

UNITED STATES PATENT OFFICE.

ANDREW F. MITCHELL, OF MUNHALL, PENNSYLVANIA.

PROCESS OF MANUFACTURING STEEL.

SPECIFICATION forming part of Letters Patent No. 721,061, dated February 17, 1903

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To all whom it may concern:

Be it known that I, ANDREW F. MITCHELL, a resident of Munhall, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Processes for the Manufacture of Steel; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the manufacture of steel, and has for its object to provide a process for improving the quality of articles made therefrom.

The main object of my invention is to provide means to accomplish this result in steel castings; but it is equally applicable to other articles of steel. For the purpose of accomplishing this result I preferably employ a steel into which nickle, chrome, aluminium, manganese, or an alloy of two or more of these, enters as a constituent.

My process consists in first heating the article to be treated to a temperature above that of recalcence and slowly cooling the article below said temperature, this being repeated until the original granular condition of the steel is changed to a granular condition of such greater fineness as may be desired, and then heating the article to a certain temperature, which varies according to the composition of the steel, but which in all cases lies at or immediately below the temperature of recalcence, instantly stopping the application of heat, all this being accomplished without removal from the furnace in which the first heating was done, and then cooling the article either naturally, by exposure to the air while covered with ashes or other non-conductor of heat while held in a closed receptacle, or by other suitable means.

My process is especially well adapted to the production of steel articles—such as pinions, rolls, spindles, coupling-boxes, and the like—that are required to be very tough.

In case it is desired to secure a hard surface on the article an additional step is necessary. After changing the crystalline condition of the steel into a fibrous one by means of the former treatment I reheat the article to be treated by a rapid severe heat applied to the surface of the object or a particular part thereof to a point somewhat above that formerly used and then cool the article in any

desired manner, as by water or other cooling liquid. For this purpose I preferably use a steel having a high degree of carbon content. The purpose of this rapid heating being to avoid the excessive heating of the remainder of the article, it is obvious that if any other means be taken to keep this remainder cool it will not be necessary to apply the heat rapidly.

I am aware that armor-plates, which can be included under my process, are being made under a somewhat similar to but more expensive and complicated process than that I have invented; but I am not aware of such plate being manufactured without a decrease in elementary constituents, principally carbon, in the ingot and throughout the mass, and the only following heat treatments being for forging or rolling to finished gage, fiberizing, bending or shaping, tempering, and finally rectification of shape after the tempering. My treatment also differs in that it is directly applicable to the casting before subjecting the same to any forming or machining.

My process will be thus seen to consist in heating the steel above the temperature of recalcence one or more times, allowing it to cool below said temperature after each heating, heating it to a temperature immediately below said temperature and again cooling it, and finally, if desired, hardening or chilling the exposed or wearing surface or surfaces of the article to the desired depth.

I do not wish to confine myself to the exact form of the process as herein described, but wish to include all such variants as properly come within the scope of my invention as defined by the claims.

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

1. The herein-described process for toughening and hardening steel, consisting in subjecting the steel to a heat sufficient to raise the temperature thereof above recalcence, then cooling the steel to a temperature below recalcence without removal from the heating-furnace, again heating the steel to a temperature immediately below recalcence, and then again cooling the same, substantially as described.

2. The herein-described process for tough-

ening and hardening steel consisting in sub-
jecting the same to a heat sufficient to raise
the temperature thereof above that of reca-
lescence, then cooling the steel to a temper-
5 ature below recalcence without removal
from the heating-furnace, and again heating
the steel to a temperature near recalcence,
substantially as described.

3. The herein-described process for harden-
10 ing and toughening steel which consists in
heating the same to a temperature above that
of recalcence, then cooling the same below

said temperature without removal from the
furnace, again heating the steel to a temper-
ature near recalcence, and finally treating 15
the steel by heating a portion thereof to a
temperature above recalcence and then cool-
ing the same.

In testimony whereof I, the said ANDREW
F. MITCHELL, have hereunto set my hand. 20
ANDREW F. MITCHELL.

Witnesses:

Mrs. J. S. GIBSON,
EDWIN B. LYON.