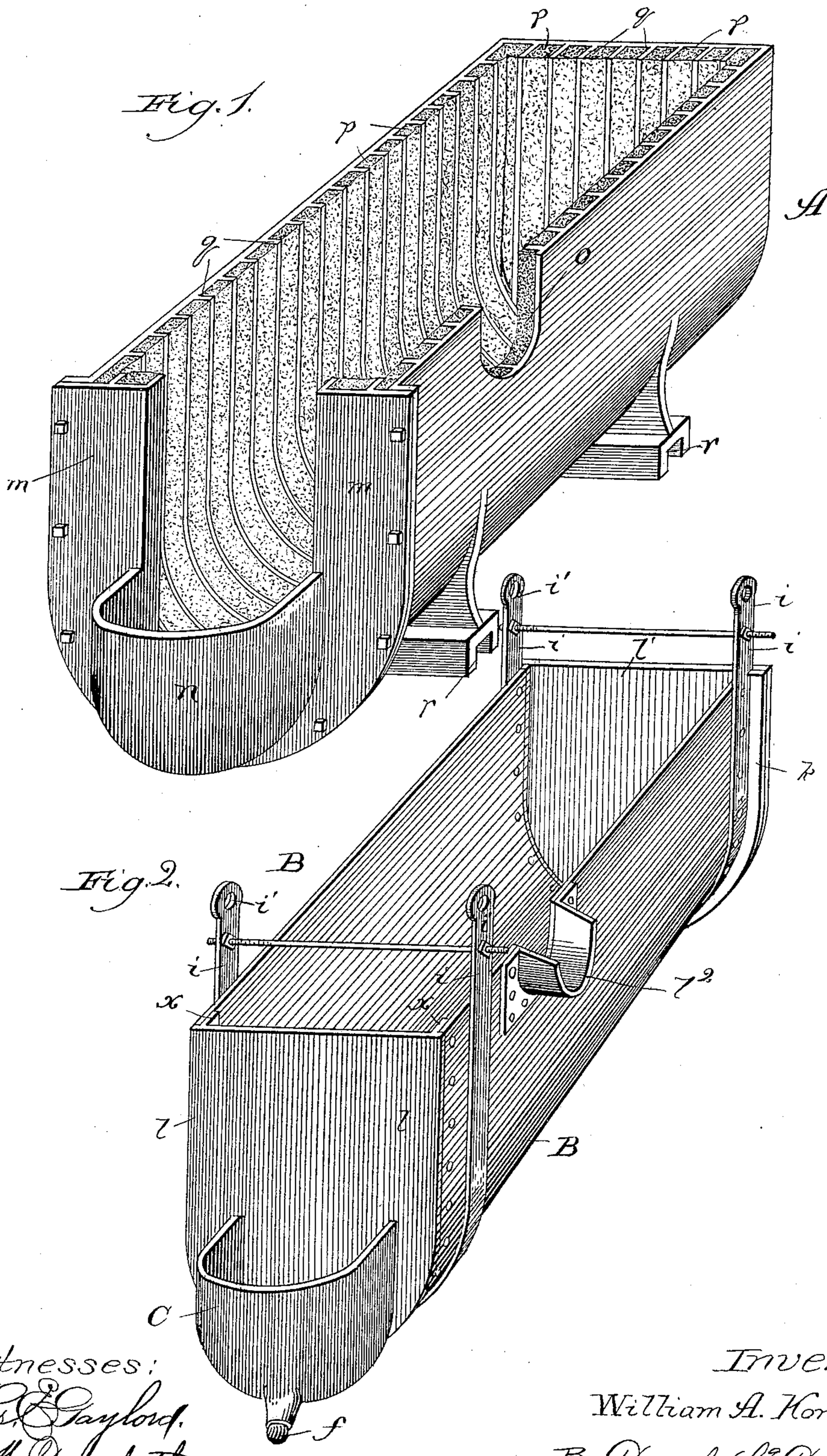
(No Model.) 4 Sheets—Sheet 1.

W. A. KONEMAN.

FORE HEARTH FOR LEAD SMELTING FURNACES.

No. 390,785. Patented Oct. 9, 1888.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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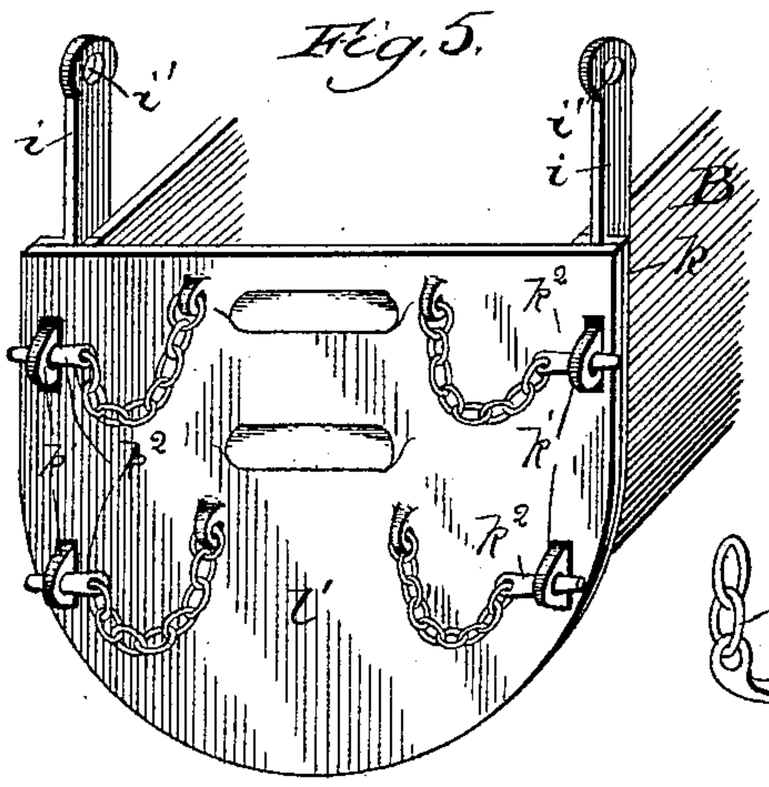
Fig. 5.



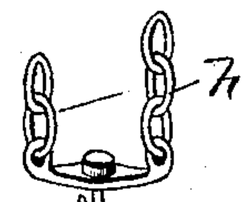


Fig. 3.

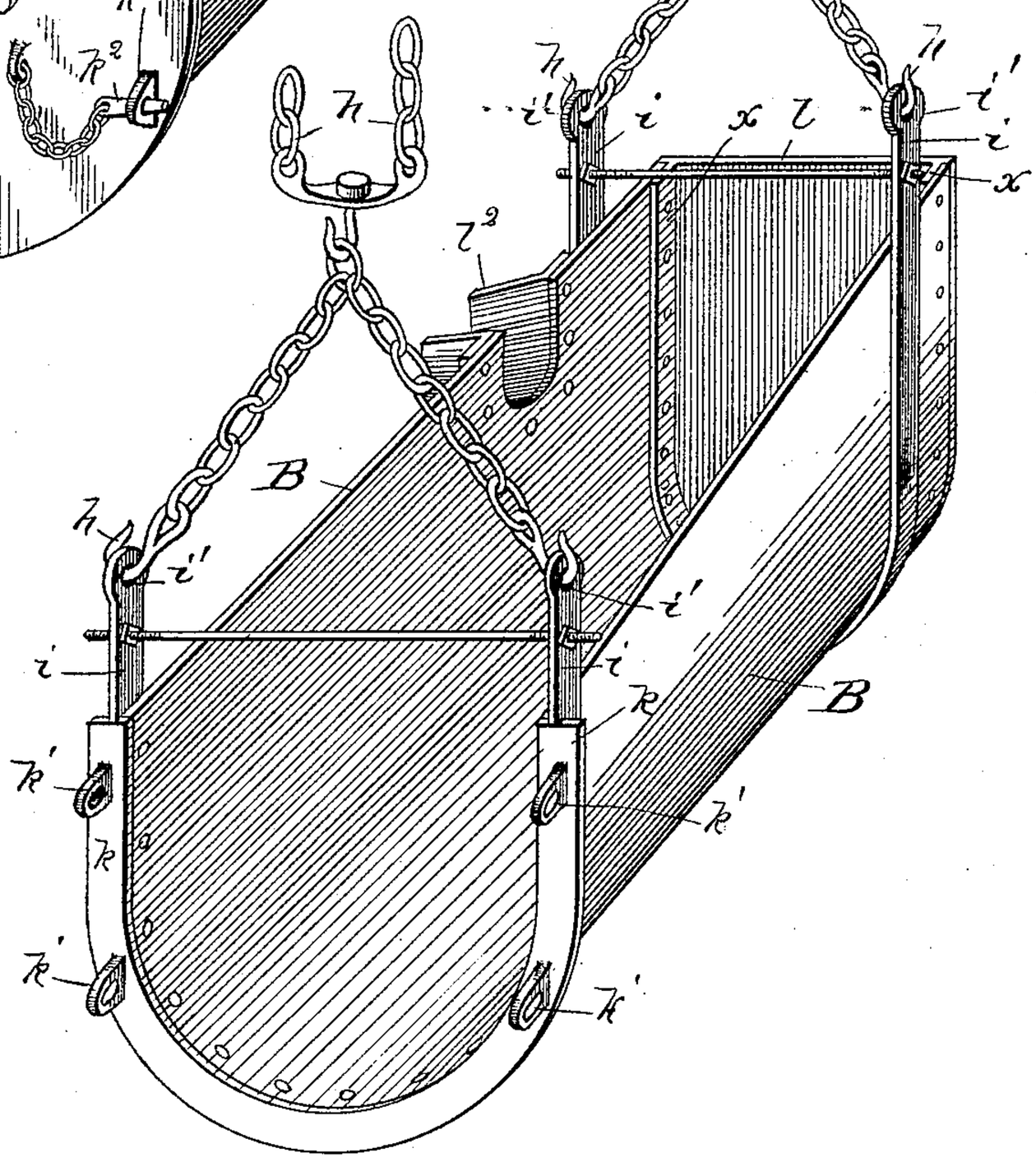


Fig. 4.

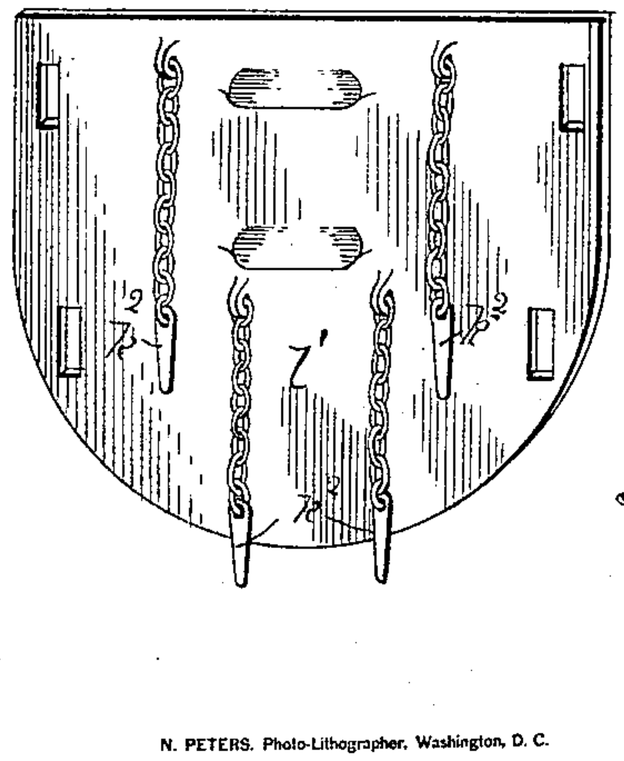


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Fig. 7.

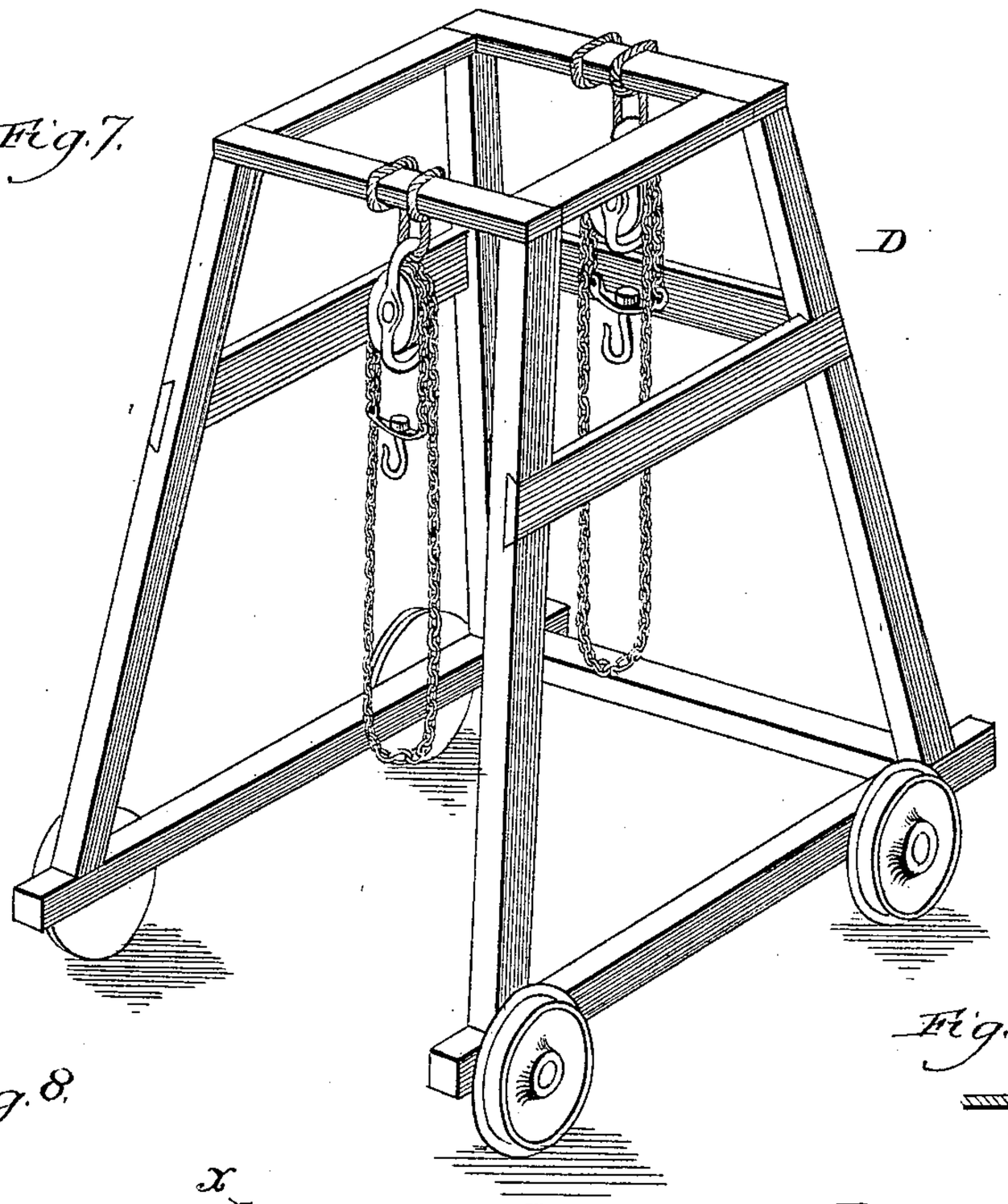


Fig. 6.

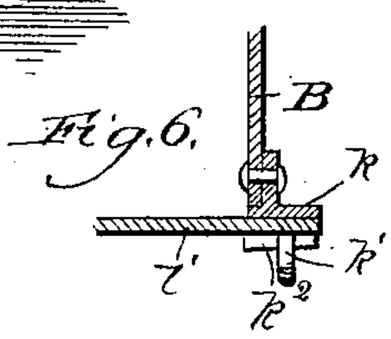


Fig. 8.

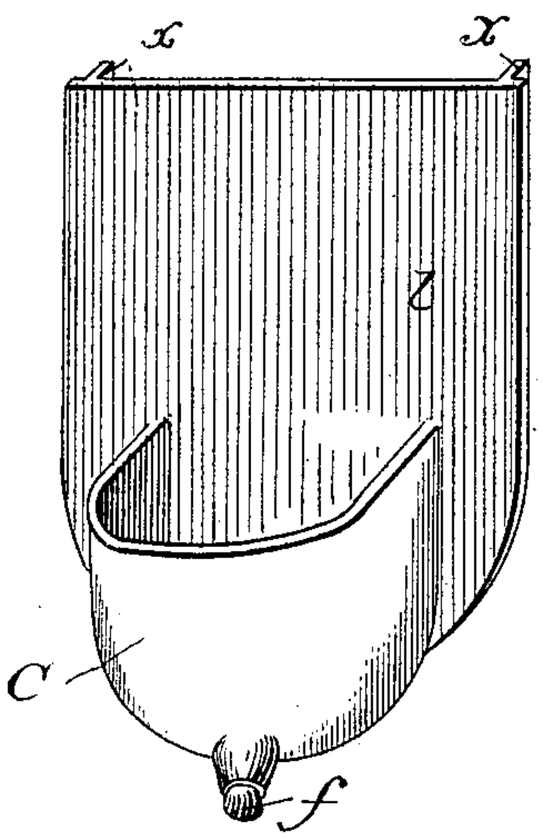
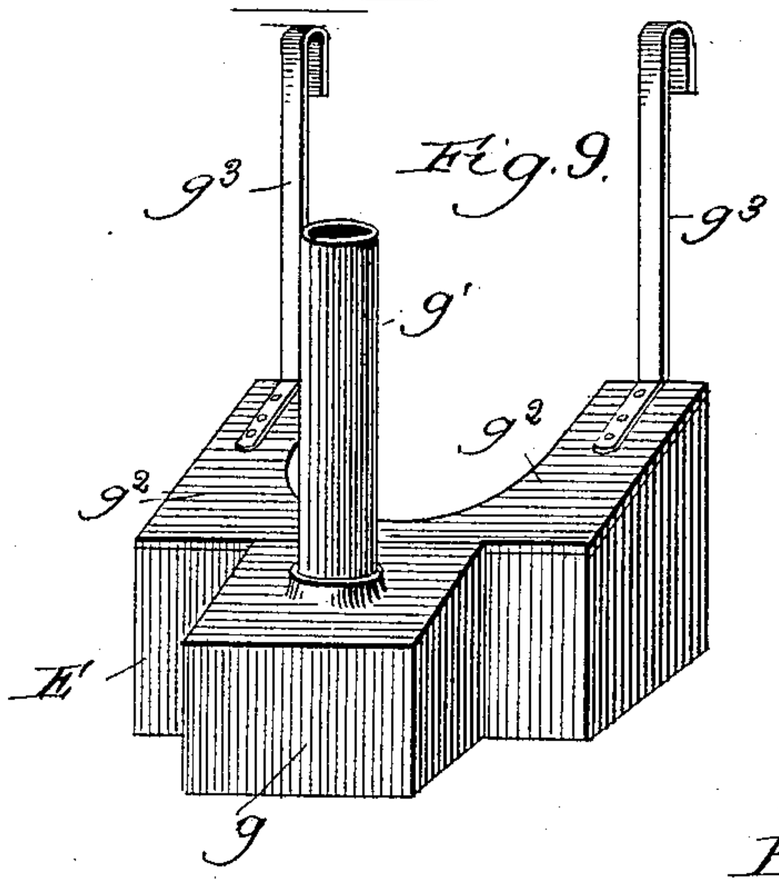


Fig. 9.



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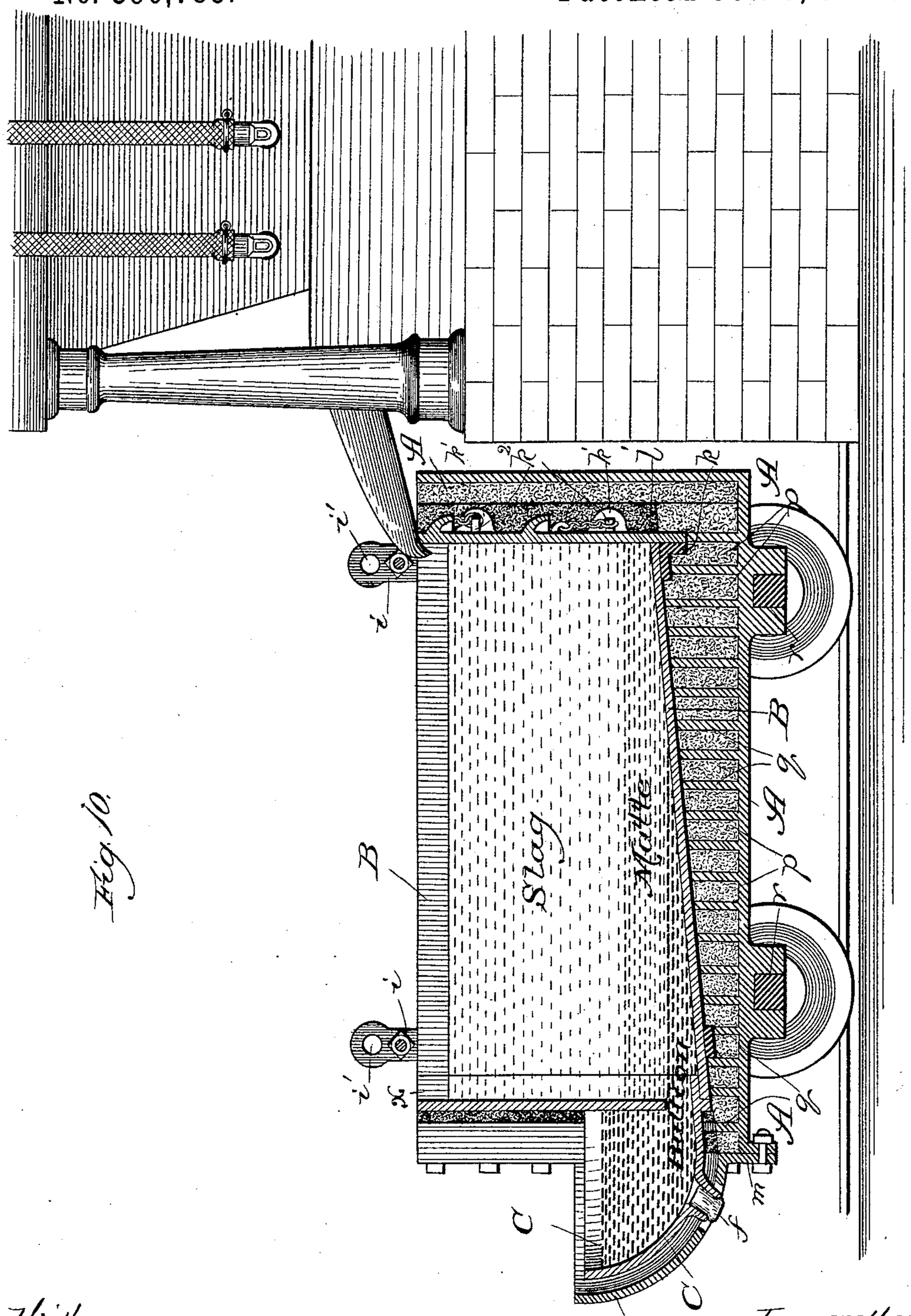

Fig. 10.

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UNITED STATES PATENT OFFICE.

WILLIAM A. KONEMAN, OF MAGDALENA, TERRITORY OF NEW MEXICO.

FORE-HEARTH FOR LEAD-SMELTING FURNACES.

SPECIFICATION forming part of Letters Patent No. 390,785, dated October 9, 1888.

Application filed March 16, 1888. Serial No. 267,297. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. KONEMAN, a citizen of the United States, residing at Magdalena, in the county of Socorro and Territory of New Mexico, have invented a new and useful Improvement in Fore-Hearths for Lead-Smelting Furnaces, of which the following is a specification.

My invention relates to an improved apparatus of the class for use in smelting ore to effect automatically and without loss of metal ready separation of the molten metal from the slag, and comprising a receptacle into which the smelted ore is run from the furnace, and provided with a dip-well into which the molten metal flows from the receptacle, and whence it may be dipped out. When the smelted ore is introduced from the blast-furnace into the crucible or "fore-hearth," as it is also technically termed, the molten metal separates from the slag, sinking by gravity to the bottom of the receptacle, while the slag remains on top and is run off by overflow. The purpose of the dip-well portion is to permit removal of the metal as it separates without disturbing the operation to effect it, and thereby control the rise in the crucible of the contents with a view to preventing loss by the overflow of metal with the slag, which, being of less specific gravity than the metal, will rise to the surface of the latter and alone run off by maintaining through the dipping the rise of the metal below the height of the opening to the overflow-spout.

It is well known that brick-lined fore-hearths or external crucibles have been used for some years and are now being used in connection with copper-furnaces for the production of copper matte; but no such use has been heretofore made of any apparatus which has given practical results of such importance that the internal lead-crucible in blast-furnaces for smelting lead or lead and silver ores could be dispensed with. Any ordinary receptacle of almost any shape may be used for my purpose, provided it be so arranged that valuable and waste products will separate in it, and provided it be rendered non-conductive of heat, in order to prevent the inflowing mass of slag and other materials from chilling; hence the ordinary copper fore-hearth, which is usually a rectangular brick-lined receptacle and has a brick partition, might be used. The use of such an apparatus, however, has serious objections when lead or lead and silver bullion has to be produced, one of the principal objections being that as in general lead-blast furnaces are much smaller than the majority of fore-hearth copper-blast furnaces, the amount of slag and other smelting products produced and which flow into the fore-hearth is very much smaller in lead-blast furnaces than in copper-matte-blast furnaces, and therefore the material in a lead-blast furnace fore-hearth is very much more liable to chill, owing to the limited amount of the inflowing materials, which must furnish the necessary degree of heat to maintain a perfect working condition. Besides, whenever the fore-hearth shows evidence of chilling it is required to immediately change it for another apparatus. If such a change were to be accomplished by a brick-lined fore-hearth, it would, for two reasons, require that a number of such fore-hearths be kept on hand: first, owing to the necessity of preparing them for operation by keeping a very strong fire on the brick-work for a long period of time in order to heat the brick to such a degree as to prevent a chilling action on their part. A second and more serious objection would be that to a brick-lined fore-hearth there adheres a very large portion of slag and lead-bullion when an attempt is made to clean it in order to prepare it for future work, and such cleaning is thereby rendered a very laborious, costly, and wasteful process, which can hardly be avoided in copper-matte-blast furnaces, since, if metal were used to form the fore-hearth, the copper matte, being a sulphide, would attack and destroy it very rapidly.

My invention involves a metallic apparatus which is not lined internally, but which may be mechanically so constructed as to prevent the loss of heat by radiation or absorption either by means of external non-conducting packing or external firing under the apparatus, or by both external packing and firing, the application of one or the other, or both, means being dependent entirely upon the

amount of the inflowing melted mass and upon the general external temperature, state of the weather, &c.

The objects of my invention are, in the main, to permit an internal crucible in a lead-blast-smelting furnace to be dispensed with by withdrawing all of the products of smelting from the furnace while the latter is in operation and as soon as they are formed by causing them to flow into an external removable crucible or fore-hearth, by which means practically all of the serious troubles hitherto encountered in smelting, arising from freezing, crucible-incrustation, iron sows, &c., are avoided and made impossible, and to provide an external removable crucible which will not chill rapidly and may be readily and quickly cleaned and changed.

To this end my invention consists in a crucible comprising a metallic receptacle for the products of smelting, having an inclined bottom and provided with a partition forming toward the lower end of the inclined bottom a chamber communicating with the receptacle to receive the lead separated from the slag, and a jacket removable at will and formed with non-heat-conducting material for preventing chilling of the crucible and its contents.

It also consists in details of construction and combinations of parts.

In the drawings, which illustrate my improved apparatus in what I consider to be its best form, Figure 1 shows in perspective my improved fore-hearth receiver; Fig. 2, a similar view of my improved fore-hearth; Fig. 3, the same as Fig. 2, but turned around to present the discharge end from which the discharge-head is removed, and showing chains attached for hoisting; Fig. 4, a view in elevation of the removable discharge-head; Fig. 5, a perspective view of a broken portion of the fore-hearth, showing the removable discharge-head adjusted; Fig. 6, a section taken on the line 6 6 of Fig. 5; Fig. 7, a perspective view of a traveling hoist for use with my improved apparatus; Fig. 8, a perspective view of the head of the fore-hearth provided with the dip-well; Fig. 9, a similar view of a heating-stove adjunct, and Fig. 10 a sectional view showing the fore-hearth within the fore-hearth receiver and the crucible thus formed in operative connection with a smelter.

A is the receiver, formed, preferably, of cast-iron and provided with axle-bearings *r* to permit its being mounted on wheels and to render the device readily transportable. The form of the receiver is, by preference, that illustrated—namely, rectangular—with a convex bottom and open top. The inner walls and base are provided with ribs *q*, preferably of iron, to strengthen the receiver and afford spaces to receive a packing, *p*, non-conductive of heat, and which I prefer to form of a mixture of paper-pulp and plaster-of-paris. This non-conducting packing tends to prevent cooling of the fore-hearth, hereinafter described, for which the receiver affords a non-conducting jacket, a socket, *o*, being provided in one side, as shown, to admit the overflow-spout of the fore-hearth. The forward end of the receiver may be open, as shown, and provided near the base of the opening with a socket, *n*, for the lead or dip well on the fore-hearth, and the entire receiver may comprise a single casting, except as to the forward end, *m*, which is difficult to cast with the remainder, and which is also, preferably, removably adjusted to permit the substitution of an end unprovided with a socket, *n*, to allow the application to the dip-well of the fore-hearth of a heating-stove to adapt the apparatus for long runs, as hereinafter described. Only one of these receivers A is required for each furnace, as it need never be changed.

B is the fore-hearth proper, shaped to fit inside the receiver, the two together constituting a crucible or separate external portable converting adjunct to a smelting-furnace.

I prefer to make the body of the fore-hearth of boiler-iron and the head *l*, discharge-end plate *l'*, and slag-spout l^2 of cast iron. The head *l* is permanently secured in place by riveting through flanges *x*, and is well calked, while the end plate, *l'*, is removably attachable to a cast-iron lug-band, *k*, riveted to the discharge end of the receptacle B and provided with laterally-perforated lugs *k'* to extend through openings near the lateral edges of the end plate, *l'*, and receive keys k^2, attached to the end plate by means of chains, as shown, whereby they are readily accessible to be passed through the perforated lugs and secure the end plate in place, as shown in Fig. 5. This construction renders the end plate readily removable to permit emptying of the fore-hearth, and is as readily readjustable. The bottom of the fore-hearth slopes slightly on its inner end toward the dip-well end to facilitate the separation of the metal.

The head *l* has a curved spout, C, extending upward on its outer side from its base, communicating through the head with the interior of the fore-hearth B, (the head *l* thus affording practically a partition,) and constituting a lead or dip well, and lateral bars *i*, having eyes *i'* in their projecting ends, are secured to opposite sides near the ends of the shell.

To operate the apparatus, the proceeding is as follows: A fore-hearth, B, is raised through the medium of chains *h*, having hooks *h'*, caught into the eyes *i'* of the hoisting-bands *i* by the hoist D, Fig. 7, movable on wheels. The receiver A is wheeled underneath the fore-hearth, which is then lowered into it, the chains *h* detached, and the crucible wheeled to the furnace, whence smelted ore is introduced into the fore-hearth B and converted, the metal separating and accumulating at the bottom, whence it enters and rises in the dip-well, from which it is removed in the usual manner, and the slag runs off at the spout l^2. When the

fore-hearth requires cleaning, as it does from time to time, the hoist D is again brought into requisition to raise it and carry it to the place of discharge, where the end plate, *l'*, is removed and the hoist manipulated to lower the discharge end of the receptacle, thereby to cause it to hang at a sharp angle—say forty-five degrees or more—when, by tapping the shell all around it, the discharge is easily produced. As a means of facilitating the evacuation, the discharge end of the fore-hearth may be from one to two inches wider than the head end.

With the construction thus described, wherein the dip-well enters the socket *n*, rendered non-conducting of heat and provided to receive it on the jacket or receiver A, the apparatus is adapted for short runs—that is to say, the heat will be maintained in its well sufficient to prevent the chilling of the metal for from three to twenty-four hours.

If it be desired to adapt the apparatus for long runs, instead of providing the forward end of the receiver A with the socket *n*, the end is entirely omitted, whereby the dip-well end of the fore-hearth comes flush with the corresponding end of the receiver, and the dip-well protrudes beyond and is maintained hot by the application of external heat through the medium of an iron stove, E, adapted, preferably, to the burning of coke or charcoal, and wherein a good fire may readily be maintained. The stove E may be of the box variety, having a rear extension, *g*, from which the pipe *g'* extends, vertically concaved on the opposite side, and provided with hinged covers g^2 and hook-straps g^3, at which the stove is suspended by being hooked over the dip-well plate when the fore-hearth is in operation. The stove, owing to the concavity in its side, fits around the dip-well without obstructing access to the latter for dipping the metal, though, even with the heating-box attachment, it might obviously be arranged to cause the molten metal to flow over into molds.

It will thus be seen that my improved apparatus affords a durable and effective converter which may be operated for long or short runs, permits the fore-hearth to be changed with the least possible loss of time, thereby producing immaterial interruption in the converting operation, and allows the readily-removable fore-hearth to be easily cleaned, owing to the accessibility of all its parts.

It should be further stated that the dip-well C should be provided in its base with a suitable plug-tap, *f*, to enable by its withdrawal complete drawing off of the bullion and matte contents when the fore-hearth is to be changed.

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

1. An external crucible comprising a metallic receptacle for the products of a lead or lead and silver smelting blast-furnace, having an inclined bottom, and provided with a partition affording toward the lower end of the inclined bottom a chamber communicating with the portion of the receptacle for containing products of smelting to receive the lead separated from the slag, and a jacket removable at will and formed with a material non-conductive of heat for preventing chilling the crucible and its contents, substantially as set forth.

2. An external crucible comprising, in combination, a metallic receptacle having a dip-well communicating with it and a receiver or jacket for the said receptacle formed with non-heat-conducting material, and from which the receptacle is readily removable, substantially as described.

3. In an external crucible, a removable fore-hearth, B, comprising a metallic receptacle provided with a dip-well, C, and a bottom sloping toward the dip-well, and a plug-tap, *f*, in the dip-well, substantially as described.

4. In an external crucible, a removable fore-hearth, B, comprising a metallic receptacle provided with a dip-well, C, and having its bottom sloping toward the dip-well, and provided with a removably-adjustable head at its discharge end, substantially as described.

5. In an external crucible, a removable fore-hearth, B, comprising a metallic receptacle provided at one end with a dip-well, C, at its opposite end with a lug-band, *k*, and a removable end plate, *l'*, having perforations to fit over the lugs on the lug-band, and keys k^2, substantially as described.

6. In an external crucible, a removable fore-hearth, B, comprising a metallic receptacle provided at one end with a dip-well, C, and having its opposite end enlarged and provided with a removably-adjustable head-plate, *l'*, substantially as described.

7. In an external crucible, a removable fore-hearth, B, comprising a metallic receptacle provided at one end with a dip-well, C, and with a bottom sloping toward the dip-well, and having its opposite end enlarged and provided with a removably-adjustable head-plate, *l'*, a slag-spout, l^2, and hoisting-bands *i*, substantially as described.

8. An external crucible comprising, in combination, a jacket or receiver, A, formed with non-heat-conducting material and open at one end, and a metallic fore-hearth, B, removably adjusted within the jacket and provided with a dip-well, C, protruding through the open end thereof and having its bottom sloping toward the dip-well, substantially as described.

9. An external crucible comprising, in combination, a jacket or receiver, A, formed of metal, having internal ribs and packed between the ribs with a material non-conductive of heat and provided with an open end, and a metallic fore-hearth, B, removably adjustable within the jacket, and provided with a dip-well, C, protruding through the open end thereof, and with a bottom sloping toward the dip-well, substantially as described.

10. An external crucible comprising, in combination, a jacket or receiver, A, formed with non-heat-conducting material and open at one end, a metallic fore-hearth, B, removably adjustable within the jacket and provided with a dip-well, C, protruding through the open end thereof and with a bottom sloping toward the dip-well, and a heating-stove, E, removably attachable at the open end of the receiver A and adapted to envelop the protruding dip-well, substantially as described.

WILLIAM A. KONEMAN.

In presence of—
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W. J. CURTIS.