SCIENTIFIC AND PRACTICAL INFORMATION.

TUNGSTEN IN THE ARTS.

In the last few years the consumption of tungsten and its compounds has vastly increased. It is now used for improving the quality of puddled iron and steel as well as cast steel, and is one of the constituents of Mushet's special steel. Its addition to German silver renders it tougher, and it is employed in many other alloys with gold, silver, lead, etc. One alloy called minargent contains 100 parts copper, 70 nickel, 5 tungsten, and 1 aluminum. Bartels in Hanover makes a large number of tungsten preparations for use in dyeing and printing; the tungstate of soda serves as substitute for tin salt, for fireproofing fabrics, and for the manufacture of bronze powder and blue carmine. In cosmetics, tungsten is taking the place of white lead and zinc. Tungsten in steel gives it the property of retaining magnetism for a longer time and makes it useful for magnetic needles.

CONVERSION OF STARCH INTO SUGAR.

The conversion of starch, cellulose, and the like into glucose or grape sugar has usually been accomplished by the use of dilute acids in open vessels. Some Parisian chemists, Gibon, Dusart, and Bardy, now propose to conduct this operation in closed cylinders under a pressure of 3 to 4 atmospheres. The proportions taken are 35·3 cubic feet water and 4·4 pounds sulphuric acid to 4,400 pounds dried starch, and the operation lasts two hours. If a thicker sirup is desired, it is only necessary to diminish the amount of water taken. Some other acid may be used than sulphuric. The advantage of the process consists in obtaining the desired product by a single operation, since neither concentration by evaporation nor filtration is necessary.

DETERMINING THE QUANTITY OF ALCOHOL IN FUSEL OIL.

When fusel oil is imported into England, it is admitted free of duty, provided that it does not contain over 15 per cent of alcohol of 0·92 specific gravity. The method employed in the London custom house for determining the amount of alcohol depends upon the insolubility of fusel oil in water. A certain quantity of the liquor to be tested is shaken with an equal volume of water and left standing for 12 hours. At the end of that time two layers are formed, the upper one of fusel oil, the lower of alcohol and water. The specific gravity of the latter is taken, and from it the percentage of proof spirits is calculated.

This method, according to Dr. G. L. Ulex, gives too high a percentage of alcohol, for crude fusel oil contains not only amylic alcohol, but also ethylic, propylic, and butylic alcohols, which are more soluble in water. Ethylic alcohol is soluble in every proportion, propylic alcohol is very soluble, butylic alcohol dissolves in 10 parts of water, amylic alcohol is as good as insoluble.

From some experiments by the author, he found that fusel oil from beets consists of 2 parts of soluble alcohols and 1 part insoluble alcohol, and that only a small part of the former is wine alcohol. Although this liquor contains only 3 to 4 per cent of proof spirit, according to the custom house rules it would seem to contain 40 per cent of proof spirit and be taxed accordingly. This leads to very great injustice in English import duties, and although this law is not in force here, we give the following more accurate method of making the determination:

The boiling point of absolute (ethylic) alcohol is 173·12° Fah.; that of propylic alcohol, 206·6° Fah.; butylic alcohol, 228·2° Fah.; amylic alcohol, 269·6° Fah., so that this difference can be employed in separating them. If wine alcohol is present in considerable quantities, it alone will be found in the first portion of the distillate. Three and two fifths ounces of the fusel oil to be tested is placed in a retort and 1·35 drams distilled off. This distillate is mixed with an equal quantity of a saturated solution of common salt, and, after shaking, left to settle. If the quantity of fusel oil then found floating on the top is 40 minims or more, it is certain that less than 15 per cent of proof spirits is present, and hence it is free of duty. If the quantity of fusel oil is less than that, the liquor is tested by mixing it with an equal quantity of salt solution, shaking, and allowing to rest.

The salt solution is then separated and distilled by itself, and the quantity of proof spirit determined in the distillate by taking its specific gravity.

THE VELOCITY OF LIGHT.

Olaf Roemer, an eminent Danish astronomer, while observing the eclipses of Jupiter's satellites, in 1676, found that light occupied about 16 minutes and 26 seconds in passing through the diameter of the earth's orbit, and assuming the distance of the earth from the sun to be nearly 95,000,000 miles, he determined the velocity of light to be 192,500 miles in a second.

In 1723, Bradley, an English astronomer, discovered the aberration of light, and determined its velocity to be 191,515 miles per second.

In 1849, M. Fizeau invented an apparatus for measuring the velocity of light between terrestrial stations, and determined it to be 194,677 miles a second.

M. Foucault, with substantially the same apparatus, determined the velocity to be 185,177 miles per second, and showed that this result was correct to within $\frac{1}{500}$.

Quite recently M. Fizeau has published the particulars of a long series of experiments, made between stations about 6 miles apart, using the rays from a oxyhydrogen light; and he gives, as the mean of 650 good observations, a velocity of 186,363 miles per second. The result obtained by Roemer is usually given in test books, and in fact is commonly quoted as the correct velocity of light. But the close agreement of the more recent researches of MM. Foucault and Fizeau, and the elegant methods used by these philosophers in their researches, render it nearly certain that the velocity of light in the air is between 185,177 and 185,363 miles per second.

SULPHITE OF SODA AS AN ANTICHLOR.

The term antichlor, which applied originally to any substance employed to destroy the free chlorine remaining in fabrics bleached with it, is now almost entirely limited to hyposulphite of soda, $Na_2S_2O_3$. During the reaction of this salt upon chlorine, free sulphur is deposited upon the fabrics, much to their detriment. The probable reason, that this has never before been observed, is because its injurious effects have been attributed to overbleaching. This finely divided sulphur, when deposited in the fiber of paper, gradually oxidizes to sulphurous and sulphuric acid, which renders the paper brittle, and, if written upon with iron ink, bleaches or fades it. This effect upon paper has sometimes been attributed to its containing too much wood fiber.

A larger quantity of active sulphurous acid can be obtained from a given weight of sulphite of soda, Na_2SO_3, than from an equal weight of the hyposulphite, and from this no sulphur is deposited, so that it ought most certainly to be preferred for use as antichlor on a large scale. We are informed by large manufacturers of chemicals that sulphite of soda can be made at a price not higher, in proportion to its efficiency, than the hyposulphite.

Jet---How and Where it is Obtained.

A writer in the *Practical Magazine* gives the following interesting particulars regarding jet, a material much used for the manufacture of mourning jewelry. In this country, we may remark, the substance is largely imitated by vulcanized rubber, which, when new, closely resembles the genuine article. Real jet jewelry mounted in gold is worth from five and six to as high as seventy dollars per set, the price, however, depending principally upon the quantity of precious metal used. It is very serviceable, and, unlike rubber, it retains its brilliancy.

Jet is of two distinct species—hard jet and soft jet—but the latter is of very minor importance and will be referred to hereafter.

The hard jet is found in the strata known as the jet rock, which appears to be a deposit of sea anemones, and some years ago a patent was taken out to distil petroleum from it.

The jet rock occurs in the lias formation, some thirty yards above the main band of Cleveland ironstone, and is discovered in compressed masses in layers of very different sizes, being generally from half an inch to two and a half inches in thickness, from four to thirty inches wide, and four or five feet in length. It invariably tapers away, running, as the miners say, to a "feather edge."

These jet layers are always protected by a skin, the color making another division; for that found in the cliffs by the sea has always a blue skin, while that discovered in the inland hills has a yellow coating. The jet found in the same mine varies very much in quality; its worst specimens, those which are quite brown and will not take a polish, are termed "dazed jet."

The soft jet is confined to the lower oolite—in the sandstone and shale—some 160 yards higher than the hard jet, and is undoubtedly of a pure ligneous origin, the fiber and the branches of trees being more or less distinctly marked.

The most valuable finds of jet have been washed down by the sea's action, where the jet rock crops out in the cliffs, and on the cliffs, where the seams are exposed. The dealers of the town of Whitby, in Yorkshire, England, where the principal deposits of the material exist, rent these jet cliffs and inland seams from the owners, generally for a fixed lump sum paid in advance—not for a royalty—for the right to work a certain number of yards. Nearly all the jet now obtained is found inland, but in former days tales are told of men being swung by ropes over steep cliffs like the eider-down hunters of Norway. At present, cliff jet is worked with the same mining operations as that lying under the inland hills.

The process is very simple, and, to those acquainted with the intricacies of iron and coal mining, of no very great interest. A mine is commenced by drifting into the face of a rock a passage of seven feet by five. A tramway is then laid down, and the shale is tilted from the mouth of the mine, the drift continued for about forty yards, at the rate of from two to four feet *per diem;* then cross drifts are started in a variety of directions. As soon as the rock becomes too hard, the miners retire, pulling in the roofs as they recede, for the bulk of the jet is found generally in the falling top rock.

There are at present twenty-three jet mines in full work, only one of these being of soft jet. The average number of men employed in each mine is six, and there are now some hundred and fifty miners engaged in this industry. The men are generally paid by the week, and only earn from twenty-four to twenty-six shillings—a sorry contrast to the high wages of the iron miners.

Hard jet varies in prices from 75 cents to $3.50 per lb.; soft jet from $1.37 to $7.50 per stone, according to size and quality, and sometimes also according to the fluctuations of the market. For instance, when the Prince of Wales' life was in danger, Whitby was thronged with buyers for both the raw and manufactured article at any price, and some speculators were severely bitten by his happy recovery.

It is stated that the turn-over in rough English hard jet amounts to $200,000 annually.

The material is manufactured as follows: The jet is first peeled and stripped of its skin, be it blue or yellow, by means of a manual chipping process with a heavy iron-handled chisel. It is then sawn up into the exact sizes for the object for which it is intended, the saw being guided by an ingenious arrangement of little wooden directors. Much care is taken in this process of "sawing up," for great economy can, by rigid supervision, be effected, one manufacturer stating that by a very simple arrangement he was able to make his raw material go a fifth further than any of his rivals. The little fragments are then delivered to workmen, who, with the aid of small grindstones driven by a foot treadle, take off the angular portions and reduce them more nearly to the required dimensions. They then pass into the hands of the carvers who, with knives, small chisels, and gouges, soon, if it be rough work only, cut them into the desired pattern. If the work, however, be really artistic, the carving is of course a much more artistic process; and it is curious to see lads and men, who one might fairly think had not the slightest knowledge in the world of art principles, cut deftly and rapidly cameos that in their beauty of profile resemble the old masterpieces; flower scrolls and groups of fruit that have a marvellous fidelity to Nature herself; and crucifixes and pendants that rival all the ingenuity and patience of the "heathen Chinee." Sometimes you notice them with a pattern placed before them, or with a rough design scratched by a knife's point upon the material itself—oftenest, however, it would seem as though the work were altogether original.

After being carved, the goods are removed to the polishing room, where the first process, in the case of rough goods, again takes place, upon a treadle grindstone fed with oil and "rottenstone." Then the finish and the polish are given by what is termed "rougeing." Here the articles are held against quickly revolving wheels, covered with chamois leather for the larger portions and with strips of list for the indented parts of the pattern, the beautiful polish being given by means of a composition of a red pigment and oil. They are then set (the settings all coming from Birmingham) and taken to the warehouse, where they are carded, or strung if necessary, and priced and packed by young women, being then stored for the inspection of the buyers.

NEW BOOKS AND PUBLICATIONS.

THE COMMERCIAL AGENCY REGISTER, published by the McKillop & Sprague Co., 109 & 111 Worth Street, New York.

We are pleased to learn that our old neighbors and friends, Messrs. McKillop and Sprague, continue to prosper, and to issue their semi-annual volume, improved and enlarged. Their present premises are much better and larger than those they occupied at 37 Park Row; and are, we believe the best and most commodious offices in the United States used in that business. The up town movement, however, has not disconnected them from their down town subscribers, as they have established a branch office at 128 Pearl Street, near Wall, connected with the office 109 & 111 Worth Street by telegraph; they can also, from their own office, telegraph to their correspondents at any point. Their Register is a large volume, full of information such as every dispenser of credit requires, be he machinist or manufacturer: while their weekly circular gives the important changes occurring from day to day. On their circular they indicate the change, the Private Key to which is printed in front of the Register. To us this appears a most valuable feature, and it enables every holder of a book to mark off the changes, weekly.

THE UNITY OF NATURAL PHENOMENA, a Popular Introduction to the Study of the Forces of Nature. From the French of Emile Saigey, with an Introduction and Notes by Thomas Freeman Moses, A.M., M.D., Professor of Natural Science in Urbana University. Price $1.50. Boston: Estes and Lauriat, 143 Washington Street.

In this work, M. Saigey has collated some of the more strikingly similar natural phenomena, and applied them to furthering the belief in the great truth that all Nature is one harmonious system. Although the doctrines of the correlation and conservation of force, and of the unity of all the sciences, have been already promulgated by higher authorities than our present author, there is much food for reflection and pleasant reading in this work, which aspires rather to popularize facts already ascertained than to startle the world by its originality.

BREECH LOADERS. By "Gloan." Price $2. New York: G. E. Woodward; Orange Judd & Co., 245 Broadway.

The author of this readable little book has given, in addition to a practical description of the construction, mechanism, and treatment of a breech loading shot gun, a very curious historical account which will surprise many readers, as it demonstrates the origin of the breech loading system to be at least four centuries old. The book is written in a chatty, pleasant style, and will be acceptable to the numerous votaries of outdoor sports.

REPORT OF THE MINISTER OF PUBLIC INSTRUCTION for the Province of Quebec, for the year 1871. Montreal: *La Minerve* Press.

This pamphlet gives the reader a favorable impression of the state of education among our Canadian neighbors, and explains the system, of imparting instruction in all branches of knowledge, now used in the British provinces on this continent.

ON YEAST, PROTOPLASM, AND THE GERM THEORY. By Thomas H. Huxley, F.R.S.

THE RELATIONS BETWEEN MATTER AND FORCE. By John H. Tice, St. Louis, Mo.

Price 25 cents. Boston: Estes and Lauriat, 143 Washington Street.

The first of the papers in this pamphlet is most welcome, as it gives us one of the most striking of modern theories on the mystery of the origin of life, as explained by one of the creators of contemporary science, in a popular and accessible form. The second essay is full of thought and sound argument, and will be widely read as a new contribution to our knowledge of the question of all questions in the world of physics.

A TABLE OF CHANGE WHEELS FOR THE SCREW CUTTING LATHE. Camden, S. C.

This heading is all the information we possess as to the origin of one of the most handy little books we have ever seen. We have, dozens of times, answered queries on the proportions of screw cutting gear, and here we have, neatly printed, the whole subject reduced to tabular form and giving the figures to three places of decimals. We regret we cannot give the author and publisher due credit for this practically useful publication.

DIGESTION AND DYSPEPSIA; a Complete Explanation of the Physiology of the Digestive Processes. By R. T. Trall, M.D., Author of "The Hydropathic Encyclopædia," "The Hygienic Handbook," etc. New York: S. R. Wells, 389 Broadway.

Accurate information on health and dietetics is a public necessity; and we have here a fresh contribution to the voluminous literature on the subject. The book is copiously illustrated.