4 Sheets--Sheet 1.

C. J. SCHOFIELD.

Puddling-Furnace.

No. 169,047

Patented Oct. 19, 1875.

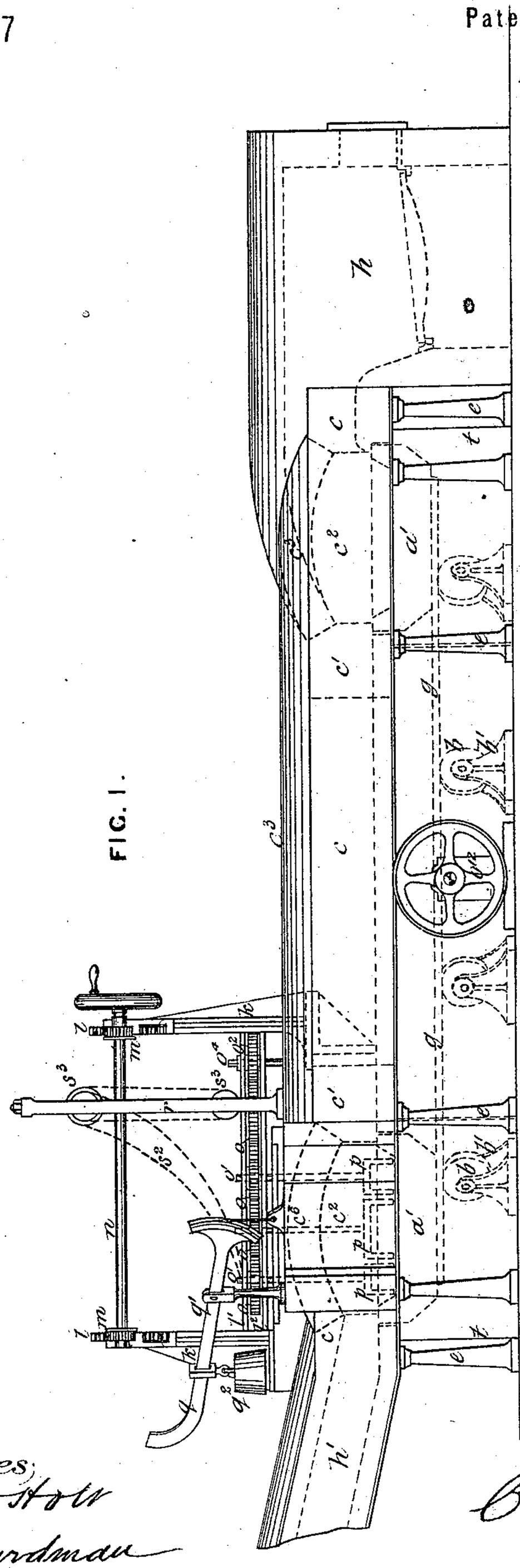

FIG. 1.

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Thomas Bourdman

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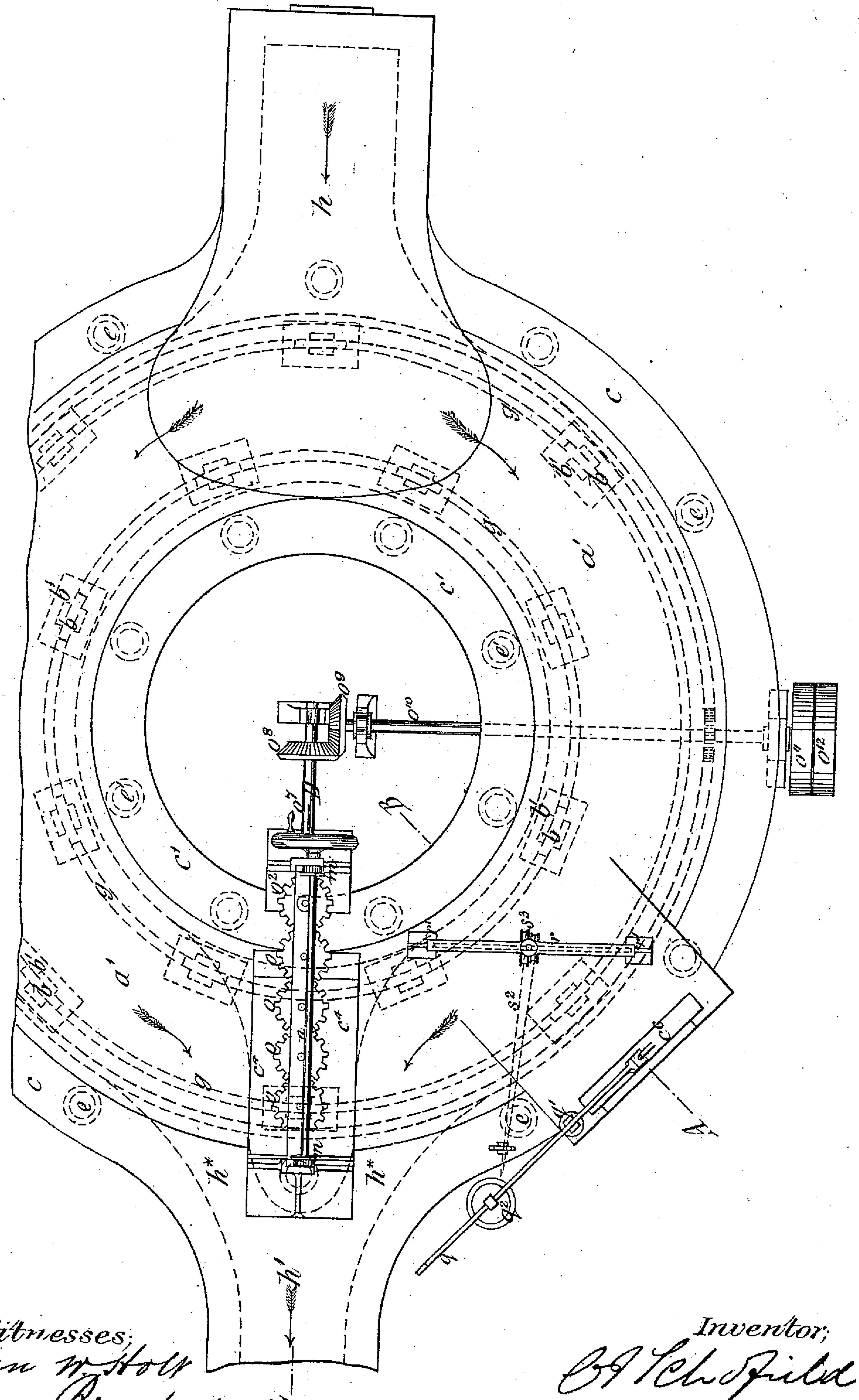

FIG. 2.

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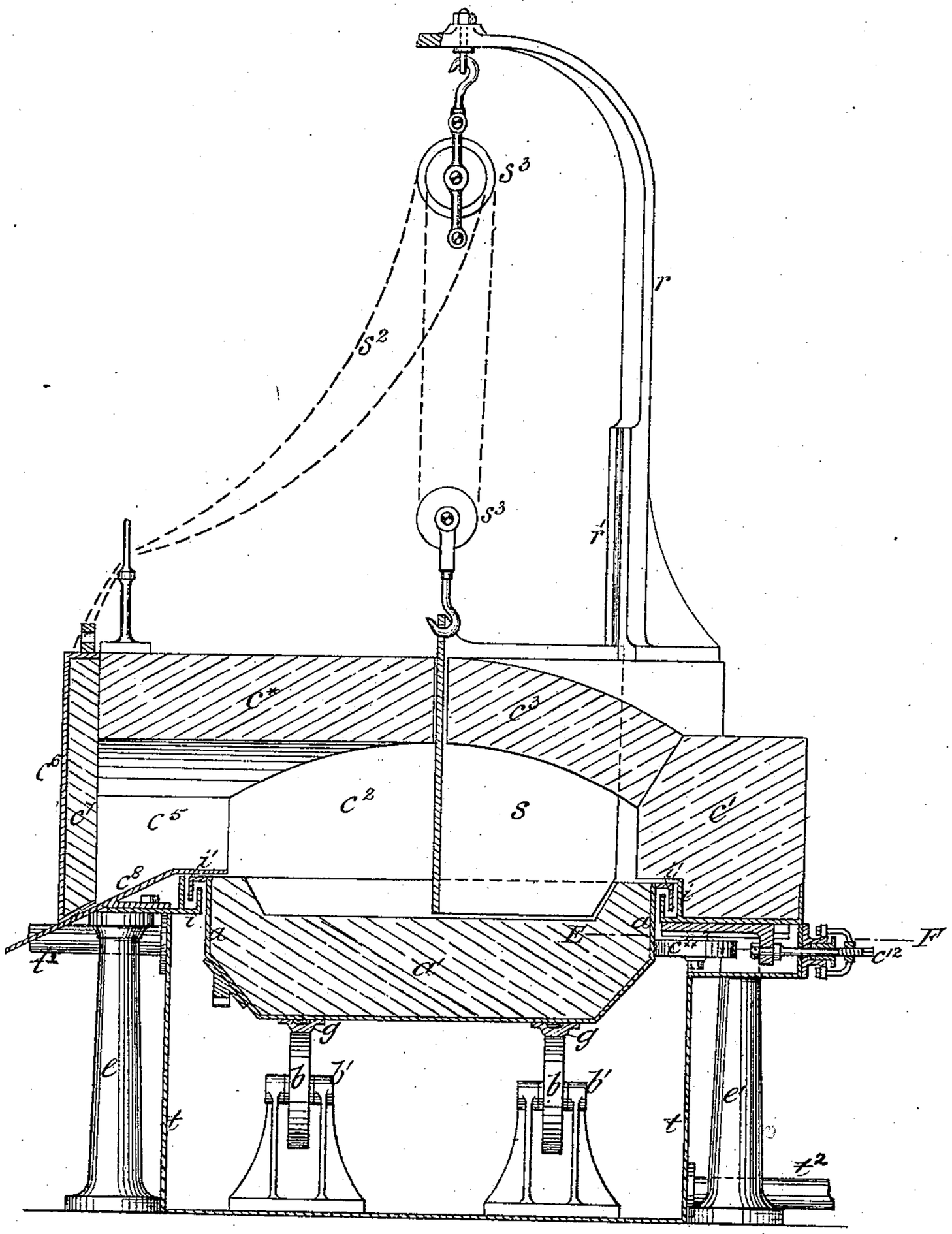
FIG. 3.



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4 Sheets--Sheet 4.

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FIG. 4.

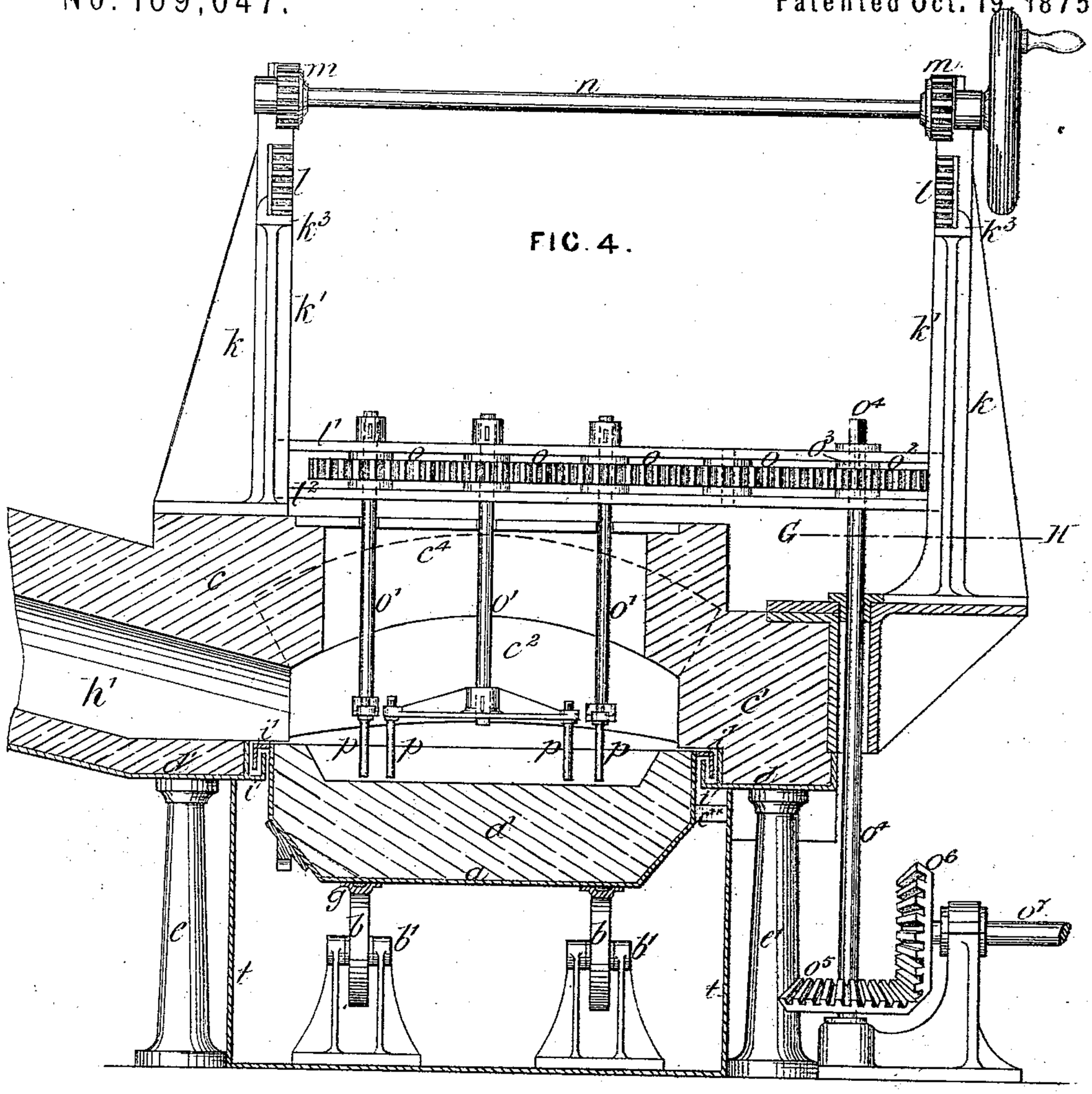


FIG. 7.

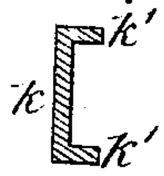


FIG. 5.

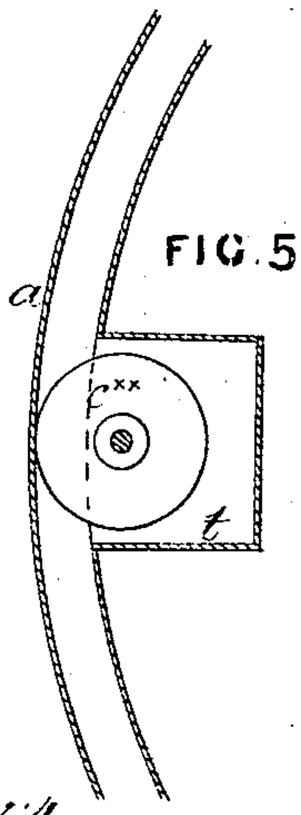


FIG. 8.

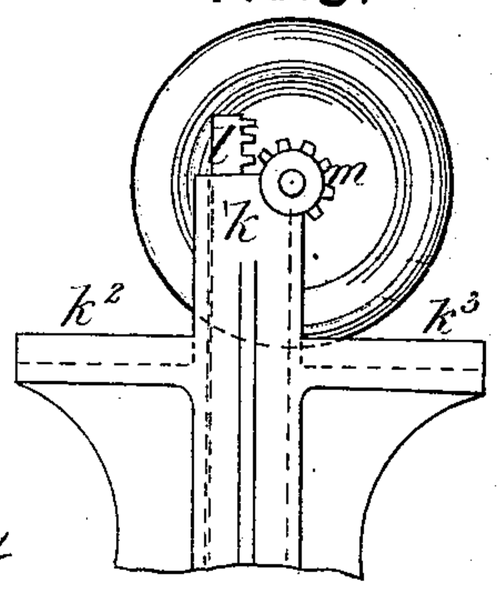
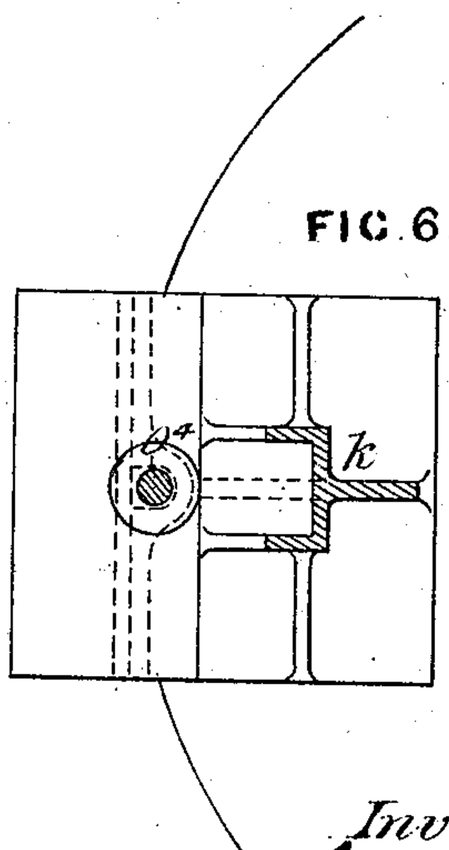


FIG. 6.



Witnesses;
John W. Holt
Thomas Bourdman

Inventor;
C. J. Schofield

UNITED STATES PATENT OFFICE.

CHRISTOPHER J. SCHOFIELD, OF CLAYTON, NEAR MANCHESTER, GREAT BRITAIN.

IMPROVEMENT IN PUDDLING-FURNACES.

Specification forming part of Letters Patent No. **169,047**, dated October 19, 1875; application filed April 17, 1875.

To all whom it may concern:

Be it known that I, CHRISTOPHER JAMES SCHOFIELD, of Clayton, near Manchester, in the county of Lancaster, Kingdom of Great Britain and Ireland, manufacturing chemist, have invented an Improved Furnace for treating iron and other substances, of which the following is a specification:

My invention relates to that class of furnaces in which the metal is subjected to treatment on an annular rotating bed; and the object of my invention is to facilitate and render automatic the discharge of the metal after treatment, a further object being to render the rotating bed less liable to injury from the excessive heat. These objects I attain in the manner which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of my improved furnace. Fig. 2 is a plan. Fig. 3 is a vertical section to an enlarged scale in the line A B of Fig. 2. Fig. 4 is a similar section in the line C D of Fig. 2. Fig. 5 is a section in the line E F of Fig. 3. Fig. 6 is a section in the line G H of Fig. 4. Fig. 7 is a cross-section through one of the standards for supporting the stirring apparatus. Fig. 8 is a side elevation of part of one of the standards, with raising and lowering gear of stirring apparatus.

a a' is the annular bed or receptacle, which is shown as being made of iron, a lined with fire-brick or fettling a'. It is arranged to rotate about its own axis, and travels on anti-friction wheels b, carried by iron standards b'. c and c^1 are two annular walls, supported by iron plates d d', carried by iron pillars e e'. The walls c c^1 form an annular space or chamber, c^2, which is covered by the brick roof c^3, supported by the side walls.

The annular bed or trough a may be made either of sheets of wrought-iron riveted together, or of cast-iron made in sections with suitable flanges, and bolted together.

It travels within the annular chamber c^2 on anti-friction wheels b, on which rest the annular rails g, supporting the bottom of the annular bed. The bed is guided by wheels $c^{\times\times}$, carried by sliding journal-boxes arranged under the inner wall-plate and made adjustable by screws c^{12}, as shown. h is a reverberatory fire-place, situated at the side of the annular chamber c^2, so that by the use of the annular bed a a', in combination with the stationary wall c c^1 and annular roof c^3, an annular flue is formed, of which the rotating bed or receptacle a a' constitutes the bottom, the walls c c^1 the sides, and the roof c^3 the top. The bed of this annular flue, so formed, contains the materials onto which the flame and intensely-heated products of combustion from the fire-place are reverberated or caused to impinge. The exits for the products of combustion from the annular flue are at $h^{\times}$. They lead into another flue, h', so that the flame and heated products of combustion on entering the annular flue are split up or divided into two streams traveling in opposite directions along the annular flue, as indicated by the arrows in Fig. 2, and meeting and leaving together by the exit h', as shown. i i are annular gutters or channels carried by the walls c c^1, and containing pulverized ore or other granulated luting material or liquid sealing, into which dip the flanges or feathers i' i', carried by the rotating annular bed.

By this arrangement I prevent the escape of the heated products of combustion and the access of cold air between the sides of the rotating annular bed or trough a a' and the walls c c^1.

c^4 is an opening formed in the annular roof c^3 for the insertion of instruments for mixing, turning over, and otherwise manipulating the substances under treatment.

The apparatus I employ for this purpose is constructed as follows: At each side of the rotating annular bed I fix two stationary standards, k, of the cross-section shown in Fig. 7. Between the flanges k^1 of each standard works a rack, l, in gear with a pinion, m, carried by a cross-shaft, n, to which rotatory motion may be communicated, when required, by any well-known arrangement for the purpose. The racks l carry a cross-frame composed of two bars, l^1 l^2, between which work, in gear with each other, a number of spur-wheels, o, whose spindles o^1 have their bearings in the bars l^1 l^2, as shown. One of these wheels gears with a spur-wheel, o^2, formed

with a short hollow spindle or elongated hollow boss, o^3. Through this hollow spindle or boss passes the upper part of an actuating spindle or shaft, o^4, driven by suitable gearing. The upper part of the spindle or shaft and the hole in the hollow spindle or boss o^3 are of angular section, or feathered, or otherwise arranged, so that the hollow spindle or boss, and its spur-wheel, are left free to move up and down independently of the actuating spindle or shaft o^4, but cannot rotate without turning it when in position for work. o^5 is a bevel-wheel fixed on the actuating spindle or shaft, in gear with a similar wheel, o^6, on a horizontal shaft, o^7, driven in this case through miter-wheels o^8 o^9 by another shaft, o^{10}, provided with fast and loose pulleys o^{11} o^{12}, so as to be driven by a strap or band. This driving arrangement may obviously be modified to suit circumstances. The spur-wheel o^2, driven by the actuating spindle or shaft o^4, as above described, communicates motion to the train of spur-wheels o in gear with it. The stirring implements p are carried by the lower ends of the spindles o^1 of the wheels o so as to dip into and agitate the materials contained in the annular bed of the furnace when the said spindles are rotated by their wheels o.

I place the stirring apparatus between the exit-openings $h^\times$ of the annular flue, as shown, the temperature there being comparatively low, in consequence of the heat being mainly drawn away by the exits $h^\times$; and I form the the roof c^3 with a dip or screen running, as it were, across the annular flue at each side of the opening c^4, so as to protect the stirring apparatus from the direct action of the products of combustion. The screens do not dip into the materials contained in the rotating annular bed.

Portions of the flanges k^1 of the standards near their upper parts are removed to enable the frame l^1 l^2 with the wheels o o^2, spindles o^1, and the agitators, when raised by the racks l, to be withdrawn and replaced, or a duplicate set of apparatus substituted.

Instead of the hollow boss o^3, I may use a clutch-box, the segments of the box being made sufficiently deep to insure that the stirrers shall be brought into action before touching the material required to be stirred.

The standards k are formed with projecting parts or brackets k^2 k^3 forming tables or supports, so that when one frame, l^1 l^2, with its wheels, spindles, and stirrers, has been raised, it may be drawn out from the racks along the one pair of tables or supports, say, k^2, and another similar set of apparatus kept in readiness on the other pair of tables or supports, say, k^3, may be thereupon slid along the said tables or supports into gear with the racks l, and lowered into position for operating upon the materials under treatment in the annular bed. The apparatus withdrawn will be supported by the tables or supports k^2, and, if necessary, its stirring implements p may be removed and others substituted.

In this way two sets of apparatus may be used alternately, in such manner as to cause, practically speaking, no interruption in the stirring of the materials under treatment.

To enable the materials that have been treated in the rotating annular bed to be readily removed, I construct the furnace so as to leave a space at one side between the upper edge of the annular side of the rotating bed and the roof, as shown at c^5, Fig. 3, for which purpose, in the arrangement illustrated, I provide a small archway, $c^\times$, projecting in a radial direction from the annular roof c^3. This archway is provided with a sliding door, constructed of iron, c^6, lined with fire-brick c^7, and arranged to be raised and lowered or held in any required position by means of a lever, q, having its fulcrum at q^1, and provided with a sliding weight, q^2. The inclined bottom of the opening c^5 consists of an iron plate, c^8, arranged to slightly overlap the outer annular side of the rotating annular bed, so as when materials are ejected from the bed, as hereinafter described, to guard against any portions thereof falling down between the wall c and the annular bed. The plate c^8 is made adjustable by set-screws, as shown. r is a frame, having grooves or guides r^1, in which slide the respective ends of a deflector, s, constructed in the present instance of iron. This deflector, as will be seen by the plan view, Fig. 2, is arranged in a direction tangential, or at an angle to the lateral part or side of the annular bed. It is made adjustable vertically by means of a chain, s^2, and differential pulleys s^3. By this arrangement the deflector s can be adjusted to any required height in the flue c^2. When the deflector is lowered it dips into and forms a partition across the bed of the furnace in such manner as that the materials required to be removed from the said bed being, by the rotating action of the bed, brought against the said deflector, are thereby accumulated and deflected or thrown aside and caused to pass over the side of the rotating annular bed through the opening c^5, out of the furnace into any suitable receiver. When the annular bed is tolerably full the deflector may, in some cases, be advantageously lowered, so as to dip at first only slightly into the contents of the bed, thereby, as it were, skimming the same at first, and after a portion of the contents have been removed from the bed the deflector may be gradually lowered until it finally assumes its lowest position toward the conclusion of the emptying operation.

When removing iron in a pasty state I cause it to accumulate by means of the deflector, and I remove the accumulated balls by means of shovel, tongs, or otherwise.

The water chamber or vessel t consists of an annular tank, constructed of wrought-iron. This tank extends some distance up the sides of the annular rotating bed. The walls c c^1, forming the sides of the annular flue c^2, are caused to overlap the upper edges of the an-

nular sides of the bed. The chamber t is provided with an inlet, t^1, for cold water, and an outlet, t^2, for water that has taken up heat from the annular bed. I place a wall or division across the chamber t, and arrange the inlet near one side of such division or wall, and the outlet at the other side of the division or wall. By this arrangement, as will be seen, the water is caused to circulate in contact with the outer sides of the lateral portions of the annular bed, as well as in contact with the outer side of the bottom of the annular rotating bed, and the bearings of the anti-friction wheels b are kept well lubricated.

Having described the nature of my said invention, and having explained the manner of carrying the same into practical effect, I claim as being novel and original—

1. The combination, in a puddling-furnace, having a rotating annular bed, of an opening, c^5, in the side of the furnace, with a vertically-adjustable and tangentially-arranged deflector, s, as set forth, for the purpose specified.

2. The combination of the chamber t t, containing water, and having an inlet and outlet for the same, with the rotating annular bed a a^1, substantially as shown and described.

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Witnesses:
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