## USES OF NICKEL.

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"No extraordinary care is required when reheating the ingots for hammering or rolling. They will stand quite as much heat as ingots having equal contents of carbon but no nickel, except perhaps in the case of steel containing over 25 per cent. of nickel, when the heat should be kept a little lower and more care taken in forging.

"If the steel has been properly made and is of correct composition it will hammer and roll well, whether it contains little or much nickel; but it is possible to make it of such poor quality in other respects that it will crack badly in working, as is the case with ordinary steel."\*

In order to procure a definite idea of the utility of alloys of nickel, steel, and iron, Mr. Riley made different mechanical tests; and we learn from him that, as chemically pure iron is practically unknown, and as the presence of very small quantities of carbon, silicon, sulphur, and phosphorus in varying proportions produce marked changes in the qualities of iron, with the view of estimating correctly the influence of the addition of nickel, the percentage of each of these elements was kept constant in all the tests he made. "The contents of nickel in the iron varied from 1 to 49'4 per cent., the carbon from 29 to 90 per cent., and the manganese from 0'23 to 0'85 per cent.

"With 2 per cent. nickel, 0.90 per cent. carbon, and 0.50 per cent. manganese, the alloys were too hard to machine with musket steel, but they made a fine tool

\* Journal of the Iron and Steel Institute, No 1, 1889, p. 46.