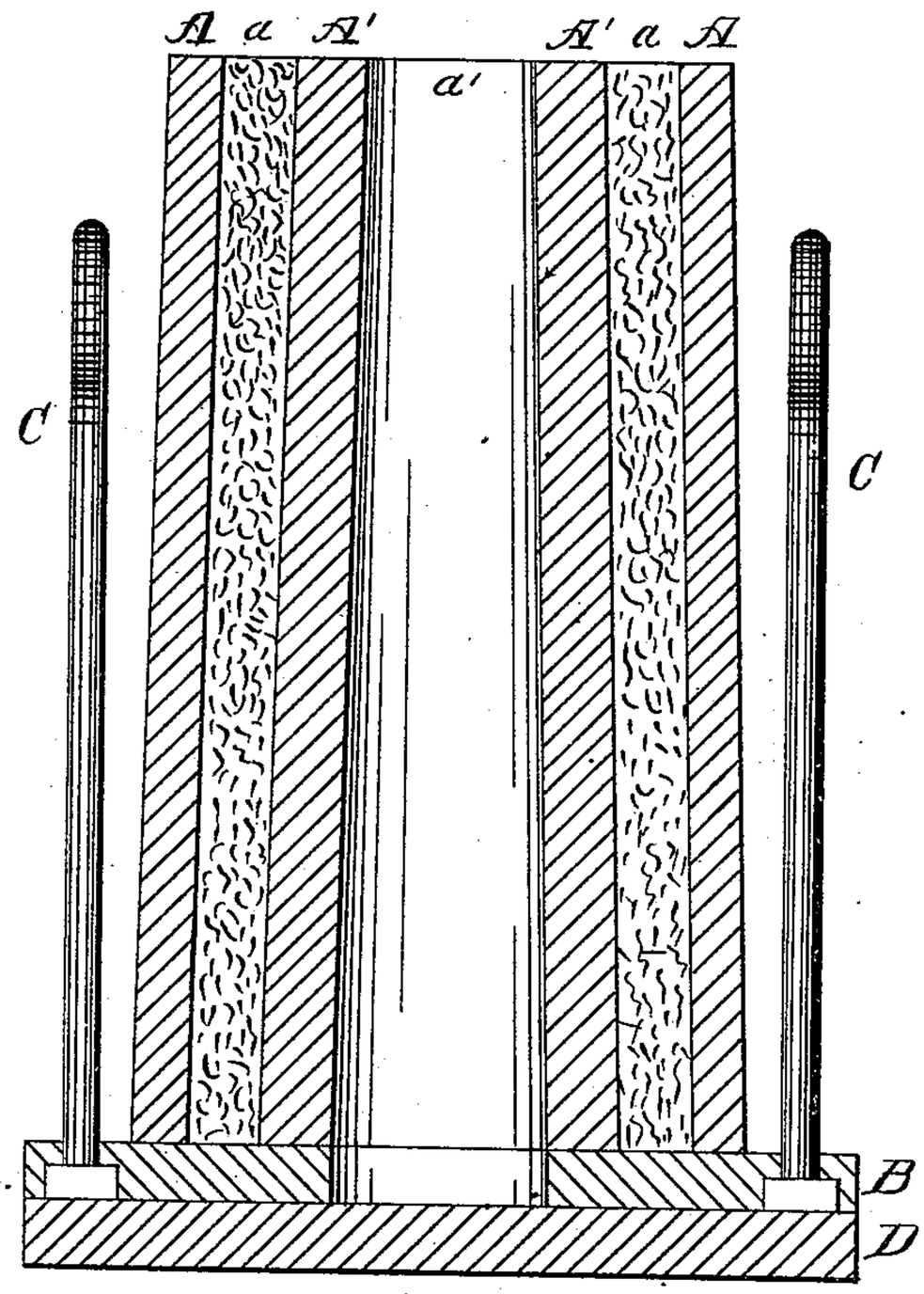
(No Model.)

W. HAINSWORTH.

ART OF PREPARING STEEL INGOTS FOR ROLLING.

No. 272,682. Patented Feb. 20, 1883.



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WILLIAM HAINSWORTH, OF PITTSBURG, PENNSYLVANIA.

ART OF PREPARING STEEL INGOTS FOR ROLLING.

SPECIFICATION forming part of Letters Patent No. 272,682, dated February 20, 1883.

Application filed January 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HAINSWORTH, a citizen of the United States, residing at Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in the Art of Preparing Steel Ingots for Rolling; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawing, making a part of this specification, which illustrates by a vertical sectional view one form of ingot-mold suitable for use in carrying out my invention.

In the manufacture of wrought-steel by fusion and casting, metal molds are usually employed, one effect of which is to cool the surface of the cast ingot rapidly, reducing the temperature at the surface below the proper degree for rolling before the interior has become crystallized or sufficiently cool for rolling.

Various expedients have been resorted to by manufacturers, including "soaking-pits" (so called) of different kinds and heating-furnaces, with reference to securing the requisite temperature and crystalline structure throughout the whole mass of the ingot preparatory to rolling. All of these expedients or methods of preparation have, so far as I am aware, involved stripping the molds from the ingots as a preliminary step. In thus exposing the ingot much of its heat is lost, the exterior crust is chilled even more rapidly than when first poured in the mold, and it becomes necessary to resort to the soaking-pits and furnaces referred to in order to reheat the chilled surface, with a considerable expenditure of time and labor in the repeated handling of the ingots required. It is desirable, for commercial reasons, to prevent this waste of heat, labor, and time, and the purpose of my present invention is to accomplish these desirable results. In general terms it consists in utilizing the mold in which the ingot is first cast to effect the requisite distribution of heat throughout the ingot, and also to secure the requisite crystalline structure of metal. This is done by permitting the ingot to remain in its mold until after the chilling of its surface by contact with the cold metal of the mold ceases and the second stage of cooling is in progress—namely, a reheating of the surface of the ingot by conduction of heat from the inner body of metal, and a consequent lowering of heat in such interior, attended with granulation or crystallization of the metal therein. This stage of cooling will also be attended by a rapid heating of the mold, and by observation of the temperature and condition of a mold of known capacity and weight the skillful workman can in a measure judge of the condition of the ingot.

Ordinary ingot-molds may be used successfully in carrying out my invention; but, in order to secure the best results, I prefer to use a mold having provision in its construction for arresting conduction of heat, and thereby better to retain the heat of the ingot for the purpose of heating the surface. I have illustrated such a mold in the drawing, in which A represents an outer shell or case of metal, and A′ an inner shell or mold proper, between which is a packing, *a*, of asbestus, dry sand, clay, or other suitable non-conductor or low conductor of heat. The inner part, A′, of the mold has a mold-cavity, *a*′, corresponding in size and form to that desired in the ingot, with sufficient body of metal therein to withstand destruction or fusion by contact with the molten metal of the ingot. The amount and distribution of metal usually employed in ingot-molds will answer well for this purpose.

The outer shell, A, may, if desired, be comparatively light; but I prefer to employ a considerable body of non-conductor, *a*, in order to prevent escape of heat through the same, whereby the heat is accumulated, so to speak, in the inner wall, A′, and in the surface of the ingot. If a continuous body of good conductor separates the hot metal of the ingot from the surrounding air or space, heat will escape rapidly therefrom, and it will be more difficult and require a heavier body of metal in the mold to secure the desired uniformity of heat in the ingot, owing to rapid loss at the surface by conduction and radiation. By interposing a body of non-conductor between the inner and outer mold-surfaces, as above described, such difficulty will be removed, and the surface of the ingot may be reheated quickly to a degree suitable for rolling, with substantial

uniformity of temperature and granular or crystalline structure throughout the mass of the ingot.

The non-conducting packing *a* may be kept in place by a base-plate, B, on which it as well as both shells A A′ rest. By lifting on the stirrups or rods C the base-plate, with both shells and the intermediate packing, may be stripped from the ingot, leaving the latter standing upon the bed D.

In operation the molten steel is poured into the mold-cavity *a′* in the usual way of doing such work. The mold is then removed to the blooming-mill. The first stage of cooling the ingot—namely, chilling the surface—will, in an ordinary twenty-five-hundred-pound ingot, occupy about ten minutes after pouring. Instead of stripping the ingot at this stage, as heretofore, I permit the ingot to stand in its mold, say, about twenty minutes, more or less, depending upon the construction of mold employed and the weight of ingot, until in the second or surface reheating stage the interior of the ingot has granulated or become crystallized, and the whole body is at proper temperature and condition for rolling. This state or condition of the ingot can be determined by the skilled workman in substantially the way now practiced for reheating or soaking—namely, by the color of metal and time of exposure. This stage of cooling in the ingot being reached, the mold is stripped off, as before described, and the ingot is passed by preference directly to the blooming-rolls. By this method of treatment I avoid the necessity for repeated handling of the ingot to and from pits, chambers, or furnaces, with the necessary expenditure of time and labor, and I also avoid the expense of costly plants for carrying out such soaking or reheating operations. In these elements of time, labor, and plant my invention will be found to be an important improvement in the art of preparing ingots for blooming.

I claim as my invention—

1. As an improvement in the art of preparing ingots for rolling, the method herein described, consisting in casting the molten metal in a metal mold, permitting the ingot thus cast to remain in its mold until its inner body has granulated or become crystallized, and its outer surface first chilled by contact with the mold has become reheated to proper temperature for rolling, and then stripping the mold from the ingot and passing the latter to the rolls, substantially as set forth.

2. As an improvement in the art of preparing ingots for rolling, the method herein described, consisting in casting molten steel in a metal mold, retaining the ingot in such mold for the purpose of securing a granular or crystalline structure of metal in its center, and in connection therewith accumulating heat in the chilled surface of the ingot by arresting or retarding conduction of heat through the walls of the mold, and then stripping the mold from the ingot and passing the latter to the blooming-rolls, substantially as set forth.

In testimony whereof I have hereunto set my hand.

WILLIAM HAINSWORTH.

Witnesses:
C. L. PARKER,
R. H. WHITTLESEY.