No. 666,517. Patented Jan. 22, 1901.

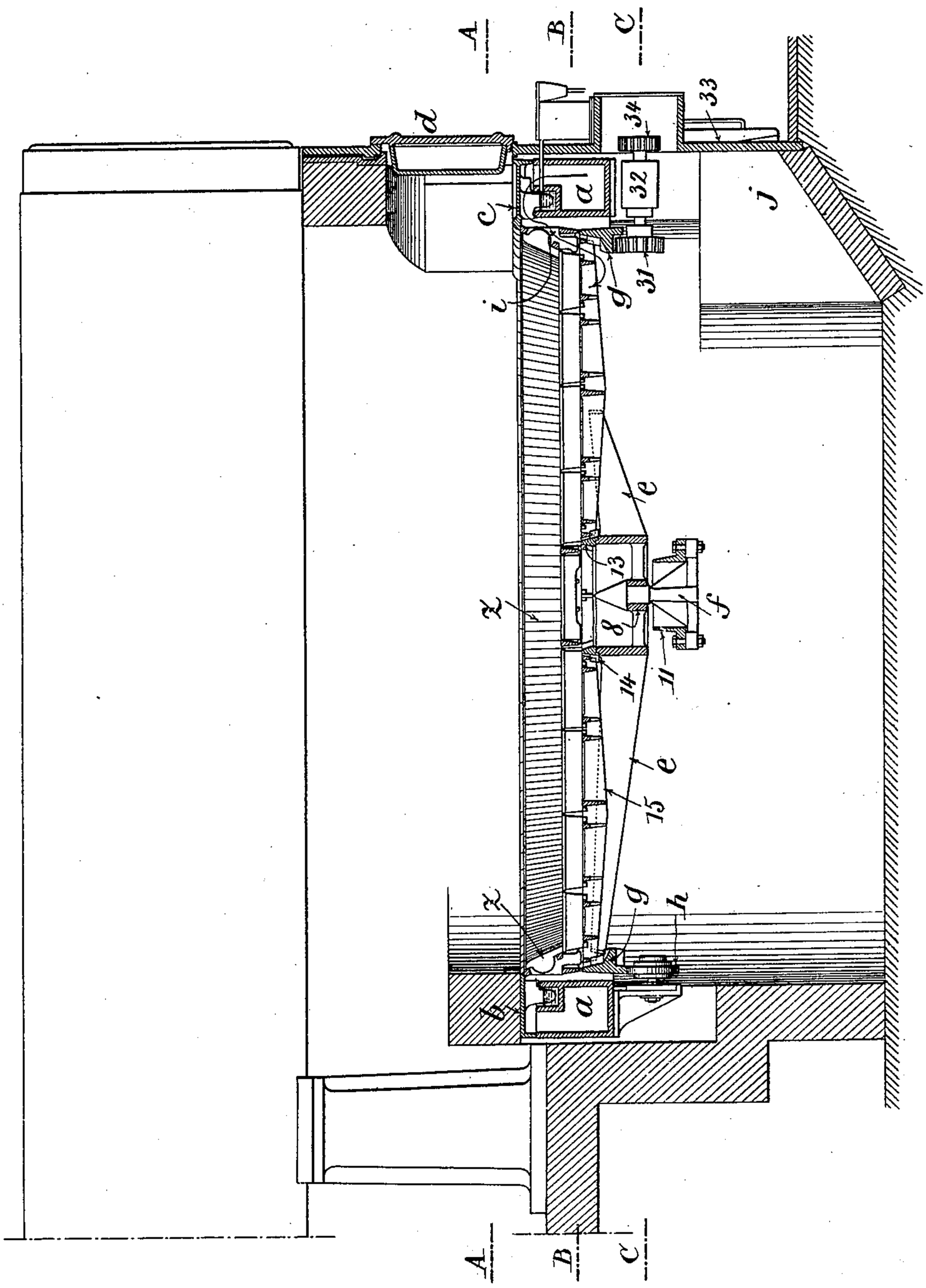
C. GROLL.

ROTARY FURNACE.

(Application filed May 12, 1900.)

(No Model.) 5 Sheets—Sheet 1.

FIG. 1.



WITNESSES:

William P. Goebel.

Alfred H. Davis

INVENTOR.

Charles Groll.

BY Munn & Co.

ATTORNEYS.

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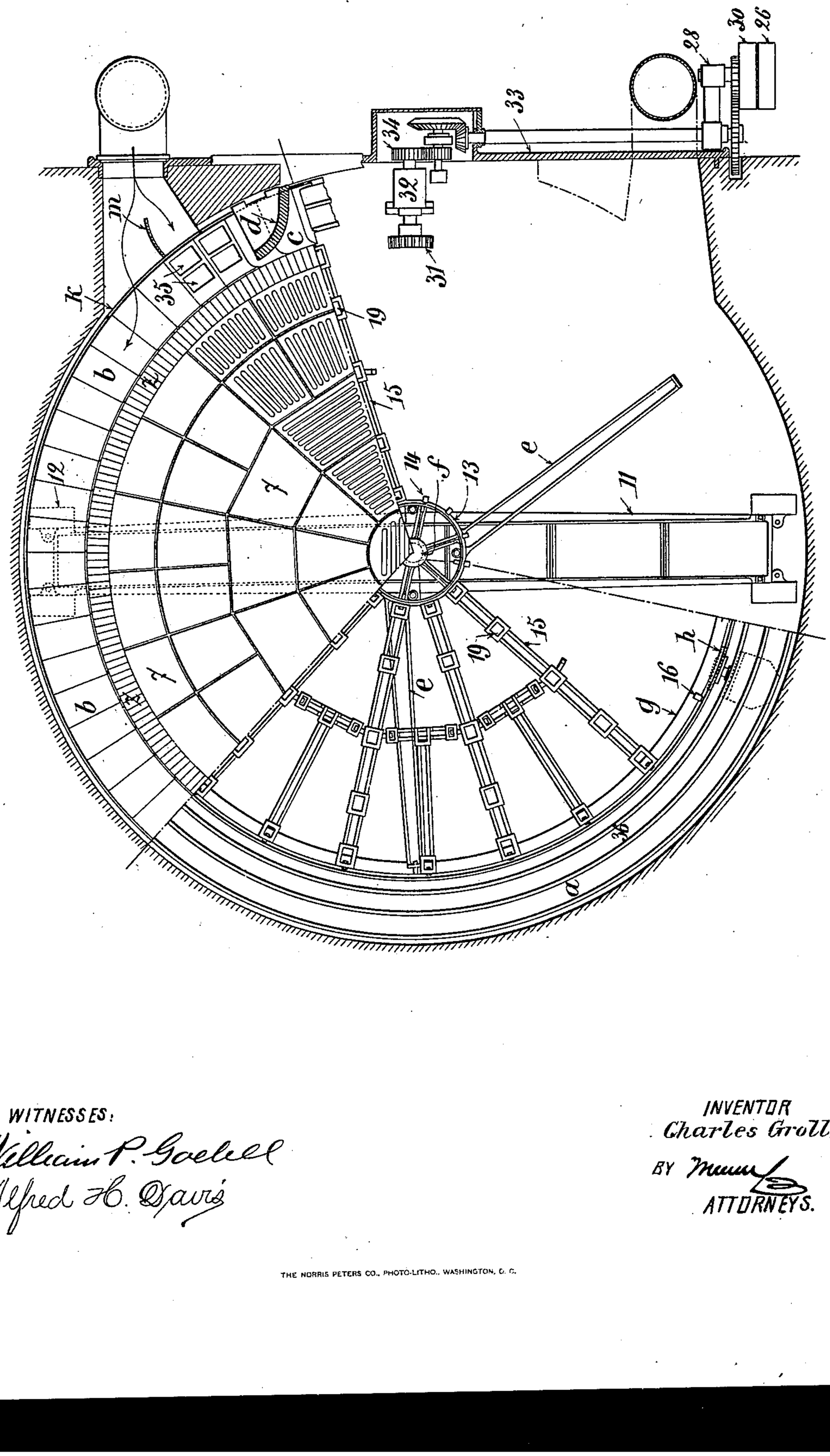
FIG. 2.



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5 Sheets—Sheet 3.

FIG. 5.

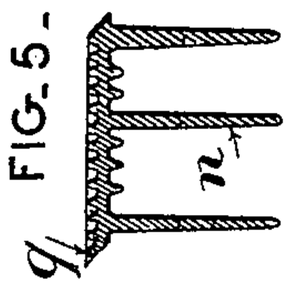


FIG. 4.

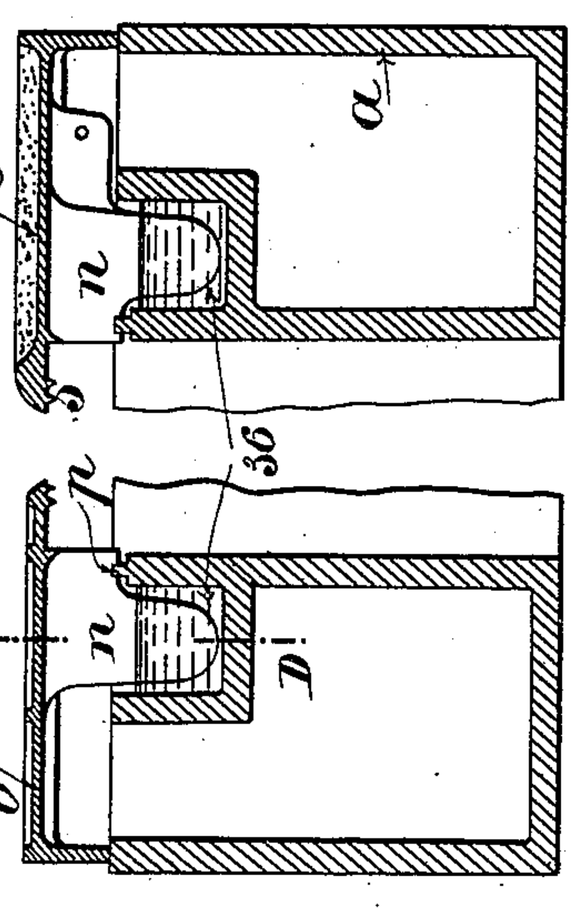


FIG. 9.

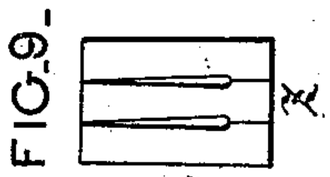


FIG. 8.

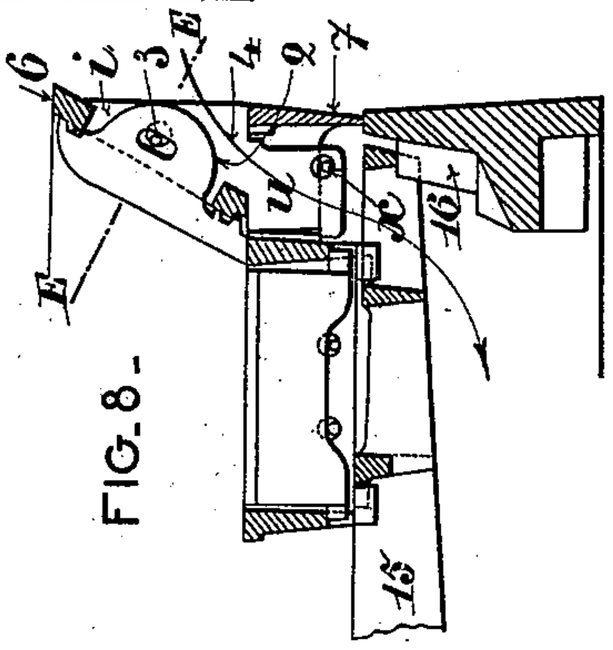


FIG. 10.

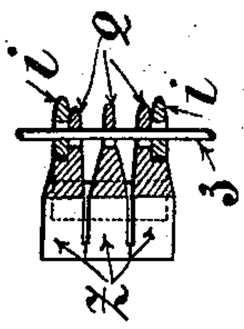


FIG. 11.

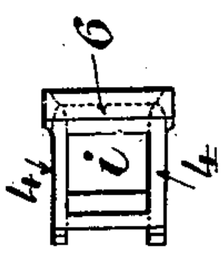


FIG. 3.

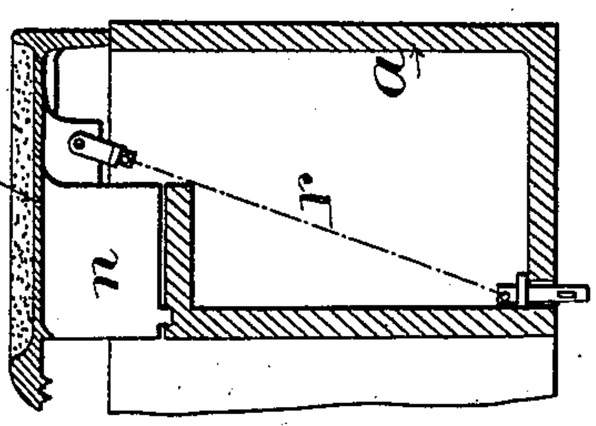


FIG. 6.

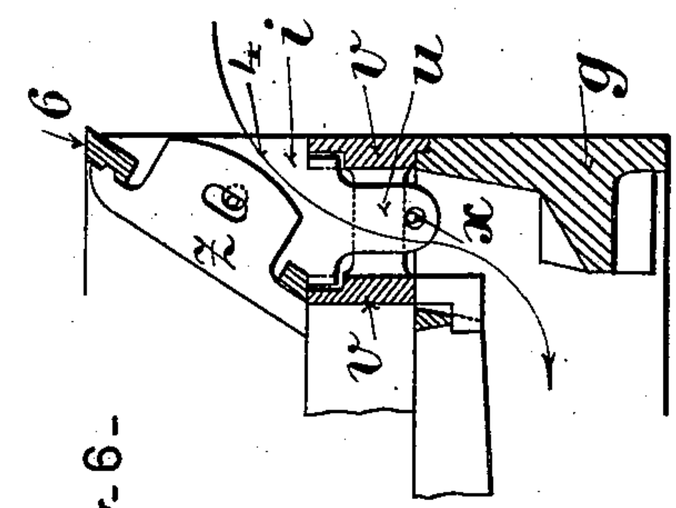
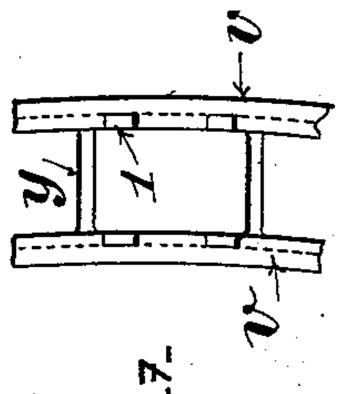


FIG. 7.



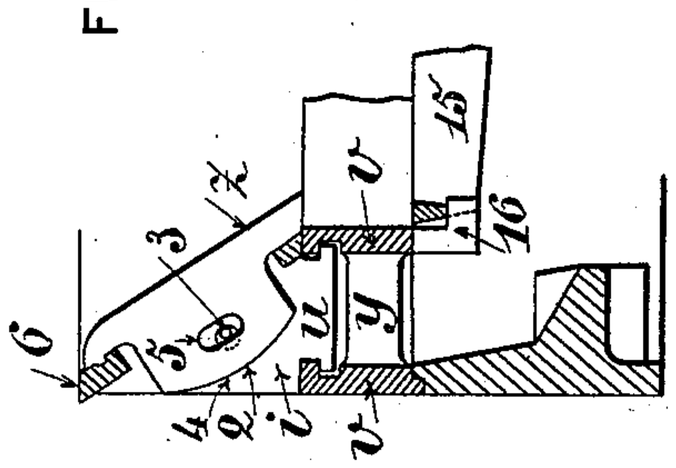


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FIG. 5a.

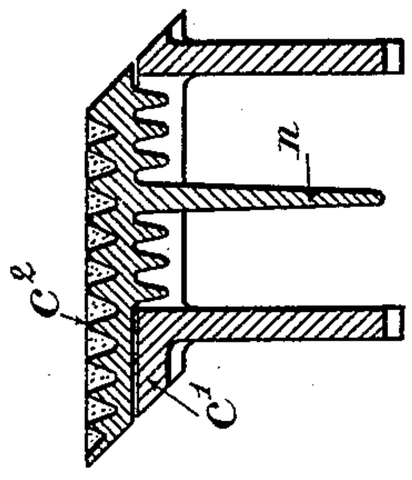
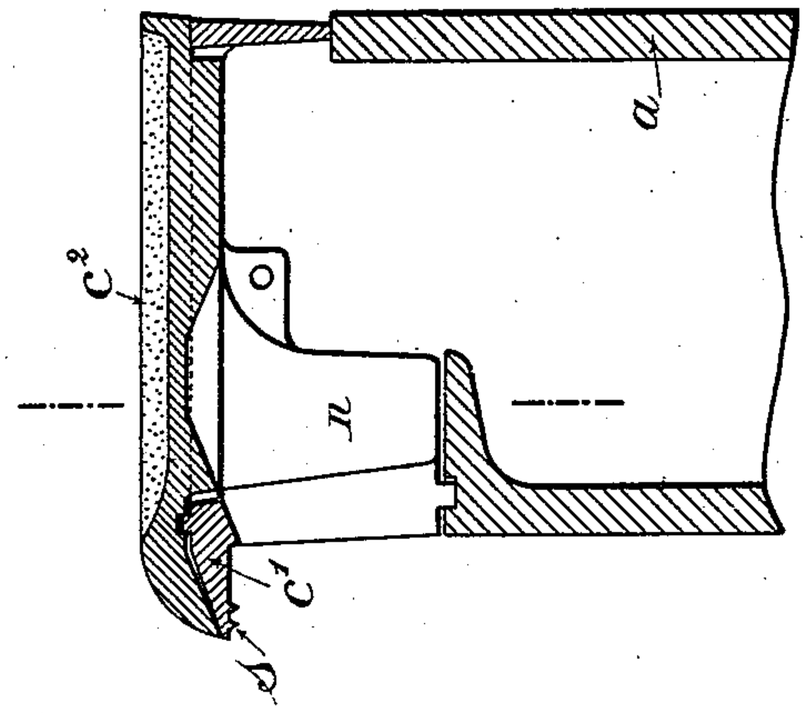


FIG. 4a.



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(No Model.) 5 Sheets—Sheet 5.

FIG. 17.

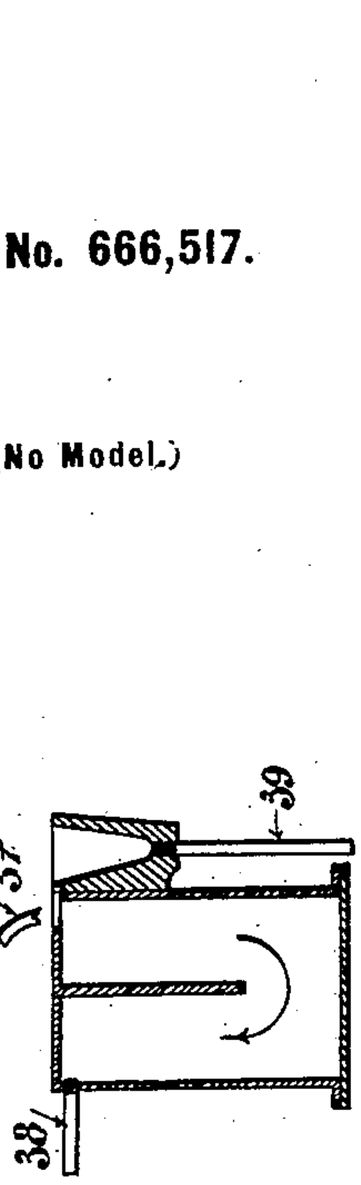


FIG. 18.

FIG. 16.

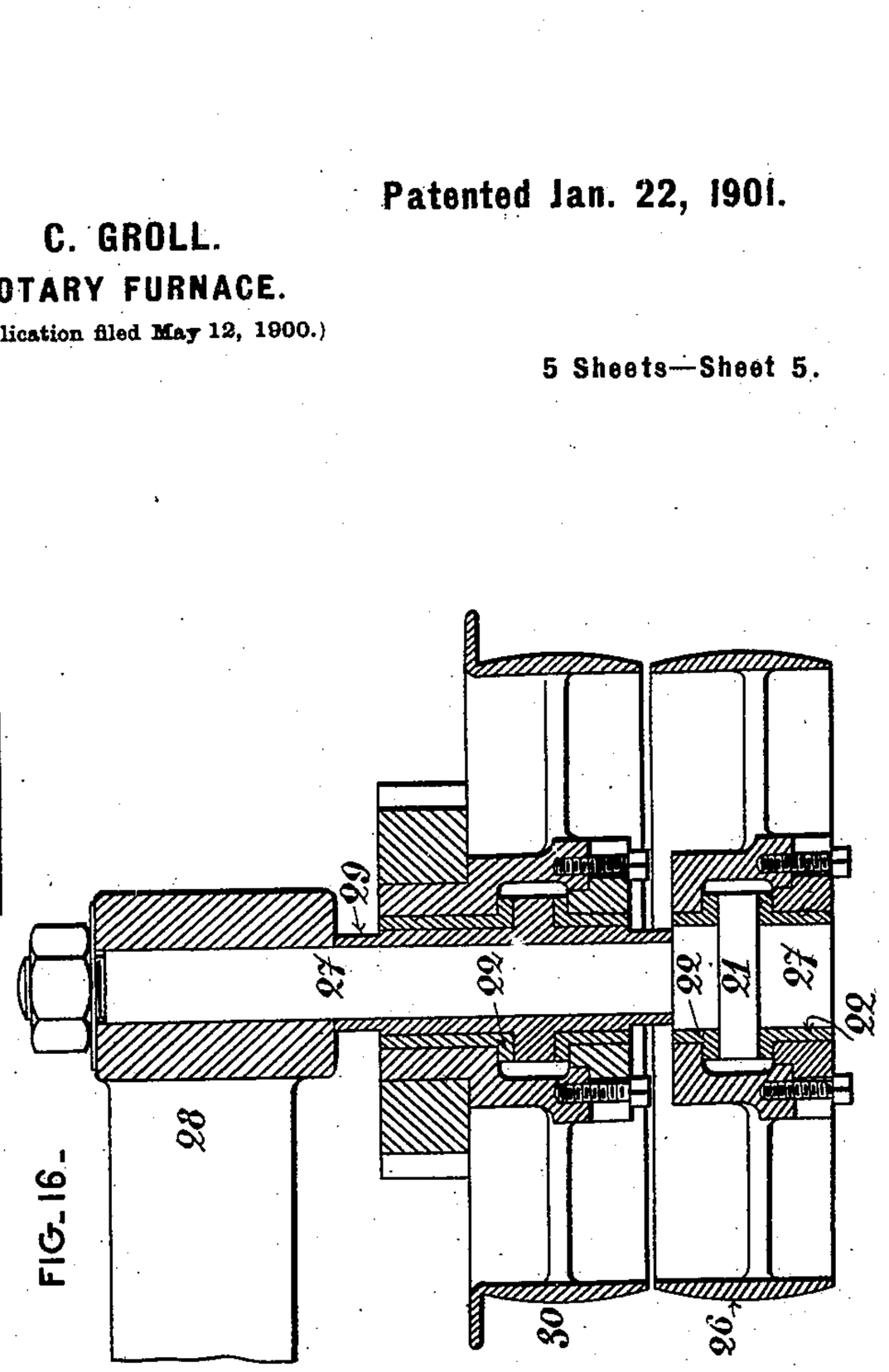


FIG. 14.

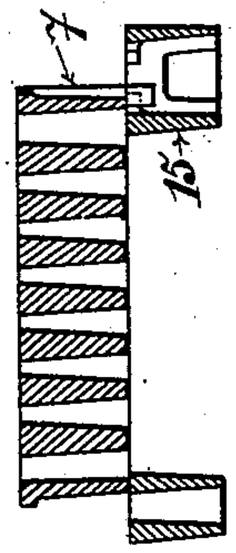


FIG. 12.

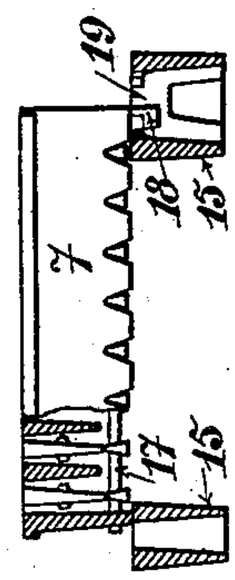


FIG. 13.

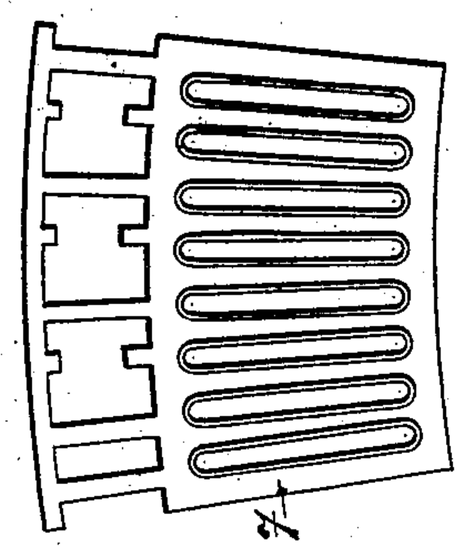
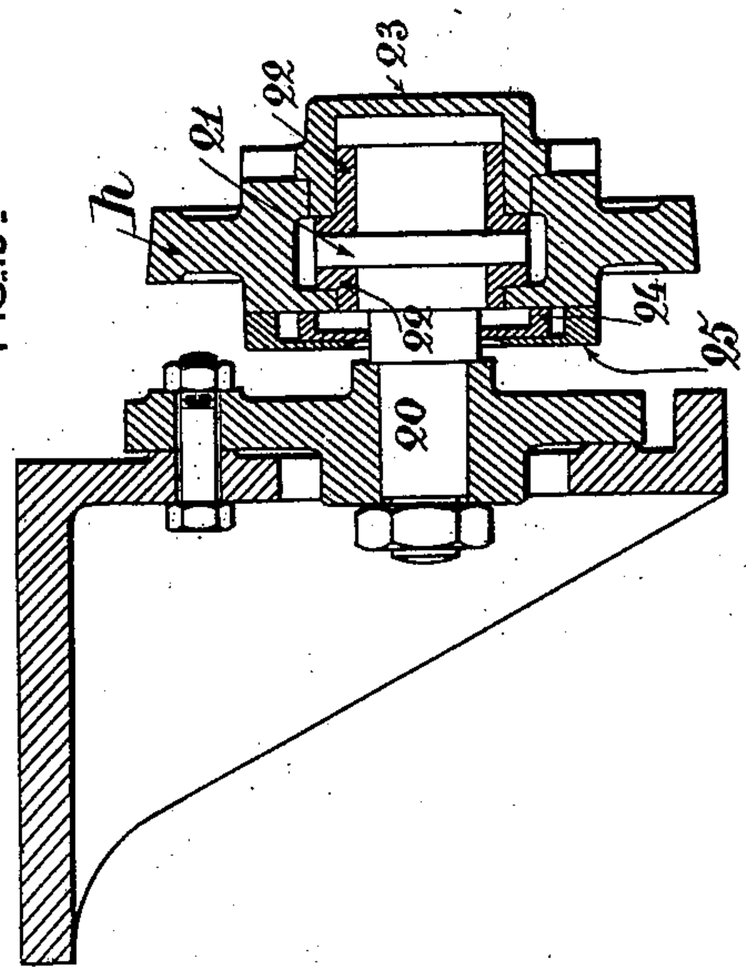


FIG. 15.



WITNESSES:

William P. Gaebel

Alfred H. Davis

INVENTOR

Charles Groll.

By Munn & Co. ATTORNEYS.

UNITED STATES PATENT OFFICE.

CHARLES GROLL, OF ROUBAIX, FRANCE.

ROTARY FURNACE.

SPECIFICATION forming part of Letters Patent No. 666,517, dated January 22, 1901.

Application filed May 12, 1900. Serial No. 16,448. (No model.)

To all whom it may concern:

Be it known that I, CHARLES GROLL, a citizen of the Republic of France, residing at Roubaix, in the department du Nord, in the Republic of France, have invented new and useful Improvements in Rotary Furnaces, of which the following is a specification.

The improvements which form the object of the present invention relate to furnaces having a circular grate revolving around a vertical axis, and they are for the purpose of preventing the regular working or operation of the said furnaces from being interfered with by fragments of coal which work in between the fixed and moving parts, notwithstanding the distortions to which the said parts are subjected through the influence of the heat.

In order to secure a regular working of the rotary grate, I construct the latter of a certain number of pieces so combined that their respective expansions do not modify the contour of that portion of the periphery of the grate which forms the joint at the contact or nearly at the contact of a ring fixed to the walls of the hearth. For the same purpose the parts of the said fixed crown forming a joint with the grate are composed of comparatively numerous pieces, the expansion of which does not interfere with the working of the parts in contact or nearly in contact. Furthermore, the expansion of the whole of the said parts, whether fixed or moving, forming the joint between the grate and ring is very much reduced and rendered uniform by the action of a current of air which is caused to circulate all around the periphery of the grate. I use for that purpose the whole of the air necessary for combustion and cause the same to pass inside the fixed ring which surrounds the grate. With such particular arrangements of the parts those forming the joint at the periphery of the grate preserve their form or contour; but in order that they shall not rub against each other it is still necessary to prevent the pivot around which they revolve from changing its level or its inclination under the influence of the expansion caused by the heat. For that purpose the pivot of the grate is mounted on a crosspiece fixed at one end to the ring, while the other end is capable of longitudinal movement between guides. The result of this construction is that the play left between the fixed and movable parts of the furnace may be exceedingly small, so as to prevent the smallest fragments of coal coming between the said parts. Finally, in order to secure the regular working of the grate there must be further excluded all danger of clogging by coal-dust becoming lodged between the parts of the devices which revolve the grate and the rollers on which it is supported. For that purpose I have devised an arrangement of trunnions having lateral abutments which prevent the entrance of coal-dust.

In the accompanying drawings, which show one form of my improved rotary furnace, Figure 1 is a vertical section of the furnace through the axial line of the same. Fig. 2 is a horizontal section, partly on the line A A of Fig. 1, partly on the line B B, and partly on the line C C of the same figure. Fig. 3 is a radial section of an air-chamber. Fig. 4 is a radial section of another air-chamber. Fig. 5 is a section, on the line D D of Fig. 4, through one of the plates closing the top of the air-chamber. Figs. 4^a and 5^a are two vertical sections, respectively at right angles to each other, of a cover-plate for the air-chamber. Fig. 6 shows an arrangement of border-pieces for the grate. Fig. 7 is a part plan of a ring supporting the said border-pieces. Fig. 8 shows another arrangement of the border-pieces. Fig. 9 is an elevation of the inner face of inclined bars arranged around the grate. Fig. 10 is a section on the line E E of Fig. 8. Fig. 11 is the plan view of the border-piece shown at the right side of Fig. 8. Fig. 12 is a part section of a grate-plate having bars fixed thereto. Fig. 13 is a plan view of Fig. 12. Fig. 14 is a section through a grate-plate having bars cast integral therewith. Fig. 15 is a radial section of a roller. Fig. 16 is a radial section of the operating-pulleys. Figs. 17 and 18 are respectively a vertical section and a plan of a device intended to maintain water in the fixed ring at constantly the same level.

The furnace I desire to have patented comprises a fixed ring *a*, Figs. 1 and 2, which is hollow to form an air-chamber and is covered by a series of plates *b* and *c*, below which revolves a frame carrying the "grate," prop-

erly so called. The plates *b* are covered by the masonry of the walls of the furnace, and the plates *c* constitute the threshold of the stoking-door *d*. The said frame is star-shaped, having radial arms *e*, centered by means of a fixed column *f*. The said radial arms rest on a toothed ring or rack *g*, which moves on rollers *h*. The rack *g* has mounted upon it a series of movable border-pieces *i*, the upper surfaces of which are intended to revolve very near to and under the said plates *b* and *c*, without, however, having to overcome the least friction.

The ash-pit *j* is closed, and the whole of the air necessary for combustion penetrates into the ring *a* through two or more openings *k*, Fig. 2, of varied form and arrangement, according to the kind of draft required. Partitions *m* may be arranged in front of the said openings in order to better distribute the air. It is from the said ring only that the air passes into the ash-pit *j*, as indicated by the arrow on Fig. 1, cooling on its passage the fixed plates *b* and *c* and the revolving border-pieces *i*.

The annular air-chamber *a* serves as a support for the plates *b* and *c*. (See Figs. 3, 4, and 5.) The latter are also anchored by heel-pieces *n*, provided with notches engaging a circular tongue *p*, formed in the upper part of the inner wall of the said collector. The heel-pieces *n* form a cooling-surface which is very large in proportion to the surface of the plates exposed to the fire, so that the air passing between the said heel-pieces and against the inner surfaces of the plates prevents the temperature of the latter from rising.

The upper face of the plates *b* is provided with very thin ridges *q*, which reduce to a minimum the heat transmitted by the contact with the bricks of the walls of the furnace.

The plates *c*, which form the threshold of the furnace, are not covered with bricks. They are provided at the top with a series of grooves which, filled with insulating material, prevent them from absorbing more heat than can be taken up by the current of air within. The plates *c* of the threshold not being covered with masonry they may be held in place by means of chains *r*, keyed below the air-chamber *a*, so that the said plates can be very readily mounted.

The plates *b* and *c* are provided along their circumference with two or more triangular projections *s*, so as to allow of adjusting the same very near to the border *i* without giving rise to any perceptible friction.

The plates *b* and *c*, which serve to close the top of the air-chamber, may each be made in two pieces, as shown by Figs. 4^a and 5^a. The under piece forms a frame *c'* and carries the contact-making surface having ribs *s*, intended to make a joint with the border-pieces of the grate. The upper piece c^2 is formed by a plate provided with radial ribs which are cooled by the air. In this manner the under plate or frame is not directly heated, and the heat transmitted to it by contact is carried off by the air passing along the surface. The rotary borders may be formed by frames *i*, (see Figs. 6, 7, 8, and 11,) held in place by means of the heel-pieces *u*, which take into a hollow ring *v*, located above the rack *g*. The said border can be easily and rapidly mounted by means of vertical notches 1, provided in the rim of the said ring *v*, Fig. 7, which permit of lowering the borders into their place and of sliding them one against the other in the interior of the ring *v*. The heels *u* of the border-pieces *i* are held by iron wires *x*, bearing upon the under surface of cross-pieces *y* of the ring *v*. Against the inner face of the frames *i* abuts an annular flange formed by a series of small independent bars *z*, variable in number, side by side and held in place by heels 2 and iron wires 3, which pass through the lateral flanges 4 of the frames *i*. The openings 5 made in the heels 2 are extended in order to allow the bars to expand freely. Under these conditions the frames *i*, which carry the surface of the joint 6, are not in direct contact with the coal and hardly become heated at all. The air issuing from the whole of the inner periphery of the ring *a* impinges directly against the assembled border-pieces, passes through the same, and cools fully both the frames *i* and the bars *z*.

The ring *v* may be dispensed with, (see Figs. 8, 9, 10, and 11,) and the heels *u* may take into suitable housings in the panels 7 of the grate placed at the periphery of the same. In this case the frames *i* are still held in the panels by means of an iron wire *x*, passing through their heels *u*. The bars *z* have then the supporting-heel 2 at the lower part, and they expand upward.

The hub 8 on the star-shaped frame *e* comprises a bored socket rotatable about a column *f*, Fig. 1. The latter is fixed at the bottom to a cross-piece 11, on which it can be adjusted in any direction. The cross-piece 11, Fig. 2, is bolted at one end to the air-chamber *a*, and at the other end it is held, with but little or no play, between supports 12, which leave it free to slide longitudinally in order that its expansion lengthwise shall not disturb the working of the furnace.

Fixed to the hub 8 of the star-shaped frame *e* is a concentric ring 13, centered and provided with all the heels 14 necessary to support the several arms 15, intended to receive the "grate," properly so called. The arms 15 are anchored at an equal distance from the center on the said heels, and their expansion is free at their outer end, which rests on heels 16, cast integral either with the rack *g*, Figs. 2 and 8, or with the ring *v*, Fig. 6.

The "grate," properly so called, may be formed in different ways. That shown in Figs. 12, 13, and 14 is formed by a series of panels or plates 7, the bars of which are either

cast together in one piece with their frame, Fig. 14, or fixed to the same and held in place in their frame by rods 17, Figs. 12 and 13, located underneath. In order to prevent the said panels or plates from moving, they are provided with heels 18, which fix them, two by two, in notches 19 in the said arms 15 in such a manner that by being mutually supported in the direction of the heels their expansion is free in the other direction. The result of the above-described manner in which the arms 15 are fixed on the ring 13 is that the corresponding notches 19 lie at exactly equal distances from the center and that the distances between the several elements of the grate can remain absolutely the same or uniform.

The rack *g* revolves on a variable number of rollers *h*, so protected as to make it impossible for any coal-dust to get between the parts in contact. For that purpose the laterally-abutting surfaces of the said roller are inclosed. The fixed pin 20 of a roller, Fig. 15, has a flange 21, against each side of which are pressed rings 22, fixed the one in the body part of the roller *h* and the other in its cap 23. The side opposite to the cap is closed by two washers 24 and 25, the former of which is fixed and centered, with little or no play, on the pin 20 and capable of following up the latter when the bearings become worn, and the other washer 25 is placed, without play, against the former and revolves with the roller, preventing any side movement which might allow coal-dust to get in between the surfaces in contact.

The several pivots or studs of the parts which operate the rack may be constructed and arranged in the same manner as described for the rollers *h* to prevent any abnormal wear on account of dust. For example, the loose pulley 26, Fig. 16, is mounted on a stud 27, having a flange 21, and fixed to a rigid support 28. A sleeve 29, having a flange 21, intended to receive the fixed pulley 30, is capable of revolving freely on the spindle 27 and is retained between the loose pulley and the support 28. This arrangement of sleeve with its flange or collar allows of having inner abutments for the two pulleys and provides at the same time a very simple mounting of the devices. The rack *g* is operated by a pinion 31, supported from the air-chamber *a* by means of the support 32, Figs. 1 and 2. The remainder of the operating parts are located outside the furnace and are supported from the front 33, which may be thrust out or in, on account of the masonry moving, but without causing any inconvenience, because the straight teeth of the pinions 31 and 34 are capable of sliding longitudinally.

In order to mix the gases of combustion, inlet-openings 35 are provided above the grate, the said openings being located between the plates *b* and the plates *c*, their number and size varying according to the size of the furnace and the intensity of the draft used. The distribution of the air in the mass of gases is thus rendered very uniform.

The air-chamber *a* may be provided against its inner wall with a circular channel 36, into which extend the heels of the plates *b* and *c*. The said channel being filled with water, the steam given off is carried along by the current of air and cools the grate. In order to make this cooling and preserving effect as energetic as possible, the water in the channel 36 should be kept at a constant level by means, for example, of the device shown in Figs. 17 and 18. Into the said device, located at the outside of the furnace, runs a continuous current of water through a pipe 37. A part of the said water passes into the channel 36 through a pipe 38, and the remainder runs over through a pipe 39 into the ash-pit and serves to extinguish the cinders falling into the same.

I claim—

1. In a furnace, a stationary annular casing forming an air-chamber, said casing being closed at the bottom and open at the top upon its inner periphery, a rotary grate held to move adjacent to said air-casing and having its fuel-carrying surface located at a lower level than the opening of the air-casing, and an annular flange extending upward from the periphery of the fuel-supporting surface to a point adjacent to the opening of the air-casing, to guide the air under the grate.

2. In a furnace, a stationary annular casing forming an air-chamber, said casing being closed at the bottom and open at the top upon its inner periphery, a rotary grate held to move adjacent to said air-casing and having its fuel-carrying surface located at a lower level than the opening of the air-casing, a border-flange rising at the periphery of the grate, and a supplementary flange resting on said border-flange and having an inclined inner surface flaring upwardly.

3. In a furnace, a stationary annular casing forming an air-chamber, said casing being closed at the bottom and open at the top and upon its inner periphery, a stationary horizontal cover extending over the open top of the casing and provided with apertures at intervals, to allow part of the air to escape upward, a rotary grate held to move adjacent to said air-casing, and means for directing the air issuing from the air-chamber under the rotary grate.

4. In a furnace, a rotary grate and supporting devices therefor, each supporting device comprising a stud provided with a flange or collar, a grate-supporting roller loosely mounted upon said stud, rings or sleeves arranged between the roller and the stud on opposite sides of the said flange, a cap secured to one end of the roller and covering the free end of the stud, and washers secured to the other end of the roller and engaging the stud.

5. In a furnace, a stationary annular casing forming an air-chamber, said casing being closed at the bottom and open at the top upon

its inner periphery, an annular water-trough within the upper portion of said casing and so located that the air passes over the surface of the water contained in the trough before issuing from the casing, and a rotary grate held to move adjacent to said air-casing.

6. In a furnace, a stationary annular casing forming an air-chamber, said casing being closed at the bottom and open at the top upon its inner periphery, an annular trough located within the upper portion of said casing and so located that the air passes over the surface of the water contained in the trough before issuing from the casing, a top plate or cover for said casing, provided with projections dipping into said trough, and a rotary grate held to move adjacent to the air-casing.

7. In a furnace, the combination of a rotary grate, a stationary annular plate surrounding the same, and disposed in close relation thereto, and a stationary air-casing having its outlet arranged immediately adjacent to the meeting edges of said grate and plate, to discharge air directly against said meeting edges.

8. In a furnace, a stationary annular casing forming an air-chamber, said casing having an air-inlet and being provided with an open top and with an air-outlet upon its inner periphery at the top, a stationary cover extending over the top of the casing and projecting inwardly beyond the same, and a rotary grate having a portion projected into the proximity of said cover and adjacent to the air-outlet of the casing, the air-outlet being so located as to discharge the air directly against the meeting edges of the grate and cover.

9. In a furnace, a stationary annular casing forming an air-chamber, said casing having an air-inlet and being provided with an open top and with an air-outlet upon its inner periphery at the top, a stationary cover extending over the top of the casing and projecting inwardly beyond the same, said cover consisting of a substantially horizontal lower section and a refractory upper section, and a rotary grate having a portion projected into the proximity of the lower section of the cover and adjacent to the air-outlet of the casing, the air-outlet being so located as to discharge the air directly against the meeting edges of the grate and cover.

Signed at Roubaix, France, this 26th day of April, 1900.

CHARLES GROLL.

Witnesses:
J. KONING,
ALFRED C. HARRISON.