

the different elements entering into the composition of the iron or steel. The presence of an element which alone would be objectionable may not be so when a number of others are present, also some elements modify the influence of others, while others, themselves objectionable, act as antidotes for more harmful impurities. I have noticed in the curves I have plotted that the relative amounts and the sums of the various elements vary slightly according to the slight variations in the process of manufacture. For this reason the results laid before you were made entirely from basic open hearth steel rolled into plates varying from  $\frac{3}{8}$  inch to  $\frac{9}{16}$  inch in thickness, and cut

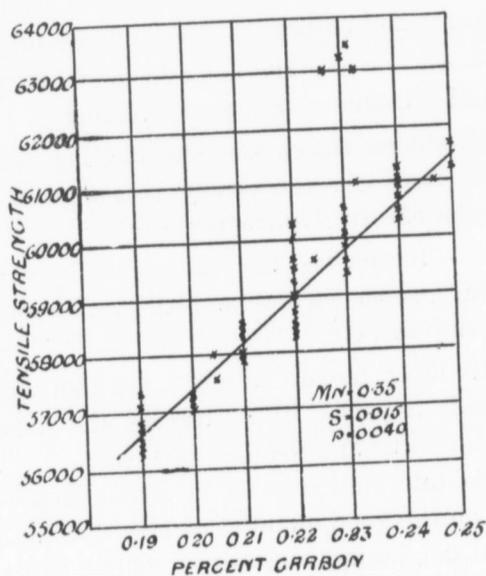


FIG. 1.

from sheets, all of which I have reason to believe were rolled from approximately the same size of ingot. As a single analysis may not indicate an average quality, it is necessary to have access to a great number of tests and analyses before arriving at anything like an approximate result as to the effect of any one element.

The conclusions given in this paper as to the effect of various elements, when acting with the other elements generally present, were arrived at by determining the analysis and various mechanical properties when the amounts of all but one of the principal elements remained constant. The results so obtained were then compared with another series of tests in which one of the elements which had

remained constant... the other elements... method is... element... To eliminate... curves extended... have compared... basic process... used for all... more difficult... analysis also... "normal"... muffle and... Steels were... the same size...

phosphorus... curve of ten... plotted. A... excepting... In this wa... varied from... to 0.055, and...

With t... on the tens... All the steel... each 0.1 pe... range of ca... The ef...