

All the recipes in use for the cementation of iron may be explained by the formation of cyanides. The charcoal used always contains potassa or soda; the animal matters which are added, bring with the alkali the nitrogen which is to transform it into a cyanide.

In fine, it seems to me that these experiments show irrefutably that in order to obtain a rapid and deep cementation, the formation of the alkaline cyanides should be promoted in the charcoal surrounding the iron. The application of this truth will be very easy in the arts. We may perhaps be able, by this means, to diminish very much the time necessary for the process, and thus keep a much greater tenacity in the mass of the metal which the cementation has not reached.

Annales de Chimie et de Physique, October, 1860.

On the Melting-points of some of the Elements. By WILLIAM CROSSLEY, Assay Master, Ormesby Ironworks, Middlesborough.

From the Lond. Chemical News, No. 35.

It is remarkable that in almost all the series or groups of the elements mentioned by Mr. Coleman there appears to exist a peculiar relation between the atomic weight and the melting point, which to a certain extent confirms his opinion that the equivalent number of an element expresses a certain amount of force, modified by its atomic volume. As an illustration we will take the group zinc, palladium, platinum.

| | At. Weight. | At. Vol. | Melting Point. |
|--------------|-------------|----------|-------------------------------|
| Zinc, . | 33 | 57 | 773° F. |
| Palladium, . | 53 | 57 | Highest heat of wind furnace. |
| Platinum, . | 98 | 57 | Oxyhydrogen blowpipe. |

Here we have a group of elements having a like atomic volume with an increasing atomic weight, not only decreasing in active chemical attraction, but decreasing in fusibility as the weight of the atom increase. Does the atomic weight here represent a force? We think so, because it appears general. Let us pass on to some other groups.

| | At. Weight. | At. Vol. | Melting Point. |
|-------------------------|-------------|----------|---|
| Sulphur (crystallized), | 16 | 101 | 239° F. |
| Selenium, . | 40 | 101 | 420° |
| Lead, . | 103.7 | 114 | 617° |
| Silver, . | 108 | 128 | 1873° |
| Gold, . | 197 | 128 | 2016° |
| Chlorine (liquid), | 35.5 | 320 | Gaseous at com. temp. |
| Bromine, . | 80 | 320 | Liquid do. |
| Iodine, . | 127 | 320 | Solid do. |
| Aluminium, . | 14 | 66 | Red heat. |
| Chromium, . | 27 | 66 | Agglomerate but not fuse at the highest heat of the wind furnace. |
| Molybdenum, . | 46 | 66 | |
| Tungsten, . | 95 | 66 | |

Here we have four groups, in each of which the elements having the least atomic weight offer the least resistance, not only to the action of other elements, but also of heat. In so many groups, taken,

as it were, at random, it cannot all be accident. There are, however, exceptions: we find them in the groups

| | At. Weight. | At. Vol. | Melting Point. |
|-------------|-------------|----------|-------------------------------|
| Manganese, | 27.6 | 44 | Highest heat of wind furnace. |
| Iron, | 28 | 44 | " " |
| Cobalt, | 29 | 44 | " " |
| Nickel, | 29 | 44 | " " |
| Copper, | 32 | 44 | 1996° F. |
| Phosphorus, | 33 | 211 | 111° |
| Antimony, | 129 | 224 | Red heat. |
| Bismuth, | 213 | 270 | 507° |

Manganese and iron, and perhaps cobalt and nickel, follow this law, but copper varies very much; for this we can see no reason. Phosphorus and antimony follow the law, but bismuth comes between. What can influence it? Look at its atomic volume; it differs 59 from that of phosphorus. We cannot, therefore, be much surprised at its having a different melting point.

These facts support Mr. Coleman's views. The subject is interesting and well worth discussing.

Translated for the Journal of the Franklin Institute.

*Mathematical Theory of the Dynamical Effects of Heat given to a Permanent Gas.** By M. J. BOURGET, Professor of Mathematics in the Faculty of Sciences at Clermont.

Up to the present time, the theory of the motive power of heat has been treated, by assuming *à priori* the following propositions:—

It is absurd to admit the possibility of creating either moving force or heat.

Heat cannot be made to pass from a colder to a warmer body.

In all cases where mechanical work is produced by heat, there is a consumption of a quantity of heat proportional to the work done; reciprocally, this quantity of heat may be represented by a quantity of mechanical work equal to that before spoken of.

I am about to undertake the same subject in a different way, confining myself to the case in which a permanent gas is the vehicle of the heat.

It seemed to me that if the principles above mentioned are true; if it be true that heat and mechanical work may be regarded as homo-

* Works to be consulted on the question of the Mechanical Equivalent of Heat:—

JOULE.—Memoir on the heating effects of magneto-electric currents; and on the mechanical equivalent of heat. *Annales de Chimie et de Physique*, Tome XXXIV.

JOULE.—On the mechanical equivalent of heat.

MR. W. THOMSON.—Examination of Carnot's theory of the motive force of heat.

CLAUSIUS.—On the motive force of heat. *Annales de Chimie et de Physique*, Tome XXXV.

QUINTUS ICIILIUS.—Memoir on the numerical values of the constants which enter into the expression for the heat disengaged by currents.—

Annales de Chimie et de Physique, Tome LI.

CLAUSIUS.—On the motive force of heat, and on the laws resulting from it.—

Bibliothèque Universelle de Genève, Tome XXXVI.

MR. W. THOMSON.—Two memoirs on the dynamic theory of heat.—

Liouville's Mathematical Journal, Tome XVII.

REECH.—General Theory of the dynamical effects of heat.—

Journal des Mathématiques, Tome XVIII.

See also the memoir entitled "A new system of Air Engine, deduced from a comparison of the systems of MM. Ericsson and Lemoine," by M. REECH.