Science Notes.

Magellan's contrary winds are to be overcome by a fleet of powerful tugboats which a Chilean company will maintain in the Straits.

The total area of land surface of the earth is calculated to be 28·3 per cent, and that of sea as 71·7 of the earth's surface, certain assumptions being made for the unknown polar regions. The ratio of land to water surface is thus 1 : 2·54, by Professor Hermann Wagner, says The Engineer. Other interesting levels are those of the mean height of the land, 700 meters—2,300 feet—above actual sea level; and of the condensation spheroid, i. e., the physical globe if the water were condensed to the density of the rocks of the crust, 1,300 meters—or 4,260 feet—below present sea level.

An interesting series of experiments on the transparency of liquids is described by M. W. Spring in the Bulletin of the Royal Academy of Belgium. The first of M. Spring's papers deals with the colors of the alcohols as compared with water. None of the alcohols observed were colorless when the thickness of fluid was 26 meters; methyl alcohol appeared greenish blue, ethyl alcohol the same, but of a less warm color, and amyl alcohol greenish yellow. The pure blue color observed in water becomes thus modified by the admixture of more and more yellow as we pass from one term of the homologous series of compounds to the next. The absorbing powers of the various liquids for ordinary light were also observed, and it was found that these formed a descending series, the simplest substance, water, offering the greatest resistance to the passage of light seen by the eye. In a second contribution, the same writer discusses the temperature at which the connection currents begin to produce opacity in a column of water of given length. Where the length is 26 meters the smallest difference of temperature that will suffice is about 0·570°, and is comparable with that which doubtless exists in lakes and seas. The author concludes that we have here an explanation of the varied colors so often seen on water. These result from the differences of temperature caused by sunshine, on the one hand, and by the cooling action of wind blowing on the surface, on the other.

Cycle Notes.

A pneumatic tricycle hearse has been built.

One French maker is putting out wheels equipped with wooden spokes, rims, and hubs.

A subscription agent of Business goes over large sections of the country, wheeling from place to place.

A short time ago a race was run in Paris in which no machine was entered which was not at least twenty years old.

In Grand Rapids, Mich., a trailer for the free transportation of passengers' wheels is run once an hour, attached to a trolley car.

A coin controlled bicycle has been devised. Unless the machine is fed with coins commensurate with the time of hiring, the wheel will refuse to turn.

An analysis of two thousand accident policies, on which benefits were paid, showed that only seventy-six were injured in bicycle accidents.

It has been estimated that the expenditure of power necessary to walk five miles would drive a bicycle on an ordinary road twenty-five miles.

Fifty bicycles were impounded in one day in Paris recently because they failed to have the owner's name and residence soldered to them as the law requires.

An agency was recently opened in Venice for the rental of a water cycle. The gondoliers promptly obtained an injunction restraining the parties from placing their cycles in use.

At some of the stations on the Long Island Railroad facilities have been provided for checking the wheels of the suburban residents, so that they can use the bicycle to carry them to and from their homes.

A good wrinkle in putting a handle on a handle bar is to smear a little vaseline around the edge of the inside ferrule, which will effectually prevent the cement from adhering to the ferrule, should any be squeezed out.

Zigzag hill climbing is easier than the straight lift. The cyclist can here learn of the mule. No mule native to a mountainous region takes a straight course up hill with a load, but "weaves" continually from one side of the way to the other.

Although very often but little attention is given to the accurate adjustment of the head, this part stands in need of it as much as any bearing in the machine, and should never be allowed to remain in the slightest degree loose. Not only will a loose head rattle over rough ground, and cause the balls and ball races to wear unevenly, but the risk of a breakage of the steering post or front forks is increased.

The Inventive Age says that the latest invention to facilitate field operations is the typewriter bicycle. This consists of a typewriter mounted on a serviceable wheel, which can follow the movements of the army through an ordinary stretch of country. The operator can take commands and general orders in shorthand and strike off several duplicates on the typewriter, being held erect by portable props. It has been tried in England and worked very satisfactorily.

THE BROOKS PERIODICAL COMET.

WILLIAM R. BROOKS, M.A., F.R.A.S.

The return to visibility, after its seven years' journey around the sun, of the very interesting comet known as the Brooks periodical comet of 1889, is a notable event in astronomical annals.

While sweeping the southeastern heavens on the early morning of July 6, 1889, with the ten inch equatorial telescope, the comet was discovered. It was in Cetus, and in right ascension 23 hours, 44 minutes, 30 seconds; declination south 9° 10′.

Fig. 1 shows the telescopic field in which the comet was discovered. The apparent motion of the comet was from right to left, as we look at the figure, but

Fig. 1.—DISCOVERY TELESCOPIC FIELD BROOKS' PERIODICAL COMET.*

this motion was so slow that it did not move out of the telescopic field of discovery for over a week. The real motion of the comet was nearly in the line of sight, and approaching us and the sun. Hence the comet grew larger and brighter daily. As it came nearer, the main comet was found to be attended by several companions.

In telescopes of moderate aperture two were seen, but in the giant refractor of Mount Hamilton, under the keen vision of Barnard, and in other large telescopes, four of these little attendants were found preceding the parent comet in its sweep through space, as illustrated in Fig. 2. It is on this account sometimes called Brooks' multiple comet.

The mathematicians soon found that the comet was moving in an elliptical orbit, with a period of revolution about the sun of a little over seven years. It is thus a member of our own solar system.

Computing backward, however, they found that it

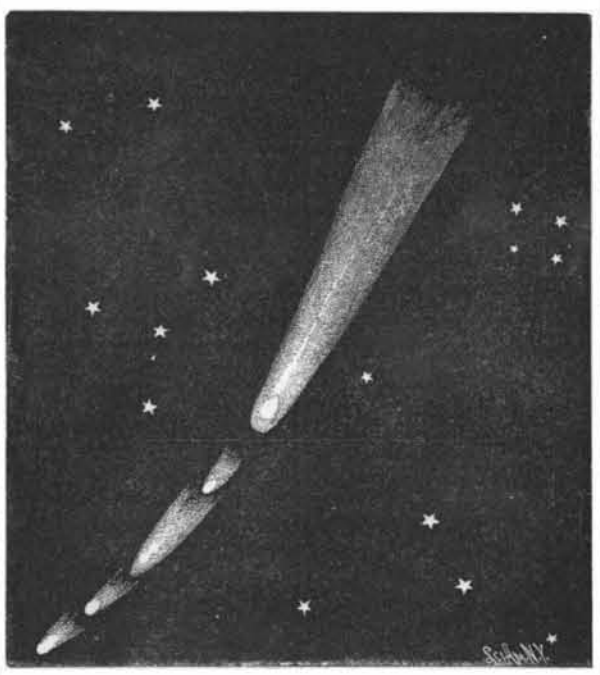

Fig. 2.—BROOKS' PERIODICAL MULTIPLE COMET.†

had not always had this short periodic revolution. It was found by Dr. Chandler that in 1886, or three years previous to the writer's discovery of the comet, it had come into Jupiter's all-powerful attraction, and its orbit and period changed from a previous one of nearly thirty years' duration to its present seven year period.

Nor was this all. It is believed that during this encounter of Jupiter and the comet, the material for the fifth satellite of Jupiter, discovered by Barnard in 1893, was secured—captured from the comet by Jupiter's superior attraction.

* Discovered by Prof. Brooks July 6, 1889.

† Discovered by Wm. R. Brooks July 6, 1896.

I append a short ephemeris of the comet, showing its place in the heavens for the next few weeks.

August.	Right Ascension.	Declination South.
12	22 h. 33 m.	18° 51′
16	22 h. 31 m.	18° 58′
20	22 h. 29 m.	19° 3′
24	22 h. 26 m.	19° 6′
28	22 h. 23 m.	19° 6′
September.		
1	22 h. 20 m.	19° 4′

From these positions the path of the comet may be traced beyond the above dates. The comet is increasing in brightness, reaching perihelion early in November next.

Smith Observatory, Geneva, N. Y., August 7, 1896.

The American Institute Fair.

The American Institute Fair will open at the Madison Square Garden on Monday, September 28, and will close on Thursday, October 29, and during this time there will be shown at the usual popular price of twenty-five cents one of the best exhibitions that the institute has given for a long time. The enterprise of securing the Madison Square Garden has been seconded by the exhibitors, who appreciate that the institute has had no exhibition since 1892. On the main floor, which will be entirely filled by the best class of exhibits, there will be much active machinery, including silk weaving, the making of asbestos cloth, the manufacture of shoes, the making of hand-made paper, an exhibit showing how cigars and cigarettes are made, and motors adapted to boats and other uses, and a horseless carriage as light almost as an ordinary road wagon. There will also be a beautiful display of boats. The bicycle will of course be represented. In the machinery department down stairs there will be ice machines in operation, high-speed and gas engines, printing presses, farming machinery, and novelties always to be seen in the mechanical department. The show of flowers, fruits, and vegetables, beginning October 5 and continuing in the concert hall under the direction of the committee on agriculture, promises to be an especially attractive feature.

The race agent of the American Rules will take charge of the flying of birds from the tower of the garden each day, and will decide upon the awards for number of birds, speed, distance, and will also arrange for the exhibit of homing pigeons during the week ending October 24.

A Machinery Exhibit in China.

The Peking (China) University, an educational institution conducted under the auspices of the American Methodist Episcopal Mission, has recently opened in one of its buildings a museum which it is proposed to devote largely to the exhibition of foreign machinery and mechanical appliances. This museum is visited daily by increasing numbers of people of the better classes, and the authorities would be glad to receive and exhibit working models, photographs, or drawings of machinery and inventions, or specimens thereof, such as plows, ships, firearms, cannon, electric machinery, cars, locomotives, wind mills, looms, printing presses, wagons, engines, etc. Each exhibit which may be presented to them will be marked in Chinese, with the name and address of the maker, together with the description and price, if desired, and a capable translator will explain their use to inquirers.

Correspondence on this subject and articles for exhibition may be sent to the Peking University, Peking, China, or to Mr. Charles H. Taft, treasurer of the Peking University, No. 78 William Street, New York City, and under an arrangement with the I. M. customs will be imported to China free of duty.

Medals or Decorations for Inventors.

An "old SCIENTIFIC AMERICAN reader," writing from Havana, Cuba, suggests that the government, in granting letters patent to an inventor, should at the same time issue to him a distinctive medal, to be worn externally, indicating his membership in the "American Legion of Inventors," who have done so much to promote our wonderful industrial progress. Such a medal, made of silver in the form of a star, to be suspended from a ribbon formed of the national colors, our correspondent suggests, would not only be a highly honorable distinction, but might in many cases be of material benefit to the inventor, acting in a manner as an introduction, and aiding him in efforts to obtain capital to facilitate the introduction of his improvement. Inventors obtaining three or more patents, it is recommended, should have a gold medal; and, for all inventions patented before such a law is passed, it is suggested that the inventors may have the medals issued to them on payment of their cost.

Water Supply for Paris and London.

It is proposed to take 440,000,000 gallons daily to Paris from the lake of Geneva, a distance of about 310 miles. London may have a new supply of fresh water, of equal importance to the Paris supply, from parts of Wales situated at an altitude of 2,790 feet above the sea level, particularly the region from which spring the Towy, Usk, and Wye.

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Forestry as a Science.

Much has been said and written, first and last, about preserving the forests in this country after the methods which have prevailed for half a century and more in Germany and France, and how not only other valuable timber might be saved, but safety from fire and flood should be had.

It is well understood that for these objects all dead wood, whether underbrush or high reaching trees, must be cleared out of the way, and where they leave too wide spaces their places must be filled with other plantations. There is a scientific method and an unscientific way of doing this, and success depends wholly upon which one of these methods is adopted. For such reasons the science and profession of forestry has flourished in other countries than America, having extensive tracts of woodland, for many years, in the same manner that gardening and botany have flourished.

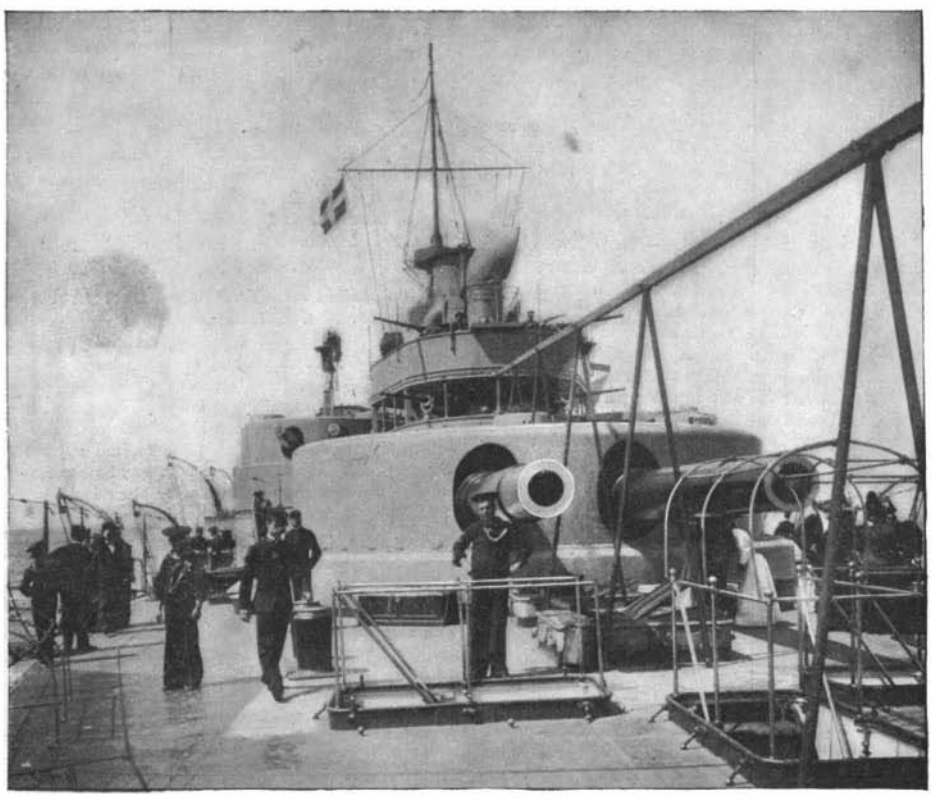
Little or no attention, however, has been paid in America to forestry until recently, says the New York Times, by either private or public persons. The States of New York, Maine, and a few others with extensive forest lands have paid some attention to the subject, but the Federal Government has only just awakened to its importance; and at the last session of Congress a commission of men who have studied the subject was authorized to investigate and report on the condition of the woodlands of the Northwest. The commission, consisting of several professors of arboriculture from the leading universities, like Harvard, Yale, Columbia, and others, with several government officials, is now at its work in Montana. Mr. Vanderbilt was an early exception to the apathy here on the subject of forest preservation, for shortly after the purchase of his estate at Asheville he began to form plans, not only for the preservation of the great domain of woodland which he found in existence, but for the rehabilitation of that portion of it which had been exhausted. The forest was broken and irregular in character, owing to the fact that the land had been divided among many small farmers, who had made frequent clearings, or had robbed the forest of its most vigorous and healthy trees. Scientific measures were required for the work of restoration, and Mr. Vanderbilt resolved to spare neither expense nor care in the scheme. It was a question whether at the end of a term of years he would have a noble forest of park-like character and a certain commercial value, or merely a barren and tangled woodland, gradually going to decay, and liable at any time to destruction by fire. Mr. Vanderbilt accordingly sought for the best talent among those who had made dendrology a study, and was fortunate in obtaining the skillful services of Mr. Gifford Pinchot, a student of forest management in the best schools of Europe, and a man fully alive to the advantages and disadvantages of the different methods in their application in this country. Mr. Pinchot took hold of Biltmore Forest, of about 5,000 acres, which he found was composed mainly of oaks and other deciduous trees, mostly young, with scattered pines, which occasionally covered old and exhausted fields to the exclusion of other species. Nevertheless, there was considerable present and prospective value in the timber and firewood of the forest, and in a report which he made of his findings, a year or so ago, he sketched a scheme in which he proposed three general objects, namely: A profitable production, which will give the forest direct utility; a nearly uniform annual yield, which will give steady employment to a trained force of foresters—woodchoppers and lumbermen; and a gradual improvement in the condition of the forest itself. These objects he proposed to obtain by dividing the estate into the high forest system and the selection system. The rotation—that is, the length of time allowed for a second crop to become ripe on the same ground after the removal of the first crop—has been fixed at 150 years.

In a thoroughly equipped forest, managed under the high forest system, there are as many subdivisions as there are years in the rotation, the trees of each subdivision being of an equal age, and only one year younger than those of the next subdivision. In this way it would be possible to cut every year one one hundred and fiftieth of the whole area, thus securing a uniform annual crop during the whole period. In the selection system forest trees of all ages are mixed together, instead of being separated in groups according to their ages. The annual product is taken from all parts of the forest, the ripe trees being selected for cutting; but such a method necessitates in the case of a large forest area expensive transportation, and to avoid this Mr. Pinchot has adopted what he calls the location selection system, under which the annual yield is taken from a certain part of the forest during several years, then from another part, and so on.

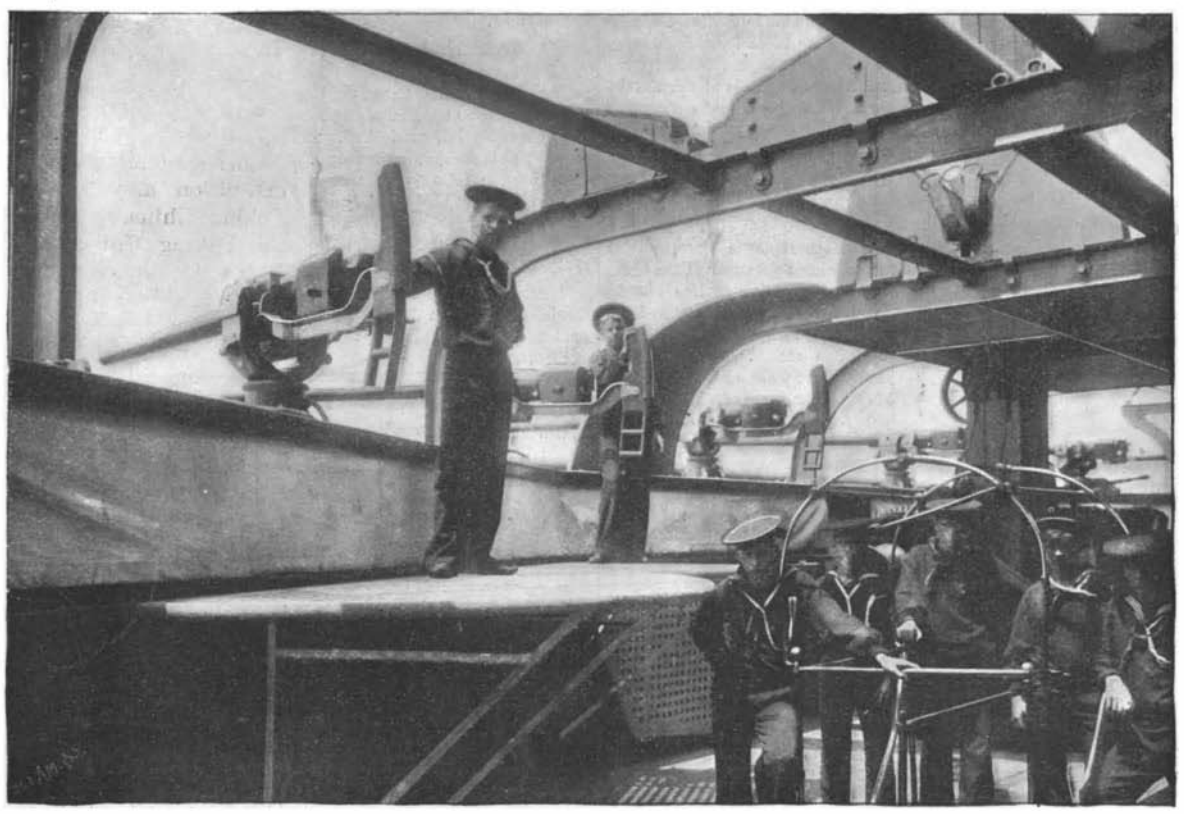
Mr. Pinchot's balance sheet in his report above mentioned, covering the first year's operations of the Biltmore Forest, shows an expenditure of $9,911.76, with receipts amounting to $5,607.11, and material on hand worth at local market prices $3,911.25, or $9,519.36 in all, showing a deficit of only $392.40. In the year 1893 this deficit became a surplus of more than $1,200—a remarkable result, in view of the poverty of the forest he had to operate in and the difficulties which are always attendant upon the establishment of a new industry, especially in one like this, where all his assistants and workmen had to be formed from the very beginning.

But Mr. Vanderbilt has broader and more liberal views in his forest operations than an effort to make his investment pay by improving the property. He intends his forest, for one thing, as an object lesson in forest preservation to the country. Already preparations are on foot for a great arboretum at Biltmore, in which are to be gathered all the trees and shrubs of the temperate regions of the world, which will form a museum of the greatest interest. It will cover some 800 acres of land, distributed along both sides of a road twelve miles in length. Here the nurserymen and foresters of the entire country will be at liberty and have full opportunity to study and gain information as to the character and growth of important forest trees not to be obtained elsewhere.

In connection with this arboretum and the general scheme of forest management at Biltmore, it is said to be Mr. Vanderbilt's intention to establish and equip a school of forestry on or near his estate. Already a number of students are residing near the place, taking practical lessons in the science from Mr. Pinchot and his chief assistants, who are resident foresters. They also have free access to the notable collection of valuable books in the library connected with the arboretum, and which it is also said to be Mr. Vanderbilt's purpose to make a public one.



THE INDIANA—THE AFTER PAIR OF 13 INCH GUNS.



THE BATTLESHIP INDIANA—BROADSIDE 6 POUNDER RAPID FIRE BATTERY.

The Great Krupp Works.

More than 1,250,000 tons of coal are consumed yearly by the famous Krupp Works at Essen, Westphalia, commenced in 1810 by Peter Friedrich Krupp, and now in the possession of Herr Friedrich Krupp, member of the Reichstag. The establishment consists, according to the Eisen Zeitung, of two steel works with fifteen Bessemer converters; four steel works with Siemens Martin open hearth furnaces; iron, steel and brass foundries; puddling, melting, reheating and annealing furnaces; draw benches; a hardening and tempering department; file manufactory; rolling mills for plates, rails and tires; railway spring and wheel manufactory; steam hammers, forges, axle turning shop, boiler shop, engineering and repair shops. Besides the above and many other departments, at Essen, connected with the making of cannons, there are steel works at Annen, in Westphalia, three collieries in Westphalia, besides participation in several others; 547 iron mines in Germany; various iron mines at Bilbao, in Spain; four iron works, including one at Duisburg, one at Engers, one at Neuweid and one at Sahn; various quarries of clay, sandstone, etc.; four steamers, and artillery ground at Meppen, Hanover.

The property owned extends over 974 hectares; and the number of hands employed in the mines and steel works is 25,301. There are altogether 1,500 furnaces of various kinds, 3,000 engines and machine tools, 22 roll trains, 111 steam hammers, two hydraulic presses, 263 stationary boilers, 421 steam engines, representing together a force of 33,139 horse power, and 430 cranes, including travelers, having a collective lifting power of 4,662 tons.

The total length of the shafting is 8·8 kiloms. (5½ miles), and that of railways, standard and small gage, 85 kiloms. (53 miles), worked by 32 regular trains, with 33 locomotives. The annual consumption of coal amounts to 1,253,161 tons, and that of lighting gas to 12,000,000 cubic meters, while there are 573 arc and 1,804 incandescent electric lamps.

THE Yale lock manufacturers have proved that in a patent lock having six "steps," each capable of being reduced in height twenty times, the number of changes or combinations will be 86,400. Further, that as the drill pin and the pipes of the keys may be made of three different sizes, the total number of changes will be 2,592,600. In keys of the smallest size the total number of changes through which they can be run is 648,000, while in those of large size the number can be increased to not less than 7,776,000 different changes.

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