(No Model.) 4 Sheets—Sheet 1.

T. M. CHATARD.

ROASTING FURNACE.

No. 541,718. Patented June 25, 1895.

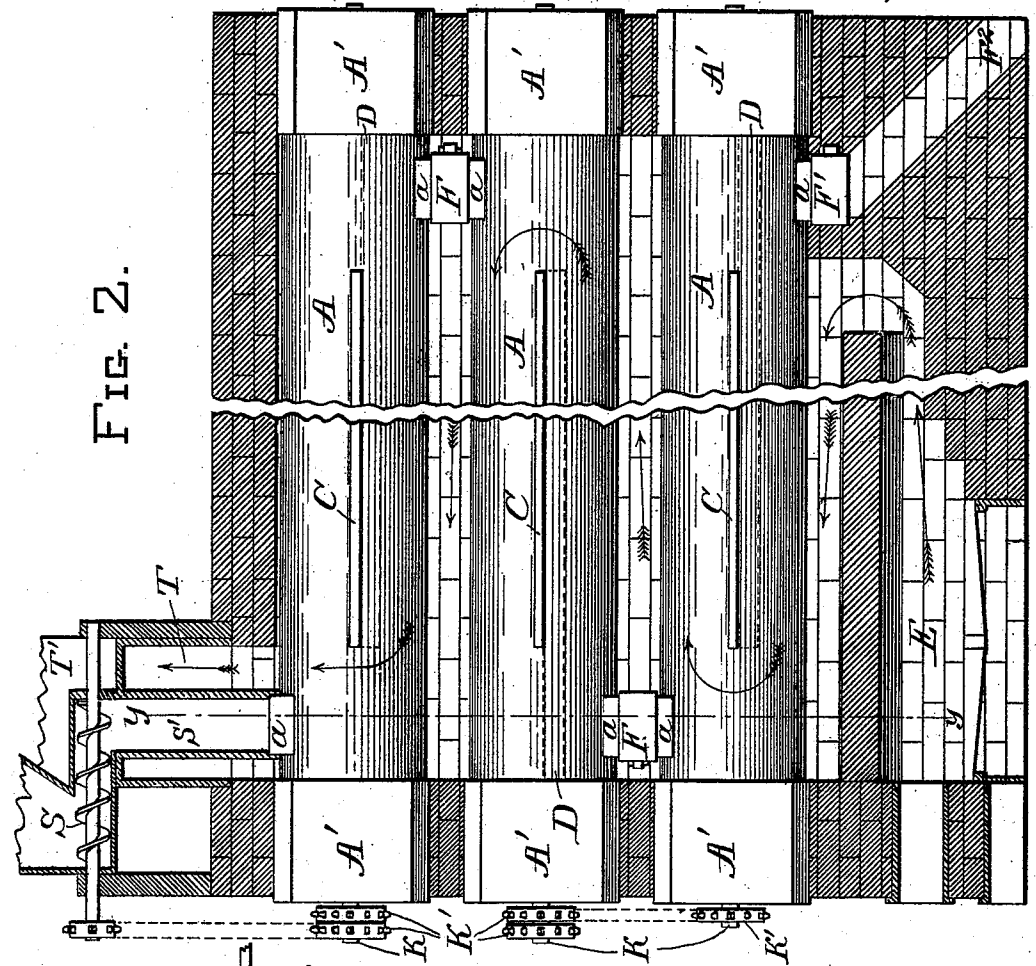

FIG. 2.

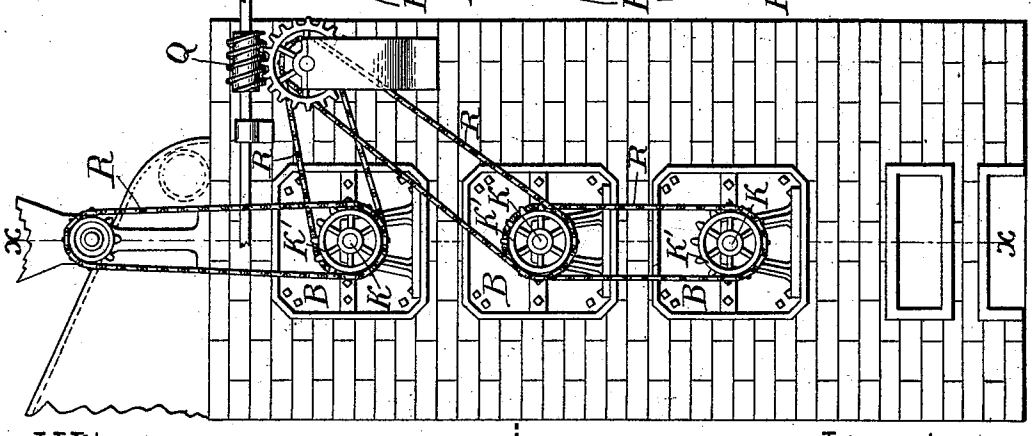

FIG. 1.

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(No Model.) 4 Sheets—Sheet 2.

T. M. CHATARD.

ROASTING FURNACE.

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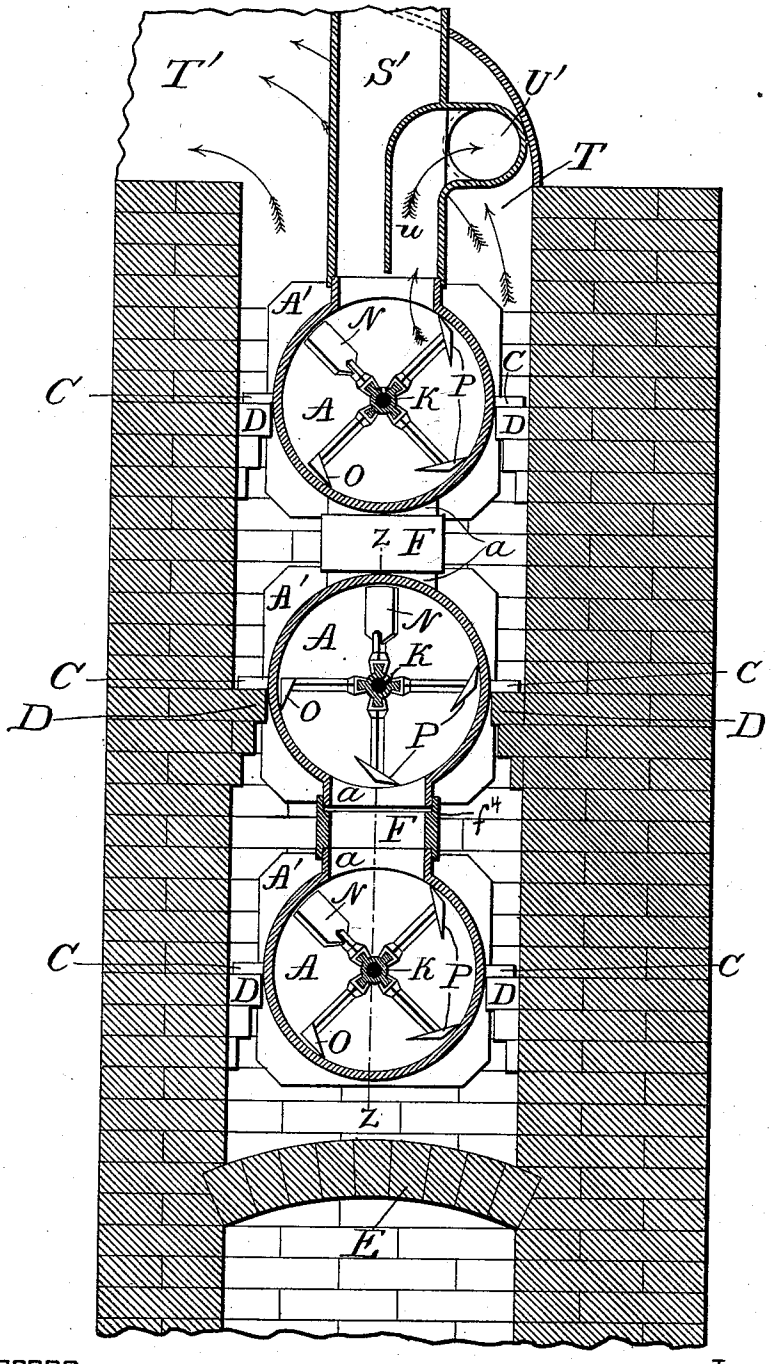

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FIG. 3.

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(No Model.) 4 Sheets—Sheet 3.

T. M. CHATARD.

ROASTING FURNACE.

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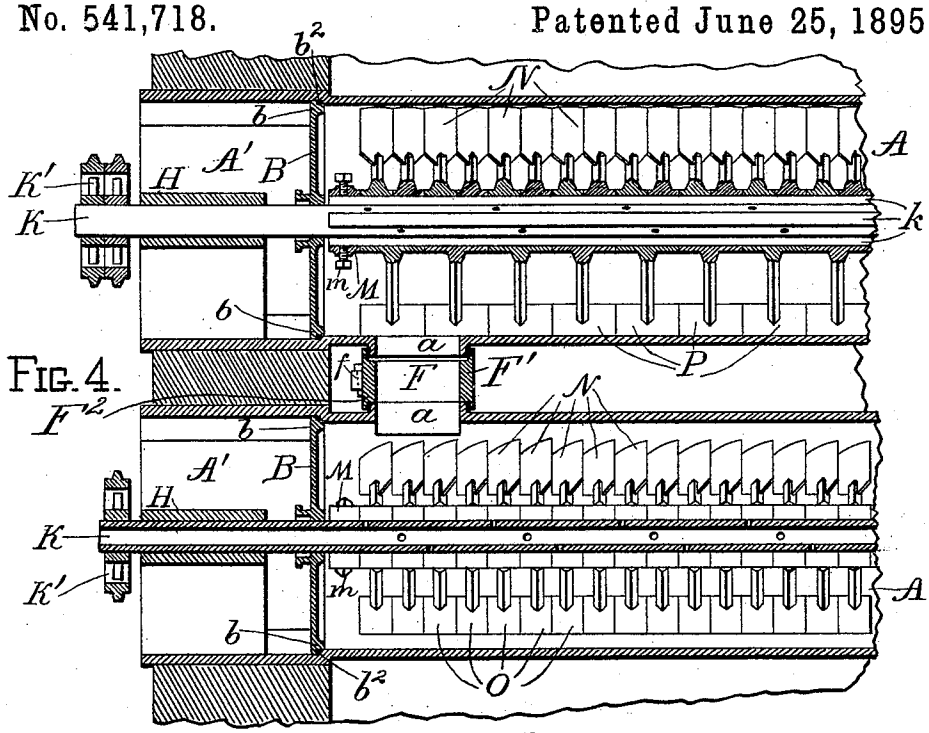
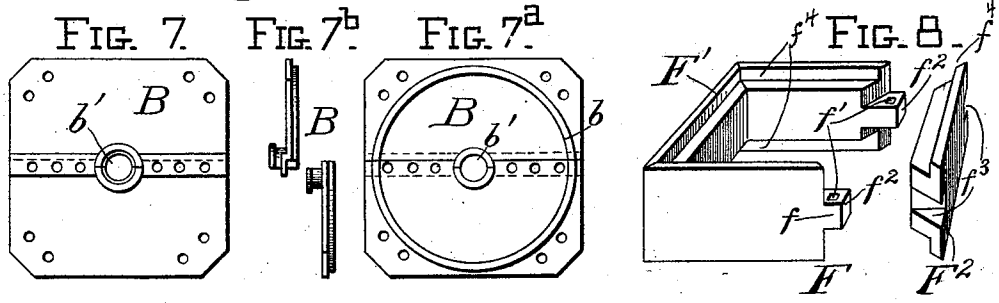
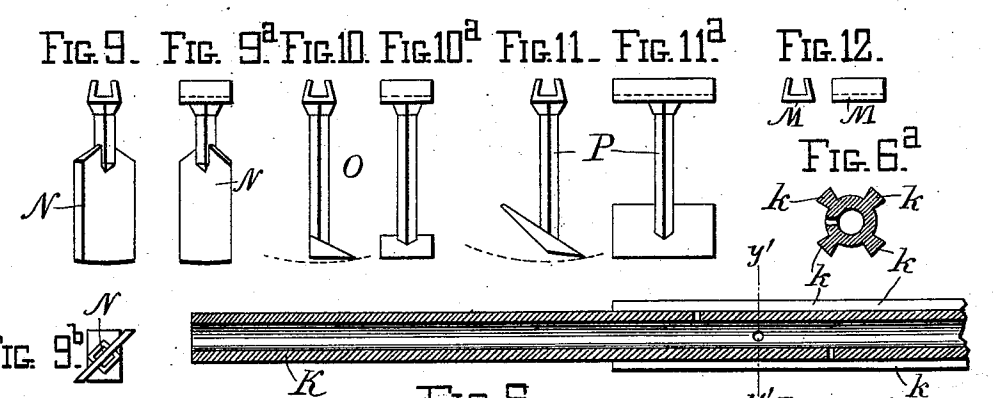


FIG. 4.





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4 Sheets—Sheet 4.

T. M. CHATARD.

ROASTING FURNACE.

No. 541,718. Patented June 25, 1895.

FIG. 4a

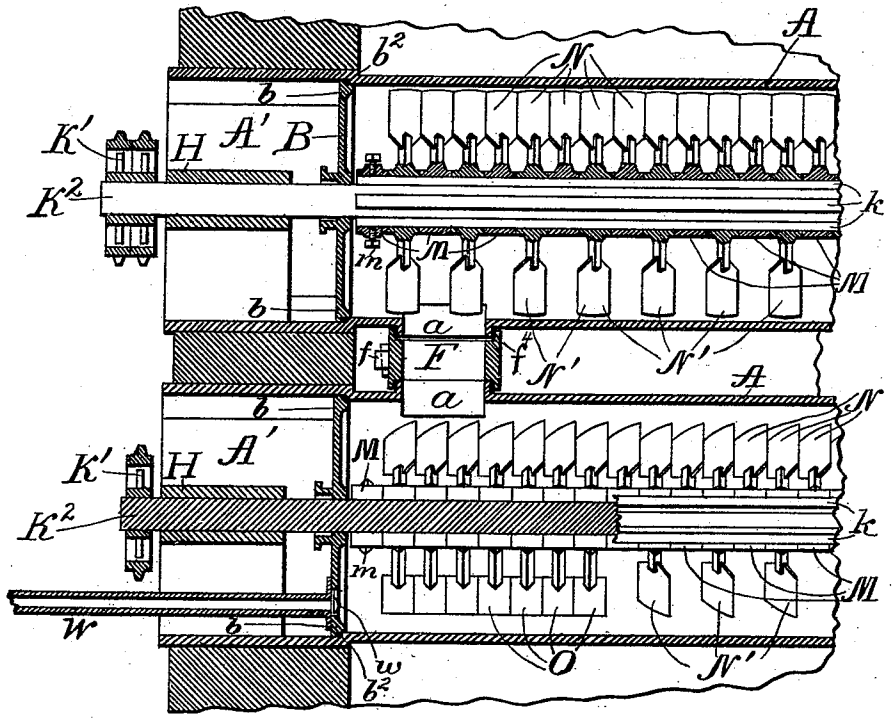
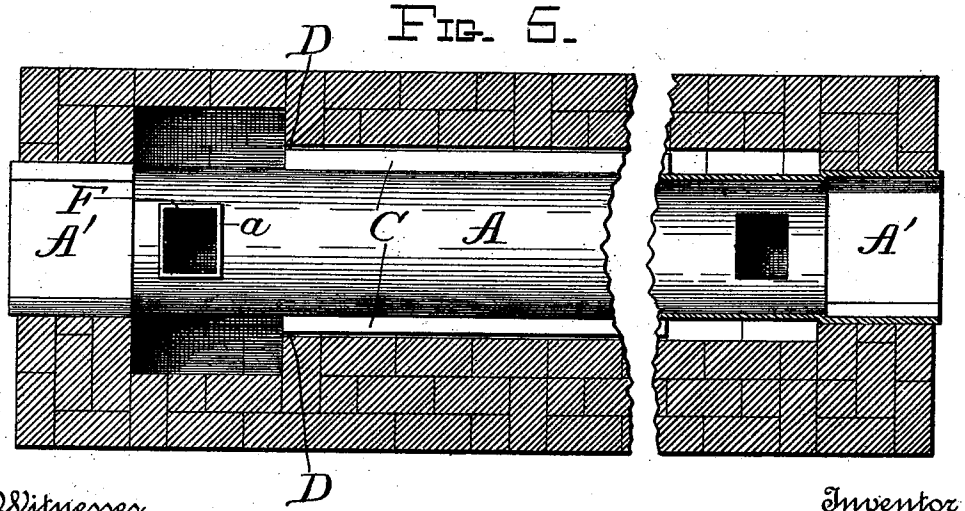


FIG. 6.



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John C. Wilkinson

Inventor
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UNITED STATES PATENT OFFICE.

THOMAS M. CHATARD, OF WASHINGTON, DISTRICT OF COLUMBIA.

ROASTING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 541,718, dated June 25, 1895.

Application filed March 18, 1893. Serial No. 466,677. (No model.)

To all whom it may concern:

Be it known that I, THOMAS M. CHATARD, a citizen of the United States, residing at Washington, in the District of Columbia, 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.

This invention relates to roasting furnaces, and has for its object the construction of a continuously operating, mechanical furnace in which the necessary stirring and conveying of the material to be roasted shall be accomplished with great simplicity of parts and efficiency of action.

It is well known to those skilled in the art that, given the proper degree of heat for a roasting process, the quality of the product will depend upon the regularity and thoroughness with which the stirring is performed, and the length of time during which the material is exposed to the temperature. Furthermore, that if the gases, given off by the material during the roasting are to be utilized, it is necessary to regulate the supply of air or steam or both, or of any other gases which may be needed in the process.

In the accompanying drawings in which similar letters refer to similar parts throughout the several views,—Figure 1 is a front elevation of the furnace, showing the arrangement of the roasting-chambers and the gearing for operating the same. Fig. 2 represents a section of the furnace along the line $x\ x$ of Fig. 1, the roasting-chambers and their connecting-sleeves being shown in elevation. Fig. 3 is a vertical section of the furnace along the line $y\ y$ of Fig. 2. Fig. 4 is a longitudinal section along the line $z\ z$ of Fig. 3. Fig. 4^a represents a similar section to Fig. 4, and represents a modification of the device shown in Fig. 4. Fig. 5 represents in sectional plan one of the roasting-chambers in the furnace. Fig. 6 is a longitudinal section of one of the hollow shafts shown in cross-section in Fig. 4, which shafts carry the devices for stirring and conveying the material to be roasted. Fig. 6^a is a cross-section of the same shaft along the line $y'\ y'$. Fig. 7 is a front view and Fig. 7^a a rear view of one of the sectional end plates which close the ends of the roasting-chambers. Fig. 7^b is a side view of the same end plate, showing its sectional construction. Fig. 8 is a perspective view of one of the connection sleeves or boxes used to connect the roasting-chambers. Fig. 9 is an end view of a conveyer-blade as it will appear when placed on the shaft, as seen along the axis of the shaft. Fig. 9^a is a side view and Fig. 9^b a bottom view of the blade shown in Fig. 9. Fig. 10 is an end view and Fig. 10^a a side view of a stirring device which may be attached to the revolving shaft. Fig. 11 is an end view and Fig. 11^a is a side view of a lifting device which may be attached to the revolving shaft. Fig. 12 comprises an end and a side view of a "blank," the purpose and manner of use of which will be later described.

The end chambers A′ of the roasting chambers A are open and have the form of a square with truncated corners forming an octagon. These end chambers are separated from the body of the chamber A by an end plate B. The interior diameter of the cylindrical part of the roasting chamber is less than that of the octagonal ends, thus forming a shoulder to which the end plate B is applied and bolted.

The exterior of the cylindrical portion of each roasting chamber is provided with two opposite ribs C which extend along a certain portion of its length but stop short of its ends. These ribs support the roasting chamber and rest upon the flue walls, D. These flue walls are arranged zig zag as shown in dotted lines in Fig. 2, and the arrows in the said figure show the direction taken by the products of combustion from the fire box E. This fire box is shown in the simplest form, but in practice any desired mode of firing can be employed.

The roasting chambers A are supported by the side flue walls D, and not by the end walls. With this mode of construction, the side and flue walls can be completed as shown in Fig. 3, and then each roasting chamber can be lowered into place by turning it through an angle of ninety degrees as it can then pass between the flue walls. When it has reached the flues upon which it is to lie, it is turned

back into its original position, placed on the flue walls and lined up. The connection sleeves F are then put into place. These sleeves are preferably made of the form shown in Fig. 8, wherein F′ represents a three sided rectangular casting and F^2 represents a detachable fourth side adapted to be secured to the part F′ by pins or wedges *f* through the holes *f′* in the lugs f^2 which pass through corresponding slots in the part F^2. A rabbet or groove f^4 is provided in the top and bottom of this sleeve to receive the flanges or boxings *a*. The joints between the sleeves and the flanges or boxings *a* on the exterior of the chambers can be made tight by any fireproof packing. Finally the open spaces of the end walls between and around the octagonal ends A′ of the chambers are walled up. Should any of the chambers become damaged, this walling can be taken out and the defective chamber removed by reversing the operation just described. Moreover, as each chamber is divisible horizontally into two symmetrical halves should the bottom of any one of the chambers be injured it can still be used by withdrawing it from the furnace reversing it, turning it end for end and replacing it. Moreover, when the bottom chambers which are subjected to the highest heat show signs of wearing out, they can be moved up and the top chambers moved down. The life of a chamber is thus much increased and the cost proportionately lessened. When the chambers are thus put into position as described, the lower half of each end plate B is bolted into its place, the joint between the plate and the end of the cylindrical portion of the chamber being made tight by a gasket b^2 of asbestos or any other suitable material. The journal-blocks H are then placed one in each open octagonal end A′ of the roasting chamber, and lined up, and a shaft is then put into position in each chamber. This shaft may be either hollow as shown at K in Figs. 4 and 6, or solid as shown at K^2, in Fig. 4^a. If it be hollow it may have the perforations *k′* as shown for the admission of air or other gas, or the air or gas may be admitted through a separate pipe W and valve *w* as shown in Fig. 4^a. The shaft is furnished with longitudinal ribs for a space nearly equal to the length of the cylindrical portion of the roasting chamber. The ribs can either be cast solid with the shaft or attached afterward, as may be preferred. The number of ribs can be varied to suit the size of the shaft and the proportions of the furnace. The cross section of the ribs may have any desired form but the keystone section shown in Fig. 6^a is preferable, wherein *k* represents one of four dove-tailed ribs.

The shafts being in position, the tops of the journal boxes are adjusted and the sprocket wheels or pulleys K′ are put on. A blank M, is then placed on the front end of each rib and fastened by a set screw *m* as shown in Fig. 4. The conveyer blades N, as also the stirrers O and the lifters P are then arranged in their proper places by sliding them along the ribs *k* from back to front. The blade of each conveyer being set at an angle to the axis of the shaft, the revolution of the latter causes the material to be propelled to the front or the rear of the chamber according to the manner in which the blade is slid upon the rib. A full row of blades being placed upon a rib as shown in Fig. 4, each revolution of the shaft propels the entire contents of the chamber toward the opening in the bottom above the connection sleeve F, the rate of progress being regulated by the speed of the shaft. If a slower rate of progress be desired at any part of the furnace thus exposing the material to a certain degree of heat for a longer period of time, this can be done without varying the rate of shaft speed, namely, by setting on one of the other ribs, other conveyer blades N′ put on in reverse direction as shown in Fig. 4^a. It is evident that if the number of such reversed blades equals that of the first series the material cannot progress at all, since what is thrown forward by the first series is thrown back by the second. If, however, a less number of reversed blades be employed as shown in Fig. 4^a, the spaces between them being filled by the blanks M, a certain proportional retardation will take place. If it be desired to retard the passage of the material being roasted at any given part of a roasting chamber, as over the hearth of a furnace, the blades may be reversed at that part of the chamber only as shown in the lower chamber of Fig. 4^a. Similarly, if these extra blades are put on but not reversed a local acceleration will result.

The stirrers O and lifters P are put on in the same manner as the conveyer blades. As each row of devices is completed, a blank is slipped over the end of the rib and secured with a set screw thus holding the end of the row against pressure axially. When all the rows for any one chamber are made up, the upper halves of the end plates B are then put on and made tight in the same manner as was done with the lower halves, the two halves being bolted together as shown in Figs. 1 and 7.

Fig. 7^a which is the rear view of the device shown in Fig. 7 shows a circular flange b^2 which fits loosely into the circular end of the roasting chamber A, and gives the plate additional strength.

Any desired alteration or replacement of any of the working devices can thereafter be effected by merely taking off the rear upper half end plate, loosening the end blank and making the desired changes. As the devices slide loosely on the ribs any damaged ones can be easily reached and replaced.

The annular space *b′*, Fig. 7, surrounding the shaft can be filled with packing, a packing ring being used, if desired. The object of thus packing all of the joints is to prevent the

escape of the roaster gases into the works and consequent loss of useful material, injury to plant, and annoyance to workmen. The air necessary for the roasting process is introduced either through the hollow perforated shafts K, as shown in Fig. 4, or else through the pipe W and valve *w* as shown in Fig. 4ª. In either case the air is delivered under pressure and the supply regulated by valves or cocks. Not shown. Steam if desired, can be introduced with the air.

In Figs. 1 and 2 the worm gear Q, the chains R and sprocket wheels K, the feeding device S, feeding throat S′, gas flue T, and smoke pipe T′ indicate the general nature and arrangement of these parts; but any other appropriate forms may be employed and their arrangement will always depend upon local conditions.

In beginning the operation of the furnace, the fire is started and the shafts put in motion. The mechanical feeder S^2 begins to deliver the material which passes through the chambers continually, being stirred and becoming hotter until it is discharged through the sleeve F′ and opening F^2 at the rear of the lowest chamber. The stirrers, a row of which should immediately precede the row of conveyer blades, loosen the material breaking up any lumps and detaching any portions which may adhere to the bottom of the chamber. It is evident that the amount of working over that the material will get for each revolution of the shaft will depend upon the number of rows of lifters and stirrers, which number may be increased or diminished as desired in different parts of the same furnace. Air, (steam also if required,) is introduced into the lowest chamber and if necessary into the others also. The amount of air introduced will depend upon the use to which the roaster gases are to be put; but as the material is in constant agitation it will be found that the oxidation is much more rapid and thorough and the roaster gases stronger than that delivered from the other forms of roaster now most commonly in use. The roaster gases after rising through the various chambers *seriatim*, escape through the flues U and U′ shown in Fig. 3.

It will be seen that, by this method of fitting the shaft and the working devices attached thereto, any desired degree of speed of progression and of thoroughness of working over can be obtained, without necessitating any variation in gearing or shaft speed; and also that forward or backward motion of the material may be secured without altering the direction of revolution of the shaft. Moreover these results are obtained by the use of but a few very simple patterns for castings, all of which are interchangeable and broken parts can be easily and rapidly replaced. It is also evident that this same mode of construction and attachment can be employed in any of the allied forms of apparatus for drying or for calcining purposes.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus of the character described, the combination with a roasting chamber, of a shaft journaled therein, and provided with axial ribs, and a plurality of working devices arranged in series on each rib and having shanks adapted to slide along the said ribs and to be held thereon, substantially as and for the purposes described.

2. In an apparatus of the character described, the combination with a roasting chamber of a central shaft journaled therein and provided with dovetailed axial ribs, and a plurality of conveyer blades and stirring devices arranged in series on each rib and having shanks adapted to slide along said ribs, and to be held thereon, substantially as and for the purposes described.

3. In an apparatus of the character described, the combination with a roasting chamber and a shaft journaled in said chamber of a plurality of conveyer blades connected thereto, for the purpose of pushing the material forward, and a less number of similar blades mounted on the said shaft and set in the reverse direction for the purpose of retarding and at the same time assisting in stirring the said material, substantially as described.

4. An apparatus of the character described, comprising a furnace provided with flue walls; a plurality of symmetrical reversible roasting chambers connected to each other, each of said chambers being provided with axial ribs on opposite sides, the said ribs resting on the said flue walls and supporting said roasting chambers, and means for stirring and conveying the material in and through said chambers, substantially as and for the purposes described.

5. An apparatus of the character described, comprising a furnace provided with flue walls; a plurality of symmetrical reversible roasting chambers connected to each other, each of said chambers being provided with axial ribs on opposite sides, the said ribs resting on the said flue walls and supporting said roasting chambers, shafts journaled in said chambers, and provided with axial ribs, and conveyer blades and stirring devices provided with shanks adapted to slide on said ribs and to be held thereon, substantially as and for the purposes described.

6. In an apparatus of the character described, a reversible roasting chamber A provided with square ends A′ having the edges truncated, and ribs or wings C, along the central portion thereof, substantially as and for the purposes described.

7. In an apparatus of the character described, a reversible roasting chamber having symmetrical ends, and ribs or wings extend-

ing axially along opposite sides of the central portion thereof for the purpose of supporting the said chamber when turned in either direction or upside down, substantially as and for the purposes described.

8. In an apparatus of the character described, the combination with two roasting chambers provided with rectangular openings and a boxing *a* surrounding the said openings of a device for connecting the said rectangular openings consisting of a rectangular sleeve F′ formed of the two detachable parts F′ and F^2 each grooved at f^4 and adapted to receive the boxing *a* of the roasting chambers, substantially as and for the purposes described.

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

THOMAS M. CHATARD.

Witnesses:
JOHN CHALMERS WILSON,
PERCY C. BOWEN.