WONDERS OF THE SCIENTIFIC WORLD.

THE increase in the production of metals—especially in the United States—has been a most remarkable feature in the industrial evolution of the last quarter-century. The output of pig iron in the United States has trebled in 10 years, and reached 24,432,106 tons in 1905, which was about equal to the total production for the rest of the world. The per capita consumption of pig iron in 1905 reached 620 pounds in the United States and was only 68 pounds in the whole world. The production of copper in the United States increased from 25,000 tons in 1880 to 413,070 tons in 1905, or from a sixth of the world's output to one-half. The annual yield of gold has quadrupled in 20 years. The output for 1905 is given by M. de Launey as 1,908 millions of francs, of which the Transvaal furnished 524 millions, the United States 436 millions, and Australia 432 millions. The production of aluminum has grown from a few pounds 10 years ago to 5,000 tons in 1905.

Illness or sudden death from entering long-closed holds of ships have been attributed to the presence of carbon monoxide or an excess of carbonic acid. Late experiments have convinced G. Giemsa that lack of oxygen is more often the cause, as many stored substances absorb this gas rapidly, while air containing less than 15 per cent must soon prove fatal. He concludes further that such processes as the drying of floor varnish may absorb oxygen to an unsafe extent in closed rooms.

Fitting a turbine vertically to the keel is Otto Schlick's method of preventing the violent motion of a ship at sea. Tested in an old torpedoboat at the mouth of the Elbe in rough weather, the roll was reduced from nine degrees to one degree.

The "Orthoptere," of which a half-sized model has been exhibited at Brussels, is pointed out as probably the most grotesque of the many projected flying machines. It is the invention of Capt. Marga, M. de la Hault and M. Jansen; it belongs to the class of machines that are slightly heavier than the air and are to be raised by planes, propellers or wings; and it resembles a gigantic bee or wasp. It has a head and six legs, which seem to serve for balancing, while the body is an enclosed cabin with two windows on each side. The action depends upon the oiled silk wings and the aluminum propellers, and the latter are driven by a 60-horsepower Buchet motor at the enormous velocity of 30,000 revolutions per minute. The body of the aparatus has a double skin of cloth, with an air-space between, while the tail is provided with three great air cushions to lessen the shock on descending.

To determine the effect upon a bicycle of a well designed propeller, driven by a six-power motor, has been the purpose of the experiments of M. Archdeacon. The motor bicycle is provided with a propeller shaft carried in a frame supplying a bearing just in front of the driver's seat and another in front of the front wheel. Power is furnished by a two-cylinder Buchet motor. The propeller has two sheet aluminum blades, and their inner portion is perforated and covered with gold beater's skin. The machine weighs about 154 pounds. Carrying the famous bicyclist Anzani, the total weight being 330 pounds, the bicycle glided along very smoothly, and ultimately developed the fair speed of 49.27 miles an hour.

The new electrical test of D. Negreano, a French electrician, distinguishes between different mineral waters and detects imitations. It consists simply in measuring the electrical resistance, which proves to be very constant for the water of any spring at a given temperature, but varies greatly for different springs. Samples from the leading Continental springs, for instance, gave resistances per cubic centimeter ranging from 27.5 to 1,289 ohms.

Various attempts have been made to estimate the light of the stars. In the northern hemisphere, Argelander has registered 324,000 stars down to the 9½ magnitude, and with the aid of the best photometric data, Agnes M. Clerk's new "System of the Stars" gives the sum of the light of these northern stars as equivalent to 1-440 of full moonlight, and the total light of all stars similarly enumerated in both hemispheres, to the number of about 900,000, is roughly placed at 1-180 of the lunar brightness. The scattered light of still fainter celestial bodies is difficult to evaluate. By a photographic method, Sir William Abney in 1896 rated the total starlight of both hemispheres at 1-100 of full moonlight; and Prof. Newcomb in 1901, from visual observations of diffused sky-radiance, fixed the light power of all stars at just 728 times that of Capella, or 1-29 of the light of the full moon. It is not certain, however, that the sky would be totally dark if all stars were blooted out. Certain processes make the upper atmosphere strongly luminous at times, and we can never be sure that this light is absent.

While cancer mortality is increasing, still in England and Wales, it is at a diminishing rate. In the five years ending with 1905, the death-rate for both sexes show an increase of 8 per cent, which was about half as great as the increase for the five years ending with 1890. The deaths in 1904 were 741 per 1,000,000 among males of all ages, and 1,006 among females. In nearly all comparable cases the rate is greater among females. A remarkable exception is cancer of the mouth, for in the four years ending with 1904 this caused the death of 7,246 males and only 1,667 females. Whether this is an effect of nicotine poisoning remains to be shown.

In a new method, the velocity of a stream is determined chemically. A certain quantity of brine is added to the water, and samples afterward taken further down are carefully analyzed.

About 80 years ago Dr. Robert Brown discovered that microscopic particles—such as powdered indigo, carmine, gamboge, etc.,—keep in rapid movement when suspended in water. The peculiar oscillations may continue for years, and seem to be the nearest approach to perpetual motion yet observed. It lately occurred to Drs. Carl Hering and E. F. Northrup to test the influence of an electric current upon this Brownian movement. When the suspending liquid was placed between two electrodes, the particles took a very decided course across the field, some being attracted to one electrode and some to the other. Each particle had its characteristic direction, and in some mixtures the particles of one material traveled with the current and those of the other against it. The motion was so positive that Dr. Northrup has made it the basis of a successful electrical measuring instrument for special purposes.

Everybody knows that plants grow largest in rich soil, but it is not so well understood that the largest roots may be found in very poor soil. This has been made a subject of late experiments by a French botanist. Lots of colza seeds were planted respectively in washed sand, in soil exhausted by many crops, and in good soil; and after seven weeks, with like watering the roots of the first lot had grown 14 to 16 inches, of the second lot 10 to 12 inches, and of the third lot only six inches. In the poorest soils the roots must extend farthest to get nutrition.

Delicate speed-regulating apparatus is required when a dynamo is geared direct to a windmill. In a new system, the windmill pumps water into a hydraulic accumulator, and water from this—kept by automatic valves at a pressure of 75 pounds per square inch—drives the dynamo. A storage battery saves the surplus power in the usual way.

The novel and ingenious anemometer of R. Goldschmidt, a Belgian electrician, depends upon variation in electrical resistance due to the cooling by the wind of an electrically-heated platinum wire. To compensate for the changing temperature of the air itself two similar wires are used, and these form arms of a kind of Wheatstone bridge, which is so adjusted that when the two wires are of equal resistance the galvanometer is at zero. After this adjustment, the cooling of the exposed wire—the other being protected—varies with the wind. The galvanometer—which may be at considerable distance away—is correspondingly deflected, and gives a direct reading of the wind's velocity, the indications having been accurately calibrated by driving one of the instruments on a rotating stand through calm air at a series of known speeds. With a recording galvanometer and an electrical weathercock—the latter acting through changes of contact on a circular slide wire—a permanent record can be kept of both the velocity and the direction of the wind.

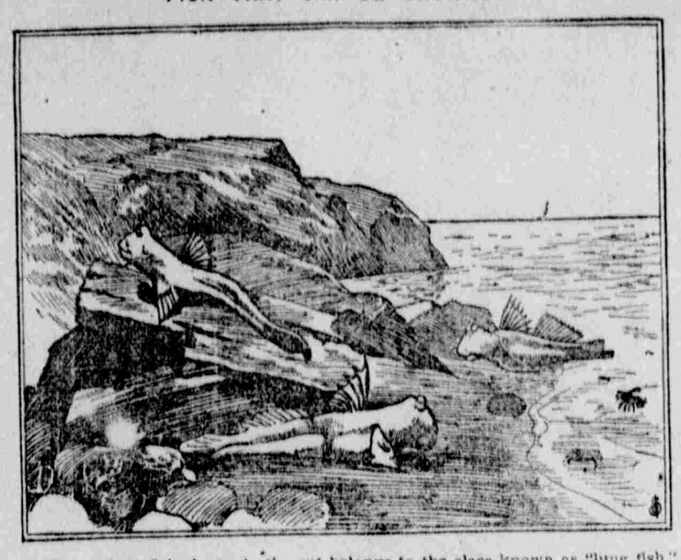
A little apparatus of great utility is the "Unilens" telescope lately produced by London opticians. It is simply a convex lens mounted in a metal ring having a projecting screw at one side, the lens being 2½ inches in diameter and having a focal length of 6 feet. The instrument serves as a very good field glass. In use, it can be held in the hand at arm's length or screwed to the end of a stick, and at maximum efficiency—about 6 feet from the eye—it magnifies four diameters. It is especially recommended for observing birds and plants. It is not intended as an astronomical telescope, but shows eight stars in the Pleiades where the unaided eye usually sees six.

A very sensitive direct-reading level, called the "shaftometer," has been brought out by a Halifax company for lining up shafting, machinery, etc. It has a rigid gun-metal base, 16 inches long, a glass tube 12 inches long, and a brass scale runs the entire length of the tube on each side, each graduation of about one-eighth of an inch corresponding to a difference in level of one-thousandth of an inch per foot. A table shows at a glance the thickness of packing required to bring a given length of shafting up to level.

The unfamiliar living world of the little—with its activities, domestic relations and tragedies—is brought into better view by the bioscope, or long focus microscope of M. De Gasparis, of the University of Naples. To be considerably magnified under the ordinaray microscope, insects must be brought within a fraction of an inch of the lens, and with the frightful observing apparatus so near their movements must be far from normal. The new instrument is very simple. It consists essentially of a tube containing a system of achromatic objectives and a wide field eye-piece, with various accessories, such as a camera lucida to aid in drawing. Objects at a distance of about 20 inches are magnified more than 12 diameters. Ants, spiders and many other insects can be watched, undisturbed; aquatic animals can be studied through the glass of an aquarium or in their natural home, and the habits, emotions, struggles, living and death of these creatures can be placed before us in an environment of strange multi-colored plants. The observations, we are told, are full of surprises. Materials submitted to high temperatures or electric charges may be viewed, and the physician gains a means of peering into cavities like the larynx, ears etc.

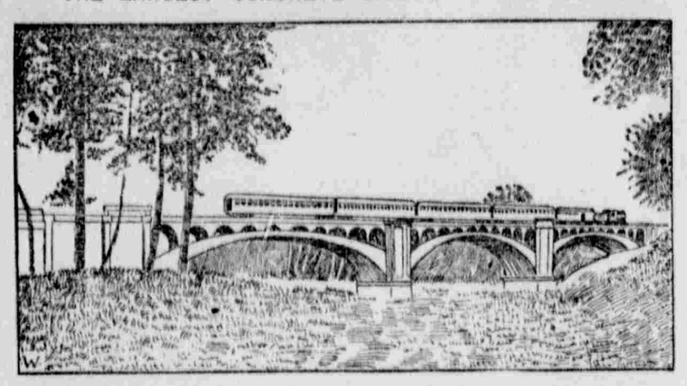
In a military test at Caux, on the Lake of Geneva, a searchlight with a reflector of 3.24 feet, has thrown its rays 7.5 miles, showing objects distinctly at 6.5 miles. A generator of 24 horsepower gave a light of 1,000,000 candles, but 40 horsepower is expected to yield $12,000,000.

FISH THAT CAN BE DROWNED.



The curious fish shown in the cut belongs to the class known as "lung fish," the air bladder being to all intents and purposes a lung. It is not only able to jump from place to place in pursuit of insects on which it feeds, but can also climb over rocks by means of its breast fins. In very deep water it would drown. It buries itself in the mud and breathes in the air like a frog.

THE LARGEST CONCRETE BRIDGE IN THE WORLD.



The bridge shown in the cut is across the Big Muddy river in Illinois and is the largest bridge, with the biggest arches, ever built of concrete. The Illinois Central railroad constructed it, and it is double track. It is 575 feet in length and contains 12,000 cubic yards of concrete and 150 tons of steel.