UNITED STATES PATENT OFFICE.

ALBERT SCHMITZ, OF ESSEN, GERMANY, ASSIGNOR TO THE FIRM OF FRIED. KRUPP, OF SAME PLACE.

PROCESS OF IMPROVING QUALITY OF STEEL ARMOR-PLATES.

SPECIFICATION forming part of Letters Patent No. 642,926, dated February 6, 1900.

Application filed March 14, 1893. Serial No. 465,943. (No specimens.)

To all whom it may concern:

Be it known that I, ALBERT SCHMITZ, a subject of the King of Prussia, Emperor of Germany, residing at Essen, in the Kingdom of Prussia, German Empire, have invented a new and useful Process for Improving the Quality of Steel Armor-Plates, of which the following is a specification.

The process forming the subject of the present application has for its object the improvement of the quality of steel armor-plates by subjecting the same after their production by any one of the known processes of manufacture to a series of additional metallurgical operations.

If a steel armor-plate of any composition—as, for example, nickel-steel, compound, or homogeneous plates, as hereinafter stated—be heated to a temperature producing a pasty condition permitting a molecular rearrangement—say, for example, 800° centigrade—and then hardened in this condition by complete immersion in oil or water or other liquids, the plate will assume a greater or less degree of hardness, with the formation of an extremely-fine-grained structure. The temperature required for this purpose is higher the less the amount of carbon contained in the plate and depends also on the chemical composition of the plate. Now if this plate thus hardened be again subjected to a glowing heat, which must, however, not be so high as the previous hardening heat—say 600° centigrade—and particularly not so high as to allow of the possibility of ready molecular rearrangement taking place, and if the plate as soon as it has reached uniformly and with certainty the temperature corresponding to the said glowing heat or is maintained for some hours at such temperature be allowed to cool slowly, the hardness proper of the plate is lost. The plate retains, however, a considerably greater resisting power against shot than the untreated plate and acquires above all by the highly-fibrous molecular grain thus produced (which has an appearance on fracture very similar to velvet with a silky border) the capacity in a very high degree of offering great resistance to fracture when struck by shot. If now the plate thus improved be again heated to the last glowing heat or to a lower temperature, which shall not, however, exclude hardening, and the plate be hardened on one face by copious drenching with water or by immersing one face of the plate in water which may also contain any known hardening agents, while the other face of the plate remains out of contact with the water, then an armor-plate is produced having a very hard face for exposure to projectiles, while the mass or main body of the plate has been converted by the preceding operations into a condition that offers the greatest possible security against fracture combined with increased resistance.

In the case of thinner or harder plates it may be advantageous in effecting the hardening on one face to protect the other face of the plate by special means from cooling too quickly. This is effected during the drenching operation, preferably by placing the plate to be drenched with its rear face upon another plate heated to a glowing heat. When the plate is to be immersed in water, the same object is effected by placing another plate heated to a glowing heat upon the rear side of the plate to be immersed.

The third heating operation may, if desired, be dispensed with in some cases and the hardening on one face be effected at the end of the second operation—that is to say, directly after the heating for the formation of the fibrous structure without previously allowing the plate to cool.

As will be seen from the preceding, the present process consists, essentially, in the following three operations for the purpose of producing armor-plates hardened on one face only, to wit: first, hardening the plates by bodily immersion in oil, water, or other media after having previously raised them to a temperature at which the molecules have acquired the capability of rearrangement; second, annealing the plates at a temperature which is as high as possible without, however, reaching the temperature at which said capability of ready rearrangement begins, and, third, hardening the plates on one side or face at the same or at a lower temperature than that specified in the preceding or second operation.

By means of this process plates are produced which are equally excellent both with

respect to their great resistance to projectiles and their small liability to fracture.

This new process is particularly suitable for nickel-steel armor-plates of various degrees of hardness.

This process is, however, applicable to plates of steel of all kinds and also to compound plates which consist only partially of steel, and also to homogeneous plates the percentage of carbon in which is different on opposite sides.

The temperatures employed in the several stages of the process must reach at least 500° centigrade, but vary with the nature of the steel from this temperature to 1,100° centigrade.

What I claim as new is—

1. The herein-described method for the improvement of armor-plates, consisting in first heating the plate to a temperature permitting molecular rearrangement and consequent conversion, upon hardening, to a fine, homogeneous grain; and then hardening the entire plate by suddenly cooling; then reheating to a maximum temperature below that permitting retroversion of the granular structure and allowing the plate to cool slowly; then reheating the same to a temperature equal to, or somewhat lower than, the temperature of the second reheating, but not so low as to exclude hardening and then hardening (by suddenly cooling) one surface of the plate only.

2. The herein-described method for the improvement of armor-plates, consisting in first heating the plate to a temperature permitting molecular rearrangement and consequent conversion, upon hardening, to a fine, homogeneous grain; and then hardening the entire plate by suddenly cooling; then reheating the plate uniformly to a maximum temperature below that permitting retroversion of the granular structure, but not low enough to exclude hardening and then hardening (by suddenly cooling) one surface of the plate only.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALBERT SCHMITZ.

Witnesses:
LUDWIG WIPFEL,
OSCAR THROEBEL.