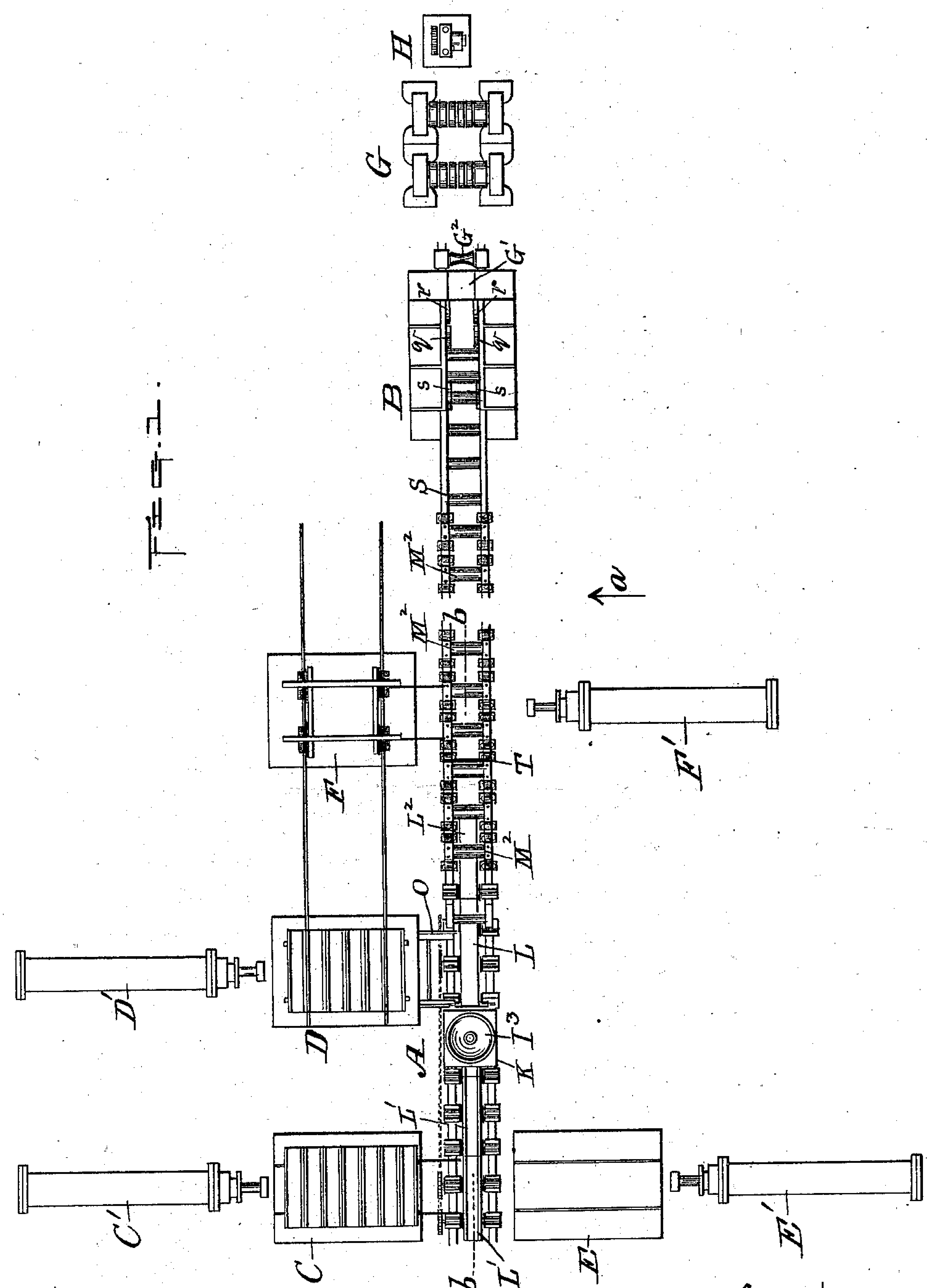
(No Model.)

6 Sheets—Sheet 1.

J. O. E. TROTZ.

APPARATUS FOR CASTING INGOTS.

No. 560,661. Patented May 26, 1896.



Witnesses;

W. B. Nourse.

C. Forrest Wesson

Inventor;

Johan Otto Emanuel Trotz.

By A. A. Barker. Att'y

(No Model.) 6 Sheets—Sheet 2.

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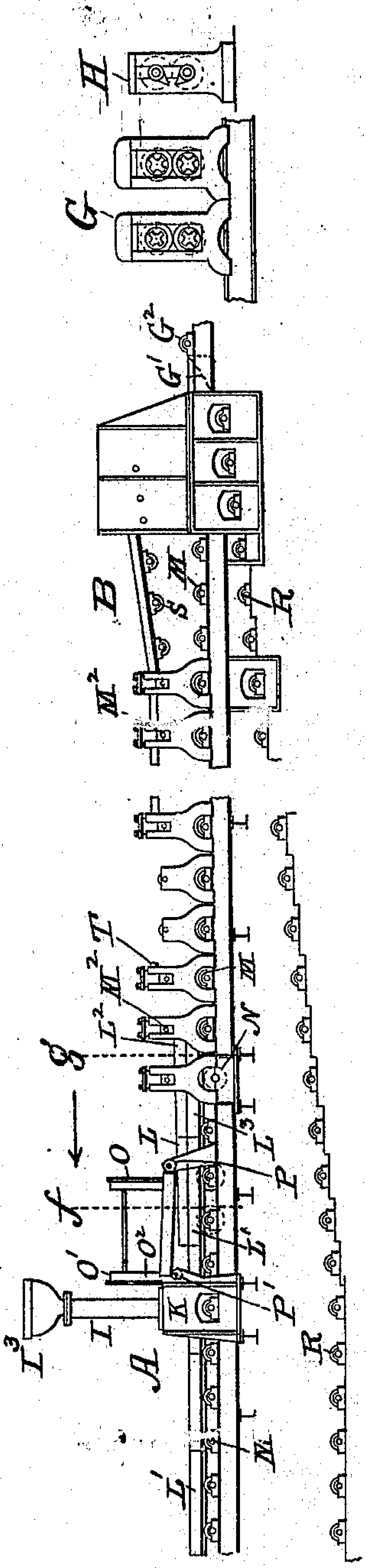
Fig. 2.



Witnesses; W. B. Nourse. C. Forrest Wesson.

Inventor; Johan Otto Emanuel Trotz. By A. A. Barker. Att'y

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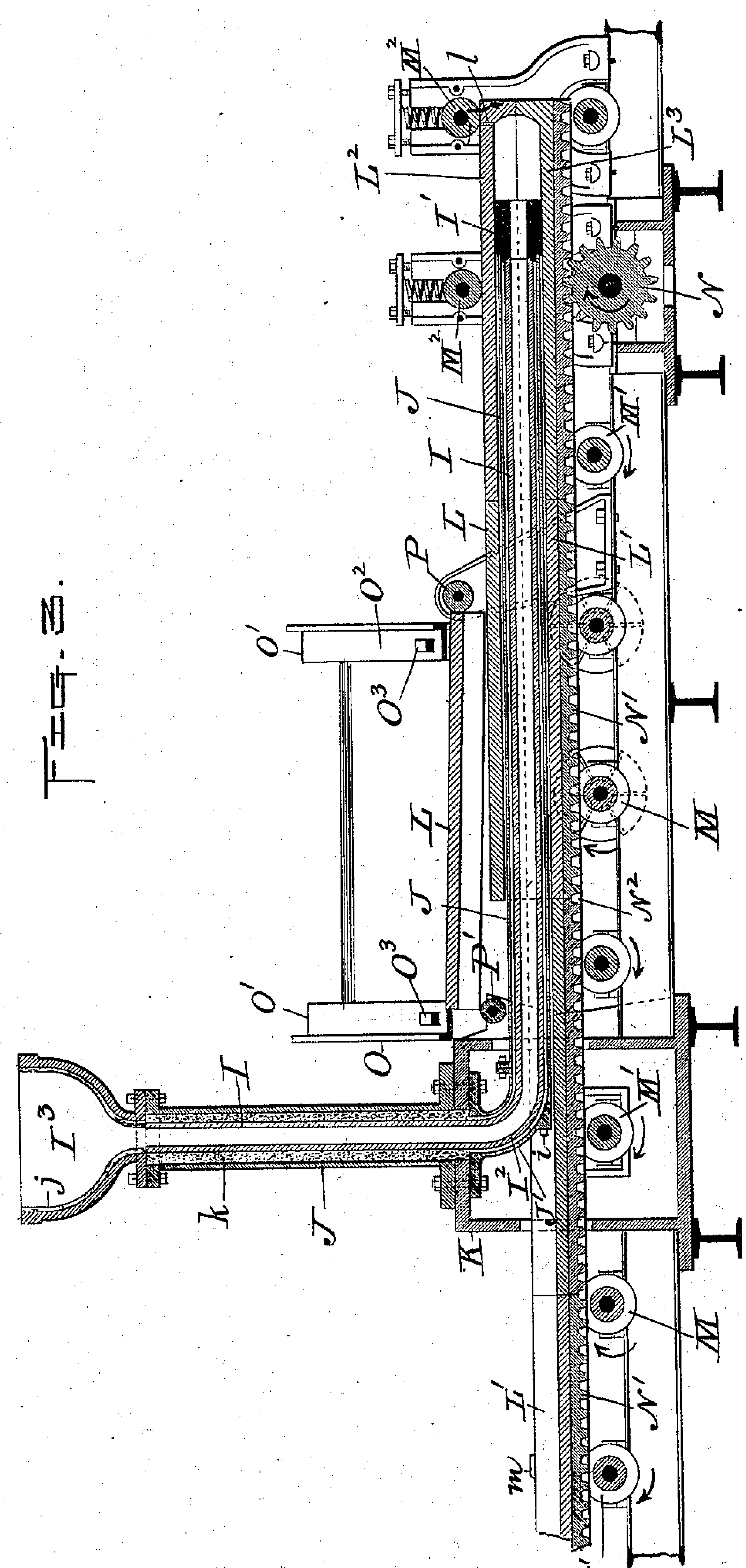

Witnesses;
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C. Forrest Wesson.

Inventor;
Johan Otto Emanuel Trotz.
By A. A. Barker. Att'y.

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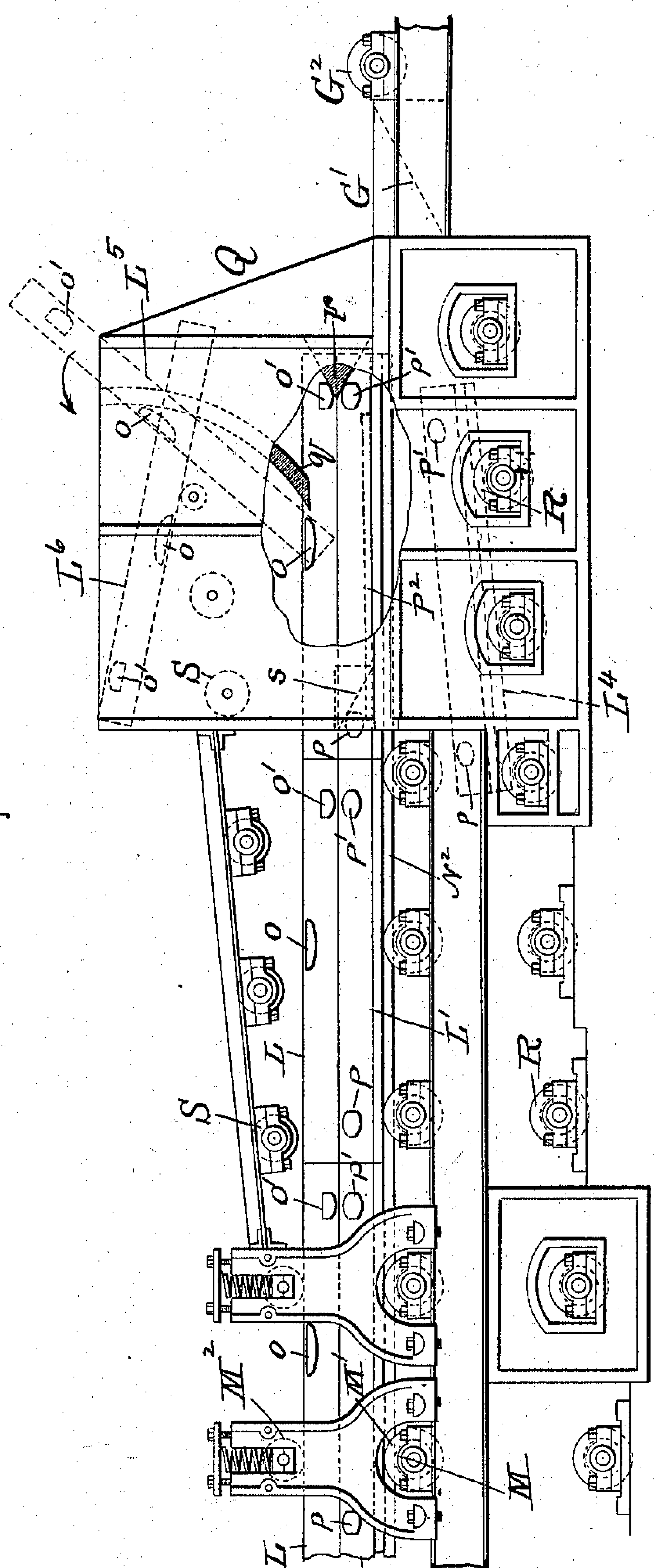

Fig. 4

Witnesses;

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(No Model.) 6 Sheets—Sheet 5.

J. O. E. TROTZ.

APPARATUS FOR CASTING INGOTS.

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FIG. 5.

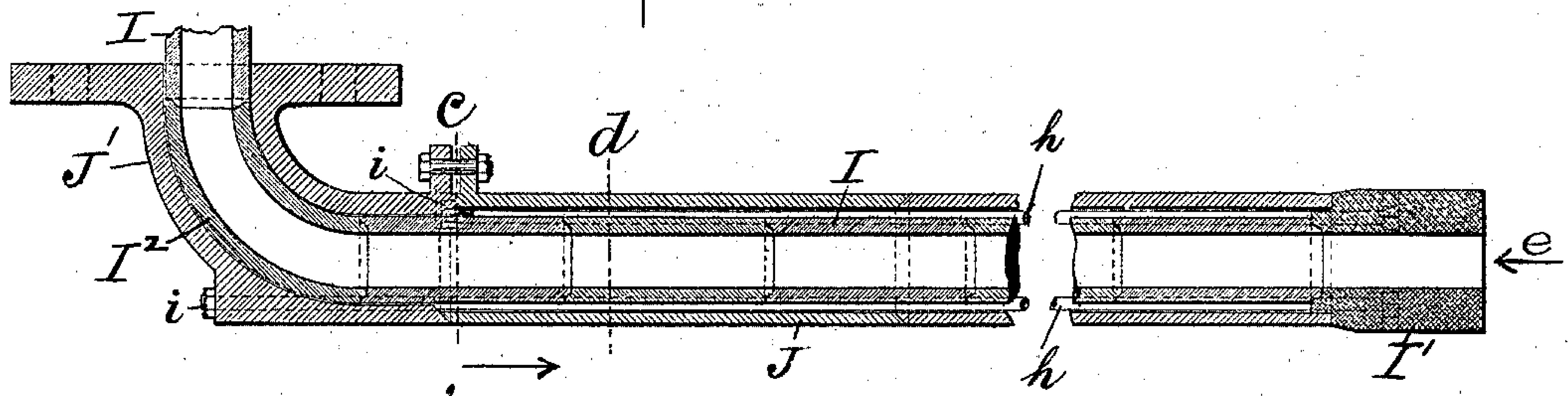


FIG. 6.

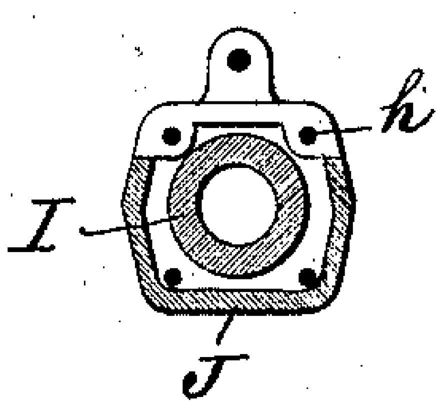


FIG. 7.

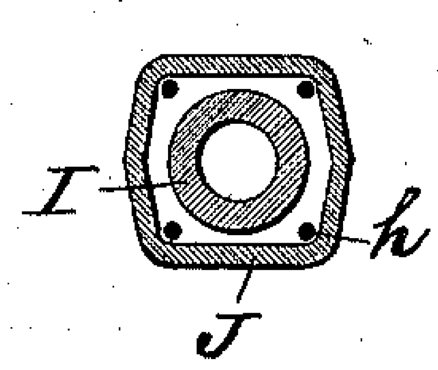


FIG. 8.

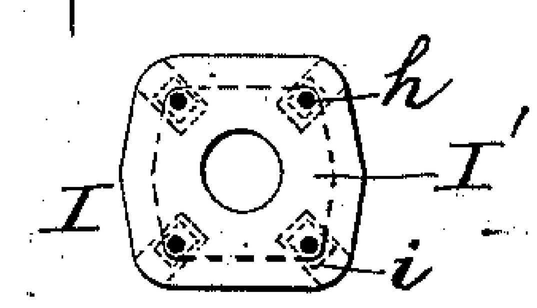


FIG. 9.

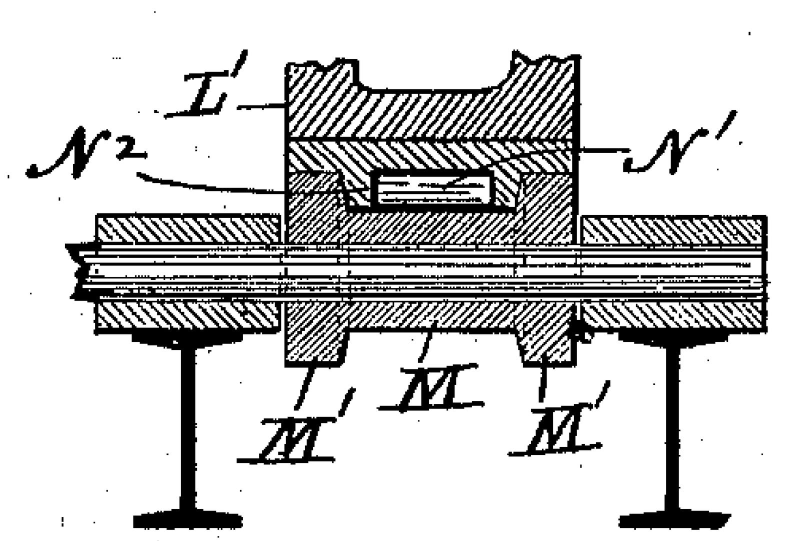


FIG. 10.

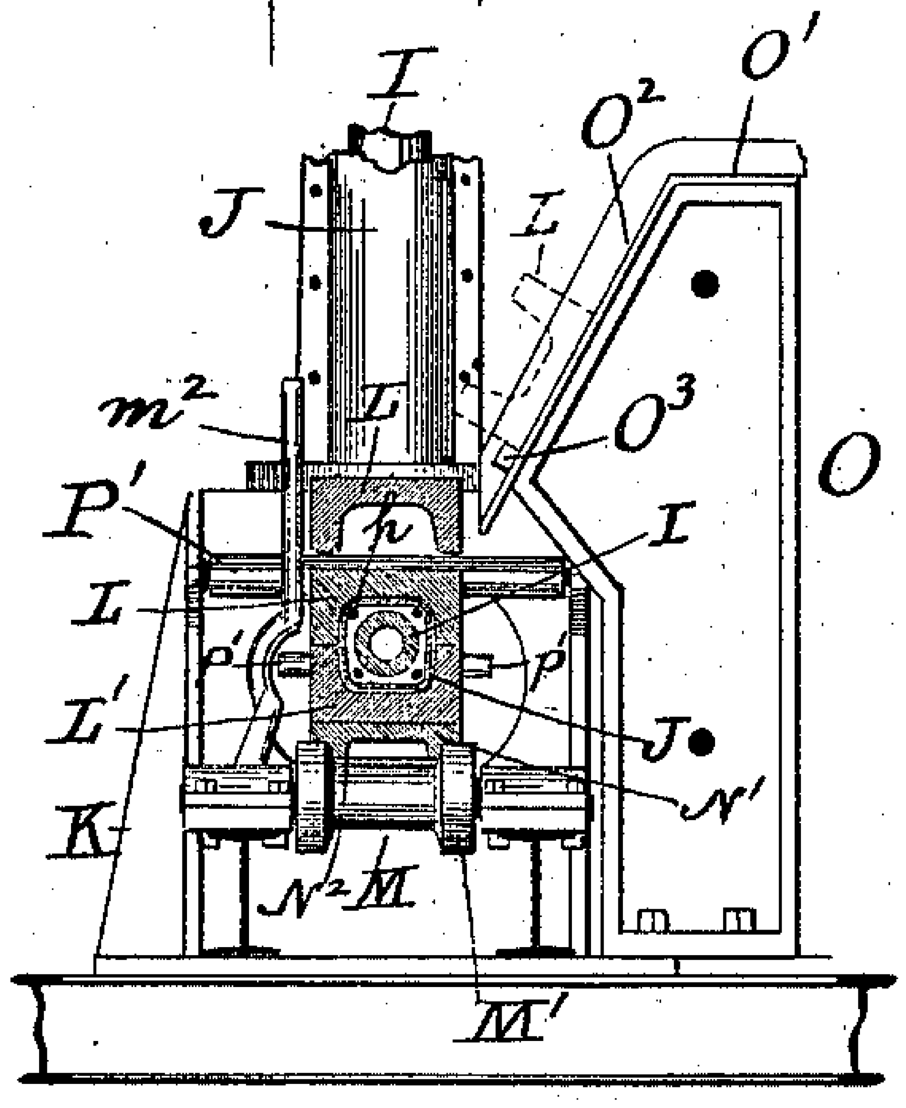
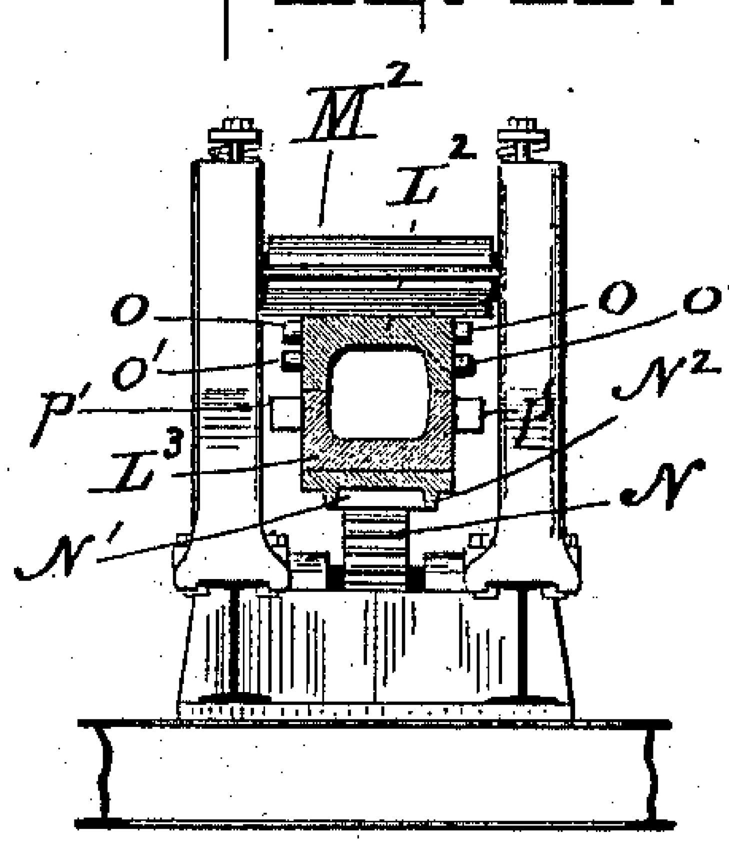


FIG. 11.



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(No Model.)

6 Sheets—Sheet 6.

J. O. E. TROTZ.

APPARATUS FOR CASTING INGOTS.

No. 560,661. Patented May 26, 1896.

Fig. 12.

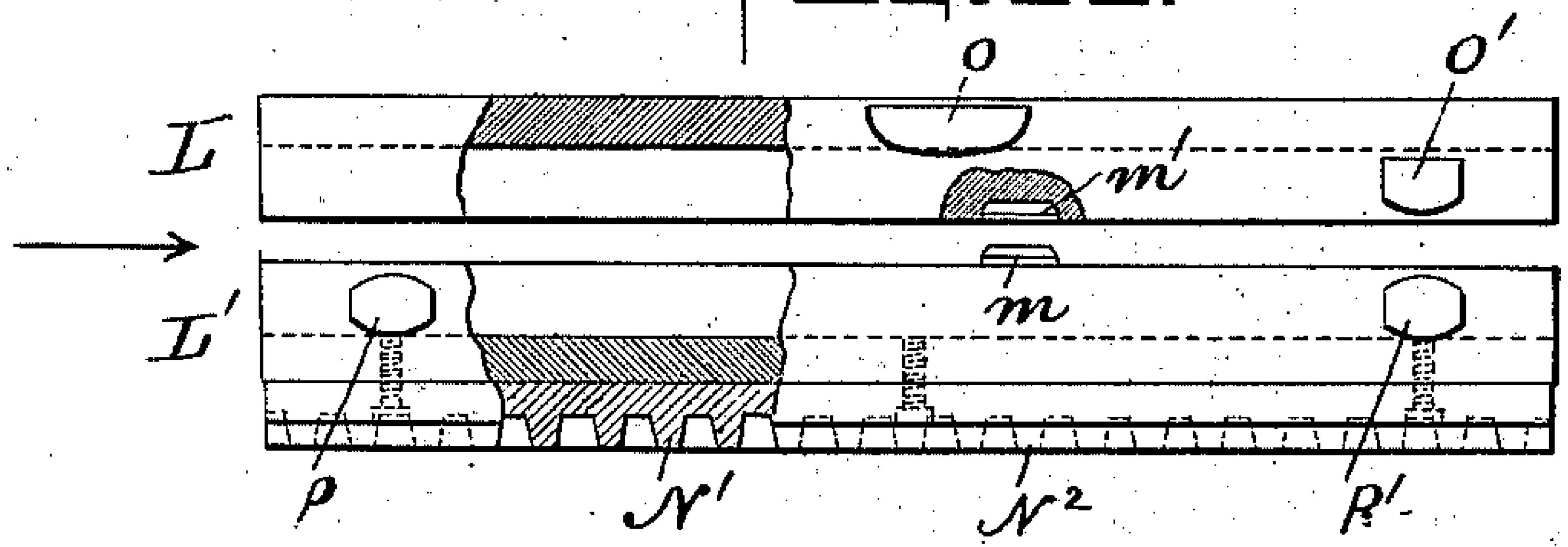


Fig. 13.

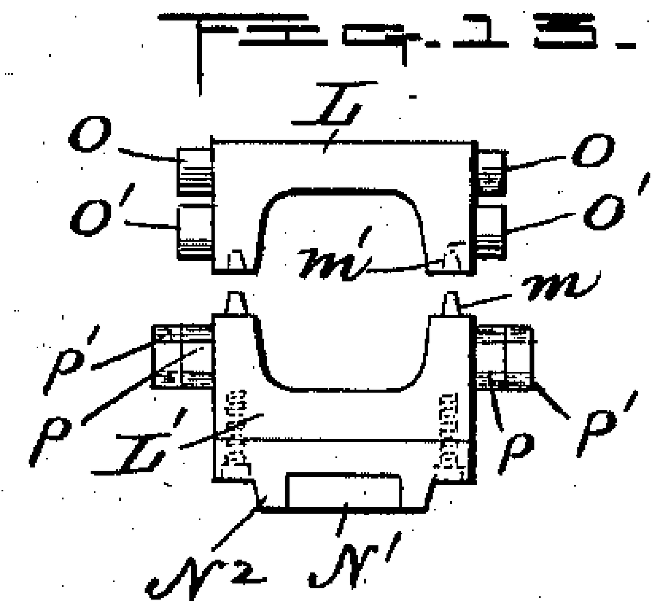


Fig. 14.

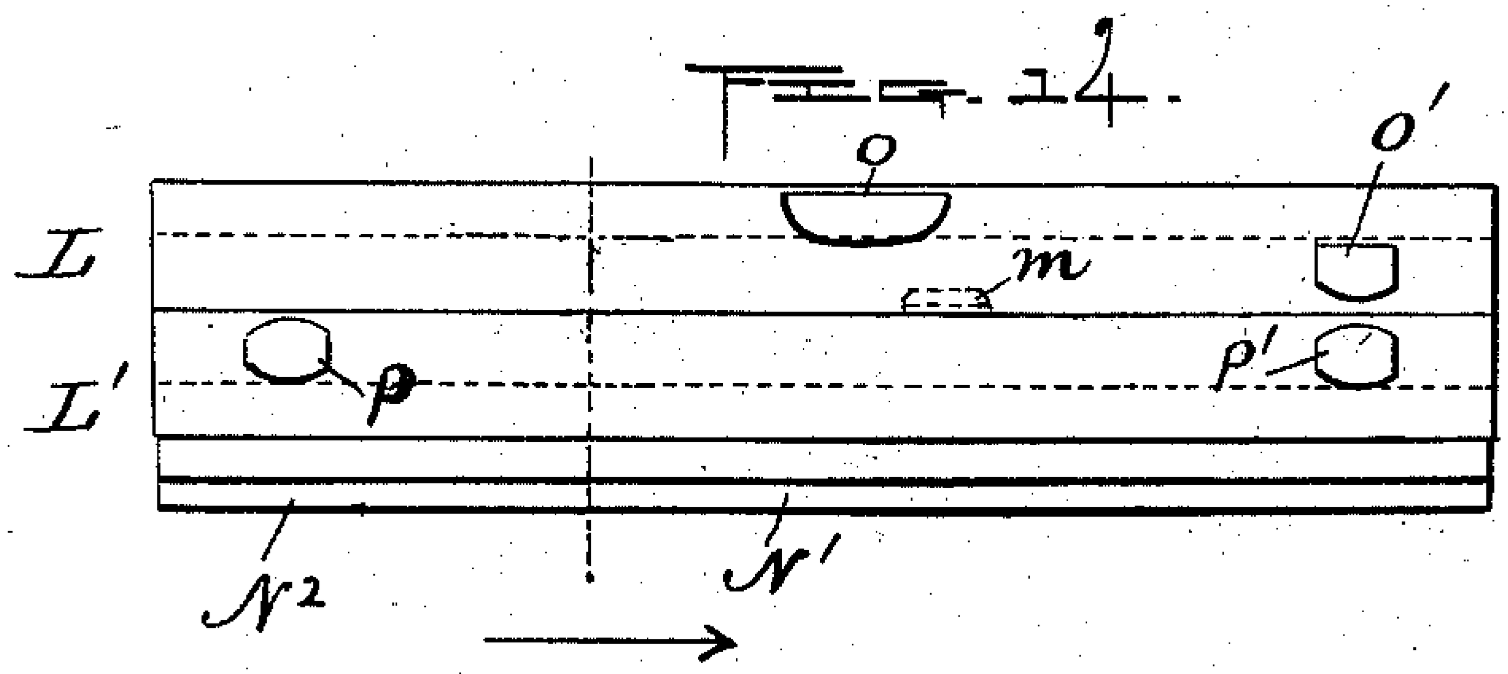


Fig. 15.

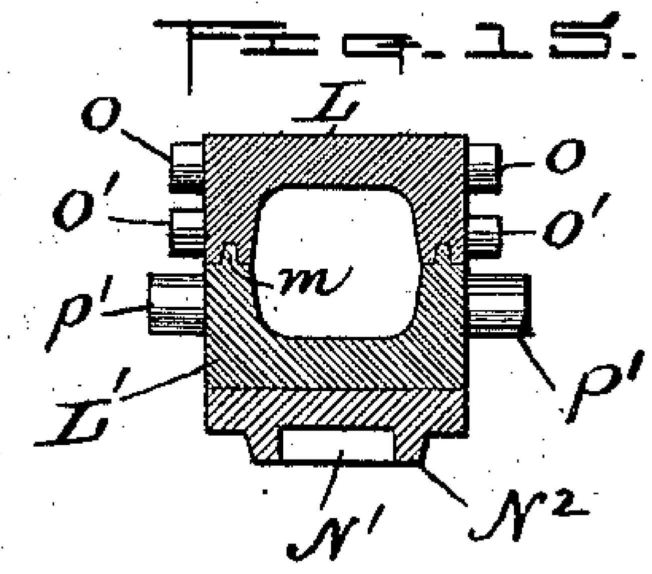
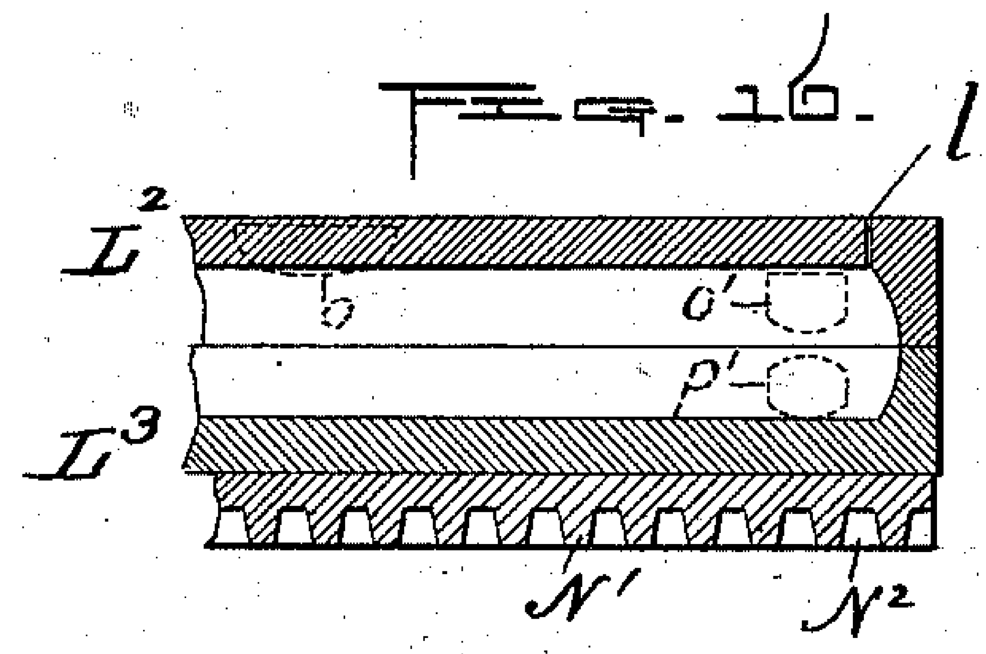


Fig. 16.



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By A. A. Barker Att'y.

ANDREW B. GRAHAM. PHOTO-LITHO. WASHINGTON. D.C.

UNITED STATES PATENT OFFICE.

JOHAN OTTO EMANUEL TROTZ, OF WORCESTER, MASSACHUSETTS.

APPARATUS FOR CASTING INGOTS.

SPECIFICATION forming part of Letters Patent No. 560,661, dated May 26, 1896.

Application filed July 14, 1893. Serial No. 480,516. (No model.)

To all whom it may concern:

Be it known that I, JOHAN OTTO EMANUEL TROTZ, of the city and county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Casting Ingots; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 represents a plan of so much of an apparatus for casting ingots as is necessary to illustrate my invention. Fig. 2 is a side view thereof, looking in the direction of arrow *a*, Fig. 1. Fig. 3 is a central vertical longitudinal section upon an enlarged scale, taken on line *b b*, Fig. 1, all the following figures also being upon an enlarged scale. Fig. 4 is a detail side view of part of the apparatus shown in Figs. 1 and 2. Fig. 5 is a central vertical longitudinal section of part of the tube and its casing for conducting the molten metal to the sectional molds forming the matrix of the apparatus. Figs. 6 and 7 are transverse sections of said tube and casing, taken on lines *c* and *d*, respectively, Fig. 5. Fig. 8 is an end view thereof, looking in the direction of arrow *e*. Fig. 9 is a transverse section through a part of the apparatus, showing the rolls and their bearings upon which the molds travel, as hereinafter described, the lower portion of one of the bottom molds also being shown in this figure. Figs. 10 and 11 are transverse sections taken at the points indicated by lines *f* and *g* of Fig. 2, respectively, looking in the direction shown by the arrow. Figs. 12 and 13 are side and end views, respectively, of one of the pairs of top and bottom molds, shown a little apart, and in Fig. 12 partly in section, to more fully illustrate the construction thereof. Figs. 14 and 15 are a side and transverse section, respectively, of said top and bottom molds with the two parts fitted together as in use, and Fig. 16 is a central vertical longitudinal section of the front end of the first or forward pair of sectional molds of the matrix for casting each continuous ingot.

The object of my invention is to provide an efficient and practical apparatus for casting continuous ingots, bars, or rods from molten or fluid metal.

To enable others skilled in the art to which my invention appertains to better understand the nature and purpose thereof, I will now proceed to describe it more in detail.

Referring to Figs. 1 and 2 of the drawings, A represents the casting mechanism; B, the mechanism for automatically separating the top and bottom parts of the molds and starting them on their return journey to the opposite end of the machine, as aforesaid.

C, D, E, and F are elevators for holding and carrying the molds at different stages in the casting operation.

C′, D′, E′, and F′ are hydraulic cylinders having piston-rods or plungers adapted to push the molds laterally when required.

G represents part of a rolling-mill, and H a shearing device for severing the cast strand as required.

The mechanism for casting the ingots and for feeding the molds forward, back, and laterally, as previously stated, is constructed and arranged to operate in unison, as follows: The pipe or tube I for conducting the molten metal to the matrix extends substantially in a horizontal line from its nozzle I′ to the elbow I^2, thence up vertically, and terminates in the receiving-tunnel I^3 at the top, into which said molten metal is poured from the usual ladle in the ordinary way. Said conducting-tube is preferably made of fire-brick and provided with an outside iron casing J, and both are made, as is shown in Figs. 5 to 8, inclusive, in separable sections of convenient lengths and of the proper shape at the ends to make tight joints when fitted together. They are made conical-shaped at the ends in this instance. The nozzle, which in practice is composed of graphite or other refractory material, is in this instance secured to the conducting-tube and its casing by longitudinal rods *h* and nuts *i*, which also serve to hold together the several parts of the horizontal portion and to fasten the same to the elbow-casing J′, the other end of said elbow-casing being in turn rigidly bolted to frame K. The vertical outer casing or cylinder is also bolted to frame K, and to its upper end is bolted the tunnel I^3. Said tunnel is lined with suitable refractory material *j*, which extends to and forms a connection with the fire-brick lining or tube I. The space between said tube and outer casing or cylinder is preferably packed with fire-sand k, said packing in this instance extending down to the elbow-casing J′.

The matrix or mold into which the molten metal is poured from the aforesaid conducting-tube I to form the continuous ingots is composed of a series of pairs of separable molds L L′, fitting tightly end to end and arranged to travel forward successively and continuously at the proper speed to receive the continuous stream of molten metal as it discharges from the nozzle of said conducting-pipe I. The construction of said sectional molds is best illustrated in Fig. 3 and Figs. 12 to 16, inclusive. They consist, as will be observed, of the top part L and the bottom part L′, each pair being alike, except the pair L^2 L^3, (see Figs. 3 and 16,) which form the forward extremity of the matrix. These two parts are constructed so as to form a tight front end, except for a small vent-hole l for the escape of air and gases in advance of the metal first poured in, which forms the forward end of each continuous ingot. Each pair of molds is locked when fitted together by a projection m, formed on one part, which fits into a corresponding recess m', formed in the other part, and each pair is moved forward together by the operation of the bottom parts L′. Said bottom parts or half-molds are carried forward by a series of horizontal transverse continuously-rotating friction-rolls M, and pinion N being arranged to rest upon said friction-rolls, as is shown in Figs. 3, 9, and 10, and each provided upon the under side with a continuous rack N′, adapted to engage with said pinion N, as is shown in Figs. 3 and 11. The friction-rolls are in practice run at a higher speed than the pinion, so as to keep each succeeding pair of molds abutted tight against those in advance, and thus prevent the accidental discharge of molten metal at the joints.

In operation the sectional molds occupy the positions best shown in Figs. 3, 4, 10, and 11, the top parts L L^2 being above the horizontal portion of the conducting-pipe I and its casing, the bottom parts L′ L^3 below, and the two surrounding the same, as is shown in Fig. 10. They are placed in said positions by means of the automatic carrying and guiding mechanism and elevators before alluded to in the following manner: In the first place, before pouring a "heat," a sufficient number of sectional molds L L′ are loaded upon the elevators D and C (parallel to the conducting-tube I) to receive the molten metal discharged at said pouring, the bottom parts L′ of said molds being placed on elevator C, which is raised so as to bring the bottom of said half-molds upon a level with the tops of the friction-carrying rolls M and pinion N, and the top parts L being placed on elevator D, which is raised so as to bring the bottoms of said half-molds on a level with the top O′ (see Figs. 3 and 10) of guide-frame O. Being thus arranged and the first two pairs of molds (shown in Fig. 3) placed in position, the apparatus is started up and the half-molds pushed from their respective elevators by the hydraulic pushing devices C′ and D′ previously alluded to, the bottom parts onto the friction-carrying rolls M and the top parts onto the guide-frame O in pairs—that is, a top mold onto the frame and a bottom mold onto the rolls continuously and successively as fast as is required to keep up an end-to-end connection of the pairs of sectional molds to form a continuous matrix or mold to receive the metal as fast as it is discharged from the conducting-pipe I. It is obvious that when the bottom parts are placed on the continuously-rotating carrying-rolls M they are at once moved forward thereby at such speed as said rolls are turned. The top parts, when delivered upon the frame O and pushed forward, slide in an inverted position (see dotted lines, Fig. 10) down the inclines O^2 of said frame O until they strike the projections O^3 O^3 at the bottom of the inclines, which causes them to tip over by force of gravity into their normal upright positions, as is shown by full lines in said Fig. 10. When thus tipped over, their forward ends (see Fig. 3) rest upon the next preceding top part against a stop-roll P and their rear ends upon a supporting-roll P′ until the rear end of the preceding pair of molds arrives at the forward end of the last top part delivered, when the latter drops into place over its bottom part and is locked against lateral or longitudinal motion thereon by the ears or projections m and recesses m', formed in said parts, as previously described. An upright rod or bar m^2 facilitates the operation of guiding said top molds into their proper positions over the bottom molds when they tip and fall over onto the same, as aforesaid. Each successive pair of sectional molds is in like manner placed in position in the apparatus as fast as the preceding ones move forward out of the way, thus forming a continuous moving mold or matrix to receive the molten metal as fast as delivered thereto. The first two pairs of molds of each matrix or series of connected sectional molds are preferably placed in position by hand, with the forward end of the first pair a little in advance of the nozzle I′ of tube I, as is shown in Fig. 3, so as to prevent the metal as it leaves the nozzle coming at once in contact with the end of the mold, which is comparatively cool. Otherwise when the molten metal enters the mold it might cool off to such an extent by contact with said cooler metal as to solidify at said nozzle and impair the proper outflow thereof.

The sectional molds of the matrix are held in position vertically from just back of the nozzle forward to where said molds are separated from the ingot by a series of spring friction-rolls M^2, which bear downward upon the tops of the molds. They are held from moving out of position laterally by flanges N^2 N^2 on the under sides of the bottom molds at each side of the rack N′, which fit between flanges M′ M′ on the friction-rolls M. (See Figs. 9 and 10.) If desired, only part of the rolls M may be arranged to be turned, and as any convenient driving mechanism may be employed for operating those that do turn it is deemed unnecessary to illustrate said driving mechanism.

The pinion N is arranged a little back of the nozzle I′, as is also shown in Fig. 3, so as to secure a perfect tightening of the joints between each preceding and following pair of molds. The pinion being thus located, it is obvious that when the rear end of each pair of molds arrives and pass by the action of the pinion they must remain at rest until the succeeding pair pushes them forward. Consequently the rear end of any pair of molds can never pass forward of the nozzle and allow the molten metal to escape should any of the succeeding molds not be fed forward properly to maintain a tight longitudinal connection with one another.

The molds must be removed from the ingot when cast, as aforesaid, after its surface has been sufficiently cooled to form an outer coating or crust capable of retaining the interior portion while still in fusion and before it is cooled enough to cause said surface to crack and produce an imperfect ingot.

In practice the apparatus is made of the proper length to provide a series of connected sectional molds, or, in other words, a matrix of sufficient length to permit the metal to be properly cooled, as aforesaid, before its release from said molds preparatory to its passage to the rolling-mill for reduction to rods or other shapes in cross-section.

It is inexpedient to show the full length of the apparatus in Figs. 1 and 2 and at the same time illustrate my improvements upon a sufficiently large scale to make the construction clear, and therefore part of the central portion is broken away, consisting in practice of as many sets of rolls and housings similar to those at each side of the broken line as are necessary in connection with the parts of the apparatus shown to extend said apparatus to the desired length.

The sectional molds of the matrix are separated from the ingot and returned to the elevators, as previously stated, in the following manner: Upon each top part L of the sectional molds (see Fig. 4 and Figs. 12 to 16, inclusive) are formed laterally-projecting ears *o o*, one upon each side near the top edge and about central between the ends thereof, and near their bottom edges and front ends are also formed the ears *o′ o′*, while upon the bottom parts L′ are also formed similar ears or projections *p p p′ p′*, two upon each side near their top edges and ends thereof. The purpose of said ears or projections is to form bearings adapted to come in contact with the curved segment-shaped lifting-hooks *q q* and the **V**-shaped separators *r r*, both formed upon or secured to the stationary frame Q, as is best shown in Figs. 1 and 4, the ears *o* engaging with the curved hooks *q* and the ears *o′* and *p′* with the separating-wedges *r r* on frame Q. In operation, as the molds move forward the projections *o′* and *p′* first come in contact with said wedges *r*, the projections *o′* above and the projections *p′* below the pointed ends thereof, and at the same time the rear projections *p* come in contact with wedges *s s*, also on frame Q, thereby, as the molds continue to move forward, causing the same to be separated from the ingot, the bottom molds dropping onto a series of transverse carrying-rolls R, as is indicated by dotted lines L^4, and the top molds first slightly raised at their forward ends by the wedges *r*, and then when the projections *o* come in contact with the curved hooks *q*, carried up by the next mold pushing it forward, first as indicated by dotted lines L^5, and then, when pushed still farther forward beyond its point of equilibrium, tipping over, as shown by L^6, and dropping onto the series of transverse inclined carrying-rolls S, down which they roll until they come against a transverse bar T. The hydraulic pushing device F′ then pushes each successive mold laterally onto the elevator F, and when all the top molds of one heat have been deposited thereon they are removed by the elevator and allowed to cool preparatory to reusing the same for another heat or pouring. The bottom molds are similarly disposed of after they have rolled down to the proper point to be removed from the carrying-rolls, which are also inclined downward from the front toward the rear, as is indicated in Figs. 2 and 4. I do not, of course, limit myself to any special way of pushing the molds from the rolls or to any special elevator or other transferring mechanism, the hydraulic devices and elevators being shown in this instance simply to serve as an illustration of one way of effecting said removal and transfer. In practice the projections *o′*, *p*, and *p′* are simultaneously caught by the wedges *r* and *s* and directly after they come in contact the projections *o* engage with the curved lifting-hooks *q* and are tipped over, as aforesaid. Therefore the bottom and top molds roll down their respective inclines to the elevators at about the same time.

The forward bottom molds are kept in contact with the ingot, after passing by the last friction carrying-roll M, by flanges on the main frame at each side of the molds, (see dotted lines p^2, Fig. 4,) upon which the lateral projections *p′* on the molds rest, said projections being made longer than the others, as is shown in Fig. 15, for this purpose. The projections p^2, as will be observed, do not extend quite up to the separating-wedges *r*, so as to allow the molds to drop down, as aforesaid. Ordinarily the bottom molds will drop down by their own weight when arriving at the proper point, and the wedges r s simply serve to start the molds in case they stick to the ingots.

When the bottom molds are pressed down and separated from the ingot, they are preferably in practice first deposited onto a suitable carriage adapted to be moved up under the molds to receive them and to then descend and deposit them onto the inclined rolls, thereby preventing them from dropping with too heavy a blow upon said rolls. As any suitable device may be employed for this purpose and it does not constitute an essential feature I have not shown the same in the drawings.

As fast as the sectional molds are removed from the ingot, as aforesaid, it moves forward in its completed form and while still in a red-hot or malleable state passes between the rolls of the rolling-mill, and is thereby reduced to rods or other shapes in cross-section in the usual way all by a continuous and automatic operation, from the operation of pouring the molten metal to the completed product. I do not limit myself, however, to the combination of a rolling-mill with my improved ingot-casting apparatus, as said operations may be performed independently, if desired, by incurring the additional trouble and expense of reheating said ingots before rolling. When the first pair of molds are removed from the ingot, leaving the same without support, it might sag down, being in a malleable state, and would then require to be supported and guided to the carrying-rolls and rolling-mill. This may be done by arranging an inclined platform G′ (see dotted lines in Fig. 4) between the casting apparatus and a series of carrying-rolls preferably used between the apparatus and the rolling-mill, only one of which, G^2, is shown in the drawings. The purpose of the shearing device H is to cut off the imperfect ends of the metal, or to cut apart the continuous metal into the desired lengths.

Having described the apparatus in detail, the operation thereof may be briefly summed up as follows: Assuming that the apparatus is ready for operation, with the sectional molds on the elevators and the metal ready to pour, said metal is released and allowed to discharge, as usual, into the tunnel I^2 in a continuous stream until all the metal of this heat is discharged. From the tunnel it flows down through the conducting-pipe I and its nozzle I′ into the first pair of molds L^2 L^3, whose forward ends are closed, and fills said molds from said closed ends back to the end of the nozzle, and as the molds are moved forward the continuous stream of molten metal fills the same, a constant pressure being maintained by the weight of the metal above the level of the molds, and in consequence no "pipe" can be formed, except in the very last part of the ingot at the end of the pouring of each heat. The graphite nozzle of the conducting-pipe I is made sufficiently tight in the molds to prevent the escape of metal around the same, but not so tight as to bind therein as the molds are moved forward. The set of molds constituting the matrix of one heat having been filled and the forward molds removed successively and returned to the elevators, as previously described, another set of molds properly cooled for another heat are set in motion, and the above operation repeated, and so on continuously for each pouring. As each pouring or heat is made into one continuous ingot and only the last part of the same has to be "cropped" or cut off the percentage of "croppings" is very much smaller than it generally is. It will also be apparent that as the poured and cooling metal is always under pressure, from the fact that the supply comes from a higher level than the molds, the cast metal is of a uniformly solid and even texture, and consequently of superior quality.

By my improved process of casting the ingots and rolling the same by a continuous operation a large saving in fuel and labor may be effected while at the same time materially enhancing the value of the product by removing the possibility of pipe being formed therein, as aforesaid.

Although I have shown and described only one line of molds and mechanism for pouring the metal therein and for feeding forward and otherwise operating said molds the construction and arrangement of the apparatus may be such as to admit of the use of several parallel lines of molds without departing from the principle of my invention. I also reserve the right of making the sectional molds of any desired shape suitable for the purpose.

Having now described said invention, what I claim therein as new, and desire to secure by Letters Patent, is—

1. An apparatus for casting ingots comprising the following elements, to wit: an incased tube for conducting the molten metal from the usual ladle to the matrix, consisting of a horizontal part provided with a nozzle at its forward end composed of suitable refractory material, also having an elbow at the opposite end of said horizontal part and a vertical part extending up from said elbow terminating at the top in an enlarged or tunnel-shaped end; a moving matrix composed of a series of pairs of removable, sectional molds, with the two parts of each pair fitted and locked together laterally, and each successive pair fitted end to end over the horizontal part of the aforesaid conducting-tube; mechanism for conveying said sectional molds from suitable platforms or elevators and depositing them in their proper positions in the apparatus, and for feeding forward said molds; also for separating the molds from the completed ingot as fast as it becomes sufficiently cooled to be released, and mechanism for transferring the sectional molds after removal, back, and laterally onto suitable platforms or elevators

preparatory to being reused when sufficiently cooled, substantially as and for the purpose set forth.

2. In an apparatus for casting ingots, the horizontal conducting-tube, inclosed within an outer casing, and having a suitable nozzle, also having an arm extending vertically therefrom, provided with a tunnel-shaped opening at its upper terminus into which the molten metal may be poured, in combination with a removable, moving matrix surrounding the nozzle end of said conducting-tube and fed forward at the proper speed to receive the molten metal in front of said nozzle as fast as it is discharged therefrom, substantially as shown and specified.

3. In an apparatus for casting ingots, the horizontal conducting-tube inclosed within an outer casing, and having a suitable nozzle, also having an arm extending vertically therefrom provided with a tunnel-shaped opening at its upper terminus into which the molten metal may be poured, and means for supporting and holding the various parts, in combination with the bottom parts of the sectional molds, having a continuous rack formed upon the under side of each; suitable rotary friction-rolls and a pinion for feeding the same forward; the top parts of said sectional molds, means for transferring the same from the elevator or platform onto the tops of the bottom parts and for locking each pair of sectional molds together, and means for holding the series of molds or matrices in position while being fed forward, substantially as and for the purpose set forth.

4. In an apparatus for casting ingots, the molten-metal conducting-tube, and the bottom of the sectional molds and their supports, in combination with the top parts of said sectional molds, and means for transferring the same from the elevator or platform onto said bottom parts, consisting of a pushing device, an inclined frame having projections near the bottom thereof for tipping over the parts when they come in contact therewith, and a stop and supporting-roll, substantially as specified.

5. In an apparatus for casting ingots, the combination of the supporting-framework, with a conducting-tube consisting of an internal pipe made in sections of refractory material fitted end to end, and having a nozzle at its forward end composed of graphite or other suitable refractory material, a portion of said pipe being horizontal and part vertical and provided at the upper terminus of its vertical part with a tunnel-shaped end lined with refractory material, said vertical part being incased in a metal cylinder having fire-sand or other suitable material interposed between the two, the horizontal part and the elbow connecting said horizontal and vertical parts also being arranged within a metal casing fastened together and to the frame by means of suitable rods, bolts and nuts, substantially as and for the purpose set forth.

6. In an apparatus for casting ingots the combination of the sectional molds of the matrix having lateral projections thereon as described, and mechanism for separating said molds from the finished ingot and conveying the same back to the elevators to be reused; consisting of stationary lifting and separating wedges constructed and arranged so as to engage with said lateral projections as the molds are moved forward, and separate the two halves of each section thereof, and discharge the same upon inclined carrying-rolls arranged respectively, above and below the ingot, down which they travel by force of gravity until stopped opposite the elevators, and devices for pushing said half-molds from their respective carrying-rolls onto said elevators, substantially as and for the purpose set forth.

7. In an apparatus for casting ingots, the combination of the top molds of the matrix having central, lateral projections near their upper edges and near the lower edges of their front ends, with the stationary lifting and tipping-over hooks; the stationary separating-wedge, the series of transverse carrying-rolls, arranged upon an incline down which said top molds travel, the stop at the foot thereof; the pushing device for transferring said molds, from the rolls to the elevator, platform, or car, and the supporting-framework, substantially as shown and specified.

8. In an apparatus for casting ingots, the combination of the bottom molds of the matrix having lateral projections at each end near the top edges thereof, with stationary separating-wedges against which they impinge, and are thereby removed from the completed ingot; the series of transverse carrying-rolls arranged upon an incline down which said bottom molds travel; the pushing device for transferring the molds onto the elevator, platform or car, and the supporting-framework, substantially as shown and specified.

9. An apparatus for casting ingots, consisting of an incased conducting-tube for conveying the molten metal from the usual ladle to the matrix, said tube extending vertically from a receiving-tunnel at the top, thence horizontally and terminating at its lower end in a nozzle of suitable refractory material; a moving matrix composed of a series of pairs of removable sectional molds locked together laterally and abutting longitudinally over the horizontal part of said conducting-tube; mechanism for conveying said sectional molds from suitable platforms or elevators and depositing them in their proper positions in the apparatus, and for feeding forward said molds, also for separating the molds from the completed ingot as fast as it becomes sufficiently cooled to be released, and mechanism for transferring the sectional molds after removal, back and laterally onto suitable platforms or elevators preparatory to being reused when sufficiently cooled; in combination with a rolling-mill for reducing the ingots, as

fast as completed, to rods, bars, plates or other shapes in cross-section, substantially as and for the purpose set forth.

10. An apparatus for casting ingots, consisting of an incased conducting-tube for conveying the molten metal from the usual ladle to the matrix, said tube extending vertically from a receiving-tunnel at the top, thence horizontally and terminating at its lower end in a nozzle of suitable, refractory material; a moving matrix composed of a series of pairs of removable sectional molds locked together laterally and abutting longitudinally over the horizontal part of said conducting-tube; mechanism for conveying said sectional molds from suitable platforms or elevators and depositing them in their proper positions in the apparatus, and for feeding forward said molds, also for separating the molds from the completed ingot as fast as it becomes sufficiently cooled to be released, and mechanism for transferring the sectional molds after removal, back and laterally onto suitable platforms or elevators preparatory to being re-used when sufficiently cooled; in combination with a rolling-mill for reducing the ingots, as fast as completed, to rods, bars, plates or other shapes in cross-section, and a shearing device for severing the metal into the desired lengths, substantially as and for the purpose set forth.

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Witnesses:
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