

# United States Patent Office.

WILLIAM HARRIS AND ADAM WOOLEVER, OF ALLENTOWN, PENNSYLVANIA.

Letters Patent No. 101,963, dated April 12, 1870.

## IMPROVEMENT IN CONVERTING CAST-IRON INTO STEEL.

The Schedule referred to in these Letters Patent and making part of the same

*To all whom it may concern :*

Be it known that we, WILLIAM HARRIS and ADAM WOOLEVER, both of the city of Allentown, in the county of Lehigh and State of Pennsylvania, have invented a new and useful Improvement in the Process for Converting Cast-Iron into Steel; and we do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same.

Our process consists in commingling with melted cast-iron certain chemical substances, which, being decomposed by the intense heat of the iron, produce the requisite chemical change and quality in the latter, which is known as steel.

The chemical substances which are thus commingled, and the usual proportions of the same, are as follows:

Common salt, one quart; saltpeter, one pound; glass, one pound; antimony, one pound; black oxide of manganese, four pounds; fuller's earth, two pounds; sulphuric acid, two pounds; litharge, two pounds; pulverized charcoal, three quarts.

The above quantities are sufficient for a charge of about four hundred and twenty-five pounds of cast-iron, more or less.

The iron is melted until quite thin in a puddling or other suitable furnace, and the above-mentioned substances are intimately mingled together, (or otherwise,) and then stirred into the iron by the usual puddling manipulations until the same is withdrawn from the furnace.

By conducting steam into the stack of the puddling-furnace at the proper time, it creates a strong draught, and rapidly removes the impurities and gases which are expelled from the metal by the chemicals used.

We also form a bottom in the puddling-furnace from the cinder and slag of wrought-iron scrap. This bottom is less impregnated with impurities, and makes better and clearer steel.

The pig-iron used should be broken into equal sizes, so that the pieces will melt at the same time, and when the iron is thoroughly melted the damper is then to be closed and the blast taken off. Then put in the chemicals. Then work the heated mass thoroughly for a few minutes. Then open the damper, put on the blast, and apply the steam to the furnace-stack to create a strong or rapid flame and heat, and thereby rapidly expel the gases and other impurities from the metal until it shows a fine grain. Then the steam and blast are taken off and the damper closed. Then the pulverized charcoal is thoroughly stirred into the mass by the usual puddling manipulations. Then the damper is raised and the blast put on, and the furnace to be kept full of flame up to the stopper-hole until the melted mass begins to drop. Then the damper is closed within one link, and the blast reduced, so as only to keep the furnace full of flame and exclude the air. Then, when it drops, keep it down in its cinder or slag by the tool, and close the mass together so as to prevent a lap, and thereby keep in all the carbon it contains.

We desire to be understood as not limiting our process to the precise articles and quantities above set forth, but contemplate the employment in practice of such modifications of the ingredients set forth in the first formula as will be found beneficial.

Having thus described our invention,

We claim as new and desire to secure by Letters Patent—

The process of manufacture, substantially as and for the purpose set forth.

WILLIAM HARRIS.  
A. WOOLEVER.

Witnesses:

E. REHRIG,  
CHAS. ECKERT.