(No Model.)

A. REESE.

INGOT MOLD.

No. 547,966. Patented Oct. 15, 1895.

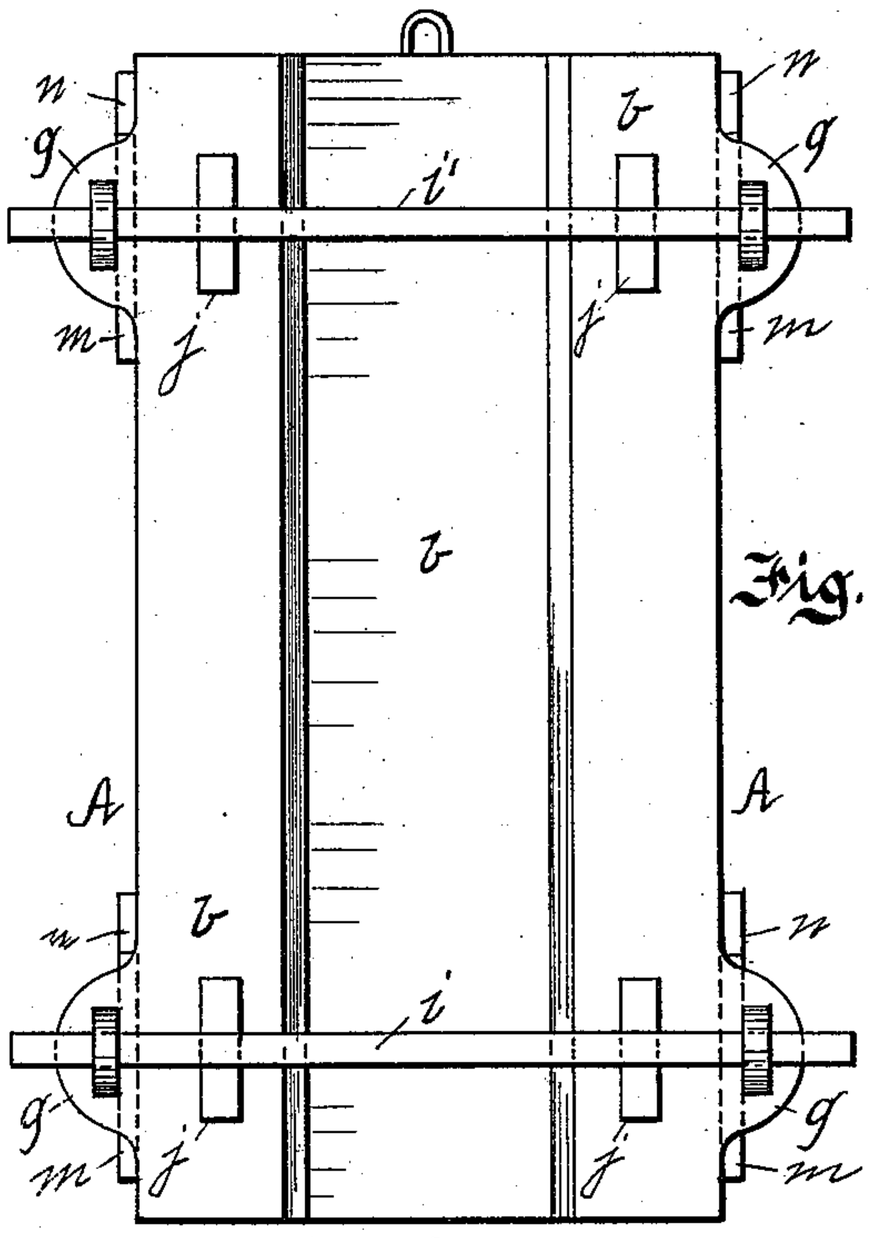

Fig. 1

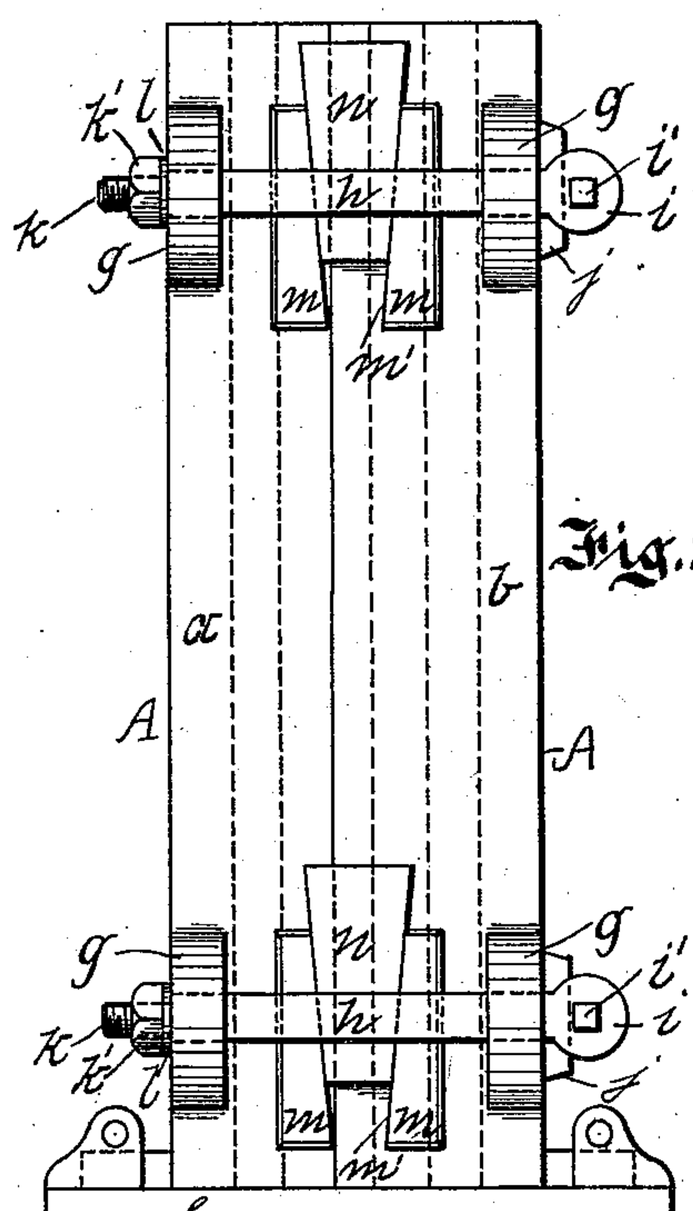

Fig. 2

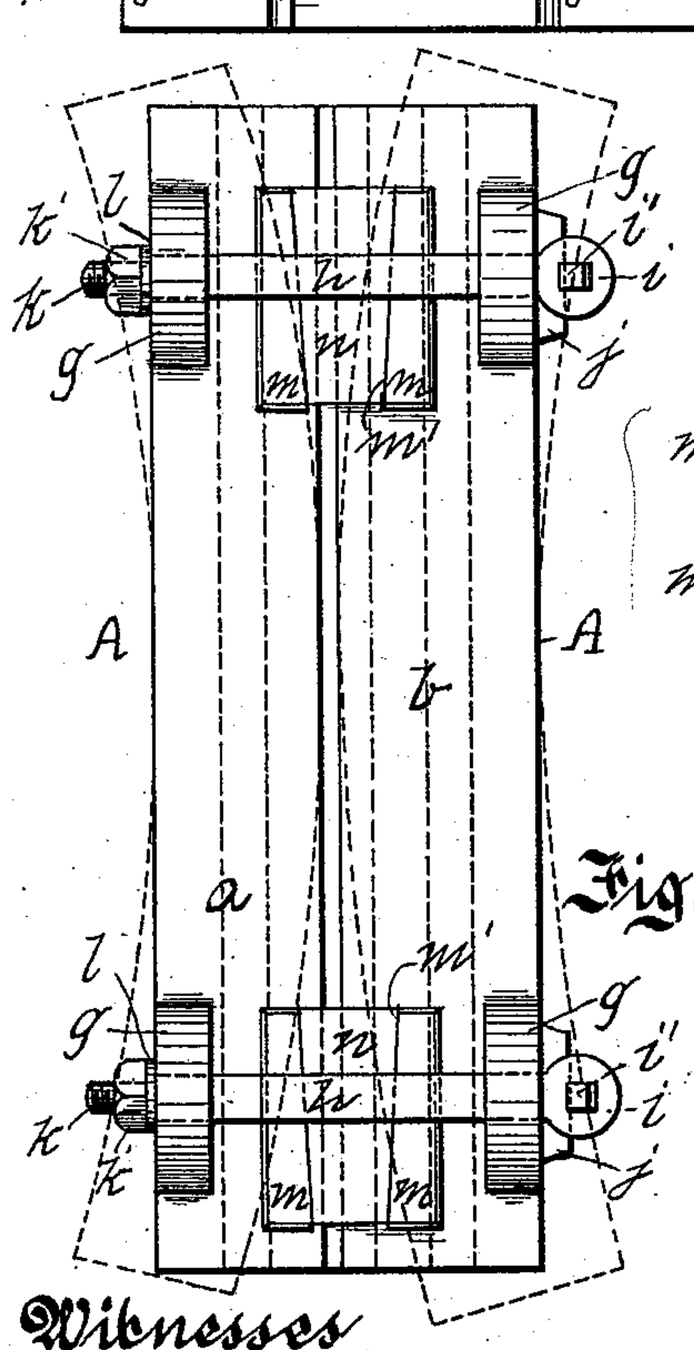

Fig. 3

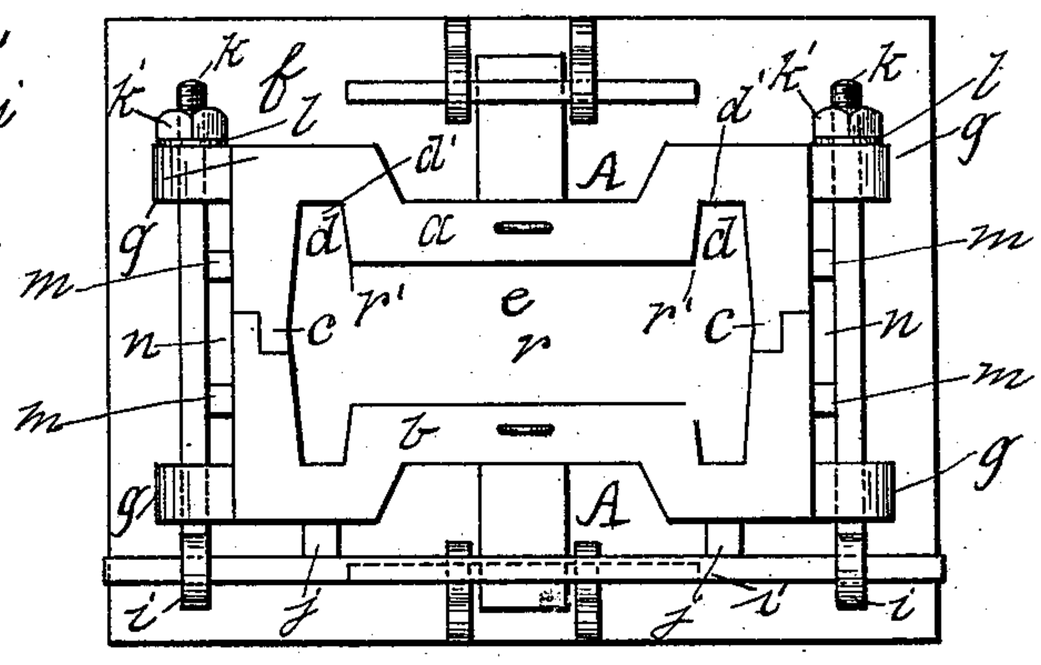

Fig. 4

Witnesses
L. deB. Litter
Robert. C. Totten

Inventor
Abram Reese
By Kay & Totten
Attorneys

UNITED STATES PATENT OFFICE.

ABRAM REESE, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO MARIE LOUISE TOTTEN, OF SAME PLACE.

INGOT-MOLD.

SPECIFICATION forming part of Letters Patent No. 547,966, dated October 15, 1895.

Application filed January 5, 1895. Serial No. 533,929. (No model.)

To all whom it may concern:

Be it known that I, ABRAM REESE, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Ingot-Molds; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to an improved method of casting steel ingots and to molds for casting the same, having special reference to the metal molds employed for casting steel ingots for the manufacture of deck-beams, I-beams, railroad-rails, channel-bars, and similar shapes having a head or flange on each side and a contracted or thinner portion between them. In the manufacture of deck-beams and articles of similar shapes from steel attempts have been made to cast the ingot to approximately the shape of the article to be rolled—namely, of greater thickness at one or both sides or edges than in the central or web portion. An ingot cast to such a shape has the advantage of being capable of being rolled to the finished article by substantially an even reduction on both sides, while at the same time the number of passes through the rolls is naturally greatly reduced. Much difficulty has been experienced in the attempts to cast ingots of such peculiar shapes for the following reason: It is a well-known fact that in casting an ingot of any of the shapes above mentioned when the molten steel is poured the ingot-mold is, of course, expanded thereby, and the parts of the mold forming the inner faces of the large cavities at each edge of the mold are expanded against the metal in the mold and so bear against the inner faces of the enlargements of the ingot that its normal contraction is prevented. This action results from the well-known law that the molten steel in setting and cooling contracts or draws toward the center, and the form of the mold prevents the enlargements of the ingot from being drawn toward the thin central portion thereof. It is thus apparent that two opposing strains incident to the expansion of the ingot-mold and the contraction of the ingot itself are at work, whereby the ingot is liable to rupture in the thin central or web portion. Ingot-molds operated by different forms of mechanism have been devised to obviate this difficulty, the general principle upon which they all operate being that the mold must be partible and be permitted to separate longitudinally in such a manner that when the ingot begins to contract the enlarged portions thereof are gradually drawn toward the web or contracted portion between them. This permits the ingot to contract normally in cooling and relieves it of the strain caused by the opposing action of the expansion of the mold and the contraction of the ingot; but while the substantially normal contraction of the ingot might be provided for another serious difficulty arose, due to the contraction of the mold itself on cooling. This contraction of the mold bound the ingot so tightly therein that it was practically impossible to remove the ingot when cooled without destroying the mold. In order to obviate this difficulty I propose to catch the mold at a stage in its expansion before it begins to contract and bind the ingots therein. To accomplish this end I take advantage of the fact that when the molten steel is poured into the mold the inner faces of the mold-halves being in direct contact with the molten metal will expand before the outer faces thereof—that is, the inner faces of said mold-halves will expand first and be of greater length than the outer faces thereof. The result of this elongation of the inner faces of the mold-halves will be that the upper and lower ends of said mold-halves will diverge outwardly, while the central portions thereof will remain at their normal position until the mold has become evenly heated throughout, when the outer faces of said mold-halves will also expand, causing the upper and lower ends of said mold-halves and the central portions to resume their normal position of alignment with reference to each other; but upon the cooling and contracting of the mold the mold-halves will bind tightly about the ingot and prevent its withdrawal therefrom. As stated, therefore, I propose to catch and hold apart by an automatic device the upper and lower ends of the mold-halves, as said ends diverge during the elongation of the inner faces thereof, so that when the corresponding elongation of the outer faces of the mold-halves takes place the central por-

tion thereof will be forced out and into alignment with the upper and lower ends of said mold-halves. The mold-halves being held apart, there is no opportunity upon the cooling and contracting of the same for said mold-halves to close together and bind the ingot; but said ingot can be readily withdrawn.

The object of my invention, therefore, is to provide a mold which will permit of the normal contraction of the ingot and at the same time to prevent the contraction of the mold to such an extent as to permit of the ingot being readily withdrawn when cooled.

To these ends my invention consists, generally stated, in an ingot-mold divided longitudinally and wedges adapted to engage with suitable faces formed on said mold to hold the sections of the mold apart automatically when the mold expands and prevent their again closing together upon the contraction of the mold on cooling, whereby the ingot may be easily withdrawn when cooled.

It further consists in the herein-described method of casting steel ingots, as fully herein set forth and claimed.

To enable others skilled in the art to make and practice my invention I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a front view of my improved mold. Fig. 2 is a side view showing the position of the wedges before the metal has been poured and before the mold has expanded. Fig. 3 is a like view showing the position of the wedges after the metal has been poured and the mold expanded. Fig. 4 is a top view.

In the accompanying drawings I have illustrated one form of apparatus suitable for carrying out my method, in which the ingot-mold A is formed in two parts *a b*, the mold being divided longitudinally along the edges either centrally or at one side, according to the shape of the article to be formed. The mold-halves *a b* overlap each other along the line of juncture, as shown at *c*, Fig. 4, so that when the metal has been poured and the mold begins to expand the mold-halves *a b* can separate to the required extent without allowing the molten metal to escape at such joints. The mold-cavity corresponds in shape to the ingot to be cast, whether for a deck-beam, **I**-beam, channel-bar, or like article, and has the enlarged cavities *d* and the contracted space *e* between them. The mold A is supported on a suitable base-plate *f*, the mold-halves *a b* both resting thereon and adapted to be held against vertical displacement by any suitable means. The mold-halves *a b* are provided with the lugs *g* and are held together by the bars or bolts *h*, passing through openings in said lugs *g*. The bars *h* are formed with the enlargements *i* at one end thereof, through which pass the rods *i'*, said rods bearing near their ends against the lugs *j* on the mold-halves. The opposite end is provided with the threaded portion *k*, with which the nut *k'* engages, a washer *l* being interposed between said nut *k'* and the lug *g*. The mold-halves *a b* are further provided on opposite sides with the guide blocks or strips *m*, said guide blocks or strips having the inclined faces *m'*. These guide blocks or strips are generally situated between the lugs *g* at the upper and lower ends of the mold-halves, but they may be arranged at different points. Within the guide-blocks *m* are seated the wedges *n*, adapted of their own weight, as will more fully hereinafter appear, to travel down the inclined faces *m'* of said guide-blocks *m* when the mold-halves separate.

The operation of my improved ingot-mold is as follows: The mold-halves *a b* are secured together in the manner described, so that they are held firmly together. The molten steel is then poured into the mold in the ordinary manner. As hereinbefore stated, the molten steel upon coming in contact with the inner faces of the mold will at once highly heat said faces and cause them to expand or elongate before the heat has penetrated the body of the mold to cause a like elongation of the outer faces of said mold. The result of this prior expansion and elongation of the inner faces of the mold will be that the upper and lower ends of the mold-halves *a b* will diverge or be thrown back, as shown in dotted lines in Fig. 3. The central portions of said mold-halves will remain in their normal positions with reference to the ingot until the heat has penetrated the body of the mold, when the outer faces of said mold-halves will elongate and force said central portions until they are in alignment with the upper and lower ends of said mold-halves. It is apparent from the above-described construction that as the mold-halves expand and separate the resistance occasioned by the rods *i'* must be overcome. While these rods *i'* are possessed of sufficient strength to secure the mold-halves and hold them firmly together before the metal is poured, yet they are not strong enough to resist the powerful outward pressure of the mold-halves due, to the expansion of the same; but bearing, as they do, upon the lugs *j*, the pressure of the mold-halves will be sufficient to bend the ends of the rods *i'* beyond the lugs *j* inwardly toward the mold-body. In this manner the separation of the mold-halves is provided for. Meanwhile, as the mold-halves *a b* are gradually forced apart by the expansion of the molds the distance between the inclined guide-blocks *m* on said mold-halves *a b* is likewise increased, whereupon the wedges *n*, by the force of their own weight, travel, automatically and exactly in accordance with the rate of expansion, down the inclined faces *m'* to approximately the position shown in Fig. 3. When the mold itself begins to contract, the natural tendency is, of course, to draw the mold-halves toward each other and close in around the ingot with such tenacity as to render it practically impossible to remove the ingot without break-

ing the mold. However, with the wedges *n* in the position shown in Fig. 3 it is impossible for them to be forced up by the contraction of the mold, the consequence being that the mold-halves cannot close together and bind the ingot tightly therein. The high heat of the molten steel coming in contact with the mold, at once causes said mold to expand, practical experience proving that the end portions of the mold-halves separate before the central portion, while upon the further expansion of said mold-halves the central portion separates the same distance as the end portions. The mold-halves thus separate all along the lines of juncture. At the same time as the steel sets and begins to contract the enlarged portions of the ingot are gradually drawn toward the contracted portions between them. The separation of the mold-halves, due to the expansion of the mold, increases the space in the mold-cavity and allows the ingot *r* to contract normally, the inner faces of the enlargements of said ingot sliding over the inner faces *d'* of the cavity *d* of the mold as said ingot contracts.

In the devices heretofore employed to permit of the normal contraction of the ingot it was necessary to relieve the pressure of the mold-halves by hand mechanism of some kind; but it was practically impossible, even with the exercise of the utmost skill and care, to operate the mechanism with sufficient accuracy and promptness to allow for the normal contraction of the ingot; but by the mechanism which I employ in the present invention the gradual separation of the mold-halves is regulated by the heat of the molten ingot. It does not depend on the skill of the operator to determine to what extent to relieve the pressure of the mold-halves; but the mold-halves separate to the exact extent of the expansive force of the heat in the ingot, while the wedges act accordingly to hold the mold-halves at such distance apart as they have been forced by the expansive force of the heat in the ingot.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A partible ingot mold having guide faces formed on the mold-halves thereof, and wedges adapted to travel automatically down said guide faces as the heat of the molten metal separates the upper and lower portions of said mold halves, substantially as and for the purposes set forth.

2. A partible ingot mold having inclined faces formed on the mold-halves thereof, and wedges adapted to travel automatically down said inclined guide faces as the heat of the molten metal separates the upper and lower portions of said mold halves, substantially as and for the purposes set forth.

3. A partible ingot mold having the mold-halves thereof formed with over-lapping edges, guide blocks or strips on said mold-halves and wedges adapted to travel automatically down said guide blocks or strips as the heat of the molten metal separates the upper and lower portions of said mold halves, substantially as and for the purposes set forth.

4. A partible ingot mold having guide-blocks or strips formed on the mold-halves thereof, wedges adapted to travel automatically down said blocks or strips, lugs on said mold-halves, securing bars or bolts passing through said lugs, and rods passing through said bolts and means for causing said rods to hold the mold halves in position, substantially as and for the purposes set forth.

5. The herein-described method of casting ingots consisting in pouring the steel into a partible mold, utilizing the heat of the molten metal to force apart the upper and lower ends of the mold-halves by the unequal expansion of the mold sections while the central portions thereof bear on each other and holding the end portions of the mold halves apart, so that the central portions of the mold halves will be drawn from each other as the mold-halves become more evenly heated throughout, substantially as described.

In testimony whereof I, the said ABRAM REESE, have hereunto set my hand.

ABRAM REESE.

Witnesses:
ROBT. D. TOTTEN,
ROBERT C. TOTTEN.