

what is the best plan to adopt under the circumstances to overcome the difficulty? Some months ago, while carrying out some experiments, I found that by combining a steam jet in the tuyere in certain proportions it produced a molecular change in the casting; that the casting was finer in the grain, softer and stronger than ordinary, that in melting old rusty scrap which under ordinary practice would result in great waste, in this case the loss was under two per cent. This should be conclusive evidence that Hydrogen gas is a powerful reducing agent, that its influence in reduction of the oxide of iron in an ordinary cupola plays a very important part, and aside from this most valuable feature it has other valuable functions, namely, softening and strengthening the casting. These are the plainest terms that can be used, and every foundryman will readily understand their meaning. It makes little difference to him whether the action is chemical or allotropic, *i. e.*, the capacity to undergo without change of chemical composition, a change of chemical and physical condition, or plainer still, a rearrangement of the molecules. To the man of science the chemical reactions produced by the H_2O is most marvelous, which is best observed by the aid of a spectroscope, that most marvellous little instrument. When examining the gases as they pass up by the charge door of the cupola and by the simple turning of a small steam valve having a $\frac{1}{4}$ " opening, these gasses can be changed and the changes analysed just as readily as if we had them bottled up on the shelves of our laboratories. There can be seen the yellow sodium line, the blue hydrogen, the red carbon and other lines well known to all those who have studied the colors of these gasses through this wonderful little machine. This simultaneous production of several different forces changed by the simple operation of a small valve may seem at first sight to be irreconcilable with their mutual and necessary dependence, and it certainly presents a formidable experimental difficulty in the way of establishing their equivalent relations. But when examined closely it is not at all inconsistent with the claims I have made both in my patents all over the world and my claims to the public, but is indeed a strong argument in their favor.

Difficult as it may seem to the scientific mind to restrict the action of any one force to the production of any other force and of one only—yet if the whole of one force in chemical action be supposed to be employed in producing its full equivalent of another force, say heat, then as this heat is capable in its turn of producing chemical action and in the limit a quantity equal or at least only indefinitely short of the initial force, if this could at the same time produce independently, say magnetism, we could by adding it to the total heat get