

ing, a canvas or board cover when working in the sun. When much fatigued, do not go to work, or be excused from work, especially after 11 o'clock in the morning on very hot days, especially if the work is in the sun. If a feeling of fatigue, dizziness, headache, or exhaustion occurs, cease work immediately, lie down in a shady and cool place, apply cold cloths to and pour cold water over head and neck. If any one is overcome by the heat, give the person cool drinks of water or cold black tea or cold coffee, if able to swallow. If the skin is hot and dry, sponge with or pour cold water over the body and limbs, and apply to the head pounded ice wrapped in a towel or other cloth. If there is no ice at hand, keep a cold cloth on the head, and pour cold water on it as well as on the body.

"If the person is pale, and very faint, and his pulse feeble, let him inhale ammonia for a few seconds, or give him a teaspoonful of aromatic spirits of ammonia (hartshorn) in two tablespoonfuls of water with a little sugar."

**SOME SOURCES OF BAD WATER.**

There is no such thing as pure water, neither at the sources nor anywhere else, except in a laboratory. Pure water, therefore, or good water, in ordinary parlance, is understood by the engineer to mean a palatable wholesome water, not insipid like rain water, and not foul by the reception of that class of impurities which endanger the individual health. Unpolluted water, as we have explained in a previous article, is tasteless, inodorous, possesses a neutral or faintly alkaline reaction, rarely contains in 1,000,000 lbs. more than  $\frac{1}{10}$  lb. of carbon and  $\frac{1}{10}$  lb. of nitrogen in the form of organic matter, and is incapable of putrefaction, even when kept for some time in close vessels at a summer temperature. The chief causes of pollution are found in the refuse fluids from factories and in animal sewage. By a recent law in Massachusetts, the Board of Health of that State was required to investigate the pollution of rivers, estuaries, and ponds, by such drainage and sewage. And in the seventh annual report of that body we find a valuable and complete record, in which are included detailed descriptions of industrial refuse, which now, as our industries expand, threatens greatly to impair the purity of our water sources, and so react unfavorably upon the public health.

Than some of the liquids for which there is no utilization, and which are allowed to contaminate running streams, it is difficult to imagine anything more nauseously filthy. To make thirty tuns of woolen cloth, for example, over eighty-six tuns of matter composed of grease and dirt from the raw wool, urine, oil, glue, pigs' dung, pigs' blood, urine (second use), soda, common salt, soap, fullers' earth, dyestuffs, and alum are discharged into the nearest water courses. Cotton manufacture involves the pollution of large volumes of water, partly by mineral, but chiefly by organic matters. Nearly the whole of madder dyestuff is waste. We may gain some idea of the extent of the pollution from the fact that an average factory, of 250 hands, sends out some 600,000,000 gallons of foul water per annum, charged with some 1,446,000 lbs. of refuse matter, including 42,560 lbs. of arsenate of soda, containing 833 lbs. of metallic arsenic. All the chemicals used find their way into the stream. From calico dye and print works, the total impurities are found to be 76.2 per 100,000 parts, and, from Turkey red dye works, 105.7 parts. Linen and jute bleacheries discharge caustic soda, lye, waste chloride of lime liquor, waste sulphuric acid liquor, and waste carbonate of soda and soap liquor. Works for dyeing linen and jute contribute polluting liquids essentially the same as those produced in the calico industry. Silk works discharge comparatively small quantities of dyes and gums. Papermakers contribute refuse from the dusting process, lime refuse from the treatment of soda, alkaline waste liquors from the boiling process, the insoluble part of bleaching powders, the waste bleaching liquor (if used in excess and without due caution), and the drainage of the making machines. Next to the fouling of water by the washing of filthy rags, the discharge into rivers of the soda liquor in which esparto has been boiled is the most formidable source of pollution from paper mills.

In comparison with the damage which is inflicted upon river waters by the sewage of towns and by drainage of textile fabric factories, the damage caused by the metal trades, with one or two exceptions, is quite insignificant. It consists of pollution by cinders, scoræ, and furnace ashes, by acids, and by metallic salts. Iron works pollute streams in an insignificant degree by the water used for cooling the rolls, which becomes charged with tar or coarse grease from the bearings. The waste liquors discharged from wire and galvanizing works are the most intense and noxious sources of pollution contributed by any of the metal industries. The waste contents of acid baths render river water unfit for the support of fish life, and the free acid corrodes the cement and loosens the brickwork of sewers. In some tin plate works, the sheet iron, previous to receiving its coating of tin, is pickled repeatedly in dilute sulphuric acid; but the waste liquor, instead of being discharged as formerly into the neighboring stream, is concentrated in shallow leaden evaporators, until, on cooling, it deposits a copious supply of crystals of green copperas, which is sold at a small profit. The mother liquor from these crystals is fortified with fresh sulphuric acid, and used over and over again, none being allowed to go into the streams.

The effect upon fish of a number of leading and potent polluting substances, occurring as manufacturing refuse, was the subject of elaborate experiments in Scotland some years ago. The information thus obtained was of great value, as showing the degree of dilution at which the noxious

matters prove fatal or are within safe limits. Goldfish and minnows were employed, the one species for its tenacity of life, the other on account of its delicate vitality. It appeared that, of nitric and sulphuric acid, one part in fifty thousand of water killed the fish. Carbolic acid was found peculiarly destructive; and tannic acid, in the proportion of  $\frac{1}{10000}$  for minnows, or  $\frac{1}{70000}$  for goldfish, caused death. Sulphate of copper was the most virulent metallic salt, a strong fish dying in water which contained only  $\frac{1}{1000000}$  part. Other substances proved fatal, as follows: Sulphate of iron and of alum,  $\frac{1}{100000}$ ; acetate of lead,  $\frac{1}{10000}$ ; chloride of lime (saturated solution),  $\frac{1}{10000}$ ; chlorine (saturated solution),  $\frac{1}{10000}$ ; iodine,  $\frac{1}{70000}$ ; bromine,  $\frac{1}{35000}$ ; caustic potash,  $\frac{1}{30000}$ ; foundry coke,  $\frac{1}{10}$ ; furnace cinders,  $\frac{1}{10}$ ; coal tar,  $\frac{1}{8000}$ .

The most deadly of all contaminations is sewage, and this is now believed by chemists to be all but indestructible, being only rendered insensible in the water by being diluted with at least 100 times its volume of good water. Ordinarily, the human stomach is apparently unaffected by water exposed to a considerable measure of impurities; but it becomes fearfully sensitive to the same waters during the prevalence of an epidemic. This was conclusively shown to be the case during the terrible cholera visitations in London in 1849 and 1854. It may be added that the evil effects of much polluted water, as compared with water but little polluted, which become so palpable during epidemics, cannot cease to exist, except in degree, when no epidemic prevails. Accordingly as the river waters are cleansed from the impurities which now are expected to hide themselves there, the general health of all living things depending on them and using them must be benefited.

**THE CENTENNIAL EXPOSITION.**

The ceremonies at Philadelphia on July 4 partook of a national character, and in this respect they must be distinguished from the local celebrations which took place in every city, town, and village in the country. Although not occurring on the Centennial grounds, they were, nevertheless, a part of the great scheme whereby we emphasize our rejoicing over the completion of the first century of national existence, and they therefore must be chronicled with the history of the Exposition.

The military parade which preceded the ceremonial included representative militia regiments and companies from the different States, the U. S. Corps of Cadets, detachments of sailors and marines, and civilian societies, making a display fully in keeping with the importance of the occasion. At a comparatively early hour, Independence Square, where the grand stand had been erected, became thronged; and when the formal proceedings commenced, the crowd was estimated at over 100,000 people. On the platform was grouped an array of distinguished men, such as has rarely before been seen. The Vice-President of the United States, in the absence of President Grant, presided. About him were the Emperor of Brazil, the Crown Prince of Sweden, Governor Hayes of Ohio, and the Governors of several other States, General Sherman, Count Rochambeau, besides the Foreign Centennial Commissions, the Diplomatic Body, and other dignitaries. The orchestra opened the proceedings by performing the grand overture composed for the occasion, which was followed by prayer by Bishop Stevens, of Pennsylvania. The hymn of welcome to all nations, by Dr. O. W. Holmes, was then sung. The most impressive episode of all succeeded. The Vice President's announcement of what was to come was not audible to the vast crowd; but when the Mayor of Philadelphia stepped upon the rostrum, holding aloft a faded yellow piece of parchment enclosed in a simple frame, the cheer which arose attested the recognition by the people of the original Declaration of Independence. The scene of enthusiasm which the production of the immortal document elicited baffles description. The applause became a mighty roar, the infection spread to the sedate dignitaries on the platform, and all rose to their feet and joined in the tremendous ovation. None cheered more lustily or swung his hat more vigorously than did His Majesty Dom Pedro II. Again and again the acclamations burst forth, until at last, through sheer weariness of its makers, the noise died away. Then Mr. Richard Henry Lee, grandson of the mover of the Declaration in the Centennial Congress, received the document, and in a clear voice read it. The Brazilian hymn, composed in honor and by order of Dom Pedro, was next rendered by the orchestra and chorus, and its repetition was demanded by the people. A superb ode, by far the finest lyric production which the Centennial year has brought forth, was recited by its author, Mr. Bayard Taylor, and received with storms of applause. Lastly followed Hon. William M. Evert's oration, a noble address, a shade too purely intellectual in character, perhaps, for the average thought, but none the less brilliant, masterly, and able. Its nature is such as to forbid abstraction; but the keynote of all was that the Declaration created what was declared, the independence of a new nation. The oration terminated the formal proceedings at Independence Square.

On the Exposition grounds, the Catholic temperance fountain and the Humboldt monument were dedicated with appropriate ceremonies. The attendance (in all 46,125), was somewhat above the average, a fact remarkable in itself in view of the other attractions in the city. Thousands of visitors from New York and other cities arrived, taking advantage of the holiday, and manfully doing the Exposition, despite the almost intolerable heat of the weather.

The Exposition itself is now running as smoothly as could be desired, and the only discontented people are those foreign exhibitors who are converting the fair into a market by selling their articles. They are required, under present

custom house regulations, to pay duties on an entire invoice before a single object pertaining thereto can be delivered to the purchaser, and this regulation they are endeavoring to have abrogated. The encampment of the West Point cadets in the grounds has added a new attraction, and the morning and evening parades are attended by thousands of people.

We gave last week a brief account of the

**RUSSIAN EXHIBIT**

in Machinery Hall. The principal display made by that nation is in the Main Building, and no part of the Exposition will more richly repay careful study. Russia is but little known to Americans by her productions, although accounts of her recent achievements in industry have not been wanting. The opportunity here afforded, of learning something definite regarding the wonderful growth, notably in art industries, the taste for which did not exist in 1851, but which now in Russia has reached almost a mania, is therefore of the highest value. It is not extravagant praise to say that the Russian exhibit is superb. The silver work is not excelled in the entire fair. Very curious effects are produced by imitations in white silver of the Russian napkin, with the border worked out in such a faithfully minute manner that the threads can almost be counted. These napkins sometimes form the covers of punch bowls, sometimes appear as if carelessly thrown over salvers; and so exquisite is their workmanship that they might easily be mistaken for real fabrics of linen. A peculiar Russian industry is the manufacture of a variety of articles from stones found in the Ural mountains. Malachite, jasper, and lapis lazuli are the materials mostly used; but there are also articles made of minerals quite unfamiliar in this country, such as labrador, rhodonite, and nephrite. Very beautiful are the bunches of fruits carved from the various stones, the natural colors of which reproduce almost exactly the colors of the natural fruit. We have already, in a previous article, described the magnificent malachite mantelpiece and vases. There are also numerous small tables of the same precious mineral, valued at from \$100 to \$1,000 each. A unique collection of fabrics come from Circassia, all of which are exquisitely embroidered in silk and in gold and silver. The display of furs is the finest in the Exposition, and some idea of the beauty of the articles may be formed from their cost. A little bunch of sable skins, of the finest quality, is valued at \$2,400, a lady's cape of black fox fur is marked \$1,400, and a cloak made of the backs of sables is valued at \$2,700. Some gold jewelry is exhibited, remarkable for the delicate shadings of color, varying from the lightest straw yellow to brownish red. This is produced, we learn, simply by subjecting the metal to various degrees of heat. A pavilion of graceful form is devoted to the display of rubber goods, an American industry introduced recently in Russia, which has met with remarkable success, the product of the single factory making the goods amounting, it is said, to \$5,000,000 in value per year. Some handsome carved work comes from the government school in St. Petersburg. The most noticeable object is a peasant's chair in black walnut, across the seat of which lies the imitation of a towel made of some white wood. The handles are formed of hatchets. At the back of the seat is a pair of mittens admirably carved, and in the frame appears the characteristic motto in the Russian language: "Go slow and you will go far."

The Russian government is represented by superb collections of minerals and fossils, and of school books, school furniture, and other objects relating to education. Among the other exhibits are pianos, scientific instruments, amber, soap, chemicals, ladies' cloaks of velvet lined with the white hair of the Thibet goat, fans, and umbrellas. There is also a jeweled figure of St. Alexander Nevsky standing in a kind of shrine, which may be purchased for \$3,500.

In Agricultural Hall the Russian display well represents the farming industries of the empire. There are grains of all kinds in sacks with glass covers and in sheaves, flax, wool, and dried fruits, canned goods, biscuits, wines, liquors, and so on through a long catalogue. The agricultural implements consist only of a mower, a thrasher, and a few fanning mills. Russia also makes an admirable exhibit in the Shoe and Leather Building, showing shoe and upper leathers, kid boots, shoes, gloves, etc., all of fine manufacture.

For a long time it was supposed that Russia would make no display at all; but when her government concluded to participate, it evinced prompt energy and liberality. A commission appointed at the eleventh hour made a list of the articles wanted and of the manufacturers who produced the best of each kind. The government undertook the payment of freight and insurance to and from Philadelphia, and of all expenses of installation. Thus, in a remarkably short space of time, a thoroughly good and, in some respects, exceedingly brilliant exhibit was organized.

**Longitude by Telegraph.**

The *Philosophical Magazine* has an article on the determination of the longitude of Cairo, from Greenwich, by the exchange of telegraph signals, by Captain C. Orde Brown. The actual experiments were between Porthcurnow and Alexandria, the whole series of cables being joined direct. The total length of cable was 3,222 nautical miles; 40 Menotti cells were used, although signals were read with 12 cells. The mean loss of time before the signal or make of circuit was visible was 134 seconds, and that before break of current signal was 1.28 seconds, the mean being 1.31 seconds.

THE Society of Arts, Geneva, Switzerland, celebrated the first century of its existence on June 1, 1876,