(No Model.) 2 Sheets—Sheet 1.

A. MATTHES & H. W. LASH.

INGOT MOLD.

No. 342,920. Patented June 1, 1886.

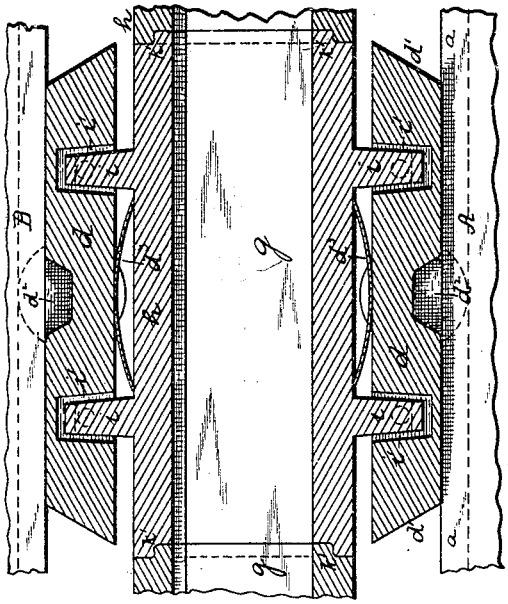

Fig. 5.

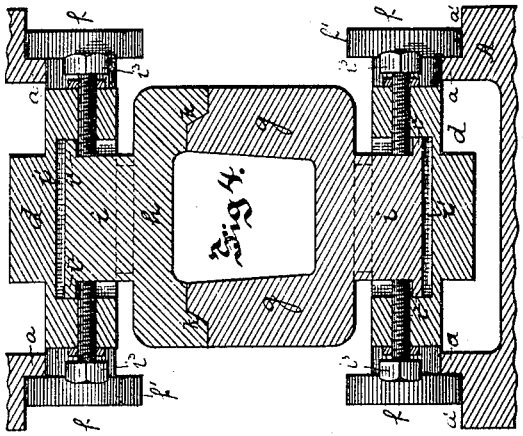

Fig. 4.

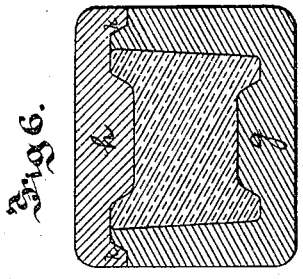

Fig. 6.

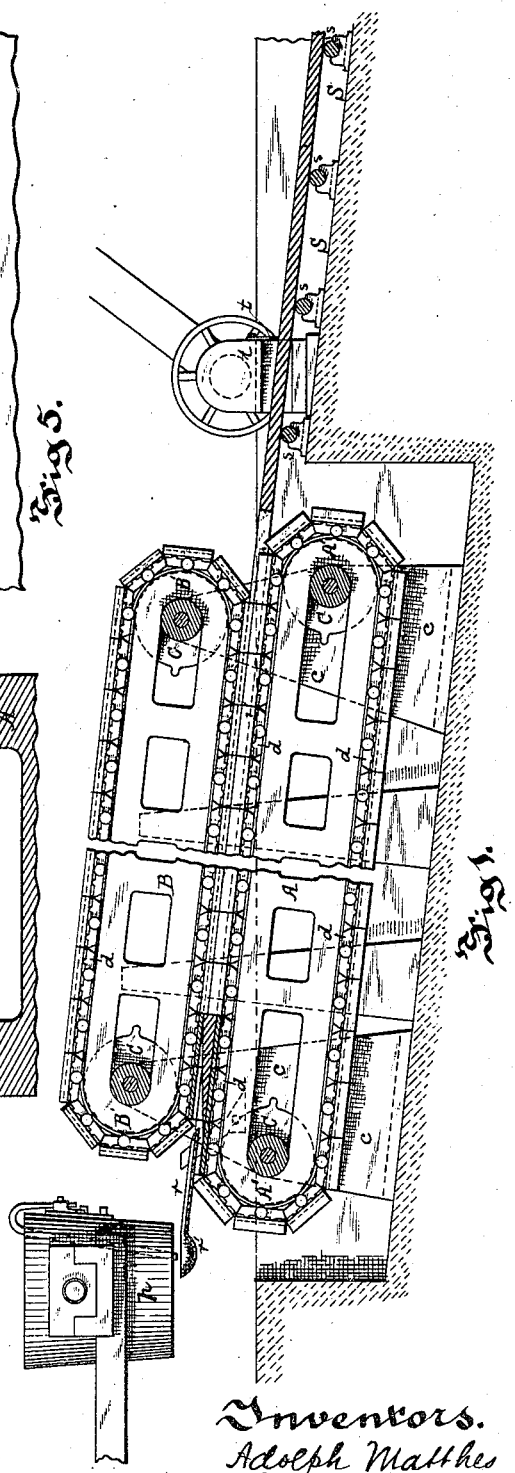

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

A. MATTHES & H. W. LASH.

INGOT MOLD.

No. 342,920. Patented June 1, 1886.

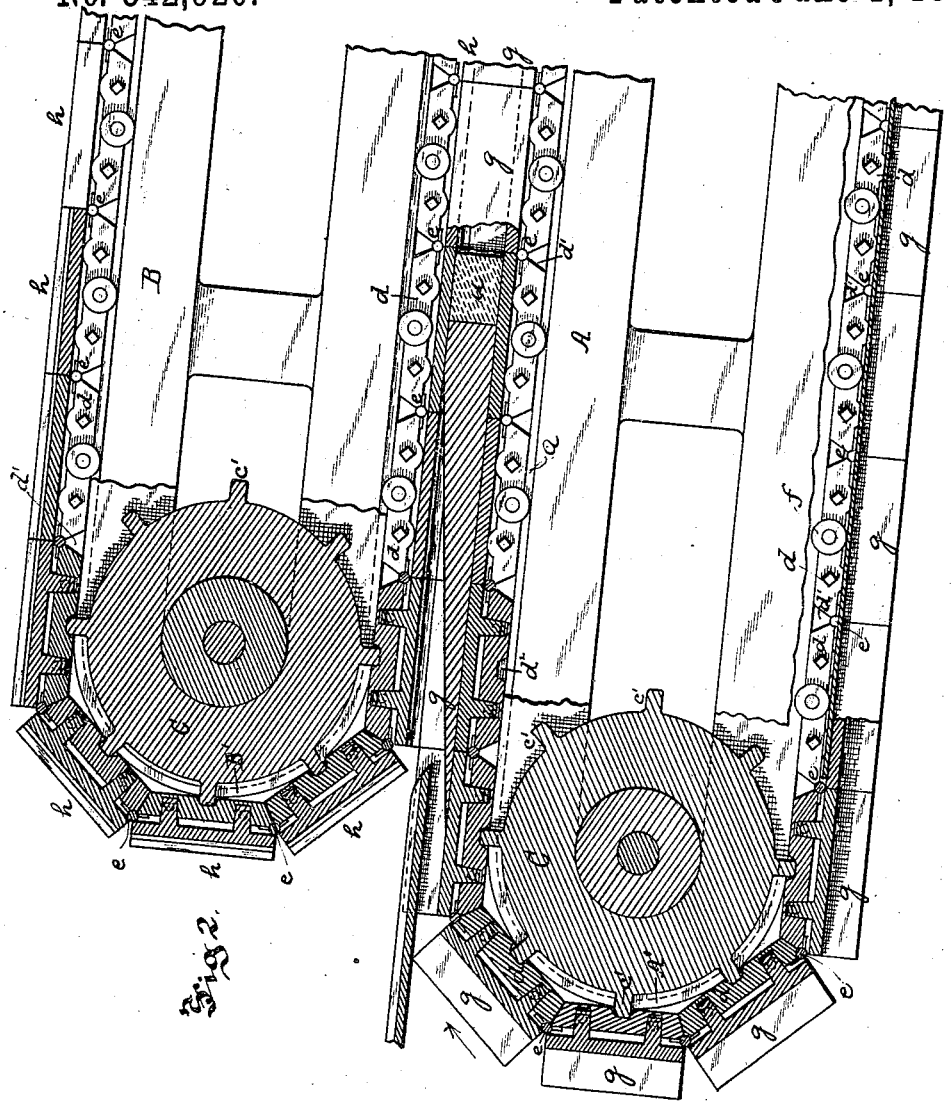

Fig. 2.

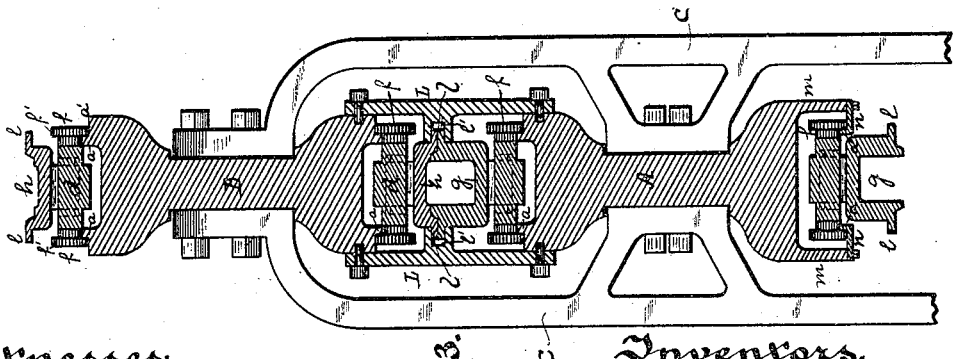

Fig. 3.

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UNITED STATES PATENT OFFICE.

ADOLPH MATTHES, OF CLEVELAND, OHIO, AND HORACE W. LASH, OF PITTSBURG, PENNSYLVANIA.

INGOT-MOLD.

SPECIFICATION forming part of Letters Patent No. 342,920, dated June 1, 1886.

Application filed May 14, 1885. Serial No. 165,504. (No model.)

To all whom it may concern:

Be it known that we, ADOLPH MATTHES, of Cleveland, in the county of Cuyahoga and State of Ohio, and HORACE W. LASH, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Ingot-Molds; and we do hereby declare the following to be a full, clear, and exact description thereof.

Our invention relates to ingot-molds for casting steel-ingots made by the Bessemer, open-hearth, and kindred processes, its object being to provide means to cast ingots of comparatively small section or diameter from the large casts of these metals formed in the converter or open-hearth furnace.

Our invention has special reference to what are known as "traveling" or "continuous" ingot-molds, in which the molds are formed in sections, which fit together and form a continuous mold, within which the metal becomes chilled and set sufficiently to retain its form, being then fed from the mold in the form of a long ingot of small section.

Our invention consists, essentially, in the combination, in such continuous ingot-molds, of a supporting-frame, traveling carriers hinged together and moving thereon, and mold-sections secured to said carriers and fitting together to form a continuous mold, whereby we are enabled to adjust the several mold-sections on the carriers, to cause them to fit together properly, and to change the mold-sections according to the size or shape of ingot to be cast.

It also consists in certain improvements in the construction of the molds and the apparatus for carrying and operating them, as hereinafter particularly and fully described.

To enable others skilled in the art to make and use our invention, we will describe the same, referring to the accompanying drawings, in which—

Figure 1 is a side view of our continuous or endless mold and the operating apparatus. Fig. 2 is an enlarged side view, partly in section, of one end thereof. Fig. 3 is a cross-section thereof; and Figs. 4, 5, and 6 are detail views.

Our improved apparatus is supported in a suitable frame or frames, the lower portion, A, of the frame and the upper portion, B, thereof being supported in any desirable way in or on the casting pit or floor, the frames A and B being preferably arranged at a slight inclination, as fully shown in Fig. 1, the purpose of this position of the apparatus being fully described hereinafter. At the ends of the frames are mounted the sprocket-wheels C, these sprocket-wheels being mounted in suitable bearings, *c*, and operated by any suitable power connections, the power being applied to the traveling mold through these sprocket-wheels from any engine or power apparatus. The frames A and B are provided with tracks, on which travel the endless chain-carriers *d*, the shape of the track and the means of supporting the carriers thereon not being important, as any suitable means for supporting a series of carriers on or within said frames may be employed. That illustrated in the drawings is found to be well adapted for the purpose, and will be fully described. Extending out from the faces *a'* of the frame are the rails *a*, forming the track on which the carriers travel, the carriers having wheels *f*, extending out at the sides thereof, and said wheels fitting on said track, and being provided with flanges *f'*, which fit on the outer edges of the rails *a*, so holding the carriers in proper position on the frames, the faces or peripheries of the flanges *f'* running on the top faces, *a'*, of the frames below the rails *a*. These carriers *d* are connected together at their ends by suitable pivots or hinges, *e*, and their end faces, *d'*, are formed on a bevel or incline, as shown, this incline being at an angle of about sixty degrees to the top face, so that when the carriers are traveling around the ends of the frames the ends of the adjacent carriers will fit against each other and form a support for each other, as is fully shown in the drawings, the carriers being braced as they travel around the semicircular ends of the frames by means of the rolls *f* on the track *a*, and these inclined end faces, *d'*, of the adjacent carriers fitting against each other.

As before referred to, the frames A and B have the sprocket-wheels C at their ends, and the ends of the frame are formed curved or in a semicircle, as shown at A' B', and the traveling carriers *d* travel around the semicircu-

lar ends of the frames, along the top and the bottom of these frames, thus forming the endless chain carriers. On the under surface of each carrier is the sprocket-recess d^2, into which the sprocket-teeth c' of the wheel C fit, and by means of which motion is imparted to each series of traveling carriers. Secured to these traveling carriers by any suitable means are the molds and covers forming the sections of the traveling mold embodying our invention, the mold-sections g and cover-sections h fitting together, as illustrated in the drawings, and so forming the continuous or endless mold. The means preferred by us for securing these mold and cover sections to the traveling carriers d is fully illustrated, the mold and cover sections having lugs i, which fit into suitable recesses, i', within the carriers, these lugs i having shoulders i^2 at their outer ends, and the carriers being provided with bolts i^3, which enter said slots i' below the shoulders i^2, and so retain the molds within the carriers.

In order to press the molds out and hold the faces of the molds and covers together we employ between the carriers and the mold or cover sections the springs d^3, and when the mold and cover sections are brought together these springs act to press their meeting edges together in such a manner as to form tight joints between them, the bolts i^3 allowing this movement to the mold or cover sections, as they do not bind tightly upon the body of the lugs i. The meeting edges of the mold-sections g and cover-sections h preferably fit together by suitable tongue-and-groove or rabbet joints, k, and similar tongue-and-groove or rabbet joints, k', are also preferably employed between the end portions of the mold-sections and cover-sections, as shown, so that as these sections fit together at the ends and the covers fit down upon the molds a suitable joint is formed between the cover and mold and their sections to prevent the escape of molten steel poured therein.

We prefer to provide the mold and cover sections with the longitudinal flanges l, extending out along the meeting edges of these flanges and fitting within a suitable groove, l', within the frame L, said frame being secured to the frames A B and extending between said frames in such a position as to fit over these flanges l on the mold and cover sections and hold the two parts together, as shown. This clamping-frame L is not, however, necessary, as the molds will press against each other through the springs d^3, above referred to, and the covers h will rest upon the mold-sections and be held in proper position by their own weight and that of the traveling carriers, to which they are secured.

As the cover-sections and their carriers rest upon the mold-sections, as before described, we generally form the lower track, a, on the upper frame, B, along the under surface of said frame; but the molds and their carriers are not supported in this manner when traveling along the base of the lower frame, A; and for this reason, in order to provide a suitable support for them and prevent any great and unnecessary strain on the hinge-connections e of the carriers, we have extended the body of the frame A down below the carriers as at m and secured them to plates n, these plates n extending out underneath the carriers and so forming the tracks a, on which the carriers rest, as fully illustrated in the drawings, so that the sagging of the endless chain-carriers when in this position or the straining of the hinge-connections between these carriers is entirely prevented.

The ladle p is of the usual construction, being brought above the runner r, and the metal passing from said ladle into the enlargement r' of the runner, whence it flows along the runner into the mold, as shown, and the ingot cast passes out from the opposite end of the apparatus onto a suitable bed, S, preferably provided with idle-rollers, as at s; and, as the ingots formed would be of such length as to occupy much more space than desirable at the end of the apparatus and be unwieldy to handle, we provide suitable shears, t, these shears operating across the line of movement of the ingot cast, and being employed to shear off the ingot at intervals, so that it may be removed from the bed S, and while still at a proper heat sheared into suitable lengths for the small ingots required. The apparatus is set on an incline in order to cause the metal flowing from the runner to fill the mold gradually, and to prevent the necessity of a deep pit for operating. It also enables us to feed the metal from the runner to the traveling mold without such fall or drop as will cut out or score the mold, as the runner can be brought close to the base of the mold, and the molten steel will flow back under the end of the runner, as shown in Fig. 2, the upper surface of the molten steel being level, so that the steel is poured from the runner into the molten steel, and the stream of the metal does not strike the body of the mold.

In order to form a base for the mold when the pouring of the ingot is commenced, we employ the block u, corresponding in size and shape to the cavity of the mold, and this block is inserted within the mold, being held therein by the pressure of the mold-walls, or, if desired, fitting into a special mold-section provided with special means for holding it. These blocks can be made of metal or refractory material, and as many of them as desired be employed, one being inserted whenever it is desired to divide the long ingots into lengths or sections, and the shears t be thus dispensed with.

The operation of the apparatus shown is substantially as follows: The apparatus being set in motion the mold-sections and cover-sections attached to the traveling carriers d are caused to travel around their respective frames A B by the sprocket-wheels C, the sprockets c' on said wheels fitting into the recesses d^2, extending into the under surface of

the carriers *d*, and so carrying them around the semicircular ends of the frames and causing the mold-sections and cover-sections to fit together at the feeding end and be drawn apart at the opposite end of the apparatus. The upper frame, B, is preferably made shorter than the lower frame, so that the mold-sections are brought into proper position, and their rabbeted or tongue-and-groove ends *k'* fit into each other before the covers are placed upon them, and, as the cover-sections rest upon the mold-sections, the rabbet-joints *k'*, at the ends of the cover-sections, and the joints *k*, between the cover-sections and mold-sections, fit into each other, so that a perfect continuous mold is formed. It is not necessary that the ends of the cover-sections and mold-sections shall coincide. Where the clamping-frames L are employed, as the mold-sections and cover-sections are brought together the longitudinal lips or flanges *l* fit within the grooves *l'*, and the mold and cover sections are thus clamped together. The block *u*, forming the base of the mold against which the molten steel is poured at the commencement of the cast, is inserted within the mold and the pouring commenced, when the steel will flow against said block and fill the section of the mold, as shown, the molten steel running back under the mouth of the runner on account of the inclined position of the mold, and so preventing the cutting out of the mold by the dropping of the molten metal thereon. The apparatus carrying the traveling-mold is then set in motion and travels slowly, and the molten steel from the ladle *p* is fed gradually from the runner *r* into the mold, the runner *r* extending some distance within the mold, so that the steel does not enter until the mold-sections are fitted together. The molten steel of course seeks its own level as it flows into the continuous mold, and the ingot is thus formed, the ingot so cast being carried along by the continuous traveling mold until it becomes chilled and set sufficiently to be withdrawn from the mold. The length of the apparatus will, of course, vary according to the diameter or section of the ingot to be cast. When the ingot reaches the opposite end of the apparatus, the cover-sections *h* are first lifted off, as shown, and then the mold-sections *g* are drawn from below the ingot, and the ingot passes out onto the bed S, the base-block *u* dropping off as soon as the end of the ingot passes out of the mold; and as soon as the ingot has reached the desired length it is sheared off by means of the shears *t*, and the portion sheared off is carried away by means of suitable tools, and either reheated and rolled into the form required or sheared into shorter lengths, according to the purpose for which it is to be employed. As the apparatus continues to travel it feeds out the ingot until a length sufficient to shear off is again formed, and in this manner the entire cast from the ladle can be cast by means of the one continuous traveling mold into ingots of small section suitable for the formation of smaller articles, as desired. The size of the ingots formed, as well as their shape, will of course vary, and the apparatus may also be employed in casting ingots of large section.

In illustration of the formation of different shapes we have shown in Fig. 6 the cross-section of the continuous mold where it is employed for casting ingots for the manufacture of I-beams. By the employment of the carriers hinged together and supporting the sectional parts of the mold, which fit together to form the continuous ingot-mold, we are enabled to remove the mold-sections and replace them with others, according to the size and shape of the ingot to be cast, and at the same time to adjust each particular mold-section, to cause it to fit or coincide accurately with the adjoining mold-sections. We find that by forming these ingots about four inches in diameter or section we provide small ingots for the manufacture of wire, nail-plate, and other articles, which, when reheated and rolled to proper form, receive all the reduction necessary to improve their quality without any deterioration or weakening on account of the frequent reheatings and reduction, as is the case when made from large ingots.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In a traveling ingot-mold, the combination of a supporting-frame, traveling carriers hinged together and moving thereon, and mold-sections secured to said carriers and fitting together to form a continuous mold, substantially as set forth.

2. In a traveling ingot-mold, the combination of the supporting-frame having a suitable track, the mold-carriers pivoted together and moving on said track, the mold-sections secured to said carriers and fitting together to form a continuous mold, and the sprocket-wheels or similar apparatus engaging with the mold-carriers, substantially as and for the purposes set forth.

3. The combination of the supporting-frame having the track *a*, the traveling carriers running thereon, and the mold-sections secured to the carriers and fitting together to form a continuous mold, said carriers being hinged together and having inclined end faces, *d'*, substantially as and for the purposes set forth.

4. The combination of the traveling carriers having recesses *i'* and bolts i^3, and the mold-sections having lugs *i*, provided with shoulders i^2, substantially as and for the purposes set forth.

5. The combination of the traveling carrier, the mold-section, and the spring d^3, confined between them, substantially as and for the purposes set forth.

6. The mold-sections *g* and cover-sections *h*, supported on the traveling carriers, and having the rabbet or similar joints between their meeting edges and end faces, substantially as and for the purposes set forth.

7. The combination of the mold-sections and cover-sections fitting together to form the

traveling mold, and having the flanges *l* along their meeting edges, and the clamping-frame L, substantially as and for the purposes set forth.

8. The lower frame having the extensions *m* along the base thereof, and track-plates *n*, secured to said extensions, in combination with the traveling carriers, substantially as and for the purposes set forth.

9. The combination of the traveling mold arranged at a slight inclination from a horizontal plane, and the runner *r*, extending within the mold-cavity, and having the enlargement *r'*, to receive the metal and feed it gradually to the mold, substantially as set forth.

In testimony whereof we, the said ADOLPH MATTHES and HORACE W. LASH, have hereunto set our hands.

ALOLPH MATTHES.
HORACE W. LASH.

Witnesses:
T. G. KAY,
JAMES I. KAY.