Scientific.

IRON INTO FINE STEEL WITHOUT FUSION.

Various processes are at present known for converting cast-iron into steel; those most in use being the Bessemer process, which consists in refining by contact with the oxygen of the air, and that known as Reaumur's process, which acts by means of reaction, and which has been greatly improved by Siemens, Pierre, Martin and others. Ingenious as all these processes are, none of them have yet yielded—nor can they ever yield—anything but imperfect results; the products in all cases consisting of compounds which are intermediate between true pig-iron, cast-iron and steel. For the purpose of getting rid of these defects, and of improving the quality of the metals, they are maintained for some hours at a red heat, in the middle of a mass of charcoal, over which is slowly passed a current of nitrogen, carbonic oxide, and various gaseous hydrocarburets. Wood, charcoal, peat, coke or any kind of vegetable matter, well dried and heated to a temperature of about 122° Fahr., is plunged into some hydrocarbon, such, for instance, as schist oil, which has been heated to the same temperature. Under these conditions, the liquid is absorbed by the carbonaceous substance in the proportion of from 12% to 15%. A pile is then formed of alternate layers of bars of Bessemer metal, Martin iron or other product resulting from the refining of pig-iron, according to one or other of the processes above referred to; the whole is placed in the receiving apparatus, which consists of a kind of retort of any shape, heat being applied gradually until the iron reaches a red heat. By these means, the excess of oxygen contained in the vegetable substances forms an oxide of carbon, by combining with the vaporized hydrocarbon, and the nitrogen assists in the formation of ammonia, so that the metals are surrounded by the gaseous compound which is recognized as being the best for their conversion into finished steel or cementation steel.

PLAYING BALLS.—India-rubber has been very largely employed of late in the manufacture of playing balls. These are made either solid, inflated, or self-inflating, and are used for a variety of games. The majority of the solid india-rubber balls, until very recently, were manufactured in Germany, but an English firm having acquired the secret of their success, a very large portion of the trade has reverted to this country. All description of india-rubber balls, with the exception of foot-balls, are vulcanized in strong iron molds, cast in two sections, and turned perfectly true on the inside; a number of these molds, when the rubber has been inserted, are usually secured together by one pair of clamps. The secret of the German method of manufacturing solid india-rubber balls consists in rendering the interior of the rubber porous, while the outside is perfectly uniform and smooth. The object of this is not only to make the ball much lighter, but to make it appear more elastic, and thus impress the uninitiated with an idea that they are manufactured from a better quality of india-rubber than they actually are. To produce this effect, the following ingredients are mixed together: 20 lbs. of African ball rubber; 11½ lbs. red lead; 46 lbs. vulcanized (best rubber) crumbs; 46 lbs. vulcanized dark compound crumbs; 6 lbs. salt, wet sawdust, or other substances capable of rendering the material porous by expansion when subjected to a high temperature. Total, 129½ lbs. The mixture is placed in crumbs in the molds, a solid wooden ball being used as a sort of kernel or center for each ball.

UTILIZATION OF EXHAUST STEAM.—According to the invention of Mr. N. W. Ericson, of Stockholm, he lets steam of higher pressure, or higher temperature, or both higher pressure and temperature than the pressure or temperature, or both, of the steam which is to be used in a steam-engine or for any other purpose, pass into an apparatus for the suction and compression of elastic fluids, in order that the said higher or stronger steam may in such apparatus act as the suction fluid to the said spent steam; this suction and compression apparatus is further connected with the apparatus wherein steam is to be used in order that the spent steam may to a great or less extent be drawn into the suction and compression apparatus when the acting or higher steam passes through it. The mixture of the acting or drawing steam and the spent steam passes through the delivery pipe of the suction and compression apparatus (and its continuation, as required) either to the place where the thus compressed steam is to be used, or else first through an apparatus containing saturated steam, or water, or in so near connection with water that the steam if in a superheated state becomes more or less saturated or lowered in temperature, or else into an apparatus wherein the steam, by cooling, is rendered liquid, and the heat thereby given out is used for generation of fresh steam. This latter apparatus may be the steam boiler in which the acting superheated steam is generated, or another steam boiler or vessel. The suction and compression apparatus may be any suitable section and compression apparatus, such as an annular or other jet apparatus.

SPONTANEOUS GENERATION.—Another contribution to the spontaneous generation controversy, favoring the germ theory, has just been published by Prof. Tyndall, in a paper to the Royal Society. He reports that he took with him to the Alps during the past summer one hundred flasks of infusions, 50 of turnip and 50 of cucumber, that had been prepared in the laboratory of the Royal Institution, and carefully sealed. Of these 20 were broken in transportation, and were found to be swarming organisms. Another lot was opened in an atmosphere in which saw-dust had been shaken up, and was soon turbid with organisms; others were found to be infected by the proximity of a cascade of water derived from melting snow; while others that were opened in the pure air of the mountains were found to remain clear and uninfected. These results of Prof. Tyndall are entirely confirmatory of his previous experiments and announcements, in which he has always taken strong ground against the hypothesis of spontaneous generation advocated by Bastian and others, and has maintained the view that the origin of the swarms of organisms that make their appearance in decomposable animal or vegetable matter must be explained upon the supposition of infection from without, through the direct instrumentality of the air bearing the germ of these organisms in contact with the medium suited for their development. Tyndall, in the paper above referred to, places himself again on record as an opponent of spontaneous or non-parental generation.

SILICIURET OF IRON.—The London *Engineer* reports that the French *Société d'Encouragement* has undertaken to examine into the uses that can be made of the new compound, "siliciuret of iron." An ingot, weighing about 3 kilogs. (6.6 pounds) was sent to the Society by Prof. J. Lawrence Smith, having the following properties: Color, like platinum; specific gravity, 6.5; easily broken with the hammer; does not rust in the air; is not corroded by concentrated nitric acid, and is scarcely attacked by any reagents except fluohydric acid and by fusion with alkalies at a red heat. As a substitute for the rough-and-ready mode of testing iron and steel with the hammer, Mr. Hering proposes an electro-magnetic test. The pieces to be tested (wire, rods, bars, etc.) are passed through a magnetizing helix, when, if any break in the continuity of the fiber exists, the same may be detected by means of a magnetic needle suitably mounted on a block above the helix through which the test pieces are drawn.

DRAWING IN SCHOOLS.—The report of the judges on the school drawings lately exhibited at Boston, from various towns of the State, says that there is no feature of the exhibition this year so pronounced as the "systematic educational treatment of drawing in public schools, to make it useful as a preparation for the practical duties of life, as well as to employ it as an implement of education whereby knowledge of other studies may be acquired, rather than to consider it as an ornamental study only, of little practical importance. It is a triumph for drawing as an elementary branch of education, that all mere picture-making has been abolished, and a thing of work having industrial aims and means substituted for the thing of play that drawing used to be."

A NEW PROCESS OF GLAZING.—A new process of glazing has been introduced by which putty may be altogether dispensed with. Vulcanite is the substance that is to take the place of the old material. The window sashes under the new system are to be so arranged that the glass may be fixed into the grooves prepared for it, and, coming into contact with a strip of vulcanite attached to the frame, the glazing is complete. Any unskilled workman can fix the glass, and, when fixed, there is no putty to perish under the action of the atmosphere.

THE electrical resistance of pure water, according to the experiments of Messrs. Exner and Goldschmidt, decreases uniformly as the temperature rises. At 99° C. (= 210.2° Fahr.) it is only one-third of what it is at 2° C. (= 68° Fahr.). A similar result is observed with water acidulated with sulphuric acid.