

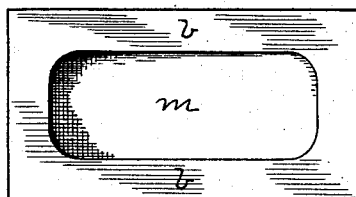
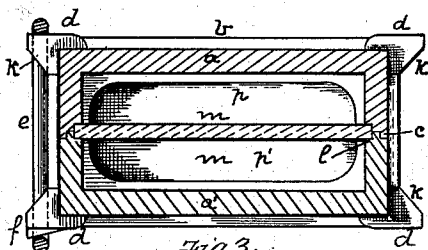
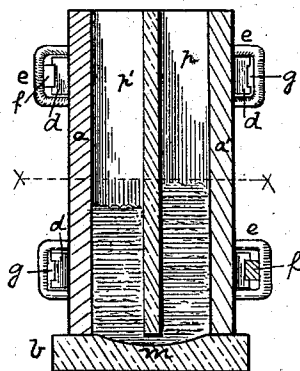
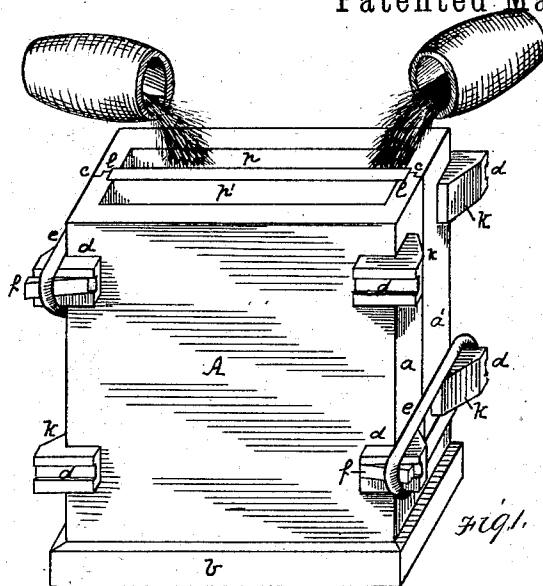
(No Model.)

J. PEDDER.

METHOD OF AND MOLD FOR CASTING STEEL INGOTS HAVING IRON CENTERS.

No. 278,593.

Patented May 29, 1883.



Witnesses.

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Fig. 4.
Durenkov.

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JOHN PEDDER, OF PITTSBURG, PENNSYLVANIA.

METHOD OF AND MOLD FOR CASTING STEEL INGOTS HAVING IRON CENTERS.

SPECIFICATION forming part of Letters Patent No. 278,593, dated May 29, 1883.

Application filed February 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN PEDDER, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Methods of and Molds for Forming Cast-Steel Ingots Having Iron Centers; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a perspective view of an improved ingot-mold illustrating my invention. Fig. 2 is a vertical section of the same. Fig. 3 is a cross-section on the line *xx*, Fig. 2; and Fig. 4 is a top view of the base-plate of the mold.

Like letters indicate like parts in each.

My invention relates to the manufacture of the large iron or soft-steel-center cast-steel ingots containing the steel from two or more crucibles, and to the ingot-molds in which these ingots are cast. The molds heretofore employed for this purpose were provided with suitable lugs for holding the plate of iron or soft steel in the center of the mold. After the insertion of the center plate the steel contained in one crucible was then teemed by a melter on each side of the plate, there being no opportunity for the steel from these crucibles to intermingle, except around the small space at the sides of the center plate, which would be quickly closed by the chilling of the steel against the surface of the mold. As it is practically impossible to regulate exactly the amount or proportion of carbon in steel formed in crucibles, it is generally found that the steel on one side of the plate differs from five one-hundredths to twenty-five one-hundredths of one per cent. in carbon from that on the other side of the plate; and on account of the difference in ductility of the steel on either side of the center plate the rolled plate formed from the ingot would generally be exceedingly ragged or broken at the ends and sides, causing a large waste in the plate. The plates formed from these iron or soft-steel-center ingots are principally employed for the formation of agricultural implements—such as mold-boards for plows, cultivator-shovels, &c.—which are bent to peculiar shapes and then tempered; and it has been found that

where the steel on each side of the plate was not the same in carbon it had a tendency to warp out of shape, the difference in the hardness of steel causing a difference in the tempering, so that much trouble was occasioned and great skill required in the formation of these articles. By my invention I am enabled to cast these ingots in such manner that the steel on both sides of the center plate contains the same or practically the same proportion of carbon, even though the steel in the two crucibles employed in forming the ingot differ in carbon, and thus to fully overcome the objections above referred to.

It consists, first, in forming these ingots by teeming the steel from two or more crucibles on the same side of the center plate in such manner that it will be thoroughly commingled while at a high heat and assume the same or about the same degree of carbon throughout, and the heated steel so commingled will pass to the other side of the center plate and form the finished ingot; second, in a mold for forming these ingots in which the center plate fits closely against or within the end of the mold, and which has an opening below the plate to permit the melted and commingled steel to pass from the side in which it is teemed to the other side of the plate; third, in certain improvements in the means of securing together the two halves of the partible ingot-mold; and, fourth, in certain improvements in the method of securing the ingot-mold to overcome warpage.

To enable others skilled in the art to make and use my invention, I will describe the same more fully.

In the drawings referred to, A represents my improved ingot-mold, formed in two halves, *a a'*, and having the base-plate *b*. The two halves of the mold are joined by the rabbet-joints *c* to retain them against endwise motion. Each half-mold is also provided with four lugs, *d*, formed integral with it, which extend out horizontally beyond the ends of the half-mold, and around which links *e* pass to secure the two half-molds together, the half-molds being drawn tightly together by means of a wedge, *f*, fitting between one end of the link and the outer surface of the lug. In order to retain the wedge *f* in place the outer surface of each lug *d* is grooved horizontally for its

reception, as at *g*, or lugs extending horizontally along its top and bottom edges are formed for the same purpose. The inner face, *k*, of each lug is inclined outwardly from the body of the mold, to present a better face for knocking the mold apart after the casting of the ingot. Extending down the center of each end of the mold is the groove *l* for the reception of the center plate. This groove is generally made at the junction of the two halves, so that the plate will not interfere with the opening of the mold after the casting of the ingot. This manner of centering the plate is preferred by me, though the only requisite is, that the plate fit close against the ends of the mold, and prevent the melted steel from passing around the sides of the plate, and the plate may be centered by a groove in the base-plate, instead of grooves in the ends, and between lugs at the top of each end of the mold. However the center plate is centered, the base-plate *b* of the mold has a concave recess, *m*, formed across its upper surface, to permit the melted metal to pass from one side of the center plate under it to the other side of the plate, and thus form the ingot. This recess *m* is made sufficiently large to permit the metal to flow readily under the plate; and where the base-plate is grooved, as above described, to center the center plate, the recess is formed correspondingly deeper than the groove.

Instead of recessing the base-plate, the groove for the reception of the center plate may be made to extend nearly but not quite to the bottom of the mold proper, and so support the plate sufficiently above the base-plate as to permit the melted steel to pass under it; or the center plate may be otherwise supported above the base-plate for the same purpose.

In carrying on my improved process the partible mold *A*, resting on the base-plate *b*, is fastened together, the links *e* being fitted over the lugs *d* and the wedges *f* driven in to clamp the two halves *a a'* of the partible mold together. The iron or soft-steel center plate, previously scaled by an acid bath or other means, is dropped into the longitudinal groove *l*, thus dividing the mold into two chambers, *p p'*, with a connecting opening below the center plate. The melters then at the same time teem the melted steel from two or more crucibles, according to the size of the mold, into the chamber *p* on one side of the center plate, and as the metal is at a white heat, and is thoroughly commingled by the pouring, the carbon from the more highly carbonized metal passes over to that having less carbon, so that the whole mass becomes the same or approximately the same in carbon, and after so commingling passes into the chamber *p'* on the other side of the center plate, rising in that chamber, and thus forming an ingot the cast-steel of which is the same or practically the same in carbon throughout. Instead of arranging the mold in such manner that the commingled steel passes below the plate into

the other chamber, the center plate may fit against or within one side and the base of the mold and the commingled steel pass around the other side of the plate; but I prefer the arrangement of the mold shown in the drawings. After the ingots have sufficiently cooled, the wedges *f* are driven out, the links *e* knocked off, and the ingot-molds opened by blows on the inclined faces *k* of the lugs *d*, these inclined faces giving a broad face for the blows of the hammer and doing away with the necessity of battering up the top of the molds, this being the previous method of opening the molds.

Practical experience has fully proven that ingots formed as above described roll more evenly, forming square or almost square ends to the plate formed, and that the plates so rolled, being the same in carbon on each side, have no tendency to warp or draw out of shape when tempered, so that they can be bent to whatever shape desired and tempered without losing that shape.

I find the lugs, links, and wedges a rapid and convenient means of securing together the partible mold, as the links can be easily placed around and are supported by the lugs; and by means of the wedges driven between the links and lugs the two halves can be easily and quickly secured together, even where, on account of the warping of the molds or from other cause, the lugs do not come exactly opposite each other. I am also enabled by their use to entirely do away with the serious warping of the ingot-molds, and overcome this hinderance to their long use. This I accomplish by securing the two halves together by the lugs diagonally opposite each other—as, for instance, the upper left-hand corner and the lower right-hand corner, as shown in Fig. 1—so that when the mold, having absorbed the heat from the melted steel, is warped or thrown out of shape in cooling, the warping will take place at the corners diagonally opposite each other, which are not connected. When the mold is next used it is secured by the links and wedges at the corners left unconnected at the last casting—as, for instance, the upper right-hand corner and the lower left-hand corner—and the warping at this casting will draw the mold back to its original shape. By employing this method the mold may always be kept in proper shape for use, and need never be abandoned on account of warping, this being often the case with other molds, because they give a greater thickness of steel at certain points on one side of the center plate than at the other, and the plates formed from the ingot will warp on this account.

Before my invention partible ingot-molds have been formed with ribs extending along their joining edges, the two halves being secured together by clips or double hooks fitting around and driven down these ribs, the outer sides of which were slightly inclined. These double hooks were, however, difficult to use,

as it was necessary to employ different lengths of hooks to fit the different widths of the rib, and to support the clips during the clamping of the mold, and they were liable to spring and permit the opening of the mold on account of the sudden heating and expansion of the mold by the melted metal cast, or, in case of heavy pressure on the metal, to compact it. The essential features of my improved means of fastening are that the links are easily placed over the lugs and supported by them, so that the workmen can drive in the wedges and clamp the half-molds together with the same-sized links and without supporting the links, and the half-molds can be secured together even where the warping throws the lugs out of proper position. As there is no spring to the links, they also lock the half-molds so securely together as to prevent springing in case of the sudden expansion of the mold, or, if pressure is applied, to compress the steel therein.

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

1. The method herein described of forming cast-steel ingots having iron or soft-steel centers, consisting in teeming the steel from two or more crucibles on one side of the center plate in such manner that it will commingle, and then causing the commingled metal to flow to the other side of the center plate, substantially as and for the purposes set forth.

2. A mold for forming cast-steel ingots having iron or soft-steel centers, having the center plate fitting against or within the sides of the mold, and an opening below the plate, substantially as and for the purposes set forth.

3. A mold for forming cast-steel ingots having iron or soft-steel centers, provided with a longitudinal groove at each end for the reception of the center plate, and a recess in the base-plate, substantially as and for the purpose set forth.

4. In partible ingot-molds, the combination of the half-molds *a a*, having the lugs *d* extending horizontally beyond the ends thereof, the links *e*, adapted to fit around and be supported on the lugs, and the wedges *f*, substantially as and for the purposes set forth.

5. The method herein described of overcoming the warpage in ingot-molds, consisting in securing the mold at the corners diagonally opposite during the casting of one ingot, and securing it at the corners diagonally opposite those corners during the casting of the next ingot, substantially as and for the purposes set forth.

In testimony whereof I, the said JOHN PEDDER, have hereunto set my hand.

JOHN PEDDER.

Witnesses:

F. G. KAY,
JAMES I. KAY.