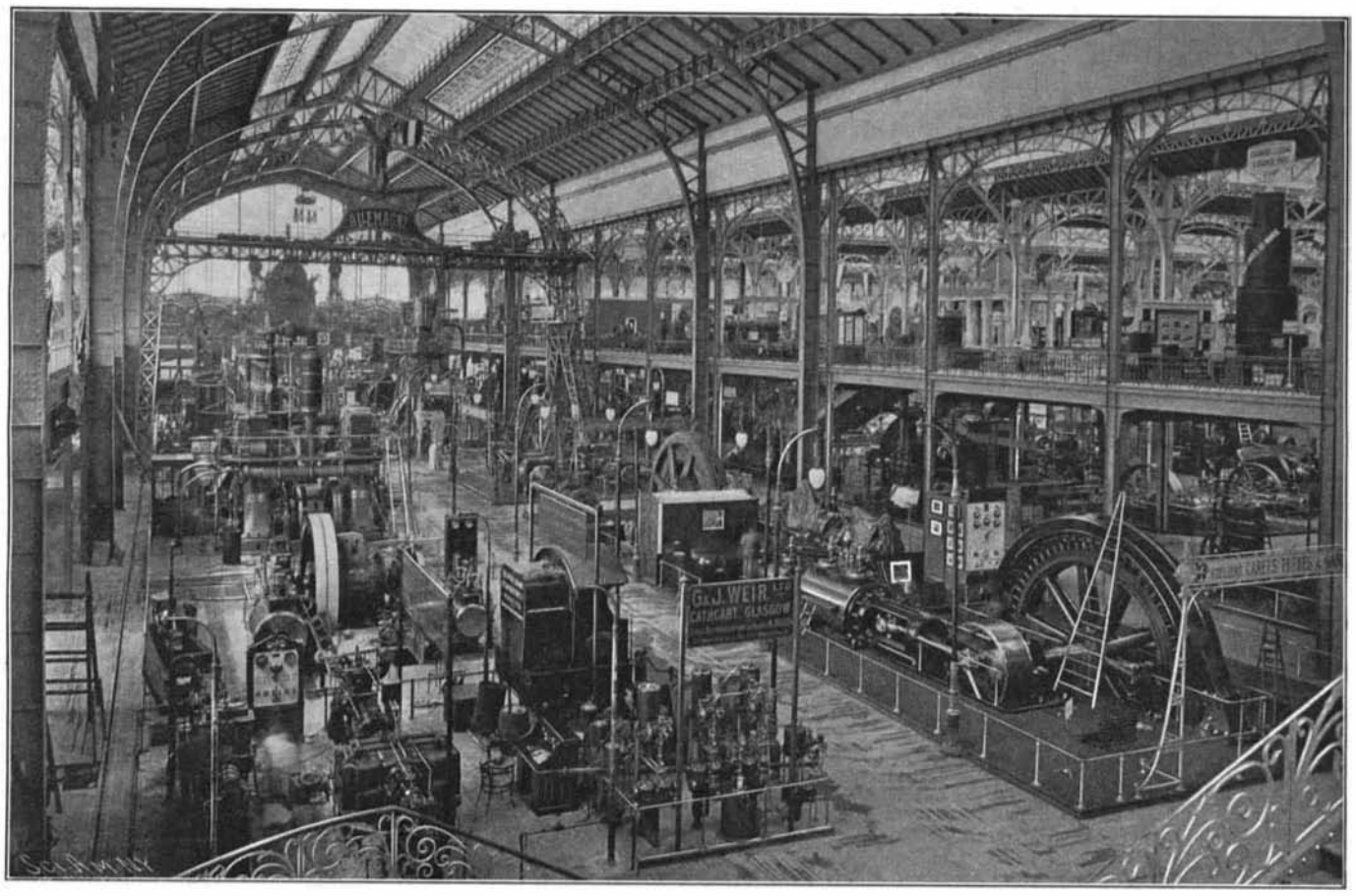
## THE POWER GENERATING PLANT AT THE PARIS EXPOSITION.

BY F. P. MANN.

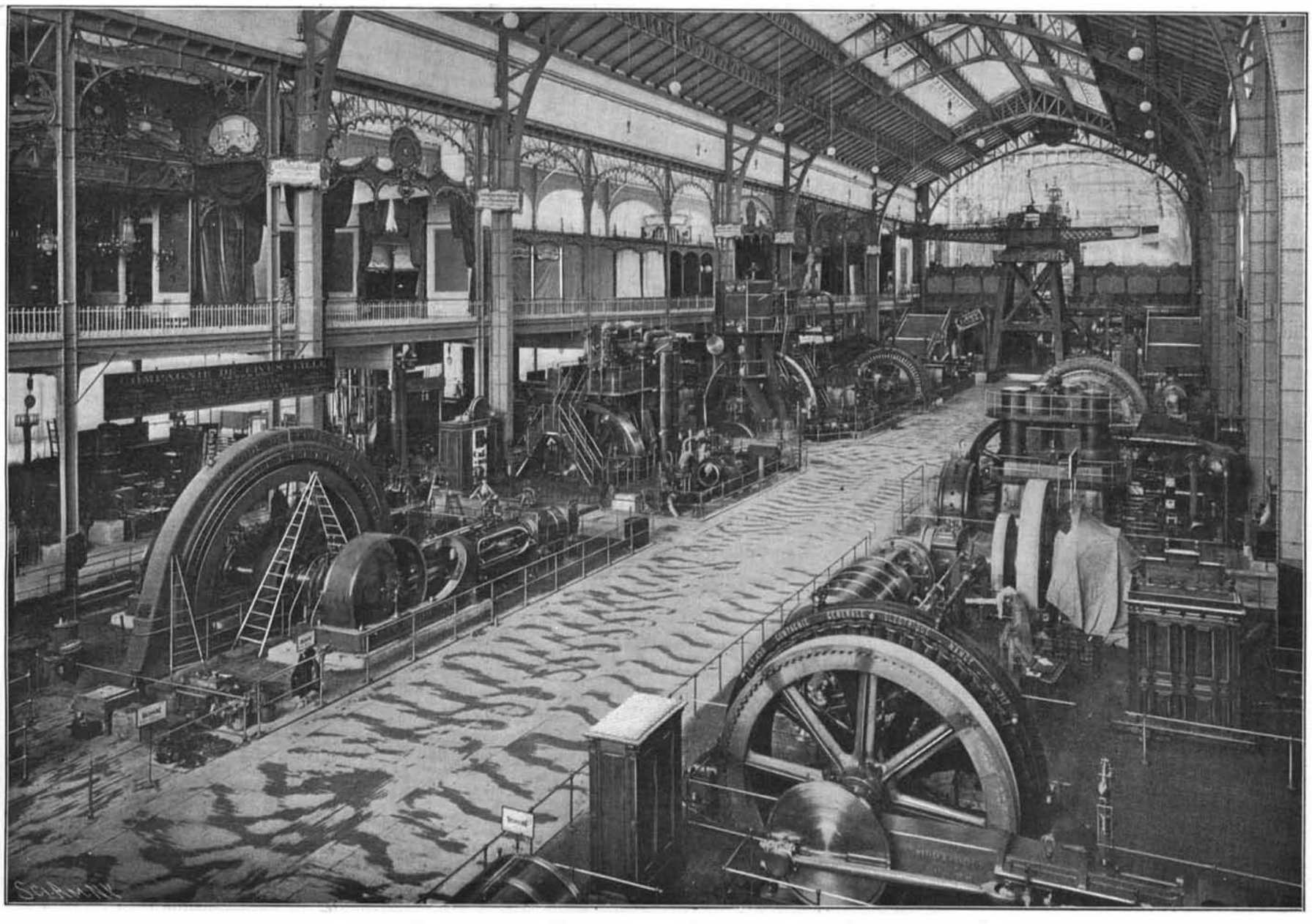
The main dynamo rooms of the Paris Exposition form part of the Electrical Palace, and lie on either side of the central portion of the building; here are to be seen the large engines and dynamos of different types which supply the lamps and motors throughout the buildings and grounds, at the same time serving as an exhibit of the most improved engines and electrical machinery. At the present Exposition a considerable amount of power is required to operate the motors used in the different exhibits, the electric system of power distribution is used exclusively, doing away with small steam engines. The total amount of energy used for lighting and power reaches 30,000 horse power, which is furnished by 38 generating groups; the total capacity of the steam engines is about 36,000 horse power.



FOREIGN SECTION OF THE POWER GENERATING PLANT OF THE PARIS EXPOSITION.

The dynamo room shown in the first illustration is that occupied by the engines and dynamos of French construction; the second dynamo room contains those of foreign makes; there are also two corresponding steam-generating plants situated in the rear of these, containing two rows of boilers erected on each side of a central passage. The dynamos and engines are supported on massive foundations in concrete, going down to a depth of fifteen feet. The piping from the boilers to the engines passes underground, and the foundations have been built to accommodate the condensors and accessories, which are thus nearly all placed below the floor level. In the French dynamo room the first generating group to the left has been constructed by the Fives-Little Company, of Paris. The engine is cross-compound, of the Corliss type, making 80 revolutions; it has a capacity of 1,200 horse power. The dynamo is of the three-phase alternating-current type, working at 2,000 volts, with a capacity of 800 kilowatts. The next generating set is furnished by the Alsatian Company, of Belfort; it has a large upright compound engine of 1,200 horse power; the main shaft carries a heavy fly-wheel on one side and on the other a direct-current dynamo of 680 kilowatts, giving 500 volts. Next to it is an upright compound engine, the largest in the section, of the Allis-Corliss type, with a capacity of 2,000 horse power at 75 revolutions. The dynamo, placed in the center between the two cylinders, is of American design, having been constructed on the Thomson-Houston system by the Postel-Vinay Company, of Paris. The dynamo is one of the largest at the Exposition, giving 1,000 kilowatts at 5,000 volts. The fly-wheel is placed on the inside next the dynamo; the engine is surrounded by two platforms, which are reached by a double staircase. In front of the two latter groups have been installed two small generating sets using Laval steam turbines to drive the dynamos; these turbine sets are used to a considerable extent in the French navy, being constructed by the Maison Breguet, of Paris. Farther on is another large generating group: the engine, of 700 horse power, is furnished by the Pignet Company, of Lyons, and the dynamo, of the Grammont type, is a triphase alternator working at 2,200 volts.

The foreign dynamo room, shown in the second illustration, presents many novel and interesting types of machines. The British section, shown in front, to the left, contains two Parsons steam turbines with direct-current dynamos. Back of these is a large cross-compound engine built by Robey & Company, of 500 horse power, with a direct-current dynamo of 300 kilowatts at 250 volts. The engine has a new type of electric governor, which keeps a constant speed at all



FRENCH SECTION OF THE POWER GENERATING PLANT AT THE PARIS EXPOSITION.

loads. Near it is the large upright engine of the Galloway make, giving 680 horse power at 105 revolutions. The dynamo, mounted on the shaft between the cylinders, has a capacity of 500 kilowatts; it has been built by Mather & Platt, of Manchester. A still larger upright engine, triple expansion, is that of Willans & Robinson, giving 2,000 horse power; the dynamo is furnished by Siemens Bros. & Company, of London. The German section, at the farther end of the building, contains four of the largest generating groups at the Exposition. Two of these may be seen to the right, the first being the large Borsig engine of 2,500 horse power, carrying a Siemens & Halske alternator of 1,250 kilowatts. The engine is of remarkable size, measuring 38 feet from the ground to the highest point; it has a total weight of 350 tons, the foundation plate weighing 60 and the flywheel 41 tons. Next to it is a large triple-expansion engine of 2,000 horse power, carrying on one side a Schuckert alternator and on the other a direct current dynamo, the total representing 1,200 kilowatts. Opposite to it is a similar generating group of about the same capacity, with Lahmeyer dynamos. The remaining set consists of a cross-compound engine built by the Augsburg Machine Company, carrying an alternator of large diameter of the Helios Company, Cologne, giving 2,000 kilowatts. The external diameter of this machine is nearly 30 feet and the diameter of the revolving field 25 feet.

The machines of the Belgian section may be seen on the left; in front is a Carels engine of 1,000 horse power, with a Kolben alternator, and farther on an engine of like capacity, built by Van den Kerchove, of Ghent, with an alternator of 600 kilowatts, giving 2,200 volts; the third group has an engine of the Bollinckx make, of 1,200 horse power, and a dynamo built by the Electric and Hydraulic Company, of Charleroi. Besides the groups in the main dynamo room are those of the Swiss, Austro-Hungarian, Italian, and other sections, which occupy the neighboring spaces. In the main dynamo room is a traveling crane of 25 tons, built by Carl Flohr, of Berlin; it spans the building, running on a track at either side. The carriage running along the horizontal beam is operated by three phase motors.

### Statistics of Mining Production of Great Britain.

The figures for the mining production of Great Britain for the last two years have recently been published. In making the estimates the mines have been divided into three classes, coal, minerals and stone quarries. The figures for 1898 and 1899 are given as follows, in millions of tons:

| | 1898 | 1899 |
|---|---|---|
| Coal | 202·0 | 220·0 |
| Refractory clay | 2·8 | 2·9 |
| Iron ore | 7·9 | 7·8 |
| Schist | 2·1 | 2·2 |

The figures show an increase in the production of coal of 8·9 per cent over that of 1898. More than one-half of this increase comes from the mines in the south of Wales, where a prolonged strike diminished greatly the figure for 1898. The number of persons employed in this class of mines in 1899 has been 729,009, of which 583,009 are employed underground; this represents an increase over 1898 of 22,115 persons. The mines of the second class give the following figures in millions of tons:

| | 1898 | 1899 |
|---|---|---|
| Gypsum | 134 | 158 |
| Iron ore | 2,167 | 1,957 |
| Limestone | 556 | 590 |
| Rock salt | 183 | 190 |
| Slate | 178 | 179 |
| Zinc ore | 24 | 23 |

The number of persons employed is 35,187, of which 20,618 are underground. The total production of iron ore is thus nearly 10,000,000 tons. Iron ore is also found in the quarries, which in 1898 gave more than 4,000,000 tons; the figure for 1899 is not yet given. The importations of iron ore amounted to more than 7,000,000 tons for 1899, and thus the total consumption for the year is at least 21,000,000 tons.

### The Death of Jasper R. Rand.

We regret to note the death of Jasper R. Rand. Mr. J. R. Rand and his brother became interested in rock drills when they were in the pioneer stage, with at most a small and uncertain future before them. Rock drills were among the first American machinery products to find recognition among foreign engineers, and they are to-day at work in nearly every country on the globe where the mining industry has passed beyond the most primitive stage.

THE question as to whether strontium and barium can replace calcium in plants has been made the subject of inquiry. Dr. M. Suzuki gives a contribution to this question in a recent number of The Bulletin of the College of Agriculture of Tokio. Experiments were carried out with several species of plants and in soils containing varying amounts of calcium; the results show that strontium and barium can never replace calcium, as they are strongly poisonous, although the poisonous action may be lessened to a certain extent by the addition of lime salts.

### Science Notes.

Messrs. Macfadyan and Rowland report that they have exposed various micro-organisms to the temperature of liquid air for some days without finding that the vitality of the organisms was impaired in any way, except that in one or two cases their growth was slightly delayed.

Dr. Donaldson Smith, the Philadelphia explorer, recently reached Cairo after a remarkable journey to Lake Rudolf and Stefanie. From Uganda he was conveyed down the Nile from Khartoum in an Anglo-Egyptain gunboat, the first vessel to traverse the Nile since the cutting of the sudd. Dr. Smith has accomplished considerable interesting work in hitherto unexplored regions.

Dr. J. J. S. Lucas has developed a system for the Nordrach open-air treatment of consumption, which possesses several points of interest. A maximum amount of fresh air is prescribed, together with a strict but generous diet. The fresh air seems to be an indispensable aid to any successful treatment of tubercular disease. The work is entitled "Nordrach at Home," and is published at Bristol, England.

According to Herr Reinmann, there is no relation between rancid paste and the odor of butter and the quantity of free acid found in it. The greater the amount of caseine and of milk sugar in butter, the more quickly does it become rancid. It does not appear that light and air exercise any direct influence upon the process. Butter made from sterilized cream will rarely become rancid, but if brought into contact with rancid butter it will turn in a few days.

Several educational awards to the United States have been made at the Paris Exposition. In three instances distinguished merit was recognized in the case of individuals; Prof. H. A. Rowland, of Johns Hopkins University, Prof. Nicholas Murray Butler, of Columbia University, and Melvil Dewey, of the University of the State of New York. Grand prizes were awarded to the University of the State of New York, the Congressional Library at Washington, Harvard University, University of Pennsylvania, Johns Hopkins University, and the American Library Association.

A new record for high kite flying was established at Blue Hill, Boston, July 19, when a height of 15,900 feet was reached with a line of six kites in tandem. Five were an improved box pattern and one was a rib kite. The greatest height was reached with four and three-quarter miles of steel piano wire used as a flying line. The temperature registered by the automatic instrument was 30°; at the sea level it was 80°. The velocity of the wind was 26 miles an hour and the atmosphere was very dry. It was difficult to see the highest kite from the Observatory without the aid of a telescope.

Injudicious restorations have awakened storms of complaints from the time of Ruskin down. There have been, however, many cases where restorations have not only been justified, but have been carried out in a thoroughly satisfactory manner. The church of Santa Maria della Spina, on the Lung'Arno at Pisa, was taken down about two years ago, as it was in a most dilapidated state, and was re-erected at a higher level, so as to protect it from the damp of its original position. Not only was the masonry of the walls replaced stone by stone in the proper place, but every fragment of old carved work was preserved, and where small pieces had been lost, they were reproduced with an accuracy which would please archæologists.

The Hudson Bay Company officials have received word that Indians, hunting on the east coast of Hudson Bay north of St. George, discovered some wreckage that may possibly have been that of the Andreé expedition. It is stated that they found last spring a vast quantity of wreckage and the bodies of two men and one man who was dying. The language which this man spoke was not English, and the Indians were not able to understand it. They described the car and other wreckage accurately. The Hudson Bay officials seem to be convinced that it was the Andreé expedition, and have sent out a party guided by the Indians to find and bring back evidence to establish the truth of these statements.

Vanillin is developed in the leaves of the vanilla plant by a ferment, or by mineral acids. It has now been proved that a similar combination exists in the fruit. Busse obtained from the botanical Gardens of Berlin an unripe vanilla pod which was ground and extracted with alcohol at normal temperature. The extract was treated with lead acetate and the excess of lead was removed by hydrogen sulphide, and the alcohol removed from the filtrate by heat. A portion of the aqueous fluid was gently heated with a small percentage of sulphuric acid, another equal portion with hydrochloric acid, and a third with a few grains of emulsion and warmed. In all three cases the odor of vanilla was very strong. The product was purified by dissolving in ether and washing the solution with water; on evaporation of the ether a pure vanilla odor was obtained.

### Engineering Notes.

Large deposits of the rare earths, s chuas zirconia, thorium, ittrium, etc., have been located in Central Tasmania.

A project is on foot to connect the railways of Greece with those of Turkey, so as to connect Athens with Europe by rail.

The British consul at Copenhagen calls the attention of persons trading with that country to the necessity of registering their trade marks in Denmark.

The opening of the new freight station in the Pennsylvania Avenue Subway at Twentieth and Hamilton Streets, Philadelphia, practically completes the Reading Subway, which was fully illustrated in the SCIENTIFIC AMERICAN for October 21, 1899.

An engine shaft with its attachments weighing 240 tons was recently raised with the aid of screwjacks and overhead crane at the power house of the Metropolitan West Side Elevated Railway in Chicago. The shaft belongs to one of the big engines operating the dynamos. The rotation of the flywheel caused the pillar blocks to become loose and approach each other. The shaft was raised in order to put in new work so that the foundations of the engines will be stable.

Dr. Goldschmit has devised a new method of welding rails, in which he makes use of the great heat developed by aluminium when it combines with oxygen furnished by a metallic oxide. In the process of welding which he uses at present, the ends of the rails are brought together in a crucible, in which is then placed a quantity of finely divided aluminium and iron ore. The rails, previously planed at the ends, are pressed together tightly and the mixture ignited; the heat produced is sufficient to make a good weld, the more so as the high temperature causes an expansion of the rails and brings them firmly together.

Prof. Lunge, at a recent meeting of the Society of Chemical Industry, at Liverpool, made some interesting remarks on sulphuric acid manufacture. He stated that we are confronted with the greatest revolution which has taken place since the acid became a commercial product. This is the total abolition of the vitriol chamber and of the use of nitrous fumes as oxygen carriers. By the use of the catalytic power of platinum, perhaps also by that of ferric oxide and other substances, a great many industries will probably be able to make their own sulphuric acid by the new process, as it is simpler and can be successfully carried out upon a small scale.

An English inventor has devised an apparatus whereby the sides of railway cars may be thoroughly washed and cleansed without the use of hand labor, which is now commonly employed for this purpose, says The Railway Review. The device comprises rotary brushes adapted to be moved into engagement with the sides of the car, shields partially inclosing the brushes and movable therewith, spraying pipes carried by the shields and flexible connections between the pipes and a water-supply pipe. The machine is mounted in a shed or other enclosing structure located on a track siding, through which the cars may be conveniently passed. As the cars are drawn slowly between the washers power is applied to rapidly revolve the circular brushes, and at the same time water is turned into the shields to aid in removing the dirt.

A curious and unexpected development has arisen in connection with the cutting off suddenly, at Assouan, on the Upper Nile. The large volumes of water which were liberated had been stagnant for many months, and, therefore, possessed no free oxygen; consequently the fish in the river at Assouan have been destroyed by the hundreds of thousands. The chief of the engineering staff reports that there are over 1,000,000 dead fish ranging from two or three inches to six or seven feet in length, lying exposed to the sun within one hundred yards of his office. The odor exhaled by the decomposition of these fish by the torrid sun is nauseating in the highest degree. To accelerate the gravity of this situation there is no other drinking water available. Fortunately, however, no virulent epidemic has yet broken out among the inhabitants as a result of drinking such polluted water.

According to a compilation made by the Land Office of the State of Washington, 15,858 square miles in that State were originally covered with merchantable timber—fir, cedar, hemlock and spruce, says The New York Evening Post. One-fifth of this area has been ravaged by fire, 22½ per cent has been cut, and the remainder, or 9,039 miles, is covered with standing timber. Upon this timbered area there is estimated to be standing 103,503,576,000 feet, board measure, which in itself is sufficient to supply the saw mills of the United States for four years under the present rate of cutting. By a comparative table the report shows that with the single exception of the redwood forests of California, the forests of Washington are the densest, heaviest, and most continuous in the United States. With the exception of a few prairie openings and where the timber has been removed by fire or the axe, they cover the country as a thick mantle from high up on the Cascade range westward to the shores of the Pacific.