

moreover, are very much cheaper to build and maintain than those with them; and in cases where the draw is unavoidable, it is very much easier to signal and warn off a slow sailing vessel, or even a steamer, than a lightning express train.

THE CENTENNIAL EXHIBITION.

"The prospects of the Philadelphia Exhibition are so gloomy just now that its friends are filled with alarm. Every effort has been made to stimulate the people of the United States to enthusiasm in its favor, but there is a very widespread feeling across the Atlantic that exhibitions are a nuisance; and the requisite funds cannot be obtained for the completion of the undertaking from a people who refuse to respond to the most pressing invitations for subscription. As a last resource, the Exhibition promoters are going to Congress for a vote of \$1,500,000, or, say, £300,000. The applicants state very plainly that it is their last resort, having failed to get what they need from the people directly, and that without this aid their enterprise may be limited and delayed. There appears thus far to be no party feeling upon this measure, and probably there will be none. The want of money is, moreover, not the only trouble in store for the management.

It will be remembered that foreigners refused to send their goods to America, unless they were permitted to affix the prices at which they could be sold if admitted duty free. This point was conceded without much opposition at the time, but the native manufacturers now find that they cannot possibly compete with foreigners in price, and they are now beginning to utter indignant protests against the publication of any prices. In a word, the protectionists are afraid that the people of the United States will learn so much at the Exhibition that they will rise *en masse* and crush the party. Already it is rumored that, if the price rule is adhered to, many of the leading houses in the States will not exhibit, while, on the other hand, if the rule is broken, foreigners will not put in an appearance. Altogether things do not look well for the Centennial; and if we may be allowed to use an expressive Yankeeism, it is not impossible that the whole thing may end in a gigantic 'fizzle' after all."—*The Engineer*.

Our esteemed cotemporary is evidently not posted in respect to the "hard pan" of the Exposition. He does not realize that all the buildings are nearly done, that all will be ready before they are actually wanted, that all the arrangements are complete to ensure the success of the Exhibition, and that there is not the remotest possibility of its becoming a "great fizzle."

The Exhibition Company has, it is true, applied to Congress for a grant of \$1,500,000, which, if allowed, will be a convenient plum for the managers, ought to augment the greatness of the affair, and add to its renown. But whether the payment is granted or denied will not materially affect the fact of the success of the Exhibition, since that is already assured.

In applying for this grant, it has been necessary, we presume—it is always necessary in such cases—to make use of a little special pleading. Our cotemporary has probably allowed his ideas of the state of the enterprise to be more affected by this pleading than by the astonishing magnitude of the works and labors that have been actually realized, and which, as stated, place the final success of the Exhibition beyond question.

We regret that our British friends have thought it unadvisable to take any very prominent part as exhibitors; but we feel sure that they will flock here in thousands as visitors, and we shall welcome them most cordially. We hope to surprise them by the extent and extraordinary novelty of the display. If good old England is not a great contributor, her people, when they come, will find that her descendants have not been lacking, and that they have appreciated the glorious industrial lessons which she taught them in 1851.

BAMBOO AS A SOURCE OF PAPER STOCK.

The steadily increasing demand for fiber for papermaking has driven our manufacturers to the ends of the earth in search of new fibers. Not a few have looked with longing eyes upon the wealth of raw material going to waste, the world over, in bamboo thickets; and many attempts have been made to convert such fiber economically into paper stock.

Mr. Thomas Routledge, a progressive papermaker, claims that the slow progress made with this plant has been due not to any inherent unfitness of the bamboo, but to the fact that insufficient attention has been paid to age of material used.

Like the asparagus plant, the bamboo is succulent and tender when young, but rapidly becomes hard and woody with age. When mature, it is, as all know, exceedingly dense, and in most varieties the outer part is so hard and silicious that it will strike fire like flint. To convert stems at this stage into pulp, they must be subjected to long-continued boiling in strong solutions of caustic alkali, at high temperature, under a pressure of ten or eleven atmospheres; a process at once difficult, costly, and dangerous.

Mr. Routledge finds that these objections may be obviated, and the bamboo made to furnish excellent fiber cheaply, simply by using the plant when young and green. Before the stems become indurated and woody, a very mild treatment of alkaline baths, at atmospheric pressure, suffices to dissolve the mucilaginous and extractive compounds combined with the tissues, so that the fibers may be readily separated pure and free.

For many years Mr. Routledge has devoted much time to the investigation of new fibers for papermaking, testing both chemically and practically as a papermaker nearly every

known fibrous material; and he does not hesitate to say that no other fiber can approach the bamboo in economy of production, and very few if any in the quality of the stock it yields for the manufacture of paper. And it has the further advantage of being practically inexhaustible in quantity. The bamboo is of extremely rapid growth, and it flourishes in every tropical country. Grown under favorable conditions of climate and soil, it excels every other plant in amount of available fiber to the acre, and there is no plant which requires so little care for its cultivation and continuous production. The estimated yield is twenty times that of flax, hemp, jute, or cotton.

In view of the threatened exhaustion of the supply of esparto, owing to the greed of the native collectors, the utilization of the bamboo promises to be a great public advantage, even if the paper produced from it falls far short of Mr. Routledge's anticipations. The sample furnished—Mr. Routledge's pamphlet on "The Bamboo Considered as a Paper-Making Material" being printed on bamboo paper—shows it to be fully equal, indeed superior, to much of the common and cheap news paper in use. In fineness and strength it surpasses any made use of by our great dailies, and in color all but the *Herald*. It has, however, the serious fault of semi-transparency, the letterpress showing through.

As an essential point in the proposed plan of utilizing the bamboo for papermaking consists in the use of young and preferably freshly cut stems, it will be necessary to have the fiber prepared where the bamboo grows, thus adding a new industry to tropical regions.

OUR WATER SUPPLY.

In 1870 the average daily consumption of water in New York city was 85,000,000 gallons; in 1871, 87,000,000 gallons; in 1872, 90,000,000 gallons; in 1873, 100,000,000 gallons; in 1874, 102,000,000 gallons; in 1875, 107,000,000. As the Croton aqueduct is now used to nearly its full capacity, the demand for water threatens to exceed ere long the amount which the aqueduct can deliver.

About 340 square miles of territory are drained by the Croton river above the dam. On this area the rainfall is sufficient to furnish an average daily supply of 300,000,000 gallons. The actual yield of the river is very much greater, showing that many of the springs which supply its tributary streams are fed from without the Croton water shed. Croton lake, which covers some 400 acres, has a storage capacity of 500,000,000 gallons. The old reservoir in Central Park holds 150,000,000 gallons; the new reservoir, 1,000,000,000, and the distributing reservoir on Fifth avenue, about 20,000,000 gallons: making a total of about 1,670,000,000 gallons. At or near the sources of the tributaries of Croton river, in Putnam county, there are many small lakes, some of them of great depth, which have been converted into natural reservoirs by lowering their outlets. Of these, Lake Glendon covers 182 acres, and will supply 168,000,000 gallons, when drawn down 3 feet; Lake Gilead, 122 acres, drawn down 12 feet will supply 396,000,000 gallons; Lake Mahopac, 603 acres, drawn down 3 feet will supply 584,000,000 gallons; Lake Kirk, 101 acres, lowered 20 feet will supply 528,000,000 gallons; Lake Barrett, 70 acres, lowered 10 feet will supply 198,000,000 gallons; Lake China, 50 acres, lowered 10 feet will supply over 132,000,000 gallons: a total of over 2,000,000,000 gallons.

Besides these natural reservoirs, there is an artificial reservoir at Boyd's Corners having a storage capacity of 2,700,000 gallons, and an unfinished reservoir on the middle branch of the Croton which will have a storage capacity of 4,000,000,000 gallons. Thus the supply of storage water amounts to the enormous quantity of nearly 6,000,000,000 gallons, to be increased by the new reservoir to 10,000,000,000. In 1868 there were 9 days when the daily flow of Croton River did not furnish a full supply of water for the city; in 1869, 80 days; in 1870, 107 days; in 1871, 35 days; in 1872, 30 days; in 1873, 109 days; in 1874, 85 days; in 1875, 39 days.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE LARGEST GLASS CYLINDER IN THE WORLD.

Mr. Thomas Degnan, of the Union Glass Works in Somerville, Mass., recently made an enormous glass cylindrical shade or cover for a statue which is to be exhibited at the Centennial. The process began by inserting a long hollow iron tube into the pot of molten glass, and by careful manipulation about 75 lbs. of the latter was caused to adhere to the tube. This was then taken to a wooden mold of semi-circular form, in which it was rolled a few times by three men, and thus brought to a white heat. It was then taken to a wooden cylinder placed beneath the floor of the factory; and after it was placed therein, Mr. Degnan began the work of fashioning the cylinder to its proper proportion, which he did by blowing through the iron tube and into the body of the glass; while at the same time, two men, guided by a wave of his hand, raised and lowered the glowing cylinder gently but quickly until it came forth finished, and measured 5 feet in height and 74 inches in circumference.

CLEANSING WATER MAINS.

It frequently happens in iron water mains that deposits of rust are formed, sufficiently thick to reduce materially the diameter of the pipe. To clean the interior, Mr. E. Dodds, an English engineer, has lately devised a pipe scraper, which operates as follows: The pipe is cut, the scraper is inserted, temporary joints are made, and the water is turned on at highest pressure, which drives the scraper on at great speed. In the first experiment, a distance of 300 yards of pipe was thoroughly cleansed in 2 minutes and 20 seconds,

CONDENSED MILK FOR CHILDREN.

Dr. Edward Smith, author of an excellent work on "Foods," thinks that condensed milk is not a suitable food as a substitute for pure milk for infants. It is more fattening but less nourishing, and greatly reduces the child's power of resisting diseases. Dr. Smith states that children brought up on impure London-fed cows' milk will resist an attack of acute disease better than children fed on condensed milk.

A NEW REFRIGERATOR CAR.

Very good success has been obtained in preserving grapes by means of a new refrigerator car which has been recently tested on the Union Pacific road. A fan blower attached to one of the axles forces air through ice, and the blast subsequently passes into the car through a perforated pipe at the bottom. After circulating among the fruit, the current returns to the blower and is again cooled. The advantage is the uniform temperature of about 40° Fah., which is maintained inside the car.

JADE.

A number of sales of Japanese and Chinese curiosities have recently taken place in this city, in which were included objects made of a material little seen in this part of the world, and about which little is here known. It is a precious stone, valuable not on account of its scarcity, because in China and Burmah large mines of it exist, but for the great difficulty encountered in cutting and carving it, necessitating an amount of patience and manual dexterity rarely found save among the inhabitants of the celestial kingdom. It is a silicate of alumina called jade, and is obtained in Tartary, various parts of China, and in the Mogoung districts of North Burmah. The true jade is hard enough to cut glass or quartz, and the most valuable pieces are of an intensely bright green hue, the ordinary material being pink and yellow. As many as 1,600 men are engaged in the jade mines of Burmah, and the substance is sometimes found in huge blocks, which three men can hardly move. The crude fragments are cut by means of thin copper disks, used in conjunction with fine silicious grit, composed of quartz and little particles resembling ruby dust. The boring of earrings and bracelets is effected by a revolving cylinder tipped at the free end with the same silicious mixture. The Chinese, with their proverbial ingenuity, make an almost perfect imitation of jade out of rice, the quality of hardness alone being absent.

AN EXPLOSIVE COPPER COMPOUND.

It has long been known that acetylen copper is a very dangerous explosive, detonating on the slightest percussion, and, worse than all, forming spontaneously on the copper pipes formerly employed to convey illuminating gas.

Recently another salt of copper has been prepared, which forms, when mixed with chlorate of potash, an explosive which may be used to fill percussion caps, torpedoes, etc. To a solution of sulphate of copper is added enough hyposulphite of soda in solution to entirely destroy the blue color. Tetrathionate of the suboxide of copper is formed, and dissolved in excess of hyposulphite of soda. To another portion of the blue vitriol solution, aqua ammonia is added until the blue precipitate, at first formed, dissolves to a dark blue solution of ammonio-oxide of copper. The two solutions are now mixed; and after long standing, a violet-colored salt crystallizes out of the beautiful blue liquor, and it is this salt which becomes explosive when mixed with chlorate of potash. The *Polytechnisches Notizblatt*, from which we obtain the above, does not state the composition of the violet salt above referred to, or the probable reason of its explosiveness, whether due to the nitrogen imparted to it by the ammonia, or to the large excess of sulphur, which latter substance, it is well known, when in a free state forms with chlorate of potash a mixture that detonates by percussion.

DEEP RED GLASS.

Pettenkofer, who analyzed the intense red glass used in antique mosaics, proposed to make it by fusing lead glass with about 9 per cent of oxide of copper and 3 per cent protosesquioxide of copper as a reducing agent. In this case, however, some of the lead is also reduced, giving a dark brown or black color to the glass, and hence Dr. Kayser employs borax as the flux. The following proportions are taken: Clean quartz sand, 60 parts; oxide of copper, 10 parts; protosesquioxide of iron, 3 parts; calcined borax, 10 parts; calcined soda, 10 parts. A high temperature should be employed during the fusing and reduction, and then it should be moderated to a dark red and kept there some time. When cold, the red glass will be covered with a thin layer of green copper glass.

ACTION OF PROTOCHLORIDE OF TIN ON CHLORATE OF POTASH.

When 2 parts by weight of stannous chloride and 1 part of potassic chlorate, both in powder, are triturated together in a porcelain mortar, the mass becomes heated in a few minutes very strongly. Beside chloric acid, large quantities of vapor of water are given off, and a yellowish white residue remains, which, when dissolved in boiling water and allowed to cool, deposits hypochlorite of potassa in splendid brilliant crystals, while the supernatant opalescent, milky mother liquor contains oxychloride of tin.

TUNGSTATE OF ZINC AS A WHITE PIGMENT.

When a solution of tungstate of soda is mixed with a solution of some zinc salt, the tungstate of zinc is precipitated as a snow-white pigment, that covers well and is recommended to artists that work in oil colors as deserving the preference over all other white pigments.