

STEEL.

The next slides showed steels made by the Bessemer, Open Hearth, and Crucible processes. These were arranged roughly in the order of the carbon percentages. They comprised longitudinal and cross-sections of rivet steel, boiler plate, structural steel, machinery steel, and tool steel.

MICRO-STRUCTURE OF UNTREATED IRONS AND STEELS.

The common characteristic of these views was the appearance of dark, well defined patches on a light background. The background showed the same grained structure as the iron fibres in puddled iron, while the dark patches were distinctly different from the slag shown in the views of wrought iron. Little or no slag appeared in the steels. The dark areas represented *pearlite*—an iron carbon alloy containing somewhat less than one per cent. of carbon. As the carbon content increased, the dark areas increased also, while the white areas diminished. It is convenient to term the carbonless iron, which is indicated by the white areas, *ferrite*.

Thus the wrought irons are made up of ferrite and slag fibres; the steels, of pearlite masses embedded in ferrite masses. The last slide of this series showed pearlite only, indicating that the steel (a tool steel) contained about one per cent. carbon.

The steels and irons shown up to this point were in the condition in which they had left the manufacturers' hands, and as they had been received from the dealers.

APPEARANCE OF TREATED IRON AND STEEL.

The next slide showed the same tool steel as in the previous slide, after it had been heated to a cherry red and suddenly quenched in water; that is, had been hardened preliminary to tempering. The structure was distinctly different from that of the pearlite shown in the previous slide. The material thus treated is termed *martensite*, and if martensite is gently heated, it is partially transformed into pearlite, thus becoming softer. By heating to a red heat, and cooling slowly, it becomes completely changed into pearlite. The martensite being very hard, the pearlite comparatively soft; any intermediate degree of hardness is thus attainable.

The next slide indicated a tool steel containing about 1.25 per cent. carbon. It showed pearlite areas surrounded by narrow, white boundaries. On account of the carbon composition, this steel could not consist of pearlite and ferrite, therefore, the white boundaries did not represent ferrite, *i.e.*,