UNITED STATES PATENT OFFICE.

EDGAR PECKHAM, OF ANTWERP, NEW YORK.

IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

Specification forming part of Letters Patent No. **143,637**, dated October 14, 1873; application filed September 20, 1873.

To all whom it may concern:

Be it known that I, EDGAR PECKHAM, of Antwerp, in the county of Jefferson and State of New York, have invented a new and useful Improvement in Purifying Iron and Steel; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention is a new way or method of purifying iron and steel during its manipulation in the catalan forge-fire or puddling-furnace; and consists in using a flux substantially in the manner hereafter described, by the use of which I am enabled to remove from the metal during the operation silica, phosphorus, and other impurities that can be removed in the cinder, and in this manner prevent their entering into the loop or ball and deteriorating the quality of the iron or steel produced.

When manufacturing iron or steel by the catalan forge-fire or puddling-furnace from ores that contain silica, phosphorus, or other impurities, the impurities, to a great extent, enter into the cinder; and, if the cinder thus made impure can be thoroughly separated from the metal, the iron or steel produced will be nearly free from the impurities.

The object of my invention is to produce a thorough separation of the impure cinder from the metal, and in this manner purify the iron or steel.

In the ordinary way or method of conducting the operation, the drop or cinder arising from the ore or pig-iron is usually allowed to collect and remain in the fire or furnace until the end of the operation; and, if the ore does not furnish cinder enough to work itself, hammer-cinder or some other substance is usually added to make sufficient cinder to cover the loop or metal; but the cinder is allowed to collect and remain in the fire or furnace until the end of the operation, and is drawn off either just before or just after the loop or ball is taken from the fire or furnace; consequently the loop or ball is impregnated with the impurities contained in the cinder.

My improved method consists in drawing off and removing from the fire or furnace the impure cinder arising from the ore or pig-iron as fast, or nearly as fast, as it is made, and supplying its place (by the use of a flux) with a pure cinder; and, if the impure cinder arising from the ore or pig-iron should be thick, and not liquid enough to separate thoroughly from the metal, (as is often the case with cinder arising from ores or pig-iron containing silica,) I add enough flux to it to make it liquid, so it will separate from the metal, when I draw it off, and supply its place with a pure cinder by adding more flux, and in this manner separate the impurities from the iron or steel. I use as a flux lime, flint, spar, or lean hematite or specular ore, or any other substance that will produce a liquid cinder free from impurities, the nature of the flux used depending somewhat upon the character of the ore or pig-iron employed. I prefer lean hematite or specular ore when it can be obtained.

If the ore or pig-iron employed produces a thin liquid cinder, any substance that will produce a liquid cinder free from impurities—such as clay, lime, or lean hematite or specular ore—may be used; but if the ore or pig-iron produces a thick gummy cinder that will not flow readily, some substance—such as lime, white sand, flint, spar, lean hematite or specular ore—must be used that will cut the thick cinder, and cause it to become liquid, so it can be drawn off.

The flux used should be made fine, about the size of coarse shot, (may be a little finer or coarser,) and should be separated from earthy matter.

When manufacturing iron or steel from the ore by the catalan forge-fire, the operation should be conducted in the following manner, viz: When the blast is turned on at the commencement of the loop, one large or two small shovelsful of flux should be put in the fire. This will melt readily into cinder, and cover the bottom of the fire, and will mix with the impure cinder from the ore and cause it to become liquid, so it can be drawn off. As soon as the loop is formed and settled to the bottom of the fire, (which will vary somewhat, according to the condition of the fire, and will be from one-half to one hour,) the cinder should be tapped and drawn off slowly until it is nearly all drawn off, care being taken to not draw it too close and leave the face of the loop dry. A sufficient quantity of flux should at the same time be added to or put into the fire

to produce cinder sufficient to cover the loop and take the place of the cinder drawn off; and in about twenty minutes thereafter (not to exceed half an hour) the cinder should again be tapped and drawn off, as before, and new flux added, and so on to the end of the loop, drawing off the impure cinder and supplying its place with the pure cinder from the flux about every half hour, and in this way remove the impurities from the ore. The ore should be charged into the fire, and the rest of the operation conducted in the ordinary way.

The operation may be varied a little and conducted in the following manner, which I think preferable; the result, however, will be the same: The cinder, after it is first tapped, may be allowed to flow slowly but steadily from the fire during the continuation of the loop, and sufficient flux added from time to time to keep the cinder thin and liquid, and the requisite amount in the fire. In this way the impure cinder is removed as fast as it is made and its place supplied with a pure cinder.

The flux may be mixed and charged into the fire along with the ore, provided care is taken to use sufficient flux to keep the cinder at all times liquid, and to draw off and remove a small cake of cinder at least every half an hour, so as to remove the impure cinder as fast or nearly as fast as it is made. It is preferable, however, to use the flux independent of the ore, as the operation can be regulated and governed better with it in that way than if mixed with the ore. At the end of the operation, and before the loop is taken from the fire, the bottom cinder-hole should be tapped and all the cinder remaining in the fire drawn off, and the fire left clean and free from cinder for the next loop.

When manufacturing iron or steel from ore or pig-iron by the puddling-furnace, the operation should be conducted in the following manner, viz: After the furnace is brought to the proper heat, flux should be first charged into the furnace, the quantity varying from two to five shovelfuls, depending upon the size of charge and quality of ore or pig-iron used, and can be readily determined by the workman, his guide being to use flux enough to make and keep the cinder thin and liquid. After the flux has been melted the ore or pig-iron should be charged into the furnace and worked in the usual manner; and as soon as the ore or pig-iron is brought to nature and separated from the dross or cinder, and before being balled, the cinder in the furnace should be tapped and drawn off, and flux enough added or charged into the furnace immediately to replace the cinder thus drawn off, (while this is being done, the furnace-damper should be closed;) after which the ore or metal should be balled and taken out. By adding flux to the impure cinder, so as to make it liquid and separate more thoroughly from the metal, and changing the cinder in this manner, the impure cinder arising from the ore or pig-iron is removed, and the balls of iron or steel produced will be impregnated with the pure cinder from the flux instead, which will greatly improve their quality. This operation may also be varied a little by allowing a small stream of cinder to flow constantly, or nearly so, from the furnace during the operation, and charging into the furnace, from time to time, flux sufficient to replace the cinder thus drawn off and keep the requisite amount of cinder in the furnace. The furnace may be constructed with an upper hearth, in which the flux may be melted previous to drawing off the impure cinder from the ore or pig-iron, and as soon as that is done the pure cinder from the flux may be allowed to run into the lower hearth and supply the place of the impure cinder drawn off; or a small stream of impure cinder may be kept flowing constantly from the lower hearth, and a correspondingly small stream be allowed to flow from the upper or flux hearth into the lower hearth, so as to keep the requisite amount of cinder in the furnace.

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

1. The process of purifying iron and steel, during its manipulation in the catalan forge-fire or puddling-furnace, by using flux, substantially in the manner previously described.

2. The use of lean hematite or specular ore as a flux for purifying iron and steel during their manipulation in the catalan forge-fire or puddling-furnace, substantially as described.

EDGAR PECKHAM.

Witnesses:

JOHN D. ELLIS,

ALBERT HOYT.