likeness of men or women. No slight indication, this, of the relative standing of a smith, a mechanical designer, in the theogony of so aristocratic and imaginative people as the Greeks.

However, in a Republic of Learning, such as Harvard, let us hope that Mr. Telfer will be happy in his title, as in his work, and quite undisturbed by any social nonsense of precedence. If he is disposed to scholarly habits, he may be stimulated by the bookish acquirements of "The Learned Blacksmith," Elihu Burritt, in the present century, or if ambitious he may recall the renowned achievements of Benvenuto Cellini, that inspired erratic brass-founder and goldsmith, in a former century. In any case this good maritime tradesman with a Scotch name can, if he will, teach to the gilded youth of Harvard the same lesson the poet has put into the life and example of Mr. Telfer's New England prototype, whose shop was under a spreading chestnut tree—that at the flaming forge of life our thoughts and for tunes must be wrought: the lesson, in short, of work, persistent effort, honest economy. Nor is it only a moral lesson that can be learned in such wise. The distinguished Dr. Bovey, of McGill, will tell us that no department of that great University is of more importance than his blacksmith shop and machine shop, marvels of equipment as they are to mould deft as well as book-learned metal-workers for the coming generation of Canadians.

PHOSPHORUS IN IRON.

N. Kjellberg has been making some investigations into the relations between phosphorus and pig iron. The following are some of the conclusions he draws:

1. When the phosphorus content of the ore is not above 1·25 per cent., the temperatures under which he worked do not influence the phosphorus-content of the pig iron, nor does the amount of silica in the slag. The greater part of the phosphorus of the ore is combined with the iron, only a small portion, 5 to 10 per cent., going into the slag.

2. When the phosphorus in the ore is above 1·25 per cent. it begins to enter the slag, and this slagging process increases in intensity with the increasing percentage of phosphorus. Both the temperature of the furnace and the acidity of the slag commence to influence the reduction of the phosphorus, and this action also increases with the amount of phosphorus up to 3·5 per cent. If the ore contains as much as 3·5 per cent. of phosphorus, the greater part of this element combines, under all circumstances, with the iron. If, however, the ore-charge be increased and the burden made basic, the phosphorus content of the ore may rise to 3·5 per cent., and still 40 to 50 per cent. of it be slagged off. With a higher temperature and an acid burden 95 per cent. of the phosphorus, already slagged, can be made to enter the iron.

3. No volatilization of phosphorus took place in the blast furnace even with ore containing 3·6 per cent.

4. The carbon-content of the pig iron diminishes with the increase of phosphorus, but is not manifest until the phosphorus rises about 3 per cent. The pig iron obtained from the ores richest in phosphorus contained only a small amount of graphite and was white, with mirror-like planes on the surface of fracture.

5. The content of silicon varies with that of phosphorus; a sample of charcoal iron with 4 per cent. of phosphorus contained no more silicon than steel does. Pig iron containing upward of 4 per cent. of phosphorus can be made to take up a few tenths of one per cent. of silicon only by urging the blast and using an acid slag. The pig iron of highest phosphorus was quite brittle, a slight blow of a hammer serving to break a bar into many pieces.

To make basic open-hearth stock with not over 0·6 per cent. phosphorus, it is advisable, Mr. Kjellberg thinks, to use 60 per cent. ore containing not over 0·4 per cent. phosphorus. For cast irons, with phosphorus up to one per cent., ore with 60 per cent. iron and not over 0.6 per cent. phosphorus should be used.

For Thomas iron, with at least 2 per cent. of phosphorus, the ore must contain at least 1·6 per cent. phosphorus, and 60 per cent. iron, as only ¾ of the phosphorus is reduced and enters the pig.

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REFLECTION shows us that the statement, so often made, that steam at the moment of exhaust contains a large percentage of water, must be quite erroneous. The only water, says the *London Engineer*, that the steam can possibly contain is that due to the liquefaction brought about by the performance of work. All the rest must be deposited on the metallic surfaces, unless, indeed, water has originally entered the engine from the boiler; and the reason is obvious. If the steam has parted with its heat, and the resulting water escapes the moment the exhaust port opens, then heat must accumulate in the engine. The truth is, that the amount of condensation due to the action of the metal is invariably measured by the evaporation during the exhaust stroke, condensation and evaporation precisely balancing each other during each revolution. All this is old knowledge. It is far more to the purpose to consider whether there is or is not some obscure cause of condensation at work, which is collateral in its operation with the action of the cylinder walls. We hold that it is in this direction that inquiry should be pushed, and the accumulated data should be carefully examined to ascertain, first, whether there is or is not liquefaction going on which can not be accounted for by the action of the metal alone; and secondly, if there is, what the liquefying agency may be.