

## SCIENTIFIC AND PRACTICAL INFORMATION.

## FACTS ABOUT FIRE ARMS.

An expert will load and fire a muzzle-loading arm once every six seconds, and a good breech-loader once every four seconds. Henry C. Bull, of New Orleans, who is one of the best marksmen in the world, has invented a new breech-loader, which is charged and fired with three motions, and which he claims can be discharged once every two seconds. During the late rebellion, a large proportion of the wounds, on both sides, were in the right arms of the combatants. This was due to the fact that, in the act of loading the gun, the right arm is lifted to work the ramrod. Those carrying breech-loaders were saved from such wounds, as the loading was done without lifting the right arm. In action, the value of a breech-loader or any kind of gun depends upon the rapidity with which the second shot can be fired after the first volley is delivered.

## ADULTERATED SILK.

Ladies who admire the rich, heavy, stiff black silks which are sold at some shops, at apparently low prices, may be interested to know that a large portion of this richness is composed of salts of iron and astringents, with salts of tin and cyanides. The silk is merely a thin skeleton which supports the adulteration until the goods are sold.

## FAILURE OF COPPER SULPHATE.

Railway sleepers injected with sulphate of copper will be preserved indefinitely, provided the copper remains in its original combination with the ligneous tissue. But M. Max Paulet shows that, on railways where carbonate of lime exists in the stone ballasting of the track or in the soil, the carbonate gradually penetrates the wood and substitutes the copper. Decay then follows, for carbonate of lime is not a septic agent.

## COTTON SAMPLING BY HAND.

During the late civil war, when the supply of American cotton was cut off, a great stimulus was given to the cultivation of the fiber in India, and the price of Indian cotton, although rated of poor quality, rose to a high figure. But as soon as the war terminated, the American staple at once assumed its wonted preference, and the Indian article shrank to zero. The British authorities have always desired to encourage the Indian product, and it has been claimed that, if proper gins could be produced, the staple might be cleaned and separated from the seeds without the injury heretofore experienced. Dr. Forbes Watson, of Manchester, has for some time past been engaged in this work, and a trial of a number of different gins upon various samples of Indian cotton has recently been made. The cleaned specimens were then sampled by the fingers of experienced brokers, with the queer result that different samplers placed different values upon similar specimens, while, in some cases, a broker in sampling different packages of the same cotton would assign different values to each package. So unreliable were the general results thus obtained that it became necessary to cause the various specimens, in lots of 20 lbs. each, to be made up into yarn. The yarn is to be subjected to definite trials of quality and strength. This will effectively settle the question of commercial value, which the brokers are unable to do.

## THE ECLIPSES OF 1875.

There are but two eclipses to appear during the present year, both of the sun. That of the 15th of April, however, will be quite remarkable, in point of length, as it is predicted that the duration of totality will be greater than during any of the succeeding eclipses due in 1878, 1886, 1892, 1893, etc. Mr. Hind, by new calculations, finds that on Bentinck Island the period of total obscurity will last over 257 seconds. The central line will pass to the north of Kaikal on Camorta Island, in the Nicobar Archipelago, at which point the duration of totality will be ten seconds longer.

The phenomenon will be visible at Bangkok, and hither the King of Siam has already invited observers. M. Janssen will, it is stated, proceed to that city, and the Royal Society has already organized an expedition, to be superintended by Mr. Lockyer.

## THE DEBTS OF THE WORLD.

The *Pall Mall Gazette* carefully summarizes the debts of the nations of the world, and calculates the aggregate sum to be \$23,750,000,000. France owes the most, then Great Britain, and then the United States. Canada is the least in debt of any civilized country. Egypt pays the highest rate of interest, or ten per cent, and Holland the least, two and three quarters per cent. England can borrow at the least rate, three and one quarter per cent, and Mexico is charged the most, or eighteen per cent.

## Geographical Progress in 1874.

Chief Justice Daly, President of the American Geographical Society, recently delivered his annual address before that association, and in so doing gave a most interesting account of the world's progress in geographical knowledge during the year lately closed. He began by remarking upon the physical occurrences, in the shape of great rainfalls, floods, earthquakes, extreme cold, etc., all of which he stated were remarkable for their violence and destructive effect; and after a brief reference to the transit of Venus, and Howarth's theory that the earth is gradually shrinking at the equator, he reviewed the general theories of oceanic circulation. Dr. Carpenter still advocates the view that there is a constant flow of cold water from the polar regions to the equator, which, reducing the ocean level at the poles, causes an indraft of the warm surface water of the Atlantic to flow toward the poles from the equator, thus producing a horizontal circula-

tion which completes itself, and accounts for the Gulf Stream and other phenomena connected with the currents and the course of the trade winds. Mr. Croll, on the other hand maintains that all the movements of the water of the ocean, the deep as well as the surface waters, are produced by the action of the winds upon the surface, in connection with the motion of the earth.

Commander G. E. Belknap, charged with ascertaining a practicable route for a telegraph cable between Japan and Puget Sound, carried on a series of deep sea soundings in that part of the Pacific Ocean, which are of the highest interest, as they confirm the great depth of the Pacific and the powerful action of submarine currents. The soundings of the Tuscarora have been continued by Commander Erben, to ascertain the suitability of the ocean bottom for a telegraph cable from San Francisco to Honolulu, in the Hawaiian Islands, and the result is that it is suitable over the whole distance, from its almost unvarying soft oozy bottom.

In Europe the governmental surveys heretofore commenced have been continued. That the remains of the ancient city unearthed by Dr. Schliemann are those of Troy is still contested. Those who dispute it, however, are scholars who have never examined the locality.

The recent excavations in Pompeii show that what has been revealed after the course of so many years is, after all, only a small part of the city, and every extension adds new objects, and some are of the deepest interest.

The excavations that are now going on in Rome are bringing to light numerous quantities of objects, especially on the Esquiline, relating to nearly everything connected with both the public and private life of the Romans.

An ancient Egyptian medical treatise has been discovered by Professor Ebers, of Leipsic, which was written 1,600 years before Christ. It is a handbook of Egyptian medical science at that time, and the description of the drugs mentioned in it shows that, at that period, Egypt had extensive commercial relations with Western Asia, and that there existed then an interchange of thought and knowledge.

Lieutenant Cameron has made a most important geographical discovery, which fixes the furthest source of the Nile within known limits, and which there is every reason to think will connect the network of lakes and rivers, of the water system that Livingstone was investigating, with the great rivers that flow to the western coast of Africa and probably with the Congo. Lieutenant Cameron surveyed Lake Tanganyika, and ascertained the elevation of the lake to be 2,710 feet.

The expedition of Rolfe for the exploration of the Lybian desert has returned. It was found to be the most sterile part of the Sahara. It is the dried-up basin of a shallow sea, below the level of the Mediterranean.

Colonel P. F. Warburton has made a remarkable journey across Australia, from Adelaide to the west coast, which was achieved under the most extraordinary difficulties. After the first 200 miles, the whole region traversed was a dreary and scarcely habitable waste, the country, with but few exceptional places, consisting of ridges of sand, with intervening flats which are without water and uninhabitable. The natives found are on the very lowest scale of humanity. They had no huts nor places of shelter, except the shady side of a bush.

## The English and American Transit Campaigns Compared.

"It seems to me," says Professor Richard A. Proctor, "that a useful lesson may be learned by comparing the methods in which the two great English-speaking nations dealt with the late transit of Venus. We English, unless stirred by emulation, are slow to move; and though we do things in a thorough way, we seldom select the most effective methods for achieving our ends. Our American cousin is less ponderous in his movements, and, though to the orthodox British mind his methods may sometimes seem 'rough and ready,' yet he generally manages to accomplish his object, which after all is the important point. Not unfrequently the ingenuity and fertility of resource of Americans enables them to go easily ahead of us—not indeed that Englishmen are wanting in these qualities, but that either we are slow to exercise them or else find their exercise not appreciated. I was repeatedly struck by this during my stay in America, not only or even chiefly in scientific matters, but in contrivances relating to the conveniences and luxuries of life. To take a few out of many examples: With an enormous country, relatively thinly peopled, their system of railway traveling is altogether superior to ours: railways on our system would not pay their expenses in America; and yet notwithstanding a far higher cost per mile, our railway traveling would be simply unendurable there. With winter weather so bitter, in the greater part of the States, that by comparison the cold we thought so much of last December seems trifling, they have warm rooms and warm houses at a tenth part of the expenditure of fuel by which we manage to roast half the body while the other is chilled by cold drafts. They have only recently (by comparison) established meteorological observatories, yet already they have morning and afternoon weather announcements, nine times out of ten correct, for the whole area of the States west of the Mississippi; while we are laboriously, and at great expense, publishing each day announcements of the weather of the day before, as if that could be of any real use. In scientific matters they have a quiet way of taking up and settling matters which we in Europe have most ingeniously and elaborately failed to solve. I incline to think that this circumstance appeals rather strongly to their sense of humor; for we publish our failures rather too ostentatiously. We got the start of them, indeed, in the matter of the solar prominences, though only by de-

parting from old usage and giving our younger men a chance. But they showed us how to settle the question of the corona, which we had been pottering over ineffectually; and it must never be forgotten that our eclipse successes in 1870 and 1871 were due to their example. Professor Young in America has gone far ahead of us in the analysis of solar surroundings. Professor Langley's investigation of the details of the sun's surface is far better than any yet made by European astronomers. They first photographed the moon, though some of our writers conveniently forget the Drapers, as well as later successes of Rutherford. Every European attempt to measure the duration of the lightning flash, or of the electric spark, failed; but Professor Rood (of Columbia College, New York) has not only measured the duration of the electric spark, but has actually succeeded in determining the relative duration of different portions of the flash. And this is only one instance, out of several, in which Professor Rood has accomplished a feat of this sort—I mean the mastery of an experimental problem of exceeding delicacy. Professor Mayer (of the Stevens Institute, Hoboken) has successfully dealt with acoustical problems, which had been practically abandoned as too difficult by European experimenters. But these are only typical instances, selected almost at random. In passing from them let me remark that I am far from thinking that our American cousins really surpass us in scientific acumen or ingenuity, though I think they are much more fortunate in their methods and in their opportunities for exercising these qualities.

Their action in the matter of the recent transit affords an excellent illustration of their method of dealing with scientific subjects—a method characterized by the combination of scientific exactness with readiness of resource and practical common sense.

Having selected eight stations, three in the northern and five in the southern hemisphere, where the whole transit would be visible, the Americans started with a chance of success far greater than we possessed. For we had but one station in the northern hemisphere (in North India) where the whole transit could be observed.

In the more important question of the method for applying photography, the American and English astronomers took different courses. I set on one side, as peculiar to our plans the use of the Janssen turning arrangement for securing internal contacts, and speak only of the methods for photographing the progress of the transit. The English and European astronomers set themselves the task of securing neat and well defined sun pictures, trusting to these pictures to indicate the true position of Venus on the sun. The Americans (and the astronomers of Lord Lindsay's party, be it noticed) set themselves the task of securing pictures which would indicate the true distance between the centers of the sun and Venus, independently of any special exactness in the definition of the limbs of the two orbs. It seems to me, viewing the matter in its mathematical aspect, that the American astronomers prove to demonstration (using the estimates of photographic work given by De la Rue and other advocates of the European arrangement) that the result of the best possible photographic successes by the European method cannot give the parallax with even as small a probable error as that affecting the determinations already obtained.

Whether we consider their general plan, or their arrangements as to details, Americans showed themselves well advised and skillful. Instead of trusting (in the main) to a single method, they had at every one of their stations four methods available. Having ascertained the untrustworthy nature of contact observations, they took measures for determining the chord of transit by photography; and having decided on this course, they adopted a mode of photographing the sun which insured measurable pictures."—*English Mechanic*.

## The St. Gothard Tunnel.

The works of the St. Gothard Tunnel continued to progress satisfactorily during the past year. The length of this immense work will be 14,920 meters, or nearly nine and a-half miles. The altitude of the northern entrance at Goeschenen will be 3,608 feet above the level of the sea, and that of the southern entrance 3,756 feet. The highest point in the interior of the tunnel will be 3,780 feet above the sea level, and it will be reached from the Goeschenen end by a rising gradient of 7 per 1,000. From the summit there will be a falling gradient of 1 per 1,000 to Airola. The rock to be traversed is for the most part mica gneiss and mica schist. The most recent reports received in England respecting the progress of this important undertaking state that at the date of the report—October 21, 1874—the work done, and that remaining to be done, was as follows: Total length of tunnel, 48,651 feet; total length driven up to October 31, 8,661 feet; of tunnel remaining to be driven, 39,990 feet.

## Boracic Acid.

At a recent meeting of the Chemical Society, Mr. Howard said boracic acid destroyed vegetable growth—grass, for instance—with a vigor and permanence which, if it were a fertilizer, would render it invaluable.

Mr. A. Smee, Jr., had found that, if 1 part of a 10 per cent solution of boracic acid were added to 8 of milk, it would keep it sweet for a week.

Dr. J. Edmunds, in a complicated case of amputation of the thigh, had employed dressing of lint, steeped in a hot saturated solution of boracic acid, with most satisfactory results in preventing putrefactive discharge. The bandage could remain for thirty-six or forty-eight hours without the slightest putrefactive odor.

Pipe clay rubbed on the hands will remove the unpleasant odor of chloride of lime.