

## UNITED STATES PATENT OFFICE.

JEAN LECARME, OF PARIS, FRANCE.

## PROCESS OF TREATING IRON, CAST-IRON, AND STEEL.

SPECIFICATION forming part of Letters Patent No. 787,926, dated April 25, 1905.

Application filed October 3, 1903. Serial No. 175,681.

*To all whom it may concern:*

Be it known that I, JEAN LECARME, a citizen of France, residing at 118 Rue de Vaugirard, Paris, France, have invented new and useful Improvements in Processes of Treating Iron, Cast-Iron, and Steel Employed in the Manufacture of Various Objects, Tools, and Sonorous Musical Instruments, of which the following is a specification.

The process forming the object of the present invention is applicable to articles made of iron, cast-iron, or steels not capable of being hardened by tempering. It has for its object to give to these articles new qualities of hardness, tenacity, and others either throughout their entire mass or only to a certain thickness and over the entire surface or only over a part thereof and to render them capable of being tempered. This result is obtained by incorporating with the surface of the metal and to variable depth a body chosen to modify in a convenient way the qualities of the primitive metal. Articles can thus be made in cast-iron, iron, or mild steel, which are easy to work, and they can then have given to them over their entire surface or only over determined parts the qualities sought of hardness, tenacity, sonorousness, &c.

The process consists in covering the pieces to be treated or only determined parts of said pieces with a composition containing the body to be incorporated and in heating said pieces to a bright red in a muffle or in boxes filled with wood-charcoal in powder or with sand or in any suitable way excluded from the air. The composition employed for this purpose has for its base a mixture of wood-charcoal in fine powder and a cyanid or ferrocyanid, to which is added an agglutinant material, such as gelatin or dextrin, and the whole is made into a paste, with which the pieces to be treated are coated either entirely or partially.

When it is desired simply to produce on the surface of the article in iron a layer of normal steel—that is to say, when it is desired to cement it—the cyanid or ferrocyanid of potassium is employed, according as it may be desired to have a more or less energetic action.

When it is desired to obtain on the surface of iron a layer of special steel by the incorporation of a metal such as nickel, chromium, manganese, &c., the cyanid of potassium will be replaced by the cyanid of nickel, of chromium of manganese, &c., or else to the cyanid of potassium will be added a salt or an oxid of the metal which is desired to be incorporated. There can thus be obtained articles having superficially all the qualities of nickel steel, chrome steel, or manganese steel.

Tools made of nickel steel which do not acquire by tempering sufficient hardness may be treated by the process above described with a view to incorporate with them superficially different metals or metalloids suitable for the purpose to which the article is to be applied. Excellent tools are thus economically obtained which never break in tempering. This method applied to the construction of rotary cutters, screw-taps, &c., is particularly advantageous.

Finally, compounds can be obtained which are endowed with very various properties by incorporating with them metalloids, such as sulfur, phosphorus, arsenic, nitrogen, &c. These bodies are ordinarily eliminated as much as possible in metallurgy, because they render irons and steels brittle and unsuitable for use in factories; but by incorporating them after manufacture they can give advantageous results in certain applications. These bodies themselves or their acids will be added to the mixture of charcoal and cyanid. The following example is a composition which would be suitable to obtain a layer of steel slightly arsenious: charcoal finely pulverized, ferrocyanid of potassium pulverized, arsenious anhydrid, (traces,) boiled linseed-oil, siccativ oil of turpentine. This mixture employed in the form of paint gives excellent results—for example, on rotary cutters made of mild steel.

The properties obtained by this process are capable of giving rise to applications entirely new in industry. Thus iron and steel acquire a remarkable sonorousness, the timber or tone of which varies with the body incorporated and the depth of the layer incorporated. Thus bells, clock-bells, and other

sonorous instruments may be made of iron or steel which may be worked with ease and afterward have given to them the hardness and the tone desired by incorporating with ; them, as above described, the bodies proper to obtain the result sought. Finally, the power of acting on the piece only partially, and even of obtaining on the same piece portions more or less hard and of different qualities, can in certain cases considerably simplify the manufacture.

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

15 The process for hardening and transforming into steel of variable qualities the entire or part of the surface of objects, rotary cut-

ters, screw-taps and other tools and bells and other sonorous instruments made of iron, cast-iron, or mild steel, said process consisting of coating the objects on the surfaces or parts to be treated with a composition containing charcoal in powder, cyanid of potassium, and a combustible agglutinant body and then heating these bodies to a bright red 25 excluded from the air, substantially as herein set forth.

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

JEAN LECARME.

Witnesses:

WILLIAM J. MURRAY,  
PAUL T. PAQUET.