

UNITED STATES PATENT OFFICE

CHARLES BURGESS, OF PORTSMOUTH, OHIO, ASSIGNOR TO BURGESS STEEL
AND IRON WORKS, OF SAME PLACE.

IMPROVEMENT IN THE MANUFACTURE OF STEEL.

Specification forming part of Letters Patent No. **141,320**, dated July 29, 1873; application filed
March 21, 1873.

To all whom it may concern:

Be it known that I, CHARLES BURGESS, of Portsmouth, Scioto county, Ohio, have invented an Improved Process for Manufacturing Steel from Cast-Iron, of which the following is a specification:

My invention relates to a rapid, economical, and effective process for the manufacture of steel direct from cast-iron, by the use of stone-coal or other suitable fuel, in a common puddling-furnace.

A fire, which may be of ordinary stone-coal, having been raised in the fire-place of a puddling-furnace, the charge of broken pig or other cast-iron, preferably charcoal-iron, is placed on the hearth, and the ash-pit and damper are left open, so as to secure a thorough draft. The workman examines the charge from time to time through the stopper-hole, and as soon as the exposed upper surfaces of the charge show signs of partial fusion, the workman gently turns over the pieces, so as to expose fresh surfaces to the action of the flame, after which he keeps shifting the pieces until they are all melted down into the condition of a puddle. The workman then (the ash-pit and damper remaining open) closes the stopper-hole, and stimulates the fire. This process of intense heating and active combustion, without manipulation of any sort, is permitted to continue for a period of five to fifteen minutes, until the workman, closely watching the behavior of the charge from time to time through the stopper-hole, observes at that portion of the puddle near the fire-bridge numerous jets of blue flame about the size of the flame of an ordinary tallow candle. At the end of two or three minutes these flames are observed to disappear, first from the hottest part, near the fire-bridge, and thence to quickly subside toward the chimney-end. This subsidence of the flame is succeeded, within one to two minutes, by brilliant scintillations, caused by the boiling up through the crust of cinder of the white-hot molten metal, in patches resembling bright silver coins of various sizes. The moment that this ebullition manifests itself, the workman

closes the damper, and, inserting the rabble through the stopper-hole, proceeds to slowly stir the mass until it assumes a slightly thickened or pasty condition, which being observed, the damper is again opened, the fire again stimulated, and the puddle stirred and boiled for a period of five to fifteen minutes, at discretion, depending on the quality of the materials, the condition of combustion, and the kind of steel to be produced.

If it be desired to produce a hard quality of steel, the workman closes the damper immediately that the puddle comes to a full boil. If, on the other hand, a softer steel be desired, the ebullition is suffered to continue until the proper decarbonization is believed to have been reached. The damper is then closed, so as to stop the decarbonization, and the metal, becoming slightly cooled, is seen to come to the condition of a spongy mass, which is then, by means of a common paddle or other suitable means, quickly divided into two or more fragments or left entire, and the piece or pieces are then "balled" and taken to the hammer or squeezer.

A flux may be advantageously applied to the iron when fused, to assist in the expelling of the impurities, such as sulphur, phosphorus, silicon, &c. The flux may be composed of the following ingredients: Sulphate of iron, coarse salt, common soda, black oxide of manganese. These may be mixed together in proportions according to the quality of the pig-iron employed, and will act as a stimulant in the iron, and cause the above impurities to escape more freely from the metal.

The following are regarded as the most essential features of novelty in my process, to wit: First, stimulating the fire until the appearance and disappearance of the blue flames, and then checking it for working. Second, closing the dampers the second time, to check the heat and stop decarbonization when a full boil is reached, or a little later, if a softer steel be desired.

The following is claimed as new:

The process herein described for manufacturing steel from cast-iron, in the puddling or reverberatory furnace—that is to say, exposing the mass to a high heat to burn out the impurities and partially decarbonize it; then working it with closed dampers; then reopening them for boiling, and subsequently

closing them while the mass is acquiring its final spongy condition, after which it is withdrawn.

CHARLES BURGESS.

Witnesses:

OCTAVIUS KNIGHT,
W. H. PEARCE.