THE BESSEMER PROCESS UNDER PRESSURE

MR. BESSEMER has lately patented a method of conducting his process of converting cast-iron into steel *under pressure*, in order to raise the temperature of the metal during the process of conversion, and to obviate the inconvenience experienced when certain of the purer qualities of Swedish pig-iron made with charcoal, and also some of the less grey and the white hematite pig-irons of this country, when treated by the ordinary process, do not produce sufficient heat in the converting vessel to allow all the steel made from them to retain complete fluidity until it is poured into moulds.

The following description of the apparatus is extracted from *Engineering*, to the editor of which journal we are indebted for the use of the woodcuts.

In the annexed engravings, Fig. 1 is a vertical section of a Bessemer converter constructed on this plan, *a* being the upper part of the converting vessel; *a* ×, the lining of ganister; and *q*, the strong riveted iron shell or vessel on the inside of the mouth of which the iron hoop, *c*, is riveted; while *d* is a flanged iron ring bevelled on the inside, and secured by screwed studs or cotter bolts to the hoop, *c*. A moulded ring, *e*, of fire-brick or other suitable refractory material, forms the escape opening or mouth of the vessel; it is retained in place by means of the flanged ring, *d*.

The aperture in the movable mouth of the vessel thus formed may in some cases be made small enough to retain the gaseous products resulting from the combustion of the carbon or other matter contained in the pig-iron under a pressure much above that of the surrounding atmosphere, so that the combustion going on in the converting vessel may be under "high pressure," and by reason of the combustion so taking place under a pressure much greater than that of the external atmosphere a more intense heat would be produced and imparted to the metal. As a guide to the workmen, Mr. Bessemer states that for the conversion of the purer kinds of Swedish charcoal pig-iron and for mottled or white hematite pig-iron mixed with grey a back pressure in the vessel from 8 to 15 lb. on the square inch will give good results, and in but few cases will a pressure of 20lb. per square inch be necessary. It will be understood that the pressure of the blast of air forced into the converting vessel must be increased in proportion to the back pressure caused by the penning up of the gases within the vessel.

Another arrangement is illustrated in Fig. 2, which represents a vertical section of the upper portion of a converting vessel or chamber in which molten pig or other carburet of iron is to be treated either by the injection of the fluid nitrate into the molten metal, as patented by Mr. Bessemer in March last, or in which vessel the nitrates or other oxygen-yielding salts or substances are so brought in contact with the hot metal as to be decomposed. The outer shell, *h*, of the vessel or chamber is made of thick plates of iron or steel securely riveted and caulked at all joints, and capable of withstanding safely a pressure of from five to ten or more atmospheres. For the convenience of lining the vessel, the upper part may be removed by unbolting the stout flanges, h^1, and one or more hoops, h^2, are riveted to the exterior of the vessel to strengthen it. A lining of fire-brick, ganister, or other refractory material, *i*, is used to defend the outer shell from the high temperature generated within; and previous to its use for conversion, Mr. Bessemer prefers to make a fire in the interior, so as to highly heat the lining and lessen its power of absorbing heat from the metal.

FIG. 1

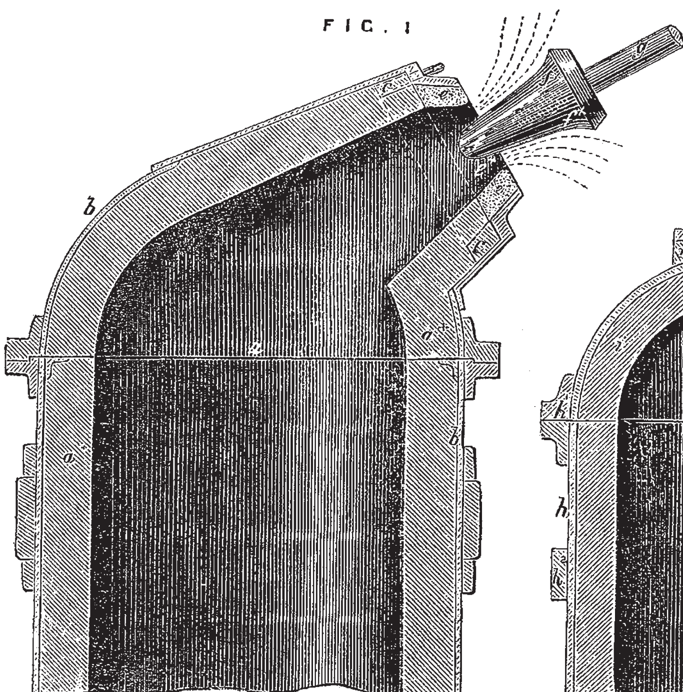
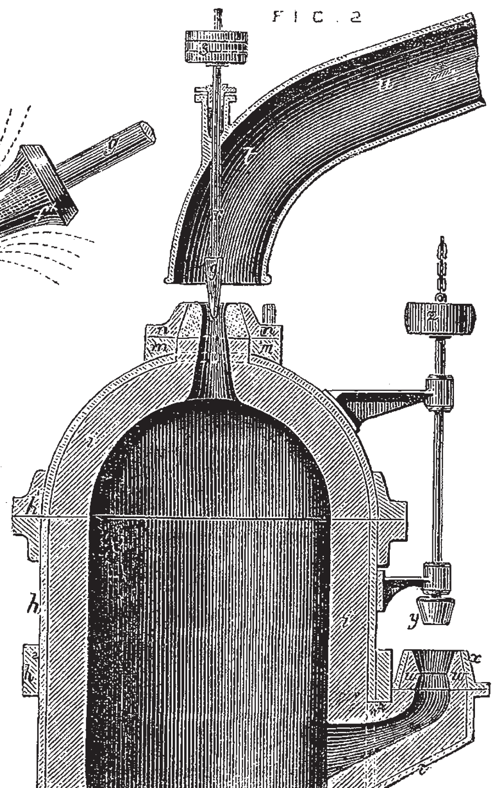


FIG. 2



On the upper part of the dome an iron ring, *m*, is riveted, to which a flanged ring, *n*, is fitted. The inside of this ring is conical, and is made to embrace the conical fire-clay ring, *p*, through which the gaseous matters evolved during the process are allowed to escape. A cone of fire-clay or of iron, *g*, is attached to the guide rod *r*, for the purpose of closing or diminishing the area of the outlet opening in the fire-clay ring *p*, and on the upper end of the rod *r* are placed weights, *s*, to regulate the pressure. The rod *r* is guided vertically upward and downward by passing through the tubular guides and stuffing-box formed at *t t*, on the curved exit passage *u*, which leads to a chimney and conveys away the gaseous products escaping from the converting chamber. On one side of the vessel or chamber is a projection, *v*, on the upper part of which a ring of fire-brick, *w*, is retained in place by a conical flanged iron ring, *x*. The opening in the ring *w* serves for the admission of the molten metal to the vessel, after which the cone *y* smeared with fire-clay is lowered down into the opening of the moulded fire-brick *w*, and by means of the weight *z* is retained in place and prevents the escape of gaseous matters during the converting process.

The cone, *y*, and its rod and weight, *z*, are suspended by a chain in the position shown during the period of running in the metal. When the metal so run in comes in contact with the nitrate or other oxygen-yielding materials, large volumes of gaseous matters are evolved, these matters instead of escaping freely from the converter rapidly accumulating in the vessel until the pressure within it is sufficient to raise the cone *g*, and escape by the small annular opening thus made, the pressure being regulated by the weight *s*. Hence the combustion of the carbon contained in the molten iron by reason of its union with oxygen derived from the decomposition of the nitrates or other oxygen-yielding materials will be effected under considerable pressure; and the gaseous products, instead of expanding freely as under the ordinary conditions of combustion, will be in a highly condensed state, by which means their temperature will be considerably raised, and the intense heat so generated will be imparted to the metal and cause it to retain its fluidity.

It will be extremely interesting to watch the working of this new process.

BOTANY

[We have been favoured by the Count Marshal of Austria with the following abstracts of Botanical papers read at the Innspruck Congress.]

Prof. Hildebrand on the Impregnation of Plants

PLANTS intermediate between *Papaveraceæ* and *Fumarieæ* gave the greatest quantity of seeds when impregnated with the pollen of another individual of the same species, less when the pollen was taken from another flower of the same individual, and least when the impregnation took place within the flower itself. For *Eschscholtzia Californica*, the proportion of seeds in these three cases was as 24 to 9 to 6. Professor Fenzl says that he obtained abundance of seeds from two species of *Abutilon* by fecundation with pollen from other individuals, and that these operations are best performed between 8 and 9 A.M.

Prof. Fenzl on the Genus Lupinus

SEEDS are with difficulty obtained from plants of this genus in the gardens of Vienna, probably on account of the unfavourable condition of the soil. The species of this genus are still very far from being duly determined, and two-thirds of them, at least, may be eliminated. Professor Koch observes, that the greatest amount of seeds is to be obtained in sandy soil, and that the great number of hybrids are merely varieties in form; the different colours of blossoms being a result of external agents, in the same way as *Nymphæa* gives us lengthened leaves when impregnated with the pollen of *Magnolia.*

Bail on Androgynous Inflorescence

SUCH inflorescences have been found on *Zea*, *Populus*, *Fagus*, *Carpinus*, *Betula humilis* and *Betula alba*, as also on *Pinus nigra*, the small scale, considered as a part of the female blossom, developing itself into an anther.

Prof. Koch on Transformations of Parts of Flowers

IN a fruit of *Solanum melongena*, the five anthers have been transformed into five smaller capsules. A capsule of poppy offers, in the centre of its cavity, a small elevation (the continuation of the axis), bearing a number of smaller capsules.

Prof. Bail on Parasitic Fungi on Insects

Empusa, attacking especially the larvæ of the Fir-Moth, invades also those of *Bombyx Caja*, which were found, sitting on branches of oaks, birches, and firs, killed by this parasite. Larvæ of *Cossus ligniperda*, of all sizes, all thickly covered with the white mucor issuing from their bodies, were found beneath the bark of a completely dried-up birch. These larvæ being kept in moist pots, *Penicillium glaucum* broke out first from their bodies, and was soon superseded by *Isariæ*, the larvæ being covered with moist moss. Those of *Melolontha majalis* are, as well as the perfect insect, destroyed by fungi. The destructive action of the fungi has, however, been exaggerated by the periodical press. Of more than 4,000 larvæ from about ten forest-districts of Prussia and Pomerania, scarcely 29 to 30 per cent. have been destroyed by fungi. The chief morbific fungi were *Isaria farinosa*, identical in all details of structure with *Penicillium*, and *Cordiceps militaris*. The *Melanospora parasitica* Tulasne, found (1858) on all specimens of *Isaria* in the environs of Meran, and on those which had come to their full development, is considered by Dr. Bail to be the higher form of fructification of *Botrytis Bassiana*. *Cordiceps militaris*, with thick, carneous, orange-yellow fructiferous clubs, differs altogether from *Isaria.*

Prof. Koch on the Formation of the Germen

THIS is not, as generally supposed, a concretion of so-called "Fruit-leaves." The germen is part of an axis, supporting the parts of a flower; it may be longer or shorter, as these parts are more or less distant from each other. The apex of the receptacle, or of the axis in general, may become suddenly stationary, and be wrapped up in plastic cellular tissue, a cavity open above, including the ovules (inferior germen), being thus formed; or this cavity includes the germina, either non-connate with the inner wall (*Rosa*, *Calycanthus*, *etc.*), or connate with it (*Cotoneaster*, many *Leptosperms*), or mutually connate, as in the Pomaceous fruits. Such a fruit-receptacle not infrequently includes whole blossoms (*Ficus*). The development of the genuine apex proceeds in two ways. Either the formation of cellules proceeds from the apex itself (as generally in inferior germens), and then its basis is the newest and the apex the oldest portion; or the new formations proceed from the margin of the wall, enlarging upwards, the increase ending in the uppermost portion, as in the fig. Professor Schuler observes, that this takes place only in figs ripened in the second half of the year, whenever the refrigerating action of the north wind has retarded their growth. Professor Koch replies, that the same increase of the margin is observable in the fruit of the *Leguminosæ*. Probably the germina of *Papayaceæ*, *Passifloreæ*, *Capparideæ*, and genuine *Liliaceæ*, likewise take their origin from the axis. The abnormal growth often observed on roses, a sudden prolongation of the axis through the cavity of the fruit-bearing blossoms (sometimes 3 above each other) and leaves, proves the new formations to proceed from the included centre of the extreme apex.

Prof. Martins on the Flora of Southern France

MANY genera of the miocene and pliocene deposits of this and other countries are represented in the living flora of South France. Such are *Laurus nobilis*, L. (=*Laura canariensis*), *Ficus carica*, *Punica granatum*, *Pinus Aleppensis* (found fossil in Unalaska), *Cercis siliquastrum* (near Aix), and *Nerium oleander*, in some localities near Toulon and Nice. All these species have lived through the glacial period; they exist now, however, only on the banks of rivers and rivulets, in localities protected against cold. It must be observed that severe cold is not the necessary consequence of extensive glaciers. A decidedly Indian form, not yet found fossil, is *Anagyris fœtida* (*Piptanthus Nepalensis*, Don.), which brings forth its leaves in October, and its blossoms in January and February. Other extraneous forms are: *Myrtus communis* (represented in Peru by *Myrtus myricoides*), *Chamærops humilis* (near Villefranche and Toulon, represented in the Caroline Islands by *Cham. serrulata*, Pursh, and *Cham. hystrix*), and *Ceratonia siliqua*, whose native country is still doubtful. *Cham. humilis* is now extirpated by the avidity of collecting botanists. Professor Koch says that *Anagyris fœtida* belongs rather to the Cytiseæ, or Genisteæ, than to any exotic family, and doubts *Ceratonia silliqua* being a leguminose. Professor Martins replies that he thinks *Anag. fœtida* to be closely related to *Thermopsis*, and observes that about 200 Lapland species occur in South France; that the littoral plants are partly the same as those on the coasts of the Atlantic, except *Spartina versicolor*, an exclusively American form, and hints at the importance of the study of fossil plants for the thorough knowledge of those existing in the present period.

Prof. Hildebrand on Marsilia

SPECIMENS of this plant, growing beneath the surface of water, regularly produce leaves which spread over its surface, and follow its level, while, if kept dry, they never produce such leaves. The leaves grown in air have stomata on both their surfaces; those grown in water have stomata only on their upper surface. Dr. Reichardt observes, that wild specimens of *Marsilia* have constantly been found provided only with large floating leaves. Professor Hoffmann says, that abundant fruits are obtained from *Marsilia* by cultivating it in slimy soil. Professor Hildebrand remarks, that specimens grown in water, and not bearing fruit, propagate themselves with astonishing rapidity without any fecundation.