(No Model.)

W. H. WRIGHT.

MODE OF HARDENING STEEL ARTICLES.

No. 470,277. Patented Mar. 8, 1892.

Fig.1.

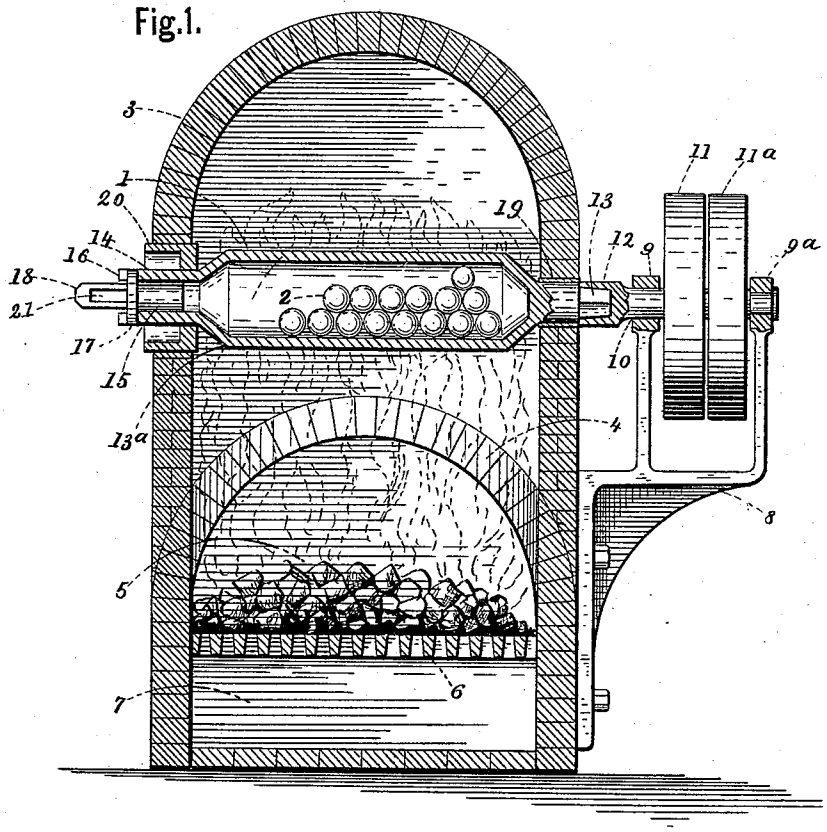


Fig.2.

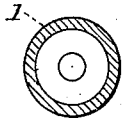
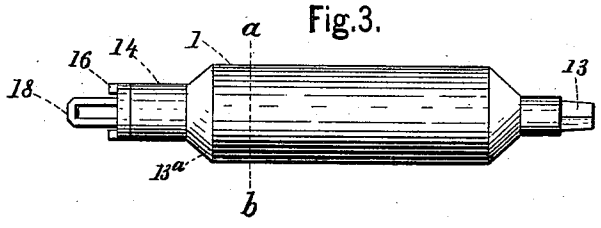


Fig.3.



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MODE OF HARDENING STEEL ARTICLES.

SPECIFICATION forming part of Letters Patent No. 470,277, dated March 8, 1892.

Application filed January 10, 1891. Serial No. 377,334. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. WRIGHT, a citizen of the United States, residing in Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in the Mode of Hardening Small or Large Steel Articles, of which the following is a specification.

My invention relates to an improved means and mode of hardening steel balls or other articles, all of which will be fully and clearly hereinafter described and claimed, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional elevation cutting through the furnace and tempering mechanism. Fig. 2 is a cross-section through the tempering-cylinder in or about line *a b*, Fig. 3. Fig. 3 is a detached side elevation of the tempering-cylinder.

In said drawings, 1 represents a hollow iron agitating-vessel for holding the balls 2 or other article to be tempered or hardened. This cylinder is mounted in a furnace or oven 3, preferably of fire-brick. Below the oven 3 and agitating-vessel is an arch 4, and through the arch is a narrow opening for conducting the flames up from the fire-chamber 5 to heat the agitating-vessel 1. The grate 6, upon which the fuel is supported, is made in the usual way and preferably of cast-iron. 7 is the usual ash-receptacle.

To one side of the oven or furnace is a supporting-frame piece 8, having bearing-boxes 9 9^a, in which is mounted the shaft 10, carrying a tight and loose pulley 11 and 11^a. At the front end of the shaft 10 is a square socketed portion 12, in which the square end 13 of the agitating-vessel 1 is placed when it is put in place, as shown in Fig. 1. At the opposite end 13^a of the agitating-vessel is an open end 14, in which is fitted a cylinder-plug 15, secured by bolts 16 passing through a flange 17. At the head of the plug 15 is a handle 18, by which it is drawn out when necessary. This plug 15 is adapted to be easily removable and is kept in place by the bolts 16, which screw into the ends of the cylinder and hermetically seal it.

The agitating-vessel 1 is journaled in a bearing 19 at the rear end, which passes through said bearing, and the square end then passes into the socketed portion 12. The opposite end 13^a is fitted in a removable journal-box 20. The outside of the journal-box 20 is made large enough so that when removed the agitating-vessel can be drawn out through the opening left by its removal.

The operation of tempering is as follows: The cylinder being removed from the furnace, the bolts are withdrawn and the plug 15 taken out. The small balls 2 or other articles are now introduced into the cylinder through the mouth of the vessel 1. I then introduce the required chemicals to insure hardness and toughness in the tempering operation—animal carbon, for instance. The plug is now tightly secured in place by the bolts 16, and the agitating-vessel put into the opening left by the removal of the journal-box 20. The box 20 is now put in place, as shown in Fig. 1, and a driving-belt adapted to run on the loose pulley 11^a is removed onto the driving-pulley 11 by any well-known means, thereby causing the agitating-vessel to rotate, which operation causes all parts of the vessel to be heated alike, and consequently transmits an equal heat to the articles within. It also prevents the agitating-vessel from melting under the intense heat while the rotation of the agitating-vessel is going on, the heat in the oven being increased until the articles within the agitating-vessel have reached the proper temperature for tempering. During this time a very heavy pressure has been generated by the decomposition of the animal carbon within the cylinder among the articles to be tempered. The agitating-vessel 1 may be cylindrical, as shown, or square, hexagonal, or any other shape, instead of cylindrical, as shown, if desired. The gas formed by the heat acting upon the animal carbon generates a great pressure within the agitating-vessel, often so great as to burst a vessel three-quarters of an inch thick; but with proper care and gaging exactly to the size of the cylinder the amount of carbon put in this may be avoided. The metal, being heated, expands so that the pores open, and thereby give the chemical used a better chance to penetrate, and the great pressure employed materially increases its action.

When the required temperature has been reached, the hot agitating-vessel is removed from the furnace by means of an iron hook being introduced into the opening 21 and then pulling the tempering-vessel through the opening in the side of the furnace, the box 20 coming out with it. The bolts 16 are now removed and the plug 15 taken out, (great care being required to avoid the effects of the gas from the cylinder, as it is often dangerous.) As soon as the plug 15 is removed the hot balls are emptied into a vessel containing cold water or other well-known cooling-liquid, and are thereby tempered exceedingly hard, so much so that the balls so tempered have been driven into a solid piece of iron or steel without breaking them.

It will be seen from the foregoing description that the balls, for instance, are heated in a closed moving vessel while under a heavy pressure by the gas generated in the agitating-vessel. The heating of the articles while thus kept in motion insures the heating of every article exactly alike, so that when one is of the proper temperature the whole are of the proper temperature. This avoids the usual objection where a number of such articles are heated together at the same time for tempering. If heated in a stationary vessel, some would be tempered too hard and some too soft. By my process all are of the same degree of hardness.

The heating of the articles in a rotating vessel is important, because it brings all sides of the agitating-vessel in contact with the fire, thereby heating all alike. The articles to be hardened are also thus equally heated on all sides by a continued turning or rolling motion in one direction within the rotating cylinder, thereby bringing all sides equally to the heat.

I have shown and mentioned the heating of the articles under pressure in a moving vessel; but many articles may be thus heated and tempered without chemicals in an agitating-vessel, and consequently without pressure.

I claim as my invention—

The herein-described mode of hardening steel articles, which consists in heating them in the presence of a carbonizing material while under pressure and in motion in a sealed agitating-vessel and then subjecting them to a cooling-liquid, substantially as described.

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