

[54] **RABBLING MEANS AND METHOD FOR A FURNACE HEARTH**

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[22] Filed: **May 21, 1973**

[21] Appl. No.: **362,335**

[52] U.S. Cl. **432/18, 432/22, 432/142**

[51] Int. Cl. **F27b 9/16, F27b 1/02**

[58] Field of Search **432/18, 22, 142**

[56] **References Cited**

UNITED STATES PATENTS

1,251,692 1/1918 Pomeroy 432/151 X

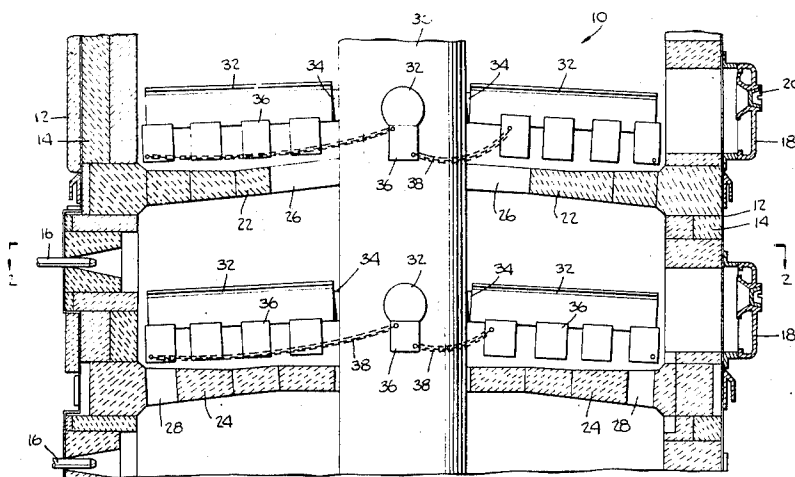
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[57]

ABSTRACT

Method and Apparatus for distributing solid material over a furnace hearth in a multiple hearth furnace having a plurality of vertically spaced hearths, a rotatable center shaft extending up through the center of the furnace and passing through each hearth, a plurality of spaced rabble arms secured to the center shaft extending radially outwardly over each hearth, a chain disposed between rabble arms associated with the uppermost of the hearths for moving the material being processed when the center shaft is rotated, alternate hearths having drop holes disposed towards the center shaft and the other hearths having drop holes disposed towards the outer periphery thereof so that when the center shaft is rotated the material being processed is moved across the hearth to its drop hole and drops down to the next lower hearth.

7 Claims, 5 Drawing Figures



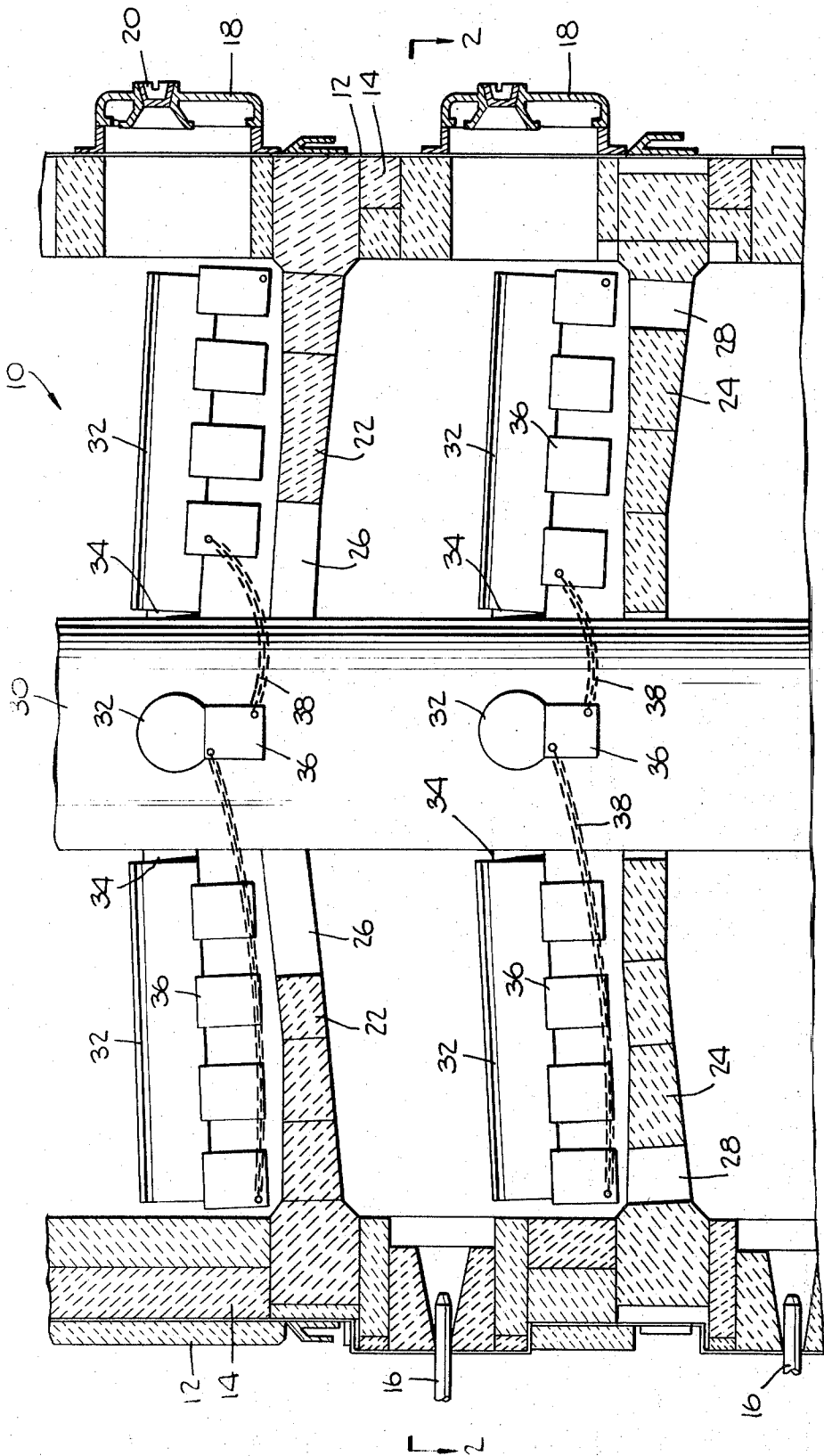
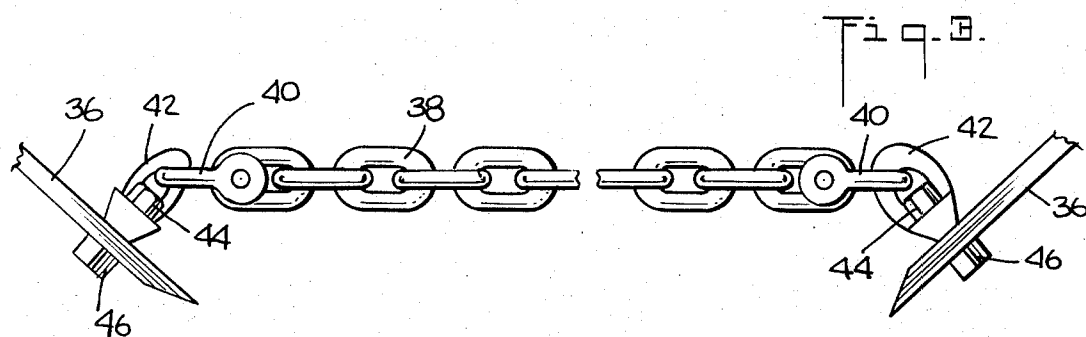
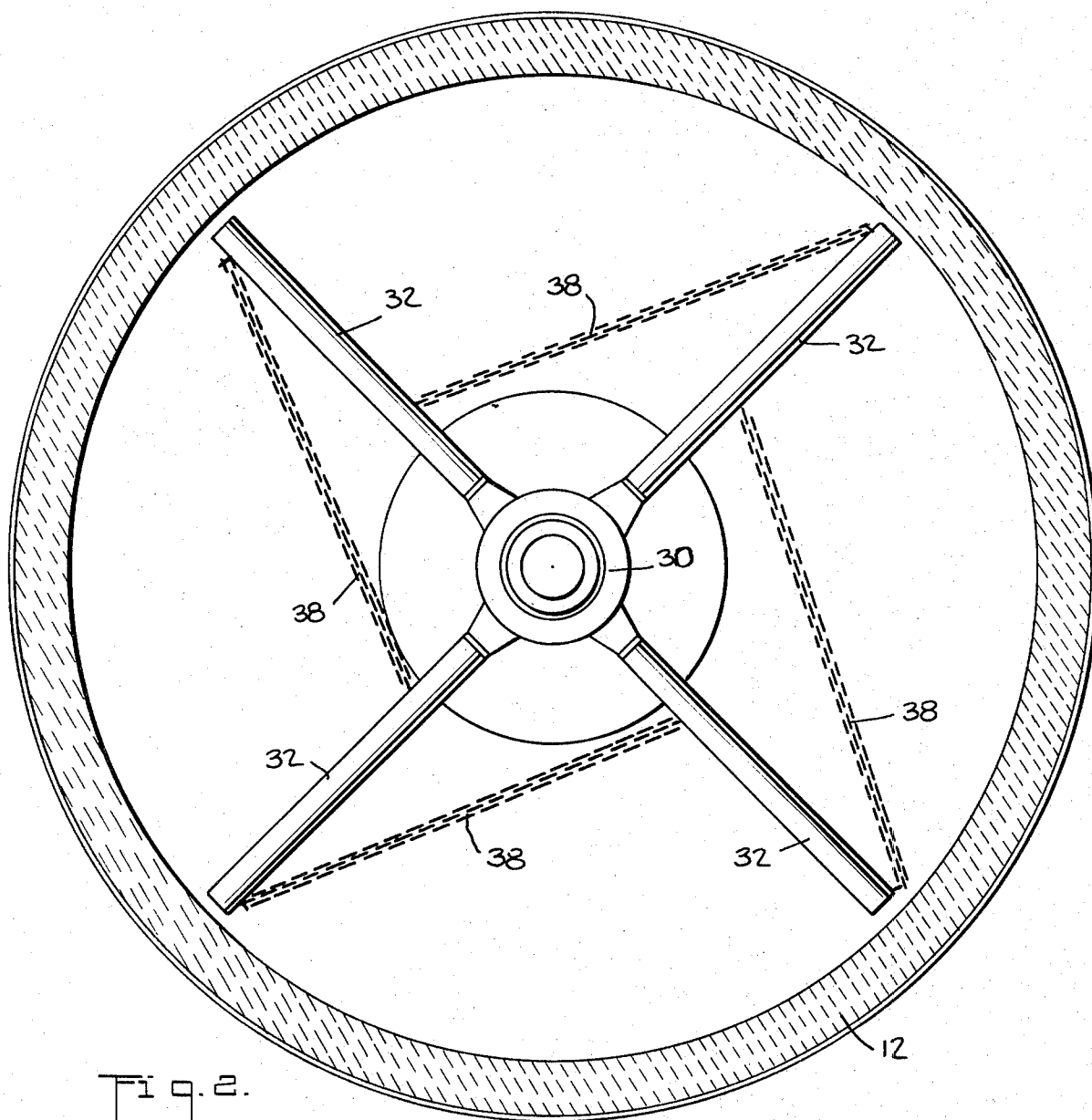


Fig. 1.



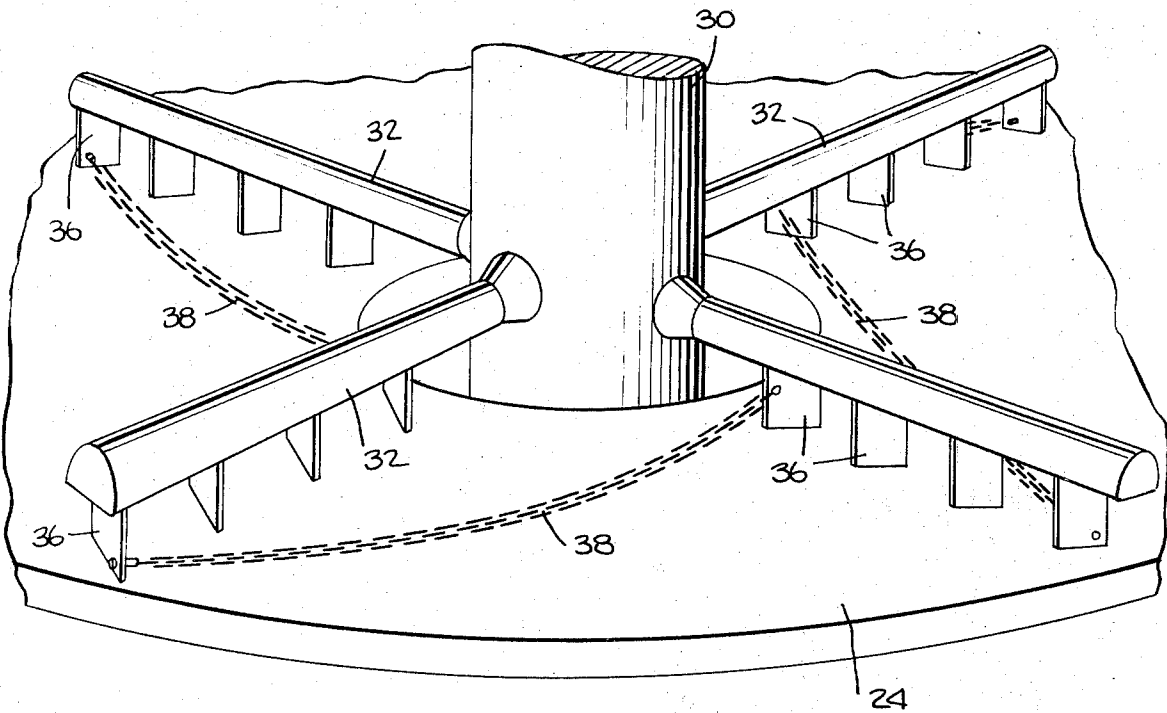


Fig. 4.

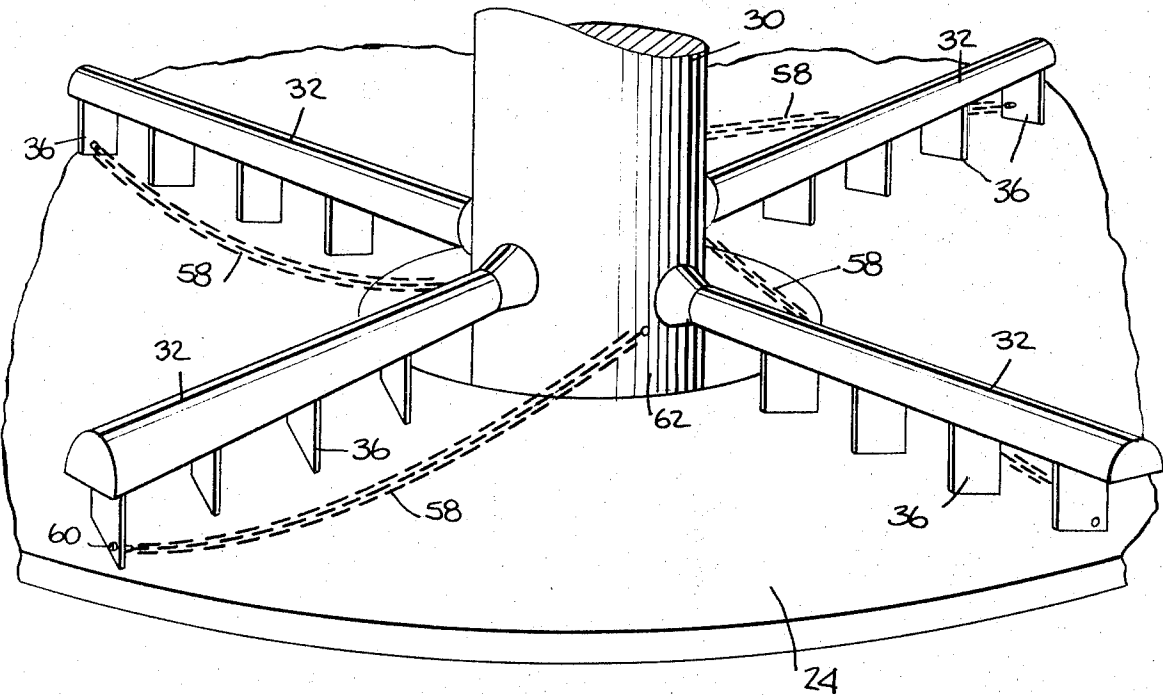


Fig. 5.

RABBLING MEANS AND METHOD FOR A FURNACE HEARTH

This invention relates to furnaces and more particularly to method and means for distributing solid material being processed over a furnace hearth. Apparatus constructed in accordance with the concept of this invention is particularly adapted, among other possible uses, for use in multiple hearth type furnaces having a plurality of vertically spaced hearths, such as are used for processing sewage sludge, for example.

Many different types of apparatus have been employed heretofor for moving solid material across the hearths of a multiple hearth furnace such as rabble teeth and disks, for example. Also, chains have been used for decreasing the load on the center shaft. My contribution to the art is a new apparatus which is an improvement over such apparatus employed heretofore, as will become apparent as the description proceeds. Related patents in this art include U.S. Pat. No. 3,153,633 issued Oct. 20, 1964, U.S. Pat. No. 3,379,622 issued Apr. 23, 1968; U.S. Pat. No. 3,419,254 issued Dec. 31, 1968; U.S. Pat. No. 1,251,692 issued Jan. 1, 1918; U.S. Pat. No. 1,879,680 issued Sept. 27, 1932; U.S. Pat. No. 2,067,823 issued Jan. 12, 1932; U.S. Pat. No. 2,117,487 issued May 17, 1938; U.S. Pat. No. 2,138,120 issued Nov. 29, 1938; U.S. Pat. No. 2,696,377 issued Dec. 7, 1954.

I have found that it is desirable to evenly distribute the material being processed across the hearth. In order to accomplish the desired results, I provide in one form of my invention, a new and improved apparatus for distributing solid material over a furnace hearth in a multiple hearth furnace. This furnace has a plurality of vertically spaced hearths, and is characterized by the combination of a rotatable center shaft extending up through the center of the furnace, a plurality of spaced rabble arms secured to the center shaft, which extend radially outwardly over each hearth. A rabble chain is disposed between the rabble arms associated with the uppermost of the hearths to move the material being processed when the center shaft is rotated. Drop holes are provided in each hearth, either in toward the center shaft or out toward the furnace wall so that when the material completes its movement over a hearth, it will drop down onto the next lower hearth.

According to one form of the invention, the ends of the rabble chain are connected between the outer end portion of one rabble arm and the inner end portion of the adjacent rabble arm, and in another form of the invention, one end of each chain is connected to the center shaft and the other end thereof is connected to the rabble arm.

According to still another form of the invention, I provide a method of continuously processing solid material in a multiple hearth furnace having a plurality of vertically spaced hearths, a rotatable center shaft extending up through the center of the furnace and passing through each hearth, a plurality of spaced rabble arms secured to the center shaft and extending radially outwardly over each hearth, a chain disposed between the rabble arms associated with the uppermost of said hearths, alternate hearths being provided with drop holes either toward the center shaft or out toward the furnace wall, the method being characterized by the steps of continuously introducing the material at the top of the furnace and evenly moving the material

across the uppermost hearth by virtue of the movement of said chain to its drop hole, and dropping the material down through the drop hole onto the next lower hearth.

There has thus been outlined rather broadly the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described more fully hereinafter. Those skilled in the art will appreciate that the conception on which this disclosure is based may readily be utilized as the basis for the designing of other structures for carrying out the several purposes of the invention. It is important, therefore, that this disclosure be regarded as including such equivalent constructions as do not depart from the spirit and scope of the invention.

Several embodiments of the invention have been chosen for purposes of illustration and description, and are shown in the accompanying drawings, forming a part of the specification, wherein:

FIG. 1 is a sectional view, taken in elevation, of the top portion of a furnace embodying the present invention;

FIG. 2 is a sectional view taken along the line indicated at 2—2 in FIG. 1;

FIG. 3 is an enlarged plan view of a chain disposed between rabble arms according to the invention;

FIG. 4 is a perspective view of the uppermost hearth of a furnace showing the chain in its operative position;

FIG. 5 is a perspective view of the uppermost hearth similar to FIG. 4, but showing an alternative mounting of the chain.

Referring to the drawings in detail, and initially to FIG. 1, there is shown a portion of a multiple hearth furnace 10 of generally cylindrical configuration. This furnace is constructed of a tubular outer steel shell 12 which is lined, as indicated as 14, with fire brick or similar heat resistant material. Each hearth is provided with a plurality of burner nozzles 16, which extend both radially and tangentially into the hearth. The burner nozzles form the outputs of various individually controlled burner assemblies (not shown) distributed about the furnace 10; and they serve to produce and/or maintain proper temperatures and atmospheres within different regions of the furnace to carry out the particular processing desired. There are also provided special working doors 18 and windows 20 for monitoring the operation of the furnace at each of the hearth levels.

The interior of the furnace 10 is divided, by means of hearth floors 22 and 24 into a plurality of vertically aligned hearths, only the two uppermost hearths being shown. Each of the hearth floors is made of refractory material and is of slightly arched configuration to be self-supporting within the furnace. Central drop holes 26 are formed in alternate hearth floors 22, near the center of the furnace, and outer peripheral drop holes 28 are provided near the outer shell 12 of the furnace.

Still referring to FIG. 1, a rotatable vertical center shaft 30 extends axially through the furnace 10 and is secured by upper and lower bearing means, not shown. This center shaft is rotated by suitable drive means, not shown, well known in the art. A plurality of spaced rabble arms 32 are mounted on the center shaft 30, as at

34, and extend outwardly in each hearth over the hearth floor. The rabble arms have rabble teeth 36 formed thereon which extend downwardly nearly to the hearth floor. The rabble teeth are inclined with respect to the longitudinal axis of their respective rabble arms so that as the rabble arms 32 are carried around by the rotation of the center shaft 30, the rabble teeth 36 will continuously rake through the material being processed on the associated hearth floor and gradually urge the material toward the drop holes 26 or 28 in the hearth floors.

As best seen in FIGS. 2 and 4, chains 38 are interconnected between adjacent rabble arms 32 to uniformly distribute the solid material being processed over the hearths when the center shaft 30 is rotated. Each end of the rabble chain 38 is mounted on a rabble tooth 36 by means of passing a shackle 40, FIG. 3, through an eye nut 42 which is fastened to the rabble tooth by a nut 44 and bolt 46, provided for the purpose. The chains are strung so that one end extends from near the periphery of the rabble arm and the other end is mounted near the inner end of the next adjacent rabble arm. The chain is installed with some slack, but not enough to drag on the hearth floor. When initially installed a gap of the order of about 1 inch is left at the bolt 46 for adjustment purposes by turning the bolt. A $\frac{5}{8}$ inch chain having an overall length of about 10.5 feet is suitable for use in a furnace having an outside diameter of the order of about 22 feet, for example. Thus, it will be appreciated that the rabble teeth 36 cooperate with the chains 38 so that when the center shaft is rotated, the material being processed is evenly swept across one hearth to a drop hole and dropped down onto the next lower hearth and then evenly swept across this hearth to its drop hole progressively from the top to the bottom of the furnace.

In the embodiment of the invention shown in FIG. 5, a chain 58 is provided having one end mounted on the rabble tooth 36 disposed towards the outer periphery of the rabble arm 32, as at 60, and the other end of the chain being connected to the center shaft 30, as at 62. The chain 58 is installed with some slack but not enough to drag on the hearth floor 24. Accordingly, when the center shaft 30 is rotated, the rabble chain serves to evenly and uniformly distribute the solid material being processed across the hearth floor 24.

It will thus be seen that the present invention does indeed provide an improved apparatus for distributing solid material over a furnace hearth which is superior in simplicity, operability, and efficiency as compared to prior art such apparatus.

Although certain particular embodiments of the invention are herein disclosed for purposes of explanation, various modifications thereof, after study of this specification, will be apparent to those skilled in the art to which the invention pertains.

What is claimed and desired to be secured by Letters Patent is:

1. In a multiple hearth furnace having a plurality of vertically spaced hearths, the combination comprising a rotatable center shaft extending up through the center of the furnace and passing through each hearth, a plurality of spaced rabble arms secured to the center shaft and extending radially outwardly over each hearth, a chain disposed between the rabble arms asso-

ciated with the uppermost of said hearths to move the material being processed over the hearth when said center shaft is rotated, alternate hearths having drop holes disposed towards the center shaft and the other hearths having drop holes disposed towards the outer periphery thereof, whereby when said center shaft is rotated the material being processed is moved across the hearth to a drop hole and dropped down onto the next lower hearth.

2. Apparatus according to claim 1 further comprising means for adjusting the tension of said rabble chains.

3. Apparatus according to claim 1 wherein the ends of said rabble chain are connected between the outer end portion of one rabble arm and the inner end portion of the adjacent rabble arm.

4. Apparatus according to claim 1 wherein one end of said rabble chain is connected to said center shaft and the other end of the chain is connected outwardly of the middle of one rabble arm.

5. Apparatus according to claim 1 further comprising rabble teeth extending downwardly from the rabble arms into the material being processed on each hearth.

6. A method for continuously processing material in a multiple hearth furnace having a plurality of vertically spaced hearths, a rotatable center shaft extending up through the center of the furnace and passing through each hearth, a plurality of spaced rabble arms secured to the center shaft and extending radially outwardly over each hearth, a chain disposed between the rabble arms associated with the uppermost of said hearths, alternate hearths having drop holes disposed towards the center shaft and the other hearths having drop holes disposed towards the outer periphery thereof, said method comprising the steps of continuously introducing said material at the top of said furnace, evenly moving said material across the uppermost of said hearths by virtue of the movement of said chain to its drip hole, and dropping said material down through said drop hole onto the next lower hearth.

7. A method of continuously processing material in a multiple hearth furnace having a plurality of vertically spaced hearths, a rotatable center shaft extending up through the center of the furnace and passing through each hearth, a plurality of spaced rabble arms secured to the center shaft and extending radially outwardly over each hearth, rabble teeth extending downwardly from the rabble arms into the material being processed on each hearth, a chain disposed between adjacent rabble arms, alternate hearths having drop holes disposed towards the center shaft and the other hearths having drop holes disposed towards the outer periphery thereof, said method comprising the steps of continuously introducing said material at the top of said furnace, evenly moving said material across the uppermost of said hearths by virtue of the movement of its associated chains to its drop hole, and dropping said material down through said drop hole onto the next lower hearth, and thence evenly moving said material across this hearth by virtue of the movement of its associated chains to thereby move the material through the furnace from the top to the bottom thereof.

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