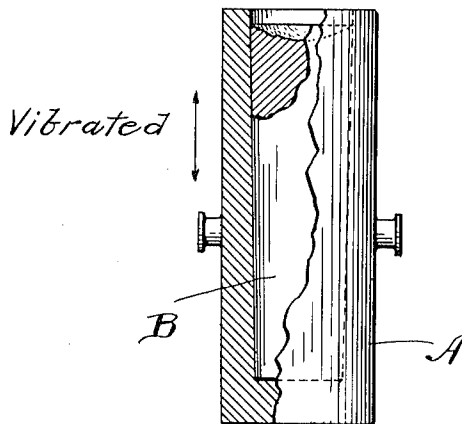


H. W. LASH.
PROCESS OF MAKING DENSE STEEL INGOTS.
APPLICATION FILED SEPT. 4, 1909.

1,061,760.

Patented May 13, 1913.



Witnesses.
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UNITED STATES PATENT OFFICE

HORACE W. LASH, OF CLEVELAND, OHIO, ASSIGNOR TO THE LIQUID FORGED STEEL COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

PROCESS OF MAKING DENSE STEEL INGOTS.

1,061,760.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed September 4, 1909. Serial No. 516,276.

To all whom it may concern:

Be it known that I, HORACE W. LASH, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Processes of Making Dense Steel Ingots, of which the following is a full, clear, and exact description.

In the manufacture of steel, great trouble is experienced in the production of sound ingots, *i. e.* ingots which do not have "blow holes," or intruding crystals; or a "pipe." Of the many methods which have been suggested for the purpose, that which is now most successfully used consists in subjecting the ingots to great pressure while the metal is freezing in the mold. This treatment does improve the quality of the ingots, but not in a satisfactory degree; and it is still a question upon which there are differences of opinion as to whether the improvement in quality is commensurate with the cost, and justifies the installation of the very expensive machinery required for producing the results. In so far as this compression process affects the production of blow holes it does not do so by eliminating the gas which produces them, but by causing the coalescency of the gas bubbles thereby reducing their number and by compressing the gas bubbles thereby reducing the size of the pockets or blow holes in which the bubbles are confined. Very little if any of the gas can escape, because in order that the metal may be compressed it is necessary to confine it in all directions. But by my process, which I term "liquid forging," and which is hereinafter described, the gas may be, and, in a large measure, is withdrawn from the ingots, with the result of producing ingots which are remarkable for their compactness and freedom from gas pockets. The process, in which I regard to be the best method of practicing it, consists in putting the fluid metal in a mold of great strength, and in then lifting said mold and dropping it upon a firm and substantially unyielding surface. This is to be done repeatedly while the metal is freezing. The inertia of the fluid or semi-fluid metal during this period will, when the mold is suddenly stopped by the collision with said unyielding surface, cause said metal to settle down in the mold and close up the gas

pockets. The gas, however, in the ingot is by this action of the metal caused to rise toward the unconfined top surface of the metal, and much of it escapes.

The drawing is an elevation, partly in section, of a mold adapted for use in the practice of the herein described invention, the said mold being shown as partly broken away in section, in order to better show its interior configuration, and the completed ingot therein.

In the practice of the process it is, I believe, preferable to use open topped molds whose sides incline slightly outward, from bottom to top, whereby the mold is largest at its upper end. This gives greater freedom for the escape of the gas which is caused to rise by the downward movement of the freezing metal in the mold produced as described. And it also causes the application to the metal of some lateral pressure as the metal is driven toward the smaller lower end of the mold. This aids in expelling the gas, and in causing the lower end of the "pipe" to close; so that when the ingot has solidified the "pipe" has taken the form of a shallow basin in the top of the ingot. The frequent jarring of the freezing metal in the manner stated also minimizes the production of the so-called pine tree crystals and the like.

It is not essential to the practice of the process that the molds shall be dropped. They might be moved down by mechanism which would cause them to move faster or slower, as required, then they would be moved by the action of gravity. It is not, indeed, essential that the mold containing the freezing metal shall move downward until suddenly stopped. It is the inertia of the metal, and its consequent relative movement in the mold toward the bottom thereof that produces the stated effects. Therefore, if the mold be held, and then be repeatedly struck rather violent blows against its bottom, substantially the same results would be produced. The essential characteristic of the process is that, while the metal is undergoing the freezing operation, it shall, as a result of its own inertia, be caused to settle down in the containing mold, as above stated. It is believed, however, that in view of the cheapness of an apparatus with which the process may be practiced, and in view of the satisfactory results from so practicing

it, the most satisfactory method, all things considered, is to repeatedly lift the mold and then drop it onto a substantially unyielding surface.

5 In the drawing, A represents the mold and B the solidified ingot therein.

Having described my invention, I claim:

1. The process of producing dense steel ingots which consists in confining the molten metal in a mold and causing the metal to settle or be compressed toward the bottom of the mold by impact against the bottom of the mold, the said mold being so formed that the metal is compressed laterally as it settles.

2. The method of casting, which consists

in subjecting the solidifying casting with its larger end uppermost to a succession of impacts applied vertically thereto in a straight line.

3. The method of casting, which consists in pouring the casting with the wide end of the mold uppermost, and subjecting the solidifying casting to a succession of impacts applied vertically in a straight line.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

HORACE W. LASH.

Witnesses:

H. R. SULLIVAN,
E. L. THURSTON.