entire apparatus was 13.75 kilogrammes (30¼ pounds). In the first trial the apparatus rose vertically with great facility; while in the second trial, after the planes had been inclined to produce forward motion by the effect of the reaction of the air upon them, the apparatus, which was attached to a central axis, was made to describe, in the free air around this axis, a circular orbit 75 feet in diameter.

THE CURRENT SUPPLEMENT.

The current Supplement, No. 1609, opens with an article by our English correspondent on a huge dredging plant for service in India. The dredger in question has a bow of triple form constituting two wells, in which rotary cutters are mounted for excavating hard material. Underneath and to the rear of these cutters are suction pipes. Excellent illustrations accompany the article. An admirable discussion of dustless roads for motor traffic is published. Mr. Walter J. May writes on the making of foundry patterns. The third and last installment of the digest of the regulations and instructions concerning the denaturation of alcohol appears. Dr. Otto Roehm discusses the modern manufacture of illuminating gas. In view of the recent important announcement that tungsten incandescent lamps are to be manufactured in this country on an extensive scale, the exhaustive article on the tungsten lamp which appears in the current Supplement will be read with interest. Messrs. Herbert J. Webber and Walter Swingle contribute an article on new citrus creations of the Department of Agriculture. The new fruit which they have succeeded in evolving is called the "citrange," and possesses some of the properties of the orange and some of the lemon.

MANUFACTURE OF IRON IN CHINA.

Iron in China is made by mixing four parts of the ore, one part of decomposed coal dust, and one part of small coal. The mixture is placed in crucibles each about 18 inches deep and 6½ inches in diameter. The crucibles are heated in a furnace having walls about 3 feet high and a floor 4 feet by 6½ feet, which is covered with clay and spread with a layer of coarse coal to a height of 7 inches or 8 inches above the clay. The furnace holds about sixty of these crucibles. The space between them is filled with small coal, and on top is placed a 3-inch layer of small coal, followed by a layer of cinders and ashes of the same depth. About sixteen hours of strong heat suffices to convert the mixture into a mass of carbon iron, says the Iron Age. This is made into wrought iron by reheating over a wood fire and by hammering it when red hot.