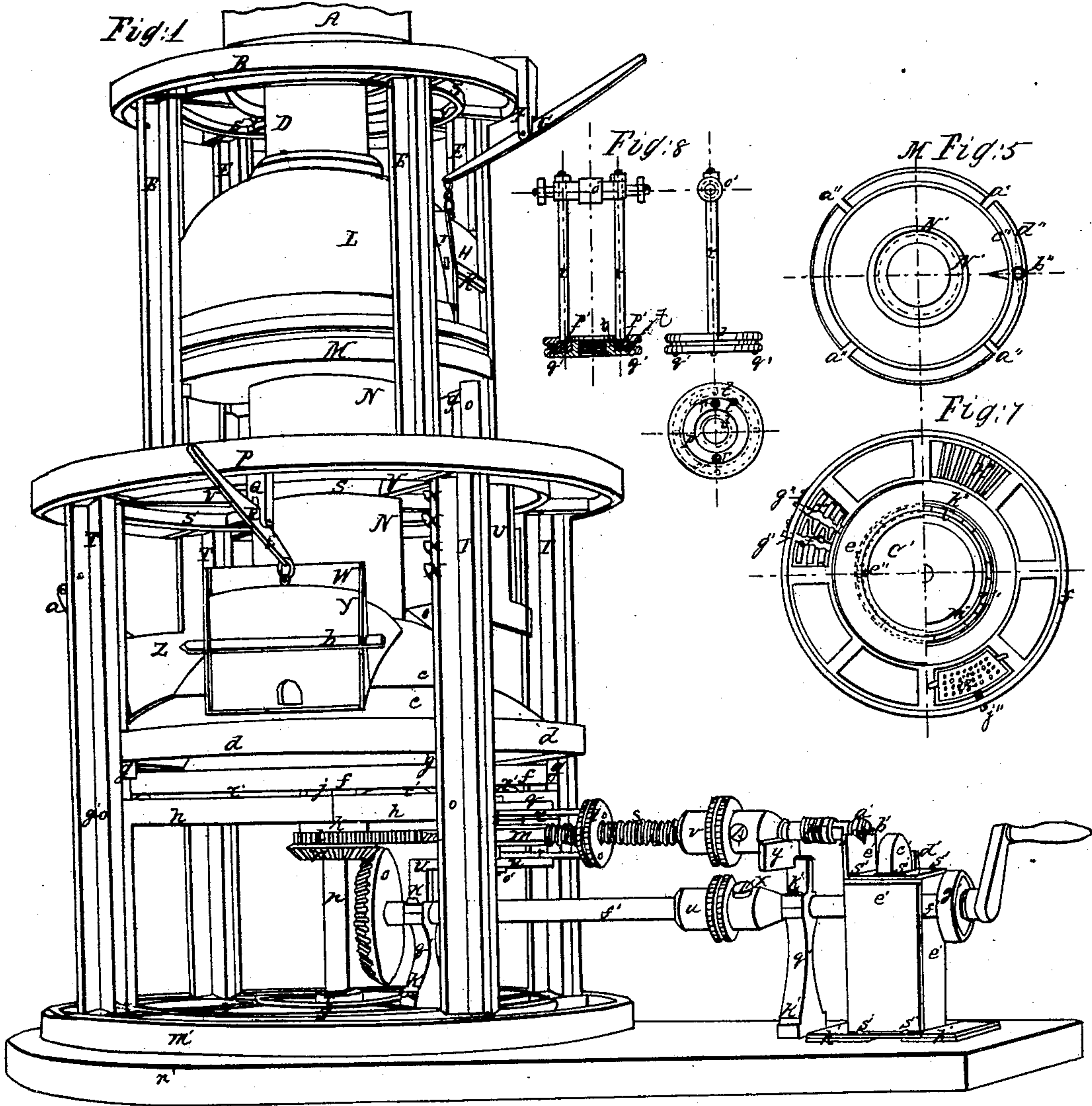


J. HEATLEY.

OSCILLATING FURNACE FOR PUDDLING AND REFINING IRON.

No. 89,310.

Patented Apr. 27, 1869.



Witnesses,
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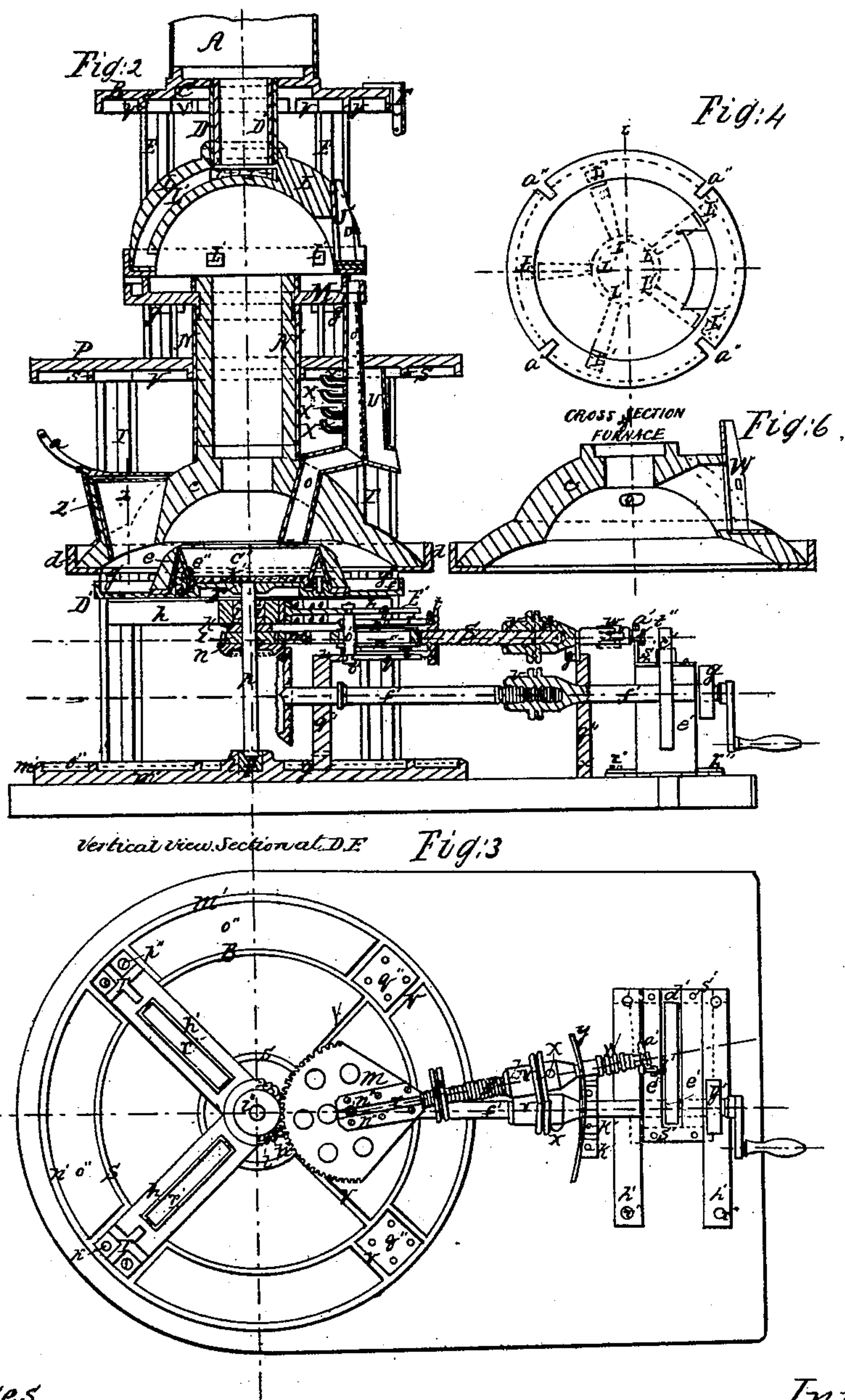
Inventor
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United States Patent Office.

JOHN HEATLEY, OF ETNA, PENNSYLVANIA.

Letters Patent No. 89,310, dated April 27, 1869.

IMPROVED OSCILLATING FURNACE FOR PUDDLING AND REFINING IRON.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, JOHN HEATLEY, of Etna, in the county of Allegheny, and State of Pennsylvania, have invented a new and useful Improvement in Furnaces for Puddling, Boiling, Heating, and Working Iron or other metals; and I do hereby declare that the following is a full, true, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference thereon marked, making a part of this specification, in which—

Figure 1 is a perspective view of the furnace as completed.

Figure 2 is a longitudinal section, formed by a vertical plane passing longitudinally through the centre of the furnace.

Figure 3 is a vertical section formed by a horizontal plane extended through fig. 2 at D E, showing the under side of the bottom plate, rollers, and a portion of the operating-devices.

Figure 4 is a section drawn through the roof of the melting-stove, showing flues.

Figure 5 is a plane view of the bottom plate of the melting-stove.

Figure 6 is a transverse section of the roof of the puddling-furnace proper.

Figure 7 is a vertical view of the puddling-pan, grates, and chill-grooves.

Figures 8 are longitudinal sectional views of the pivot and its regulating-wheel and the connecting-rods.

Like letters of reference indicate like parts in each figure.

The nature of my invention consists—

First, in the construction and use of a rotary or oscillating furnace for heating, boiling, and puddling, or otherwise working iron or other metals.

Second, in operating the same by an eccentric working from both its axis and circumference, producing either a rotary or oscillating motion, as may be desired.

Third, in the construction and operation of a sliding pivot, with its regulating-wheel and connections, by means of which the distance from the pivotal point to the cog-wheels may be lengthened or shortened, and a greater or less oscillation obtained at will.

Fourth, in the use and arrangement of fires for heating, melting, or working iron or other metals around a central pan or basin, in which the metal is placed, and rotating them underneath one hopper to be replenished with fuel.

Fifth, in so shaping and constructing the furnace and its roof that the hot air from the fires must pass directly over the metal in the chills, and so that no cold air can reach the metal.

Sixth, in combining, with the puddling or heating-furnace, a melting-stove, so placed above the furnace as to receive and utilize the otherwise waste heat therefrom for the melting of metal.

Seventh, in the introduction, into the roof of the

melting-stove, of a series of flues leading to the upper smoke-stack, the mouths of which open near the lower inner edge of the roof, and close to the metal trough.

Eighth, in connecting the melting-stove and puddling-furnace by means of a pipe, through which molten metal may be run from the one to the other, which pipe may be made with an elbow or bend in it at any desirable point, open at the top for the skimming or removal of impurities or dross from the passing metal, and to be constructed with or without a series of corresponding openings on two opposite sides thereof, arranged on one side with pipes attached suitable for the introduction of water, blast, or steam.

Ninth, in removing carbon, phosphorus, or other impurities from iron or other metal while passing through such pipe, by introducing therein, or through the metal, blasts, hot or cold water, steam, or other agent usually employed for such purpose.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

I use, in the construction of my furnace, iron, masonry, and such other materials as are usually employed for similar purposes.

Any suitable frame-work, T, or masonry in lieu thereof, is used to support the devices to be described.

At or near the centre of the frame-work T, rises, from its bed or socket *l*, fixed in a proper foundation, *m*, a shaft, *p*, so placed in position as to revolve freely, such rotary motion being imparted by devices hereinafter described, or any suitable ones usually employed for such purpose.

Near the top of this shaft *p*, and affixed to the frame-work or masonry T, are two beams or arms, *h*, (or more, if necessary, to support the weight,) crossing at right angles to each other, each arm, *h*, having a roller, *h'*, or iron balls, of a suitable size, near its outer end.

The upper end of the shaft *p* is made square, and fits into a square socket or recess at the centre of the lower face of the circular bottom plate *f* of the puddling-furnace.

e is the wall or chills, which form the outside of the puddling-pan or basin *C*, the bottom, *k*, of which pan either rests on the bottom plate *f*, or is made a part thereof.

The puddling-pan or basin *C* may be provided with tap-holes, *e'*, to draw off cinder or dross in the usual way.

The chills *e* may be provided with openings or passages, *l'*, through them, for the introduction of air or water for cooling-purposes.

Around the outside of the chills *e* are the grate-bars *f'' h'' i''*, on which the fires are made for heating, working, or preparing the metal.

Over the whole, is a roof, *O*, constructed of iron and masonry, built upon an iron base, *d*, which is supported upon the frame-work or masonry T.

The roof *O* may be shaped as a double arch, the

base-arch, as it may be called, springing from its base *d*, directly above the fire-grates, rises nearly or quite over the top of the chills *e*, and from thence springs a superior arch, forming the roof proper of the puddling-pan, from the crown of which opens the smoke-stack *N N'*.

The smoke-stack *N N'* is constructed of iron and masonry, in the usual mode, and with a damper at the top, but in two parts, the lower part, *N*, only reaching to just above the floor of the melting-stove, and the upper part, *N'*, having its base in the outer top of the melting-stove.

The upper part of the smoke-stack is fed only by the flues *L'*, leading through the roof of the melting-stove.

The heat from the grate-bars passes over the metal in the puddling-pan *O'* in reaching the smoke-stack *N*.

The weight of the grate-bars and fires, as well as that of the bottom-plate *f*, the chills *e*, and whatever metal or other substance may rest upon the bottom plate *f*, is chiefly sustained by the rollers *h'*, or iron balls.

These rollers *h'*, or balls, are intended to revolve freely, and are made and cooled as such rollers usually are.

The roof *O* is provided with suitable openings, *W*, for the introduction of the proper tools for working or taking out metal, and *Z* for feeding fuel to the fires on the grate-bars, or for other necessary objects, which openings, *W Z*, are provided with suitable doors or gates, *Y*, which may be closed to keep out cold air from the furnace.

The space inside the frame-work or masonry *T*, and below the base of the roof or frame *d*, may be closed in by metal plates or masonry, to keep out the cold air, retain the dust from the grate-bars, and is made with suitable openings for taking out ashes, and the introduction of the necessary air or water-pipes, and rods, shafts, or other operating machinery.

The motion given to the furnace is either rotary or oscillating; that is to say, the furnace may be entirely and continuously revolved in one direction only; or it may be rotated in one direction till a part or whole of a revolution is effected, and then the direction of the motion be reversed, and a return movement effected, and so on alternately.

This rotary or oscillating motion I obtain by an eccentric, *c'*, playing in a yoke or box, *e'*, operated by steam or other power, in the ordinary mode, connected by bands, shafting, or gearing, *f' s*, and cog-wheels *m o*, with the upright shaft *p*, or cog-wheels *l n* attached thereto, or other equivalent mode of applying power may be substituted therefor.

This eccentric *c'* is made to effect rotary motion from its axis, which, when revolving, turns the rod or shaft *f'*, on the end of which is properly attached the cog-wheel *o*, which acts on the cog-wheel *n*, attached to the upright shaft *p*, and thus rotates the furnace.

The eccentric effects oscillation or reversible motion by playing in a yoke or box, *e'*, to which box is attached a shaft, *s*, which shaft operates a cog-wheel, *m*, acting on a cog-wheel, *l*, attached to the upright shaft *p*, and thus oscillates the furnace.

When oscillation is desired, the cog-wheel *o*, attached to the shaft or rod *f'*, is thrust against the cog-wheel *n*, and retained in place by screws or other suitable fastenings, and acting thereon, when placed in motion, effects oscillation.

Then rotary motion is effected by withdrawing the cog-wheel *o* from its connection with the cog-wheel *n*, and the cog-wheel *m*, attached to the upper rod or shaft *s*, is thrown forward into the cog-wheel *l*, and acting therewith, when placed in motion, effects rotation.

The pivot *o'* slides in grooves cut in firm bearings,

properly erected, and is connected by two parallel rods, *r r*, which are extended, for a proper distance, above and below the cog-wheel *m*, with a regulating-wheel, *t*.

This wheel has suitably encased within it a flat, circular plate, *p'*, to which plate the ends of the parallel rods *r r* are firmly attached.

By the turning of this regulating-wheel *t*, the distance of the pivot *o'* from the cogs is increased or lessened, and a greater or less rapidity of oscillation of the furnace obtained at will.

The construction of this pivotal arrangement is fully shown in figs. 2 and 8.

The grate-bars *i''*, consisting of a perforated iron plate, may be pivoted at the sides, as shown in fig. 7, and held in a horizontal position by a catch, or pin, or screw, *j''*, inserted under or into its heavier end, and projected through the outer edge of the bottom plate *f*, so that while the grate or plate *i''* is held up, it will support the fires, and when tipped, by withdrawing the pin *j''*, will discharge its load below.

The grate-bars *f''*, as shown in fig. 7, are an entirely new and improved grate, consisting of one or two bars, working on pivots at either end, with teeth or fingers attached to and extended out from them at right angles, in two opposite directions horizontally, so that the fingers from one bar may be made to extend between those of the other.

The outer end of the bar is made square, and fits into a socket or bed in a staple or latch, *g''*, which falls over it.

This grate may be tipped by lifting the latch or staple *g''* from the end of the bar, when the weight of the heavier side will cause it to discharge its load below.

The rotary or oscillating motion of the furnace cleanses the grates sufficiently of ashes, and keeps up a strong combustion and a rapid generation of heat.

The only places through which cold air can enter my furnace are as follows, viz:

First, through the grate-bars, in passing which it would become heated;

Second, the small space, left for the free motion of the furnace when rotating, between the grate-bars and the base of the roof *O d*, in entering which it passes directly over the fires, and likewise becomes heated;

Third, the hopper *Z*, when opened for feeding fuel, which only admits air directly over the fires, when it likewise becomes heated; and

Fourth, the opening *W*, which is above the top of the chills *e*, and air admitted here either becomes instantly heated by the heat from the fires on the grate-bars passing upward in front of the opening *W*, or be carried up into the smoke-stack by the draught.

By the construction of a puddling-furnace as above described, cold air is entirely or mainly excluded from the metal in the puddling-pan *O'*, and I therefore work the iron or other metal at a more even temperature than it is done by the usual methods of puddling, produce superior metal, save time, fuel, and metal, and, to some extent, substitute mechanical for manual labor in the puddling and manufacture of iron and other metals.

I also, in combination with the puddling-furnace below, construct a melting-stove or furnace above, by extending the frame-work or masonry *T*, and supporting upon it other frame-work *E*, and an iron bottom plate, *M*.

This bottom plate fits closely around the lower smoke-stack *N*, a little distance below its top, and forms the bottom of a circular trough, to be made with clay or other suitable material, in the usual manner, in which trough pig-iron or other metal is placed.

Properly supported upon the bottom plate *M*, and by the frame-work *T E*, rises the roof *L*, constructed of iron and masonry.

This roof has, within its walls, a series of flues, L', which open close down to the metal trough, and discharge into the upper smoke-stack N.

This roof has no other openings for the escape of smoke and heated air than these flues, and the heat from the smoke-stack N reduces the metal in the trough to a molten state in passing to the flues L'.

Tap-holes, b'', are prepared in the trough, in the usual way, to run off the metal.

An opening is made in the roof L for the introduction of metal, which is closed during heats by a door, H, made in the usual way, and the melting-stove is made nearly or quite air-tight.

o is a conducting-pipe, through which the molten metal is run from the melting-stove into the chills e, in the puddling-furnace below.

x x are pipes, for discharging into and through the molten metal, as it falls through the conducting-pipe o, hot or cold water, steam, or blasts, for the removal of carbon, phosphorus, or other impurities that may be therein.

These impurities are forced through corresponding openings on the opposite side of the pipe o, into a box or waste-pipe, U, which discharges them outside the furnace.

The conducting-pipe o may be made to fall almost or quite perpendicularly from the melting-stove through the roof C of the puddling-furnace, just above the pan C'.

At any desirable point, an elbow or bend in it may be made open on the upper side, for the convenient skimming or removal of any impurities remaining on the metal before it reaches the puddling-pan C'.

I operate the furnace by placing within the trough, in the melting-stove, a suitable quantity of pig-iron or other metal, and drop the door H. The space below the frame-work d is closed in, and the fires on the grate-bars are lighted. The openings W Z, in the roof C, are closed, and, if necessary for rapid combustion and generation of heat, the furnace is rotated.

When the metal in the melting-stove has been sufficiently melted, the tap-hole b'' is opened in the usual manner, and the molten metal run down through the conducting-pipe o, into the puddling-pan C'. While the metal is passing down the pipe o, such blasts or streams of water are thrown into it by means of the pipes x x as are deemed necessary, and the impurities thus driven out are thrown into a waste-pipe, U, and by it discharged outside the furnace. Any dross or other impurities remaining on the metal are taken out or skimmed off before it falls into the puddling-pan C', at the open elbow or bend just above the roof O.

The metal being now in the puddling-pan C', and surrounded by fires, so that no cold air can reach it, the furnace is rotated or oscillated with such degree of rapidity as may be required, while the metal is sufficiently shaken, worked, and puddled. The metal is then taken up into a ball or lump, and removed through the door W. The process is then repeated.

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

1. An oscillating or rotary furnace, for heating, boiling, puddling, or otherwise working iron or other metals, constructed and operated substantially as and for the purposes above set forth.

2. A sliding pivot, o', connected by one or more rods, r, with a wheel, t, by which its distance from the cog-wheels is regulated, and thus a greater or less degree of oscillation obtained, arranged and used substantially as and for the purposes above expressed.

3. The use and arrangement of fire-grates around a central puddling-pan or basin, C', and their rotation under one fuel-hopper, Z, substantially as and for the purposes hereinbefore set forth.

4. A puddling-furnace, constructed with chills e, enclosing a circular space or pan, C', on the bottom plate f, surrounded by fire-grates, and so made as to rotate, and with openings in its roof, so relatively arranged to each other and to the fire-grates as to exclude cold air from metal in the puddling-pan, constructed and used substantially as and for the purposes hereinbefore set forth.

5. In combination with the puddling-furnace, a melting-stove, erected over it, operated by the heat from such furnace, and connected therewith by a pipe, o, arranged and operated substantially as and for the purposes hereinbefore set forth.

6. The series of flues L' in or through the walls of the roof of a melting-stove, arranged and used substantially as and for the purposes above mentioned.

7. Purifying metal, while in a molten state, passing through the pipe o, by throwing into it blasts, hot or cold water, or steam, in the manner and substantially as is hereinbefore set forth.

8. An elbow or bend in the conducting-pipe o, open at the top, substantially as and for the purposes hereinbefore set forth.

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Witnesses:

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