No. 782,467. PATENTED FEB. 14, 1905.

J. L. REPLOGLE.

METHOD OF MANUFACTURING BOLTS OR SIMILAR ARTICLES.

APPLICATION FILED DEC. 1, 1904.

Fig. 1.

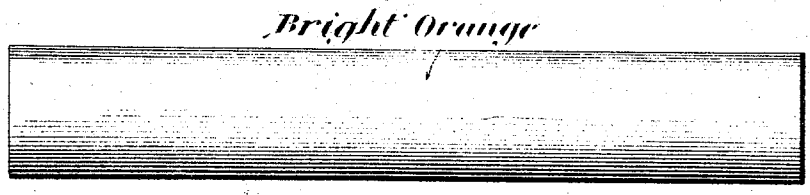


Fig. 2.

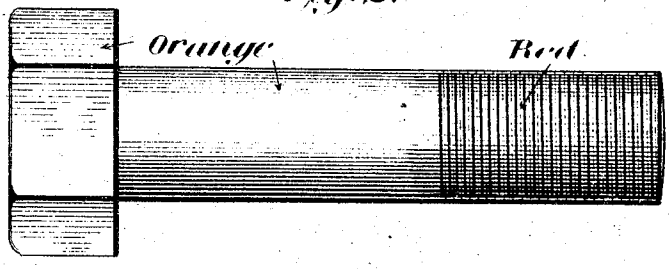


Fig. 3.

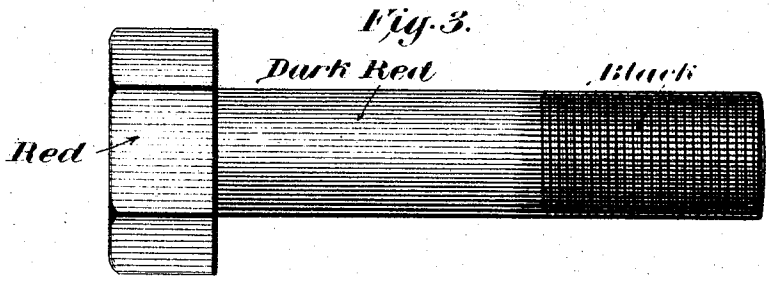


Fig. 4.

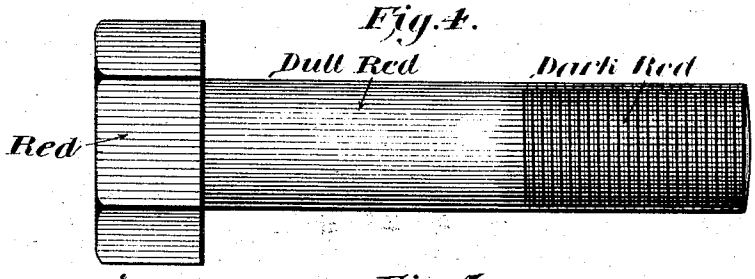
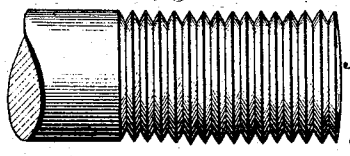


Fig. 5.



WITNESSES,

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No. 782,467. Patented February 14, 1905.

UNITED STATES PATENT OFFICE.

JACOB LEONARD REPLOGLE, OF BOROUGH OF WESTMONT, CAMBRIA COUNTY, PENNSYLVANIA.

METHOD OF MANUFACTURING BOLTS OR SIMILAR ARTICLES.

SPECIFICATION forming part of Letters Patent No. 782,467, dated February 14, 1905.

Application filed December 1, 1904. Serial No. 235,046.

To all whom it may concern:

Be it known that I, JACOB LEONARD REPLOGLE, a citizen of the United States, residing in the borough of Westmont, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Manufacturing Bolts or Similar Articles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improved method of manufacturing bolts which may be applied to those the screw-threads of which are formed by cutting in the customary dies and also bolts which have their screw-threads rolled thereon by a thread-rolling machine; but for the purposes of simplifying the description and illustration of my process herein I will confine it more particularly to bolts the threads of which have been rolled thereon, as before mentioned.

I have found by actual trials that by treating bolts with rolled threads as herein described they can be made to develop the full strength of the stock used—that is, the threaded end although of lesser diameter at the root of the thread than the body of the bolt can be made of equal or greater strength. I have discovered that this is due to the fact that the threaded end has a greater radiating-surface, due to the threaded corrugations thereof, and thereby cools more rapidly than the body of the bolt. This rapid cooling, together with the extra work done on the material in forming the roll-threaded end, strengthens said threaded end to such an extent that although of smaller diameter at the root of the thread it is equal to or greater than the strength of the body thereof. In this connection it should be noted that the radiating-surface of the threaded end of a bolt is about twice as great as that of the body for equal lengths thereof.

My method in general consists in subjecting a bolt heated to a temperature which will be hereinafter described to the cooling effect of a quenching liquid, such as water or other suitable medium, and then removing the same while it is still hot within and allowing it to cool by contact with the atmosphere and the interior heat to diffuse by conduction, and this process is particularly applicable to steel bolts.

For the purpose of more fully illustrating my improved method I will now refer to the annexed sheet of drawings, in which I have attempted to show by means of several diagrams the various degrees of heat through which a roll-threaded bolt passes while undergoing my method of manufacture and treatment. In the various illustrations the general dark effect produced by the shade-lines is intended to represent the lower temperatures, and the lighter portions of the drawings, in which the shade-lines are thinner, are intended to represent the hotter portions, the varying temperatures being represented by different intensity of the shading on the basis stated. In my description of the various temperatures it will be understood that these are gaged by the color or appearance of the article as viewed in the dark, so that it will be unnecessary hereinafter to repeat this explanation. It will also be understood that it is impossible to show degrees of temperature accurately by diagrams, and the method used in illustrating is understood to indicate these in a comparative manner only.

Referring now to the various figures, Figure 1 represents a blank or round rod of steel when drawn from a heating-furnace preparatory to being placed in a bolt-heading machine, the temperature of said blank corresponding to a bright orange color.

Fig. 2 represents the bolt after the head has been formed upon it and after the thread has been shaped by rolling through suitable dies when in the heated condition, and it will be noted that the head and body portion of the bolt is now of a temperature corresponding to an orange color, while the threaded end, owing to its larger surface and contact with the cooler dies, is of a lower temperature, indicated as red. At this stage of the manufacture a particular feature of my method is begun and the bolt represented in Fig. 2 is dipped into water or other cooling medium and there allowed to remain for a few seconds, the time depending upon the temperature of the bolt, its size, the

character of steel, and the temperature of the medium, &c.

Fig. 3 represents the bolt after it has been withdrawn from the cooling medium, the temperature of the head now corresponding to a red color, as on account of its larger bulk it is not so thoroughly cooled as the other portions, the body portion being of a temperature corresponding to dark red, while the threaded end is black hot on the exterior, owing to the large amount of surface exposed to the cooling medium.

Fig. 4 represents the bolt a short time after it has been withdrawn from the cooling medium and the interior heat allowed to diffuse toward the surface, thus making the exterior body portion of a slightly higher temperature than before and the threaded portion similarly of somewhat greater temperature than before, these two being now indicated upon the drawings as dull red and dark red, respectively, as compared with the prior temperatures corresponding to dark red and black hot, respectively.

On account of the character of the shading required to indicate the temperatures in Figs. 1 to 4, inclusive, it has been impracticable to show the threads clearly in Figs. 2, 3, and 4, as the lines for these would be confused with the shade-lines indicating temperatures. I have therefore shown the threaded end in side elevation in Fig. 5 for the purpose of indicating its general shape, proportions, and its excess of surface, as compared with the body portion.

The effect of the treatment described is to increase the elastic limit and ultimate strength of the threaded end over that of the body, owing to the more sudden and thorough cooling thereof, accomplished by immersion in a cooling liquid, due to the greater extent of radiating and conducting surface of said threaded end as compared with that of the body of the bolt, and this is a particular and important feature of my invention.

Although, as heretofore stated, I have described the details of my method as applied to bolts, the threads of which are produced by hot rolling in contact with suitable dies, I do not, however, limit myself in its application to this type of bolts only, as the threaded ends of bolts formed by any other method may be also treated and improved in like manner after first heating them to the required temperature. Although I have referred to bolts with threads and illustrated same with heads on the drawings attached hereto, I do not wish to limit myself to these alone, as my process is equally applicable to threaded rods without heads, bridge-rods with upset and threaded ends, tank or pipe bands with screw-threads thereon, and similar constructions, as will be readily understood by one skilled in this art.

I am familiar with the fact that it is not new to treat certain articles of steel, such as axles and other forgings, in a manner similar to that herein described, and I therefore do not claim such as my invention; but I do claim the herein-described method of manufacturing screw-threaded bolts, as these on account of the peculiarities of the shape and surfaces of their various portions, as previously stated, are different from the other objects named, and consequently capable of receiving different qualities in their different parts by means of my method.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of manufacturing screw-threaded bolts, which consists in forming a thread thereon, then quenching in water or other suitable medium, while said bolt is of a temperature corresponding substantially to an orange color in the dark, then withdrawing same therefrom after the threaded portion has become cooler than the body portion by reason of the greater radiating-surface of said threaded portion, and then allowing the bolt to cool and the heat therein to diffuse by contact with the atmosphere.

2. The method of manufacturing bolts, which consists of first heating a blank to a bright orange color in the dark, then forming a thread thereon by rolling said blank through suitable dies, then quenching the same for a short time in a cooling liquid whereby the threaded end is cooled to a lower temperature than the body portion by reason of the greater radiating and conducting surface of said threaded end, and finally allowing said bolt to cool and the temperature therein to diffuse by contact with the atmosphere.

In testimony whereof I hereto affix my signature in the presence of two witnesses.

JACOB LEONARD REPLOGLE.

Witnesses:

GEO. BEATTY,

ELMER SEAVEY.