THE TRICKS OF THE ALCHEMISTS.

During the sixteenth and seventeenth centuries the practice of alchemy was held in the highest repute by men of learning, while princes and even kings were seized with the popular delusion. At the same time spurious alchemists infested the country, passing from town to town and by the most specious deceptions imposing upon the inhabitants. These practitioners with the greatest ease procured from their dupes necessary funds which they—as the pioneers in the cause of science and on the point of making the grandest discovery that had ever enriched the world—required to complete their costly experiments. The more readily to attain their ends the pretended alchemist would exhibit to the gaping multitude, sometimes an apparently rusty nail which he, with great gravity and muttering some cabalistic words, would plunge into the wonderful liquid of transmutation: after the lapse of a few moments the nail is shown with its lower portion turned into the precious metal. With such proof before their eyes the credulous audience could not withhold the small pittance, their insignificant offering on the shrine of science, which the learned operator needed to renew his wonderful liquor and the cunning pretender repaints his gilded nail, fills again his vial with pure water, and passes to the next village. Sometimes a lump of lead was exhibited into which a piece of gold had previously been introduced. On heating, the lead was gradually oxydized, leaving the precious metal behind: or a crucible, concealing beneath a false bottom a bead of silver, is exposed to the action of heat, some simple powder being now thrown in, the vessel is cooled, broken, and the silver is discovered. Even such a shallow deception as washing a coin with quicksilver, thus giving it a silvery appearance, proved sufficient to deceive the simple populace.

But while these impostors were thus successful, the study of alchemy was faithfully pursued by such scholars as Augurello, Cornelius Agrippa, and the unfortunate Bombastes Paracelsus. Hitherto the sole aim of these enthusiasts had been the transmutation of the base into the precious metals: but about this time a new object to be attained presented itself. The success which had attended the use of mercury, antimony and several chemical preparations in the treatment of certain diseases awakened, the hope that by diligent study the discovery would be made of some universal menicine which should heal all disorders, and prolong human life indefinitely. This new field was occupied by new zealots, and one of these was Paracelsus, who, maintaining that strong distilled alcohol was the desired elixir vitæ, fell a sacrifice to his enthusiasm by drinking too freely of this preventive of old age.

The decline of alchemy may be dated from the middle of the sixteenth century. Few writers of reputation after that time wrote professedly on this subject, though a kind of half belief in its truth was long after cherished by even the most eminent chemists, and occasionally individuals appeared boldly claiming success in the science: such men were Agricola, Denis Zachaire, Dr. Dee and his co-laborer Edward Kelly and, as the last of the alchemists, Helvetius, Jean Delisle, the Count de St. Germain and Cagliostro. Even so late as the year 1784 Dr. Price, F. R. S., publicly proclaimed his ability of creating gold at will, but an investigation into his process being determined upon by the Royal Society, finding detection inevitable, the would-be alchemist finished his course by committing suicide.

The poverty of the alchemists as a class became proverbial, thus though avowedly in possession of the art of making gold, they were at any time willing to divulge this secret merely for a small amount of what they pretended to produce in any quantity. Although it cannot be claimed that the researches of these philosophers were in the domains of true science, yet in their fruitless efforts for obtaining the philosopher's stone, or the elixir of life, the world acquired information of far more value than the possession of either would have conferred upon it, in the advancement made in the rudiments of what has since their day developed into the grand science of chemistry.

The Engineer's Alphabet.

First obtain a fair familiarity with the mode of working out all ordinary arithmetical questions, and also a knowledge of algebra as far as simple equations. Learn also the elementary problems in mensuration, and how to measure hights and distances, and how to level and survey land.

Next gain some general knowledge of the principles of chemistry and of geology, and of the qualities of stones and cements, the action of the tides, the force of the winds, and the amount of rainfall.

Next obtain a thorough familiarity with the strength of materials, and acquire a distinct apprehension of the laws of virtual velocities and of the conservation of force.

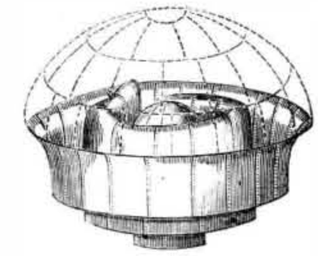
The law of virtual velocities enables the strain placed upon any part of a machine or structure to be immediately computed when we know the weight or force applied to any other part, and by this expedient, joined to a previous knowledge of the strength of materials, it can easily be determined whether any machine or structure is strong enough. Thus in a crane, if the interposed gearing is such that the travel of the handle through 100 in. will cause a tooth of a certain wheel to move through 1 in. then we know that the strain upon that tooth will be 100 times greater than the force applied to the handle, and so in all other proportions. So, also, in a beam or girder of iron of which the top flange is incompressible, if we wish to determine the breaking strain acting upon the bottom flange when the beam is loaded in the middle, we have only to suppose that the beam has been broken, and if we find that the broken edges separate only 1 in. while the weight falls through 6 in., then the strain at the edge of the beam seeking to sever it is six times greater than the weight.

The law of the conservation of force teaches that a force once existing cannot disappear except in the creation of some equivalent force, and one corollary of this law is that no form of mechanism can create power. Hence in a steam engine, if the steam were to be condensed by a jet of cold water immediately as it issued from the boiler a certain volume of hot water would be produced. But if the same steam be allowed to flow through the engine, and be finally condensed in the condenser, the resulting volume of hot water will be less in the proportion of the power exerted by the engine. Heat being a form of power, it follows that if a certain portion of it goes to generate mechanical power in the engine, there is less to expend in raising the temperature of the water by which the steam is condensed.—*Engineering.*

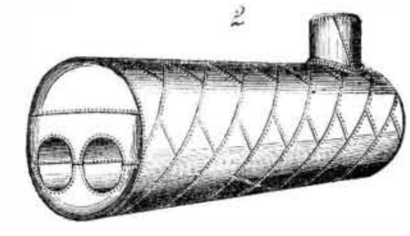
STEAM BOILERS--THEIR FORM, CONSTRUCTION, AND MATERIAL.

[NUMBER TWO.]

The balloon or haystack boiler, two engravings of which appeared in our article of April 27th, was attempted to be im-

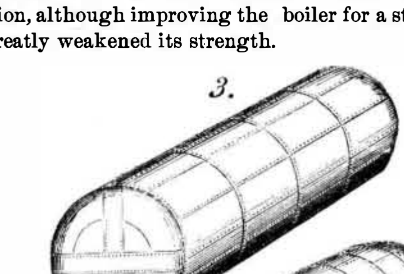


1.



2

proved by increasing its heating surface by constructing a central dome-like fire place with a curved flue conducting the gases of combustion through one evolution within the boiler before passing around the outside. It is shown in No. 1. The dotted lines show the exterior form of the boiler. Its construction, although improving the boiler for a steam generator, greatly weakened its strength.



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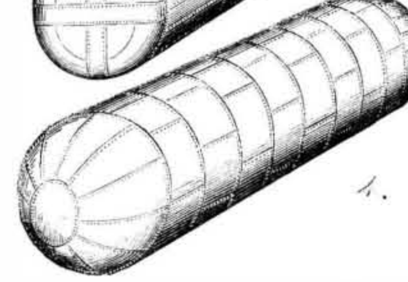
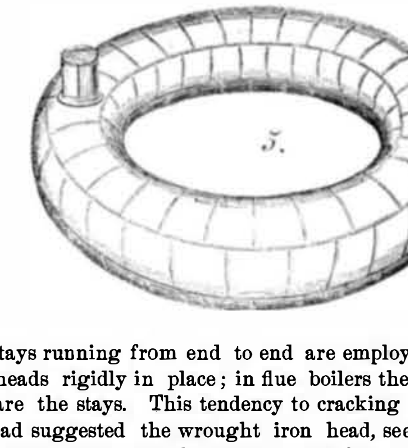


4.

The object of increasing the strength of boilers by diminishing their diameter led to the construction of boilers of a cylindrical form. They, however, had flat ends generally of cast iron, as are hundreds still in use in this country. The flat surface has much less resisting power than a convex surface, and as cast iron will not yield much without breaking, the blowing out of the boiler head is the usual form the explosion takes in case of accidents to this class of boilers.

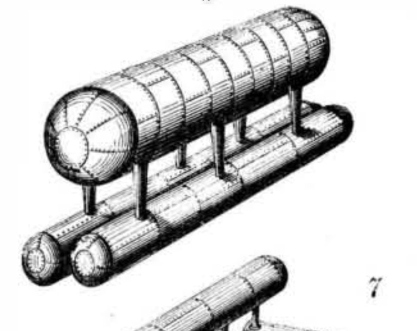


5.

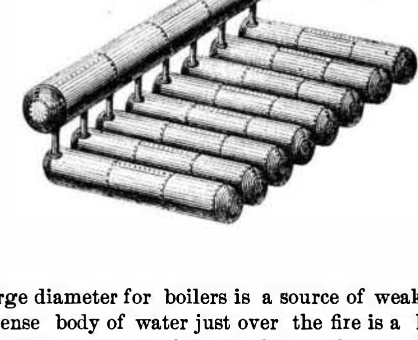
Long stays running from end to end are employed to keep these heads rigidly in place; in flue boilers the flues themselves are the stays. This tendency to cracking of the cast iron head suggested the wrought iron head, seen in Nos. 2 and 3, and in some cases the employment of bands crossing at right angles as in No. 3. To further strengthen the shell of the boiler the seams of the plates were sometimes made to run diagonally, as in No, 2.

No 4 shows an improved form of cylindrical boiler in which the ends are hemispherical. This form is now so extensively used in England that boilers of this shape greatly outnumber those of all others. This shape renders them very strong, as the whole body of the boiler is in simple tension and internal pressure has no tendency to alter the form. Plain cylindrical boilers externally fired have the advantage of being easily cleaned internally and are accessible to necessary repairs; but that part upon which the flame impinges is liable to be weakened by the action of the heat, especially when the boiler is of great length, as seventy or eighty feet, not—an uncommon length—and the heat has to act upon a large body of water at one point or on a circumscribed and limited area. Mr. Marten, from whom we largely quote, says he has seen a modification or rather extension of the cylinder boiler where great surface was obtained and extreme length avoided by curving the shell until both ends met, making an annular or ring boiler, seen in No. 5. It had a diameter of five feet for the cylinder with an external diameter for the ring of twenty-five feet, giving a total length of about sixty-three feet. It has worked for years well although exposed to the heat of six puddling furnaces.

6



7



As large diameter for boilers is a source of weakness, and the immense body of water just over the fire is a hindrance to the rapid generation of steam, the elephant boiler or as commonly known, the French boiler, so called from its general use in France, has been designed. It is seen in No. 6 and is merely a combination of small cylinders connected by upright conical tubes. The large upper cylinder is the steam chamber. The disadvantages of these boilers are difficulty in cleaning or examining internally, and the exit for the steam from the generator to the steam cylinder being cramped, tending to priming and hindering the free generation of steam. The same objections apply to the retort boiler No. 7, although both of them expose a large surface to the action of the heat, and consequently are better generators than the plain cylindrical boiler.

GLEANINGS FROM THE POLYTECHNIC ASSOCIATION.

The regular meeting of this branch of the American Institute, was held on Thursday evening, April 11th, Prof. Tillman presiding.

MISCELLANEOUS PROCEEDINGS.

The chairman read a collection of scientific items, after which a long discussion arose respecting the merits of corrugated iron in the construction of boilers. Dr. Bradley followed, explaining a plan for preventing incrustation of boilers, which was simply passing a continuous current of free electricity through the iron. After some further transactions the society listened to a paper from Mr. H. F. Walling advancing a new hypothesis relating to

MOLECULAR MOTIONS.

Mr. Walling proposed to refer all the forces of nature to one simple or universal force. Gravitation, he considered to be the resultant of equal infinite and opposite forces, intercepted by matter, thereby causing a diminution of the two opposing forces between the atoms, and a preponderance of the external force; thereby impelling the atoms toward each other. All molecular attractions are the results of gravitation in atoms, repulsion being due to the excess of momentum over gravitation. Heat, the great repulsive force of nature, is simply the momentum or centrifugal force of atoms.

In the molecular hypotheses advanced by Boscovich, Mossotti, and Prof. Norton, the conditions of solidity and fluidity are explained by supposing the ultimate atoms to be solid and encompassed by an elastic etherial atmosphere, but the inquiry suggests itself, whence is derived the atomic solidity and fluidity? In this hypothesis, the only properties attributed to ultimate matter are position, and inertia, or the capacity for associating with force and acquiring motion. Repulsions, attractions, impenetrability, elasticity, etc., are the manifestation of this associated force, and are not the inherent properties of matter. Atoms, the speaker supposed, actually moved around each other in pairs, describing in three intersecting planes, circular or elliptical orbits upon the surface of imaginary spheroids. The intersections of these orbits form six poles, each a central point in a face of an imaginary circumscribing prism. Since heat is momentum, uniform temperature is maintained in atoms of different weights, when the products of mass into velocity are equal. It follows that pairs of heavy atoms move slower than pairs of lighter ones. This explains the spheroidal forms of certain molecules, from which all forms of crystaline structure arise. Solidity and liquidity are due to the interlinking of the orbits of adjacent molecules at the six poles, a single interlinking producing liquidity, a double one solidity. The rigidity of solids is the result of this polar attractive force. The conversion of solids into liquids and liquids into gases by increasing temperature, is caused by accelerated momentum of the atoms overcoming the interlinking or polar force. A reverse action takes place when heat is dimin-