

engaged, facilitates the oxidation of a new portion of metallic iron. When once iron has begun to rust at one point of its surface, the rust spreads rapidly round this point in consequence of galvanic action, which accelerates the oxidation. The small spot of rust forms the two elements of a voltaic pile in which the iron is positive, and thus acquires for oxygen an affinity sufficiently strong to decompose the moisture of the air, and thus hydrogen is set free. Rust also contains portions of ammonia, the odor of which becomes evident by heating it with potash. Ammonia consists of hydrogen and nitrogen and when these two elements come in contact in what is called the nascent state, *i. e.*, in the very act of separating from a body under decomposition, the moisture of the air, containing a portion of the air, and consequently a portion of nitrogen, coming in contact with the rust of iron, is decomposed, and the nitrogen and hydrogen which are set free at the same time, combine to form ammonia and the ammonia is retained by the peroxide of iron, which acts towards it as a weak acid would do. It will be readily seen from the above reaction, which is both analytical and synthetical, how marvellous are the results that may be obtained in an ordinary foundry cupola, when natural laws are carried out by the introduction of a certain new element, acting in combination with other elements, thereby forming new elements and new combinations in the very act of separation by heat. It is very difficult to describe the chemical reactions at work in a cupola, because chemical action is only known by its effects. It requires very little technical skill to operate this process—no more than is within the reach of the ordinary foundryman, in order to secure the best results claimed.

These claims are:—

1. Effects a saving in quantity of fuel used.
2. An inferior grade of fuel may be used.
3. An inferior iron may be used.
4. There is less loss in iron.
5. It requires less time and power to operate the blast.
6. Castings are more perfect, being very smooth and even.
7. Castings are more easily worked in the lathe.
8. Castings are very strong, resembling malleable and steel.
9. A cleaner furnacc and very much less slag, great saving in preparing furnace and longer life of lining.

Satisfactory as these results undoubtedly were, the reduction of the quantity of iron lost in the slag resulting from the Doherty process as compared with the ordinary, appears to me the most remarkable feature; in fact, I have on some