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# STEEL

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*A*  
*MANUAL*  
*FOR*  
*STEEL USER*

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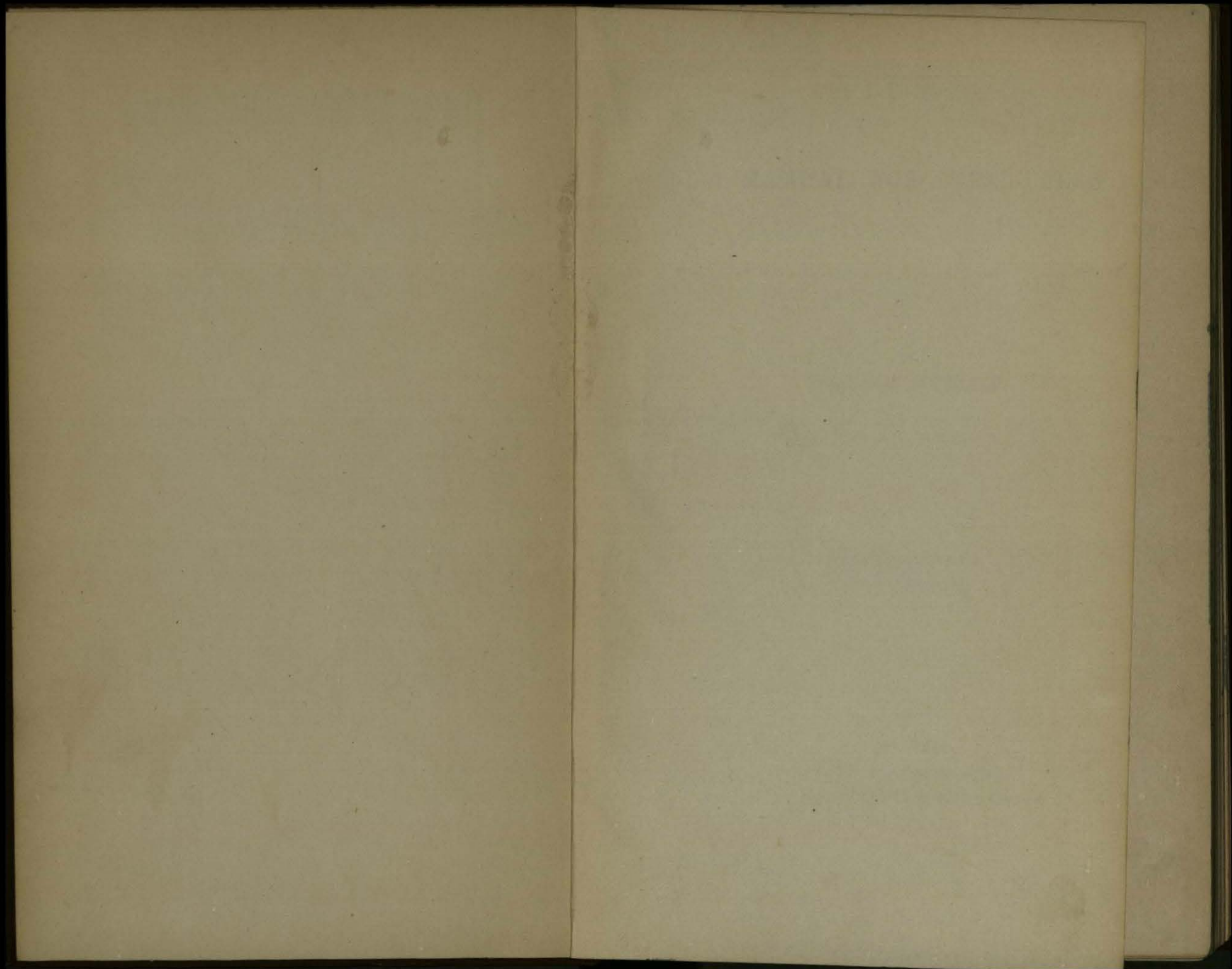
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# STEEL:

A MANUAL FOR STEEL-USERS.

BY  
WILLIAM METCALF.

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## INTRODUCTION.

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TWENTY-SEVEN years of active practice in the manufacture of steel brought the author in daily contact with questions involving the manipulation of steel, its properties, and the results of any operations to which it was subjected.

Blacksmiths, edge-tool makers, die-makers, machine-builders, and engineers were continually asking questions whose answers involved study and experiment.

During these years the Bessemer and the open-hearth processes were developed from infancy to their present enormous stature; and the shadows of these young giants, ever menacing to the expensive and fragile crucible, kept one in a constant state of watching, anxiety, and more study.

The literature of steel has grown with the art; its books are no longer to be counted on the fingers, they are to be weighed in tons.

Then why write another?

Because there seems to be one little gap. Metallurgists and scientists have worked and are still working; they have given to the world much information for which the world should be thankful.

Engineers have experimented and tested, as they never did before, and thousands of tables and results are re-



corded, providing coming engineers with a mine of invaluable wealth. Steel-workers and temperers have written much that is of great practical value.

Still the questions come, and they are almost always those involving an intimate acquaintance with the properties of steel, which is only to be gained by contact with both manufacturers and users. In this little manual the effort is made to fill this gap and to give to all steel-users a systematic, condensed statement of facts that could not be obtained otherwise, except by travelling through miles of literature, and possibly not then. There are no tables, and no exact data; such would be merely a re-compilation of work already done by abler minds.

It is a record of experiences, and so it may seem to be dogmatic; the author believes its statements to be true—they are true as far as his knowledge goes; others can verify them by trial.

If the statements made prove to be of value to others, then the author will feel that he has done well to record them; if not, there is probably nothing said that is likely to result in any harm.

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## STEEL:

### A MANUAL FOR STEEL USERS.

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#### I.

#### GENERAL DESCRIPTION OF STEEL AND OF MODES OF ITS MANUFACTURE.

STEEL may be grouped under four general heads, each receiving its name from the mode of its manufacture; the general properties of the different kinds are the same, modified to some extent by the differences in the operations of making them; these differences are so slight, however, that after having mentioned them the discussion of various qualities and properties in the following pages will be general, and the facts given will apply to all kinds of steel, exceptions being pointed out when they occur.

The first general division of steel is cemented or converted steel, known to the trade as blister-steel, German, shear, and double-shear steel.

This is probably the oldest of all known kinds of steel, as there is no record of the beginning of its manufacture. This steel is based upon the fact that when iron not saturated with carbon is packed in carbon, with all air excluded,