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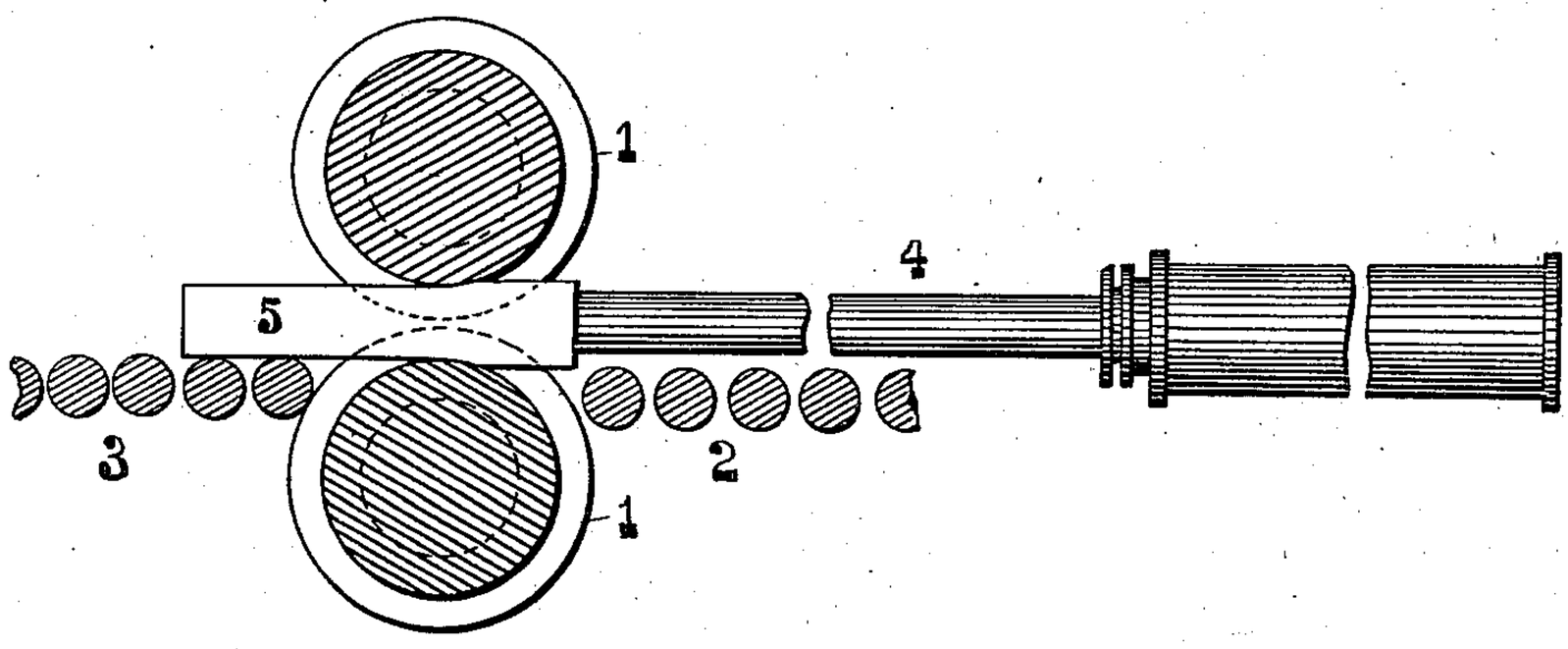
W. COOPER.

STEEL OR OTHER METAL ROLLING.

APPLICATION FILED SEPT. 13, 1901.

NO MODEL.



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UNITED STATES PATENT OFFICE.

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STEEL OR OTHER METAL ROLLING.

SPECIFICATION forming part of Letters Patent No. 723,834, dated March 31, 1903.

Application filed September 13, 1901. Serial No. 75,265. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM COOPER, a citizen of the United States of America, and a resident of the city of Denver, county of Arapahoe, State of Colorado, have invented certain new and useful Improvements in Steel and Metal Rolling, of which the following is a specification.

The accompanying drawing constitutes a part of this specification, showing a vertical sectional view of a set of rolls illustrating my invention.

My invention consists in new and useful improvements in the art of breaking down or reducing ingots or bundles of steel or other metals to the form of slabs or blooms. In the case of steel ingots it is a well-known fact that in casting the molten steel into the molds the outer surface of the ingot becomes chilled and more or less surface-hardened immediately, while the internal structure of the ingot remains liquid and heterogeneous, and the metal at the time of casting being at its highest point of expansion the interior of the ingot is accordingly full of innumerable flaws, caused by gas, blow-holes, and contraction-flaws. By the present method of breaking down these ingots are placed in reheating-furnaces or soaking-pits to equalize the heat in the ingot and are then at a very high temperature, and consequently in a decidedly-weakened condition, broken down into blooms or slabs in a train of rolls driven by powerful engines, the reduction of thickness of the ingot amounting frequently to more than one inch to each pass. This reduction of thickness, however, by the use of power-rolls does not result in a compression together of the crystals and consequent filling of the interstices and internal flaws of whatever nature in the interior of the ingot, but rather in a stretching of the ingot into a greater length, while with its more or less soft interior it is in its weakest condition to withstand the rending power incident to this form of breaking down. The effect of the ingot passing through such power-rolls is one of stretching and pulling, and the work is done so quickly that the crystalline particles instead of being compressed together in a compact homogeneous structure are slid past or drawn away from one another and do not become intimately united together. It will readily appear from the above that instead of an elimination of internal flaws or blow-holes in the ingot a lengthening and stretching of such defective parts would result just as if the ingot had been hot-drawn or stretched through the same-sized aperture without any attempt at refining or compressing the crystals more intimately together, as is accomplished by my method. Hammering has been resorted to for the purpose of compressing and solidifying the interior structure of the ingot; but the interior of the ingot being of irregular construction and of a more or less degree of fluidity some portions thereof offer greater resistance to the blows than others, resulting in varying degress of solidity or compression in the final product. Heavy presses have also been used in which the ingot is subjected to great pressure; but this method has been found to be very expensive and results in lengthening greatly the time of manufacture.

My invention consists in an improved method of rolling or breaking down the ingot into bloom or slab form in one operation in such a manner that the entire structure of the ingot is homogeneous and the crystals are compressed together evenly and cemented into a regular structure, forcing together and closing up the blow-holes and flaws without the effect of spreading or elongating the same. By my invention a much cooler ingot may be used than on the blooming-trains in use to-day, thus obviating the burring of the outside of the ingot and rendering it dry, powdery, and mealy in an attempt to equalize the heat throughout the same in the soaking-pits.

My method consists in taking the ingot and forcing the same by hydraulic or any other power through rolls, preferably of larger diameter than the usual blooming-rolls, until the proper size of bloom and a uniformly compact structure therein is obtained. The rolls are not coupled to any source of power, but are rotated simply through the forcing of the ingot between them. The effect on the ingot is the compression of its internal structure, similar to the result of pressing the ingot in a power-press and exactly the reverse of the stretching apart or sliding past of crystals and elon-

gating or spreading of the defects attendant upon the present method of breaking down the ingots in rolls driven by powerful engines, which can only operate to pull the piece from a large to smaller size. The effect of my method of rolling bundles of iron and also rolling cold copper, &c., is the same superior compressed uniform interior structure.

In one operation I combine the compressing and breaking-down processes, where at the present time the compression of the ingot, if attempted at all, is done so only in a separate operation.

It is a well-known fact that the crystalline structure of steel and other metals is much improved by rolling the same cool or at a comparatively low temperature. By my method the ingots being when rolled at a comparatively low temperature are therefore subjected to what practically amounts to cool rolling—*i. e.*, compression at a time when the interstices surrounding the crystal are of nearly normal size.

To more clearly illustrate the practical application of my invention to use, I will describe a manner of its application, reference being had to the accompanying drawing.

1 1 are the rolls fitted to revolve freely in their housings. These rolls may be provided with as many passes as may be found convenient.

2 and 3 are the feed-trains, and 4 is a hydraulic ram used to force ingot 5 between the rolls 1 1. I have shown a hydraulic ram as the source of power; but any mechanism may be used to operate on ingot 5 and force the same between the rolls. No power is applied directly to rolls 1 1, but they rotate simply through the forcing of ingot 5 between them.

It will be seen that instead of the ingot being pulled through the rolls, as is the case where the rolls are connected to some source of power and the ingot is pulled through by the rotation of the rolls, resulting in a stretching and tearing apart of the structure of the ingot, in my invention the effect on the crystalline structure of the ingot by being forced between the idle rolls is that of compression, giving the same result in addition to the breaking-down process as would the use of a heavy press.

This method of rolling may be used not only in the preliminary breaking down of steel ingots or bundles of iron into blooms or slabs, but may be utilized as long as the lengthening mass of material can be pushed through idle rolls by pressure from behind without buckling or seriously bending along the length of the piece between the source of power and the rolls.

It will be readily seen from the above that my invention marks a great advance in the manufacture of steel and iron, insomuch as the internal structure of the finished metal made by my process will be found to be of a more regularly compressed and homogeneous structure instead of the irregular, stretched, and flawey interior of the finished product furnished by the usual processes of to-day.

While I have described with minuteness my invention and shown its practical application to the working of steel and other metals, I do not wish to limit myself thereby; but

I claim, broadly, as follows:

In rolling metal, the process of forming a bloom or billet by subjecting an ingot in a heated state to the action of idle rolls by means of pressure applied to the rear of said ingot.

Signed by me at Pittsburg, Pennsylvania, this 28th day of August, 1901.

WILLIAM COOPER.

Witnesses:
EDWARD A. LAWRENCE,
J. BOYD DUFF.