No. 804,379. PATENTED NOV. 14, 1905.

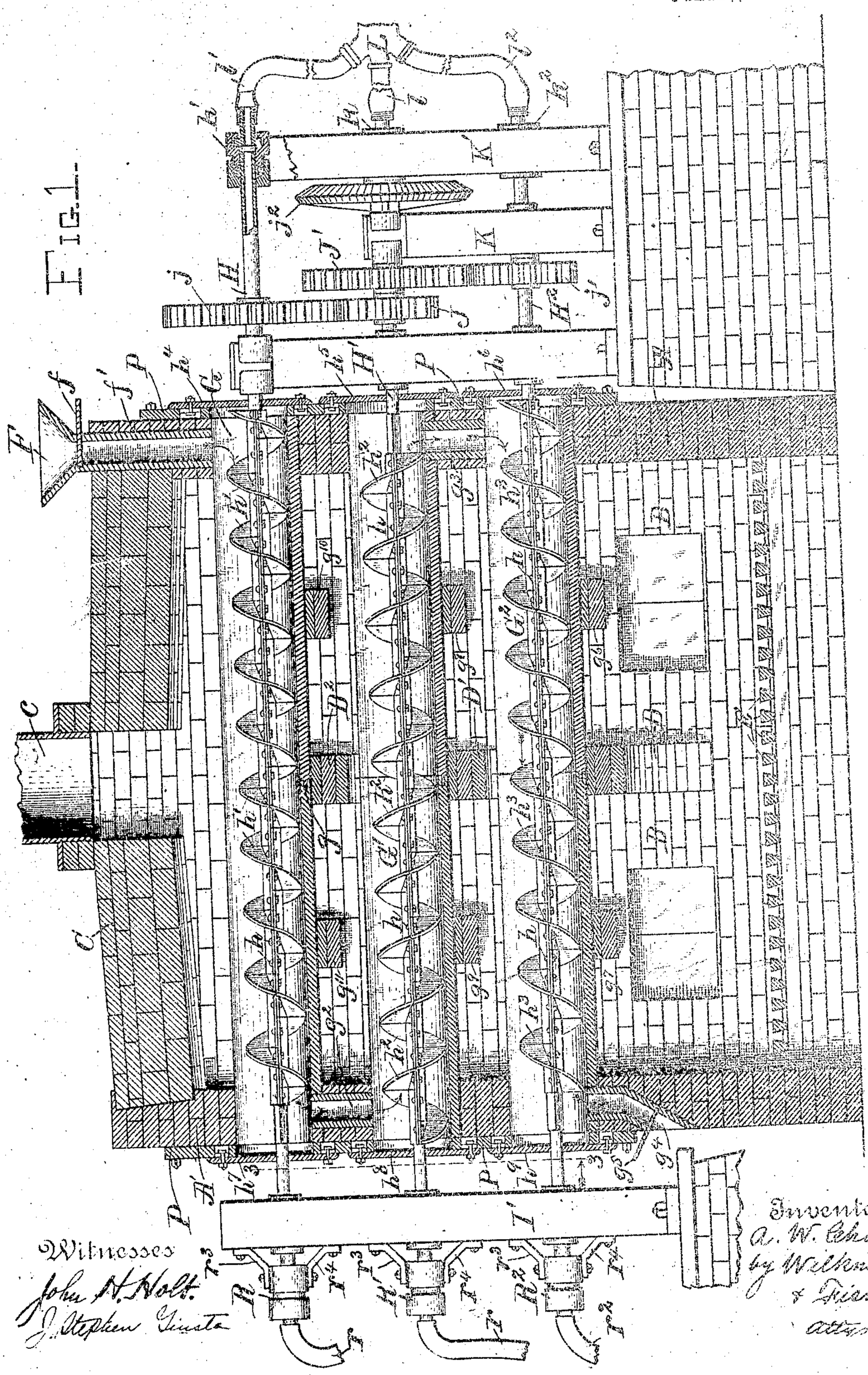
A. W. CHASE.

ROASTING FURNACE.

APPLICATION FILED MAR. 13, 1899. RENEWED MAY 22, 1905.

3 SHEETS—SHEET 1.

FIG. 1.



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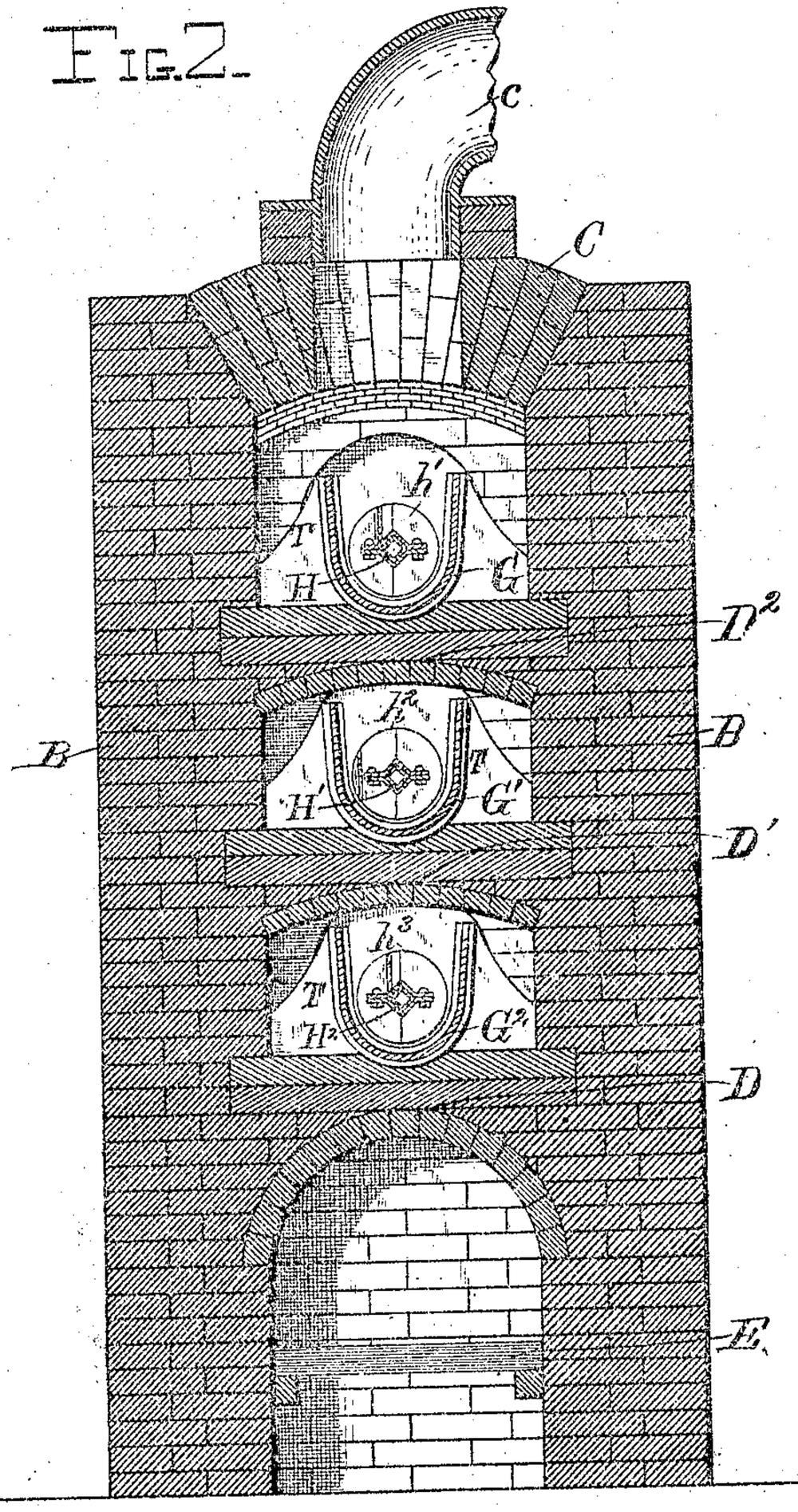
3 SHEETS--SHEET 2.

FIG. 2.



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3 SHEETS-SHEET 3.

FIG 3

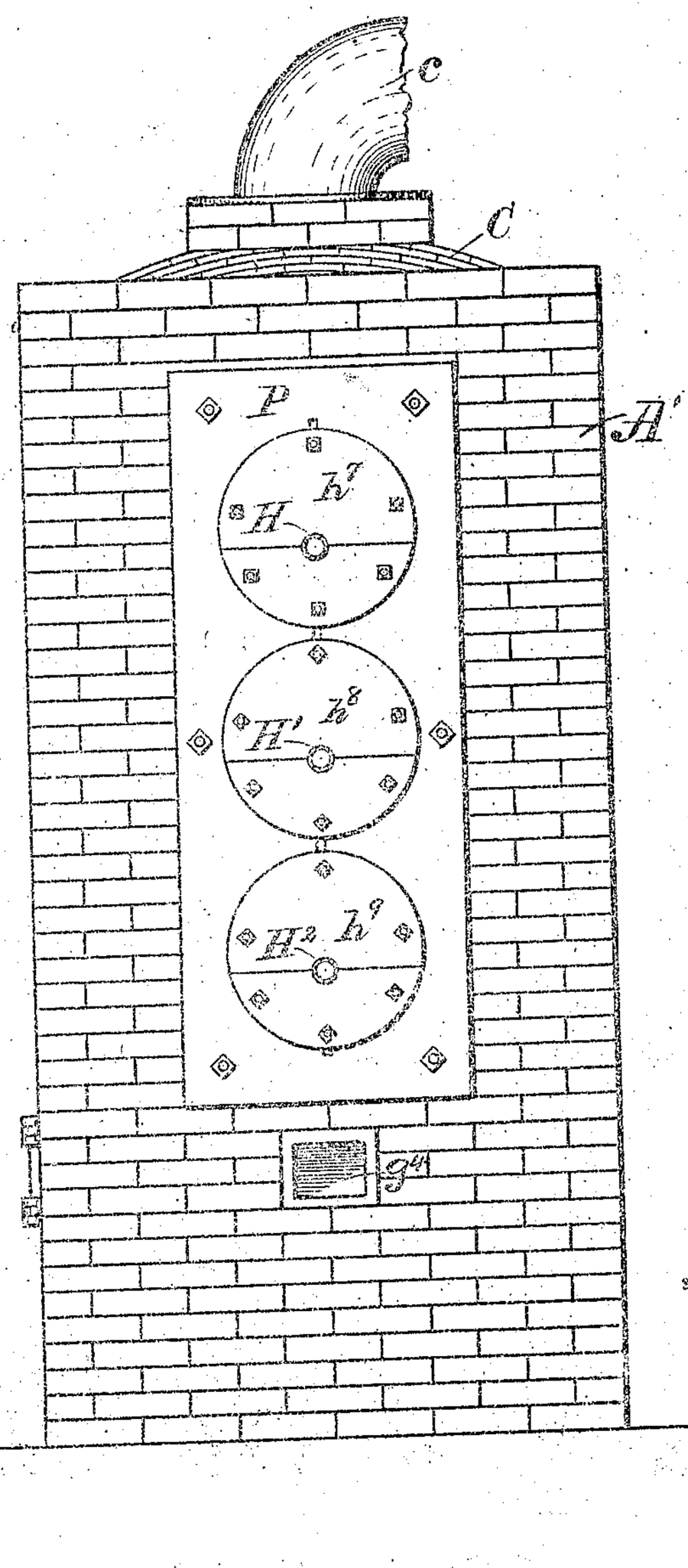

FIG 4

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UNITED STATES PATENT OFFICE.

ARTHUR W. CHASE, OF AVOCA, IOWA, ASSIGNOR TO THE CHASE FURNACE COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF DELAWARE.

ROASTING-FURNACE.

No. 804,379. Specification of Letters Patent. Patented Nov. 14, 1905.

Application filed March 13, 1899. Renewed May 22, 1905. Serial No. 261,666.

To all whom it may concern:

Be it known that I, ARTHUR W. CHASE, a citizen of the United States, residing at Avoca, in the county of Pottawattamie and State of Iowa, have invented certain new and useful Improvements in Roasting-Furnaces; and I do hereby 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 an improvement in roasting-furnaces, and is more especially designed for use in the treatment of sulfuret ores or "ash" therefrom obtained in the manufacture of sulfuric acid.

The object of my invention is to produce a compact and comparatively inexpensive furnace, one that will not clog in action, one in which the charge is freely exposed to heated air as well as to the heated products of combustion in the furnace, that will automatically feed and discharge, and be capable of handling commercially large quantities of the charge.

With these objects in view my invention consists in the constructions and combinations of parts, as hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a longitudinal central section of my improved furnace. Fig. 2 is a central cross-section of the same. Fig. 3 is a section on the line 3 3 of the same looking in the direction of the arrows in Fig. 1, and Fig. 4 shows a modification of the screw conveyer.

A A′ represent end walls of the furnace; B B′, the side walls; C, the top; D D′ D², the arched bridge-walls, and E the grate-bars.

In the top C is a pipe *c*, which leads either into a chimney or into a washer for removing the gases evolved in the roasting operation, which may be utilized by standard means well known in the art.

In the top of the wall A is a passage *f*′, which may be closed by a sliding valve *f* and which communicates with the hopper F, which is adapted to receive the charge to be roasted. The lower end of this passage communicates with a trough G, which is U-shaped in cross-section, open at the top, and made in sections dovetailed together, as shown at *g*. The trough G is supported at its outer ends by the walls A A′ and at the junction of the sections by the bridge-wall, as at D², and, if desired, between such supports by the cradle and cross-supports g^6 g^7 g^8 g^9 g^{10} g^{11}, the object being to fully support the troughs and their charges while exposing the maximum surfaces of troughs and charges to the action of the heated air and the furnace products of combustion. The furnace may be of any desired size, and the trough G may be composed of any desired number of sections; but it is desirable that outer ends of the troughs, the junctions of sections, and, where necessary, intermediate points on sections be supported, as shown. Below the trough G are similar troughs G′ G², supported by the outer walls, the bridge-walls D′ D, and the intermediate cradles and supports. Removable braces T are used to hold the troughs firmly in position. It is understood that I do not limit myself to three troughs, but may use any number.

A passage g^2 in the wall A′ connects the troughs G G′, and a similar passage g^3 in the wall A connects the troughs G′ G². Connected with one end of the trough G² is a discharge-passage g^4 in the wall A′, which is adapted to be closed by a sliding valve g^5. Suitable standards I I′ are located outside of the furnace, and journaled in these standards are hollow shafts H H′ H², one being located in each trough. These shafts are square in cross-section within the furnace and round outside of the furnace, and to the square portions of the same are fastened screw-conveyer flights h' h^2 h^3, made in sections and secured by bolts *h* or by set-screw, as shown in Fig. 4. The flights h' h^3 are pitched in one direction and the flights h^2 in the opposite direction.

h^4 h^5 h^6 h^7 h^8 h^9 are removable doors or closures bolted directly to plates P P′, provided with openings and removably attached to the furnace-walls A A′. Each closure is made in two parts which fit around the corresponding shaft. By this construction the interior parts of the furnace are made easily accessible. These plates are provided with vertical slots of somewhat greater width than the bolts of the closures h^4 h^5, &c., engaging therein for the purpose of allowing for the displacement of the troughs G G′ G² under the furnace heat or for general alinement of the conveyers and troughs when necessary.

The conveyer-flights h' h^2 h^3 are made either in two parts fitting around the shaft or in

suitable sections of complete pitches of the conveyer, or otherwise, secured in place on the shaft by the set-screws.

On the shaft H′ are mounted spur-wheels J J′, meshing, respectively, with similar gear-wheels j j' on the shafts H H². This gearing is so proportioned that the shaft H′ travels faster than the shaft H and the shaft H² faster than the shaft H′. This provision removes the material fed into the troughs G′ G² at a faster rate of travel and lesser stream than exists in the overlying trough. This not only obviates the possibility of clogging in the passages g^2 g^3, but provides that as the charge approaches the exit g^4, the furnace heat increasing as the charge is fed into lower troughs, the charge stream is of smaller cross-section, thus more largely exposing the particles of the same to the action of the heated air and products of combustion in the furnace. Two useful results are secured by this arrangement. In roasting sulfuret ores the first part of the roasting must be conducted slowly to secure the best results, while the final roasting can proceed much faster. In the first trough, therefore, a large amount of slowly turned and conveyed ore is present. The ore is in a thicker layer in the first trough than in the second, and so on through the series. In the last trough there is a very thin layer of rapidly-moving ore in the last stages of roasting. By this arrangement a much more efficient roasting is secured. The second useful result is that there is no choking. Since each conveyer travels faster than the one above it, it follows that the upper conveyer cannot push forward the ore too fast and choke the trough and connecting-pipe. This choking or clogging action in the case of finely-pulverized ore, such as applicant's furnace is designed to treat, is a serious drawback to all the ore-roasting furnaces now in the market, more especially with ores which have a tendency to frit or melt together, which often occurs during the operation of roasting.

On the shaft H′ is mounted the bevel gear-wheel j^2, which is driven by any suitable means. (Not shown.) Besides the standards I I′ other standards K K′ are provided, which aid in supporting the gearing and the stuffing-boxes k k' k^2, into which the pipes l l' l^2 deliver a cooling fluid from the main L.

The shafts H H′ H² pass through journal-boxes in the standard I′ and into stuffing-boxes R R′ R², secured to said standard by brackets r^3 r^4, which are bolted to the standard and to the stuffing-boxes. Pipes r r' r^2 are connected to the stuffing-boxes R R′ R² and serve to discharge the water or other fluid which passes through the shafts H H′ H².

The operation is as follows: The crushed ore or other material that it is desired to roast is fed into the hopper F and delivered through the passage f' after the furnace has been heated up and the conveyers set in motion. The charge is gradually fed forward by the conveyer-flights h' and is continually turned and stirred, fresh surfaces being continually subjected to the action of heated air and the products of furnace combustion or being in contact with the heated trough or conveyer. When the charge reaches the other end of the troughs G, it falls through the passage g^2 into the trough G′, where the roasting operation is continued. The charge then falls through the passage g^3 into the trough G² and finally passes out through the passage g^4.

It is seen that in roasting a charge during the preliminary heating and roasting in the trough G the cross-section of the moving charge is the largest and that as the charge is more highly heated and the escape of gaseous compounds becomes relatively greater in the lower troughs the cross-section of the charge is somewhat less, facilitating the escape of the gases when this is a desirable feature, as well as subjecting the particles of the charge to an increasing temperature, due to heated air and products of furnace combustion and more frequent contact with the heated trough and conveyer. The size of the furnace, the speed of the conveyers both in travel of the charge and relatively to each other, and the degree of heat used are so regulated that when the charge passes out of the furnace it is completely roasted.

It is obvious that many changes within the scope of the claims might be made without departing from the spirit of my invention, and I wish it to be expressly understood that I do not limit myself to the exact details shown and described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a roasting-furnace the combination of a series of troughs, located one over the other and arranged to feed from one to the other, conveyers in said troughs, means for operating said conveyers, said means being so proportioned as to drive the several conveyers at rates of speed increasing from the top to the bottom of the furnace, substantially as described.

2. In a roasting-furnace, the combination of a series of troughs, located one above the other and arranged to feed from one to the other, conveyers in said troughs provided with hollow shafts, means for driving said conveyers at increasing rates of speed from the top downward and independent means for supplying a cooling fluid to said hollow shafts, substantially as described.

3. In a roasting-furnace, the combination of a series of troughs, each trough being U-shaped in cross-section and composed of fire-clay sections, conveyers provided with hollow shafts located in said troughs, means for driving said shafts at increasing rates of speed

from the top downward, and means for supplying a cooling fluid to said hollow shafts, substantially as described.

4. In a roasting-furnace, the combination of end walls having passages therein, side walls, bridge-walls, U-shaped troughs, supported by said end walls and made in sections, conveyers in said troughs, provided with hollow shafts, means for driving said conveyers at increasing rates of speed from the top downward, and means for supplying a cooling fluid to said hollow shafts, substantially as described.

5. In a roasting-furnace, the combination of end walls, having passages therein and openings therethrough, sliding valves for some of said passages, side walls, bridge-walls, U-shaped troughs composed of fire-clay sections and supported on said end walls, conveyers, each composed of a hollow shaft and sectional flights secured thereto, located in said troughs, means for driving said conveyers at increasing rates of speed from the top downward, means for supplying a cooling fluid to said hollow shafts, and removable doors or closures for the openings in the end walls, substantially as described.

6. In a roasting-furnace, the combination of end walls, provided with openings, bridge-walls, a series of U-shaped troughs supported by said end walls, conveyers in said troughs, means for driving said conveyers, a plate provided with circular openings adapted to fit around the openings in the end walls, said plate being provided with slots, and removable plates each made in two sections fitting around the conveyer-shafts and adapted to close the openings in the end walls, said plates being adjustably secured to the first-named plate, substantially as described.

7. In a roasting-furnace, the combination of a series of troughs, conveyers in said troughs having hollow shafts, means for driving said conveyers at increasing rates of speed from the top downward, a plurality of bearings for each shaft on the driving side, preventing warping of the shafts and their displacement by the driving mechanism, and means for delivering a cooling fluid to said hollow shafts, substantially as described.

8. In a roasting-furnace, the combination of a series of troughs, arranged one above the other, conveyers in said troughs and gearing adapted to drive said conveyers at increasing rates of speed from the top downward, substantially as described.

9. In a roasting-furnace, the combination of end walls, bridge-walls each composed of a fixed arch and support, and a removable cradle, troughs supported by said end walls and cross-supports and removable chocks or braces for supporting said troughs firmly in position, substantially as described.

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

ARTHUR W. CHASE.

Witnesses:

J. STEPHEN GIUSTA,

JOHN H. HOLT.