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TREATING AUSTENITIC STEEL

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Fig. 1.

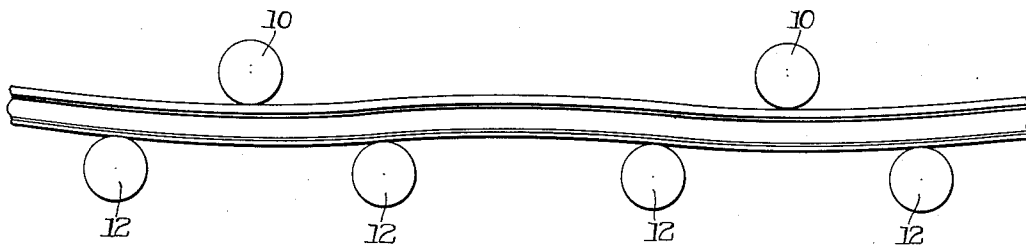
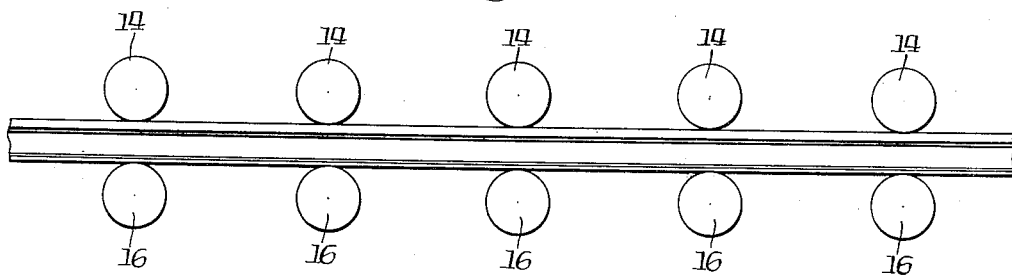


Fig. 2.



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UNITED STATES PATENT OFFICE

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TREATING AUSTENITIC STEEL

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4 Claims. (Cl. 148—12)

This invention relates to an improved process for increasing the strength and rigidity of alloy steels of the austenitic variety.

The increasing loads that are being imposed upon structural steel and steel rails bring about the necessity for increasing the static strength with regard to the elastic limit and for improving the wear resistance qualities thereof.

Numerous patents and publications of recent years have disclosed processes for increasing the wear resistance qualities of austenitic steel, a typical example of such disclosures being Patent No. 1,701,976 granted February 12, 1929 upon application of G. R. Hanks. In that patent there is disclosed a means of hardening the surface and thereby increasing the wear resistance of an austenitic manganese steel article by hammering or pressing localized areas of the surface of the article in order that such areas will be better adapted to withstand wear and abrasive action. As already pointed out, the present invention is directed to the end of increasing the elastic limit of austenitic alloy steels without seriously impairing the other advantageous qualities of the steel.

Other objects and features of the invention will become apparent from a reading of the following description in the light of the appended drawing, in which

Figure 1 shows diagrammatically a steel rail being treated in accordance with one step of the novel process, and

Figure 2 shows the same rail being treated in accordance with a subsequent step of the process.

For the purpose of discussion austenitic alloy steels may be exemplified by the so-called Hadfield type of manganese steel, which generally contains from 1 to 1.35% carbon and 10 to 15% manganese. Steel of this character is used widely today and is particularly suited to the manufacture of steel rails. In use the rails are subjected to two leading strains. First, the strain or wear upon the surface that is caused by the wheels pounding over the rails, and second, the strain that is imparted to the rail owing to its beam-like character. This second strain results from the weight of the train on the rail between ties and the thrust imparted to the rail as a train rounds a curve. The austenitic quality of the manganese steel suitably resists the surface wear that is imparted during use, and the second type of strain is resisted by imparting a high elastic limit to the steel. Today carbon steels of high elastic limit are being used in rail steel and as pointed out, the present invention is directed

to means for increasing the elastic limit of the austenitic steels without impairing the other desirable qualities of said steel.

The process is carried out in accordance with metallurgical knowledge of today by treating the metal in such a manner that an aggregate of hard constituents is dispersed through a soft matrix as contrasted with the treatment which would result in the same soft matrix holding the hard constituents in a state of solid solution. This is accomplished by creating in the austenitic steels the phenomenon of a partly martensitic structure by means of cold work. In so doing the elastic limit of the steel is raised, the wear resistance throughout is increased, and at the same time there is no appreciable decrease of ductility of the steel after quenching.

As applied to rails, and the invention has a particularly desirable application to this type of material, the process consists in cold working the rails, for instance, initially bending them by passing them through staggered rolls 10, 12 of such diameter and spacing as to attain a degree of bend beyond the elastic limit. This bending may be arranged so that the outer fibre of the head of the rail is in compression and the outer fibre of the base is in tension, or vice versa or alternately so. This operation is followed by passing the material through normal straightening rolls 14, 16 and if required, by a sizing pass to insure the rail the normal and proper sectional dimensions.

Typical data showing the improvement in the physical properties of the rails through the improved process of cold working are as follows:

	Before cold working	After cold working	
Brinell hardness.....	229-235	277-285	28.1% decrease
Deflection (drop test)...	1.46"	1.05"	13.1% increase
Tensile strength.....	130,000# per square inch	147,000# per square inch	64.4% increase
Elastic limit.....	56,740# per square inch	93,280# per square inch	25.4% decrease
Elongation %.....	41.6	31.0	19.1% decrease
Reduction of area %.....	29.2	23.6	

It is to be understood that the process for improving the physical properties of austenitic steels is not limited to cold working high manganese steel rails but is equally applicable to other rolled and forged shapes and sections as well as to other austenitic types of steel.

Having thus described my invention what I

claim as new and desire to secure by Letters Patent of the United States is:

1. The method of treating rails and shapes comprised of austenitic manganese steel which
5 comprises subjecting said rail at a cold working temperature to alternate internal compressive and tensile stresses of an intensity at least beyond the elastic limit of the steel comprising said
10 rail, said stresses being applied to said rail progressively along its length and along a plane substantially transverse to its length.
2. The method of treating rails comprised of austenitic manganese steel which comprises cooling the rail to a cold working temperature, passing
15 the rail through staggered rolls positioned to bend said rail beyond its elastic limit first in one direction and then in an opposite direction progressively along its entire length, and thereafter passing said rail through rolls to
20 straighten it.
3. The method of forming rails and shapes comprised of austenitic manganese steel, which

comprises hot working said steel to the approximate desired size, shape and configuration, cooling the steel shape to a cold working temperature, passing said shape through staggered rolls to
80 bend said shape beyond its elastic limit first in one direction and then in an opposite direction progressively along its entire length, and then through rolls to straighten said shape.

4. The method of forming rails and shapes comprised of austenitic manganese steel which
85 comprises hot working said steel to the approximate desired size, shape and configuration, cooling the steel shape to a cold working temperature, passing said shape through staggered rolls to bend said shape beyond its elastic limit first in
90 one direction and then in an opposite direction progressively along its entire length, and then through rolls to straighten said shape and thereafter cold working the shape to its desired final size.
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EMANUEL J. JANITZKY.

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