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Iron Castings, Defects and Remedies.

To many consumers an iron casting is an iron casting, and little thought or attention is given to its quality, apart from a general surface examination, to see whether it appears to be sound and if it is clean and of the desired dimensions.

In some cases, the casting must be machined prior to use, and the serious defect may develop that the iron is so hard as to turn the edge of the tool, or make the work of machining so slow that labor costs are high. If the casting cannot be machined, it must be rejected and delay occurs in getting replacement; and even when it can be slowly machined and finally gets into service, difficulty soon begins, for a casting of this type though having a high tensile strength, is unfortunately brittle and fragile under impact, and, as a consequence, failure is apt to occur after a short service.

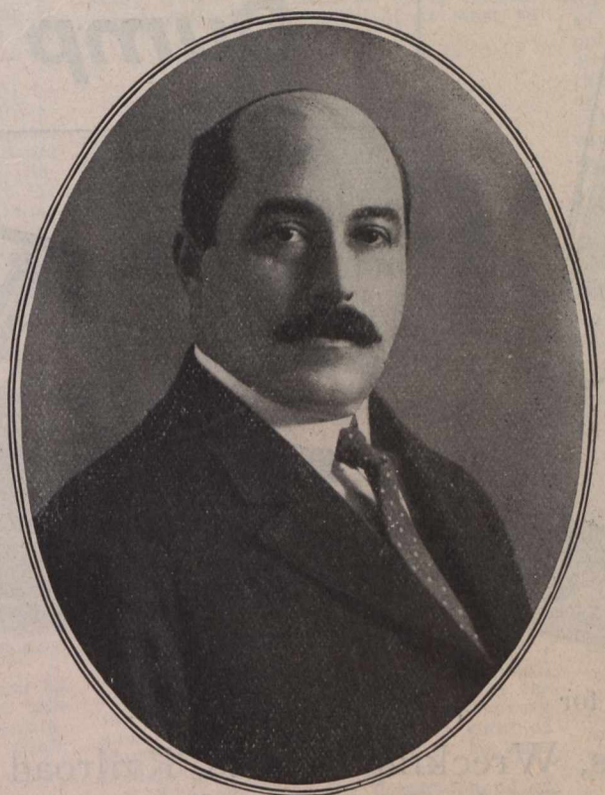
The cause of such hardness is generally excess either of sulphur or of manganese, due to defective quality of the cupola charge, that is to say, of the pig iron, or scrap, or coke, one or all. In some cases also the silicon is too low for the character of the casting. Sometimes, too, the moulding sand has been improperly tempered and the iron has been chilled, or, again, perhaps a poor grade or an excessive proportion of scrap has been used in the charge.

From this brief statement it will be evident that "hard iron" is not by any means a result of any one cause, but may be due to many widely differing conditions.

In order to find the proper remedy, the cause of the difficulty must, of course, be determined. Often an analysis of the iron will tell the story, or again, in some cases the physical condition of the casting will give the clue by presence and appearance of blowholes, shrinkage-cracks and other characteristic defects.

If the hardness is caused by excess of sulphur or by otherwise incorrect composition, the inference is that proper care has not been used in the selection of the material, and purchase should be made under carefully arranged specifications, fixing the proportion of silicon, phosporous, sulphur, and carbon to accord with the properties desired in the castings. For instance, if tough, strong, easily machined iron is desired, the silicon, sulphur, phosphorus, and manganese should be limited and the quality of the coke should be carefully investigated in order to hold down the proportions of sulphur and of ash, for obviously it is a sheer waste of time and money to pay great attention to the quality of the pig iron and then accept and use shipments of coke which may contain thirty times as much sulphur as is present in ever so poor a grade of pig iron. Under such conditions nothing but hard castings may be expected.

Porous, spongy iron is another source of annoyance and loss to the consumer Frequently a great deal of work will be put upon a casting in the machine shop, only to have a large cavity finally develop, rendering the casting unsafe for the service intended. In such case, replacement must be made by the foundry, but the labor is lost and the delay which occurs in replacement often causes great inconvenience. Frequently the surface of the casting shows no indication of this defective condition.



Howard G. Kelley
Chief Engineer Grand Trunk Railway.

Porosity is frequently due to blowholes in the iron, as for instance, when gas has been trapped in the casting owing to failure to provide proper vents. In some cases, the iron may not have been fluid enough when poured into the mold, and in consequence, the small bubbles of gas could not escape before solidification occurred, and an unsound, honeycombed castings is the result.

Every foundryman knows well the importance of "hot iron"—that is to say, iron which is at such a high temperature when poured into the ladle that it is almost as fluid as water. Such iron fills the molds thoroughly, and many of the foundry troubles which otherwise are apt to result are avoided. To secure it, one must pay special attention to the cupola charge. A sufficient proportion of coke must be used, and its quality must be carefully regulated. The proportion of sulphur and of ash must be low, and dust and small pieces which would tend to check the draught and thus prevent free-burning must be absent. A sufficient air pressure must be maintained, and the cupola practice so regulated that a quick melt will be secured. Other things being equal, the shorter the time in the cupola, the better the chance to get good castings.

Shrinkage holes or cracks are apt to occur with hard, high sulphur iron, and this condition is due simply to the fact that iron of this character contracts to a much greater extent than does a softer iron containing a large proportion of graphitic carbon. Shrinkage holes are a fruitful cause of failure, and they are particularly objectionable owing to the fact that they frequently do not appear upon the surface, and hence the weakness may not be suspected until failure occurs. The remedy for such condition, obviously is to keep at a minimum the proportion of sulphur in each constituent of the foundry charge, and take proper precautions to keep the iron soft.

Defects of castings are, unfortunately, of so many varieties that any attempt to cover the subject even in a brief description, would weary your patience, and I have, therefore, confined myself to a few of the typical cases which are seen all too often in service. "Strong as iron" is an axiom, but frequently the appearance of the metal belies the truth. As an instance of this, I have in mind, a heavy, massive cast iron base weighing many tons which supported a large shop tool. After a short service cracks began to develop, necessitating the removal of the tool and the replacement of the base. A careful investigation was made to determine the cause of failure and it was found that the proportion of phosphorus and of silicon in the iron were excessive, causing the metal to be exceedingly weak, and hence resulting in fracture. High phosphorus is particularly objectionable when the casting is subjected to impact, as for instance, in wheel-centres, cylindersr, columns, etc., and unluckily for the consumer such iron can generally be obtained at a considerably lower cost than can a stronger, tougher, grade, and consequently, unless each shipment is systematically tested before use the better quality cannot be expected. Many cases have come under our observation in which wheel-centres and cylinders containing about one per cent. of phosphorus have cracked after a service of only a few weeks, or even days, while with the phosphorus reduced