

No. 678,281.

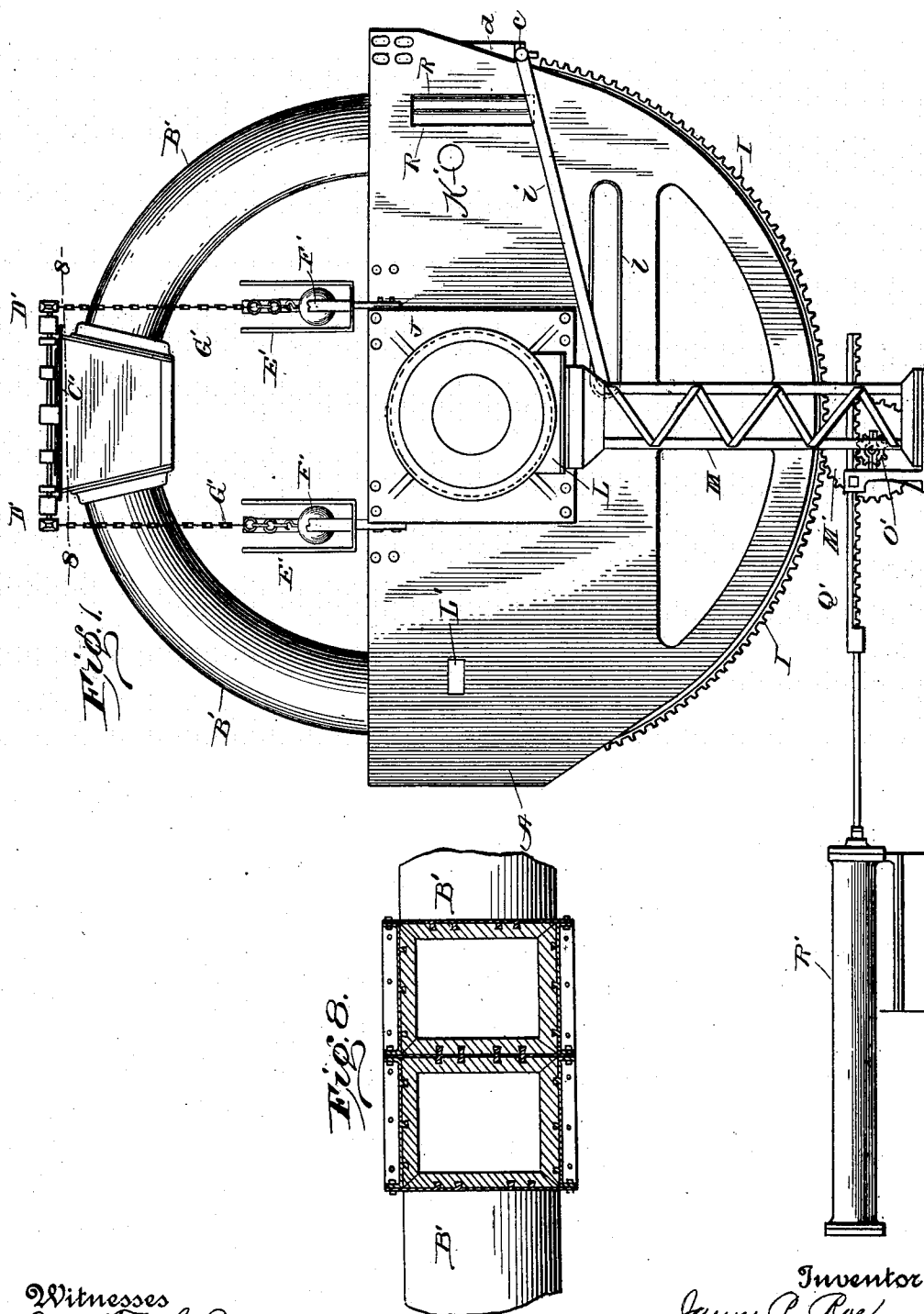
Patented July 9, 1901.

J. P. ROE.  
PUDDLING MACHINE.

(Application filed Oct. 18, 1900.)

(No Model.)

4 Sheets—Sheet 1.



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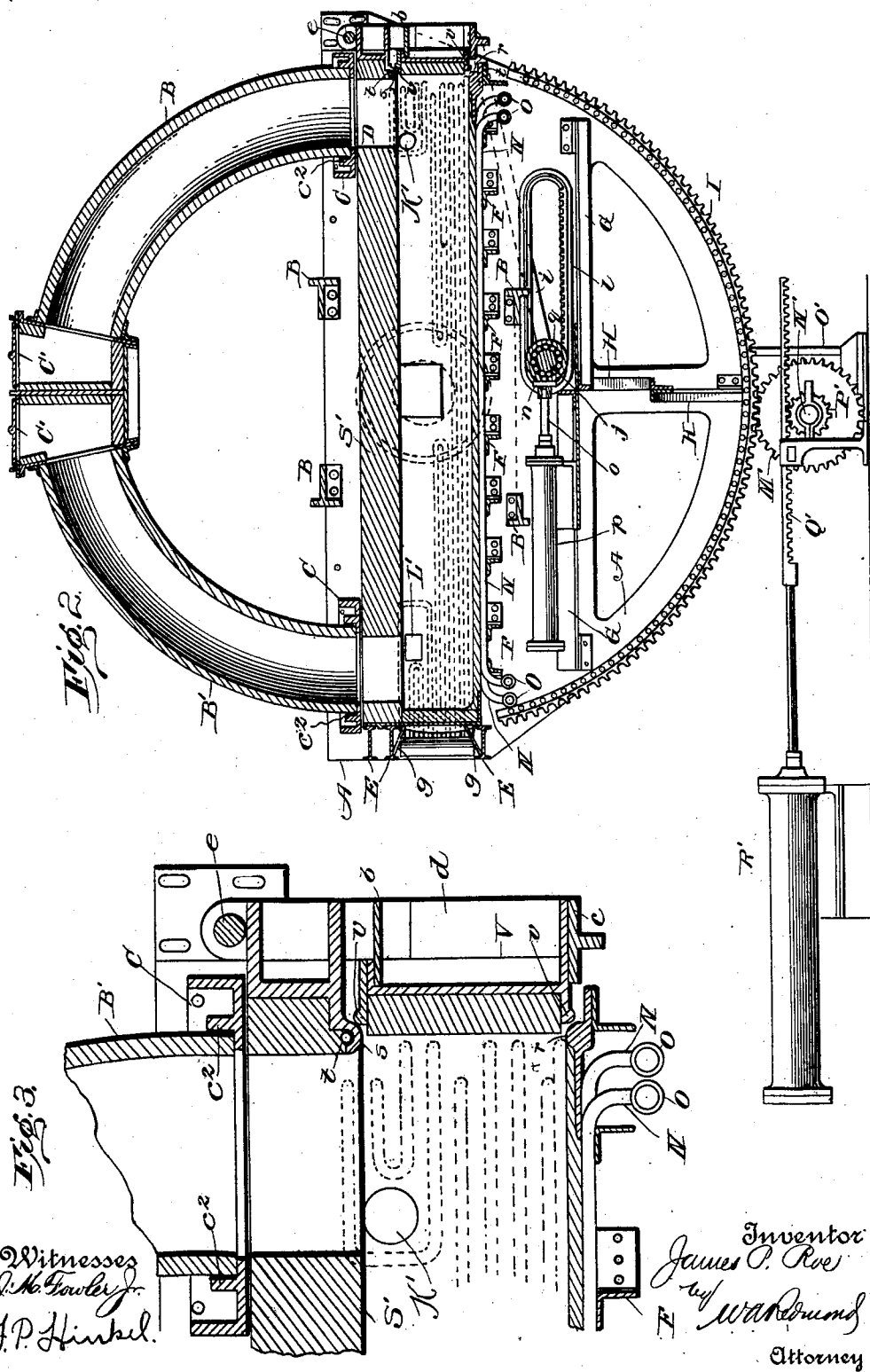
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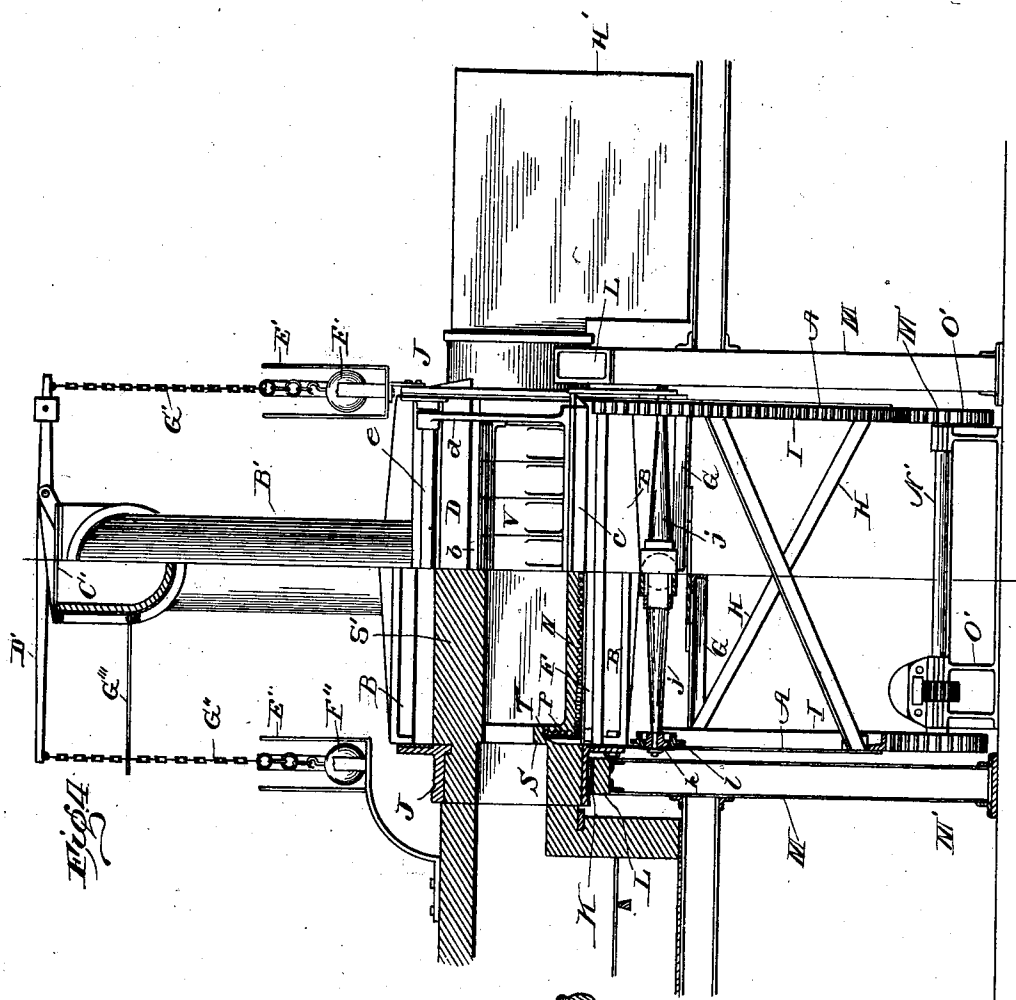
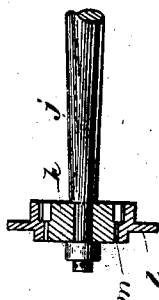


Fig. 5.



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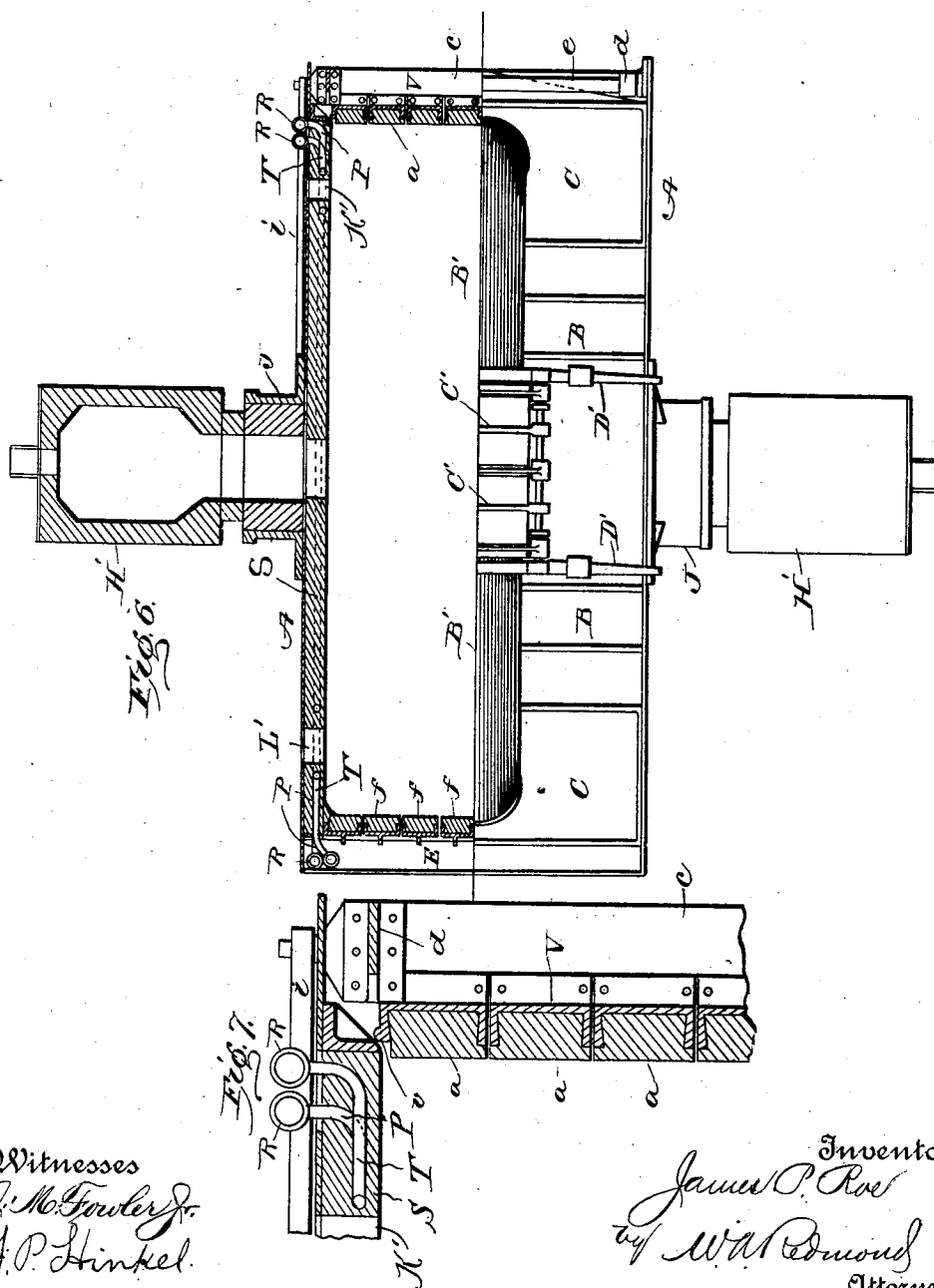
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# UNITED STATES PATENT OFFICE.

JAMES P. ROE, OF POTTSTOWN, PENNSYLVANIA.

## PUDDLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 678,281, dated July 9, 1901.

Application filed October 18, 1900. Serial No. 33,486. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES P. ROE, a citizen of the United States, residing at Pottstown, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Puddling-Machines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to mechanical means for puddling iron; and it has for its object to provide a machine adapted to produce wrought-iron of better and more uniform quality and at less cost than is possible when produced by manual labor; and it consists in the parts and combinations of parts hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a side elevation of my improved machine; Fig. 2, a central vertical longitudinal section of the same; Fig. 3, an enlarged detail vertical sectional view of the door and surrounding parts; Fig. 4, a view showing half the machine in transverse vertical section and half in end elevation; Fig. 5, an enlarged detail vertical section of the rack and cross-head; Fig. 6, a view showing half of the machine in horizontal section and half in plan; Fig. 7, an enlarged detail horizontal sectional view of one end of the door and a corner of the machine; and Fig. 8, a horizontal section on the line 8 8, Fig. 1.

Similar letters refer to similar parts throughout all the views.

Referring to the drawings, A represents the side girders of the machine, which are secured together by the transverse braces B, the stack-bases C, formed with vertical collars  $c^2$  to receive the ends or bases of the stacks, the end brace D, the end beams E, the angle-irons F, and the crossed braces G and H, all of which are suitably bolted to the said girders A. The girders are preferably of plate form, having their lower edges in the form of segments of circles, to which the toothed racks I are secured and which form the bottom flange therefor. The frame is supported by tubular trunnions J, which rest

on rollers K in the bearings L, the latter being supported by suitable pillars M or in any other preferred or suitable manner, so as to provide for the rocking or oscillation of the machine.

The hearth of the machine is formed of oxid of iron on a water-cooled trough. This is conveniently accomplished by a series of water-pipes N, arranged longitudinally of the machine and resting on the angle-irons F and forming a bottom between the side girders A, said pipes N connecting with the manifolds O at each end, as best shown in Figs. 2 and 3. The lower parts of the sides of the hearth are also formed of pipes P, which connect with the manifolds R, while the upper parts of the sides are formed of refractory brick S, with water-pipes T passing therethrough, said pipes T also connecting with the manifolds R. The connections between the various manifolds to the water-mains or sources of supply and the waste-pipes are effected by means of rubber hose or lazy-tongs.

The ceiling or roof of the machine is formed of refractory brick S'.

At one end of the machine an opening is provided for discharging the mass, said opening being provided with a swinging door V, lined with refractory brick and made up of sections  $a$  in order to prevent it being warped by the heat. The door is carried by the supporting-bar  $b$  and the cross-head  $c$ , which are not subjected to distorting heat. The bar  $b$  and cross-head  $c$  are connected to the levers  $d$ , which are secured to the shaft  $e$ , which is journaled in the frame. The other end of the machine is closed by sectional pieces  $f$ , secured in place by braces  $g$  from the end beams E, and is lined with refractory brick. The cross-head  $c$  is rounded at its ends to receive the ends of connecting-rods  $i$ , the other ends of which are connected to the ends of a cross-head  $j$ , which carries the pinions  $k$ . The pinions  $k$  gear into the teeth of racks  $l$ , supported from the side girders A, said racks having teeth on their lower faces only, as shown, and being formed with ways  $m$ , on which the outer parts of the pinions  $k$ , which parts of the pinions are also untoothed,

work, thereby forming a guide for the cross-head *j*. The said cross-head is connected by a yoke *n* to the piston-rod *o*, which is operated by the pressure-cylinder *p*, whereby the door is opened and closed as desired. Suitable ball or roller bearings *q* are interposed between the yoke and the cross-head *j*.

In order to insure a tight joint between the door and the opening in the end of the machine, I make the convex surfaces *v* around the door and corresponding convex surfaces *r* and *s* around the opening and seal the same with liquid cinder. The joint-face *r* I prefer to make sectional to avoid warping from the heat, and the joint-surface *s* I protect by placing a water-pipe *t* therein, said water-pipe *t* being connected to the manifolds *R*. The object of forming the contact-surfaces of the door and the opening with rounded or convex surfaces is to prevent the cinder lodging thereon, and thus forming an obstacle to the closing of the door.

On the stack-bases *C* the chimneys *B'* are supported, said chimneys having separate dampers *C'*, which are operated by hand from the ends of levers *D'* by the chains *G'*, which can be adjusted as to length by hooking any of the links of said chains to weights *F'*, said weights being heavy enough to overcome the natural tendency of the dampers to close, due to their own weight. This arrangement gives the necessary control of the dampers to meet the varying condition of the fires and the exigencies of the heat. The weights *F'* are arranged in guides *E'*, which are secured to or supported from the flange of the trunnions *J*, and when it is found necessary to adjust the dampers for the purposes named it is readily accomplished by connecting or hooking a different link to the weights, according to whether it is desired to lengthen or shorten the chain.

The dampers are automatically operated from the opposite ends of levers *D'* by the weights *F''*, arranged in the guides *E''* and connected to said levers *D'* by chains *G''*. The guides *E''* are secured to or supported from any stationary part of the machine, such as the fire-chamber. The connecting-chains *G''* normally hang loose and allow the dampers to remain open until the slack is said chains *G''* is taken up by one or the other end of the machine passing a predetermined elevation. This is accomplished by making the weights *F''* heavy enough to overcome the weights *F'*. The chains *G''* are guided through an opening formed in bars *G'''*, secured to the flange on the stacks.

The object of having a stack at each end of the furnace is to obtain a hearth of sufficient length to produce the necessary agitation and at the same time not to retain the gases after they have lost their effective temperature, and in case of wide furnaces I prefer to make two or more stacks at each end to keep the

gases more thoroughly diffused throughout the width of the furnace.

The stacks or chimneys are preferably brought together over the machine at their tops, as shown, to concentrate the point of emitting the gases, and thus more readily convey them away through a hood over the same.

The necessary heat is obtained through the trunnions *J* from the fire-chambers *H'* at each side of the machine in communication therewith. By arranging for the admission of the heating-gases from opposite sides of the machine a more perfect combustion is obtained, as the contrary currents thoroughly mix the gases, and thereby consume the free oxygen, and thus reduce the iron loss.

The racks I gear into the toothed wheels *M'*, mounted on a shaft *N'*, suitably supported on a subframe *O'* below the body of the machine, which shaft derives its power through a pinion *P'* thereon meshing with a rack-bar *Q'* from the pressure-cylinder *R'*, so as to impart a rocking or oscillating motion to the machine.

The operation may be observed through the openings *K'* in the sides of the machine and through which any oxids, if necessary, may be added.

Oxid of iron in the form of molten cinder and molten iron are charged through the openings *L'*.

The operation of the machine is as follows: The hearth is heated to the necessary temperature by means of the fire-chambers, which may have either coal, oil, or gas for fuel. Molten oxid of iron is then charged, which flows over the water-cooled bottom and chills on the same to a depth of two inches or thereabout. This forms the working bottom. Then sufficient molten cinder is charged to form the oxid for decarbonizing the iron, and then molten cast-iron is charged. One end of the machine is then elevated, so that the hearth forms an incline down which the iron and cinder flow by their own gravity and come into contact with the end of the furnace, which abruptly arrests the motion of the same and produces a violent and thorough working of the bath. The direction of the incline is then changed and the bath of metal and cinder flows down the same until violently arrested by the opposite end of the furnace. This operation is repeated, but with an increasing angle of the hearth as the iron granulates or comes to nature, so that the violent impact with the ends of the hearth compresses and solidifies the mass. The door is then opened by means of the cylinder *p*, piston-rod *o*, cross-head *j*, and the connections therefrom to the door and the mass projected out by its own gravity. The door is then closed, cinder charged, as before, and washed against the door, sealing the joints of the same, and the process repeated.

Among the advantages of my machine are

the following: There is no delay to fix the sides after each heat, as the cinder builds to the necessary thickness against the water-pipes wherever it washes, and above the pipes, where the sides are only subject to heat, they are formed of refractory brick protected by water-pipes. Any abrasion of the bottom by the charge is repaired by cinder building again on the same when cinder is added for the next charge and during the heat, if any should occur, and the bottom is kept smooth and hot by its exposure to the flames at such times as the moving charge uncovers the same. These features are important, as the hot bottom facilitates the working of the charge and prevents the same becoming fast to the bottom. By the easy and rapid discharge of the iron, and particularly by avoiding the delay of "fixing," much heat is saved that would otherwise be lost. The damper on the stack of whichever end may be elevated is closed automatically to direct the products of combustion through the lower stack to avoid the iron loss which the admission of any air would entail and prevent any cooling of the furnace by the same. The iron is more thoroughly and uniformly worked than is possible when done by manual labor and is produced at a greatly-reduced cost of labor and fuel.

While I have shown and described the furnace as mounted on centrally-disposed trunnions, (and such arrangement is convenient, since it provides a convenient means for supplying the necessary flame to the charge and, in connection with the controlled dampers, of delivering the flame to the charge at whatever part of the furnace it may be located,) it is obvious that trunnions may be located at either end of the furnace or at any point between the ends and that other rocking supports may be used for the furnace—such, for instance, as a horizontal bed as the support and a curvilinear surface resting thereon. Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a machine for puddling and balling or massing iron, the combination of a hearth having an opening at one end for the discharge of the iron in a mass, a door for said opening, means for movably supporting said hearth, means for oscillating said hearth, means for feeding heated gases to the hearth, and suitable chimneys or stacks carried at each end of the hearth for the escape of the products of combustion.

2. In a machine for puddling and balling or massing iron, the combination of a hearth, means for movably supporting the hearth, means for imparting a rocking motion to the hearth, means for delivering products of combustion to the hearth, and means for conveying away from the hearth said products of combustion, said delivering and conveying

means being located one at the middle and the other at the ends of the hearth.

3. A machine for puddling and balling or massing iron, comprising a hearth having its bottom and the lower parts of its sides composed of water-pipes, and oxid of iron superposed on and adhering to said pipes, means for rocking said hearth, and means for delivering heated gases to said hearth, whereby all parts of the hearth are exposed to the heated gases and the bottom and sides rebuilt from the oxid of iron contained in the bath.

4. A machine for puddling iron, comprising a trough, extending the full length of the machine, the bottom thereof consisting of a hollow metallic foundation and oxid of iron resting thereon, means for causing a circulation of water through said metallic foundation, means whereby one end of said trough is alternately raised and lowered below the level of the other end, and means for delivering the products of combustion to said trough, whereby the bath is caused to shift from end to end of the trough and thus expose said trough to the heating gases.

5. A machine for puddling and balling or massing iron, comprising a hearth, means for feeding heated gases to said hearth, chimneys or stacks mounted on said hearth at each end thereof and converging above the same, and means for rocking said hearth.

6. A machine for puddling iron, comprising a trough, means for rocking said trough, a chimney or stack at each end of said trough, a damper for each chimney or stack, means whereby the dampers are opened and closed alternately, and means for delivering the products of combustion to the trough located between said chimneys or stacks.

7. A machine for puddling and balling or massing iron, comprising a trough, means for alternately raising and lowering the opposite ends of said trough, a chimney or stack at each end of said trough, dampers for said chimneys or stacks, and means for automatically opening one of said dampers and closing the other at each oscillation of the trough.

8. A machine for puddling and balling or massing iron, comprising a trough having a chimney or stack mounted on each end thereof, means for feeding heated gases to said trough from each side thereof, and means for rocking said trough.

9. A machine for puddling and balling or massing iron, comprising a trough having a chimney or stack mounted thereon at each end, means for feeding the heating agent to said trough between the ends thereof, and means for rocking said trough.

10. A machine for puddling and balling or massing iron, comprising a trough having a chimney for the escape of the products of combustion at each end, means for feeding heated gases to said trough, and means for

alternately tilting the ends of the trough, whereby the bath is caused to gravitate from end to end of the trough.

11. In a machine for puddling and balling  
5 or massing iron, the combination of a furnace comprising a trough or hearth extending the full length of the machine, a roof over said trough or hearth, means for movably supporting said furnace, means for imparting a  
10 rocking motion thereto transverse the longi-

tudinal axis of the furnace, and means for delivering hot products of combustion uniformly to all parts of the interior of the furnace.

In testimony whereof I affix my signature 15  
in presence of two witnesses.

JAMES P. ROE.

Witnesses:

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HUGH M. STERLING.