

No. 640,715.

Patented Jan. 2, 1900.

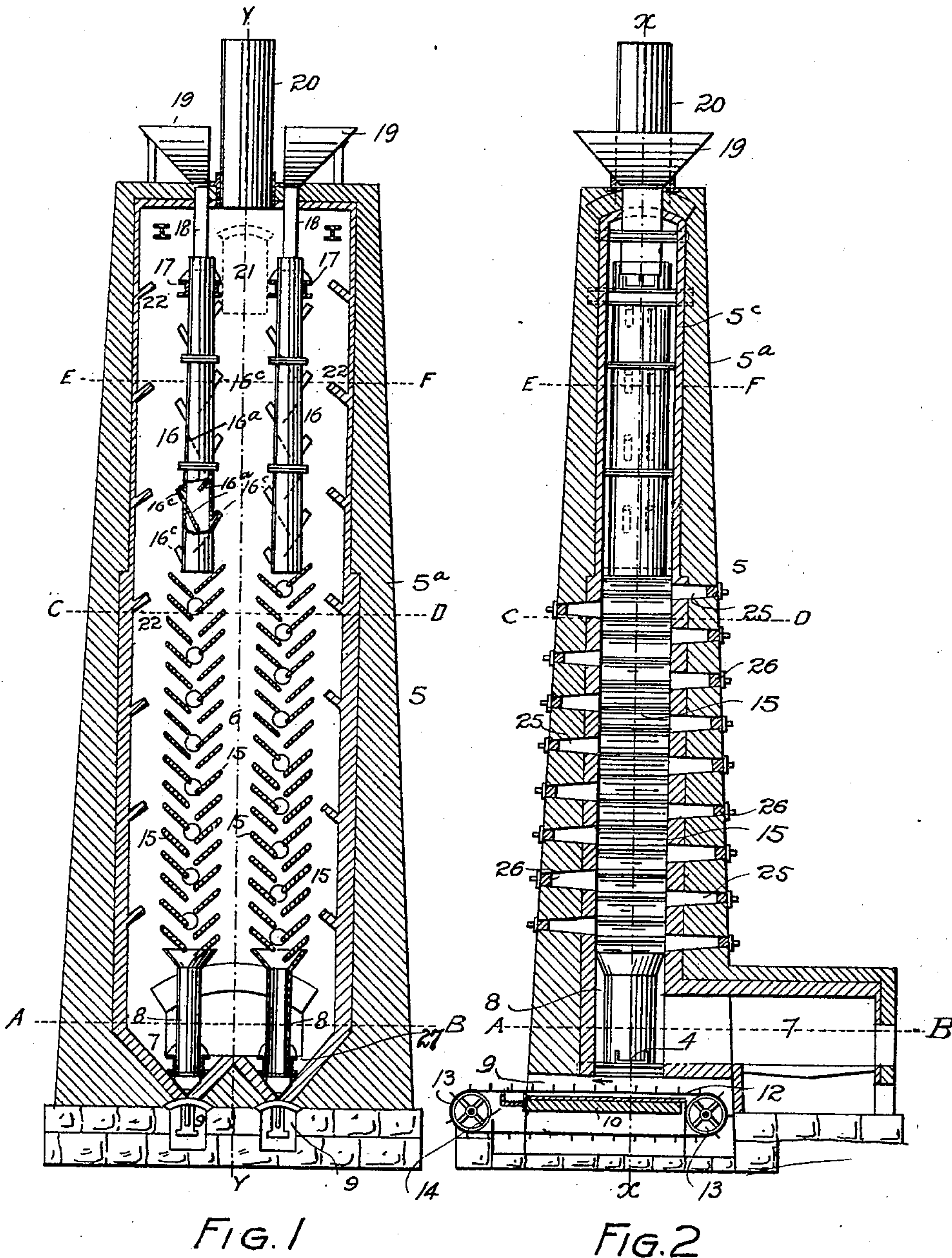
J. STOVEKEN.

VERTICAL AUTOMATIC DRYING AND ROASTING FURNACE.

(Application filed June 3, 1899.)

(No Model.)

2 Sheets—Sheet 1



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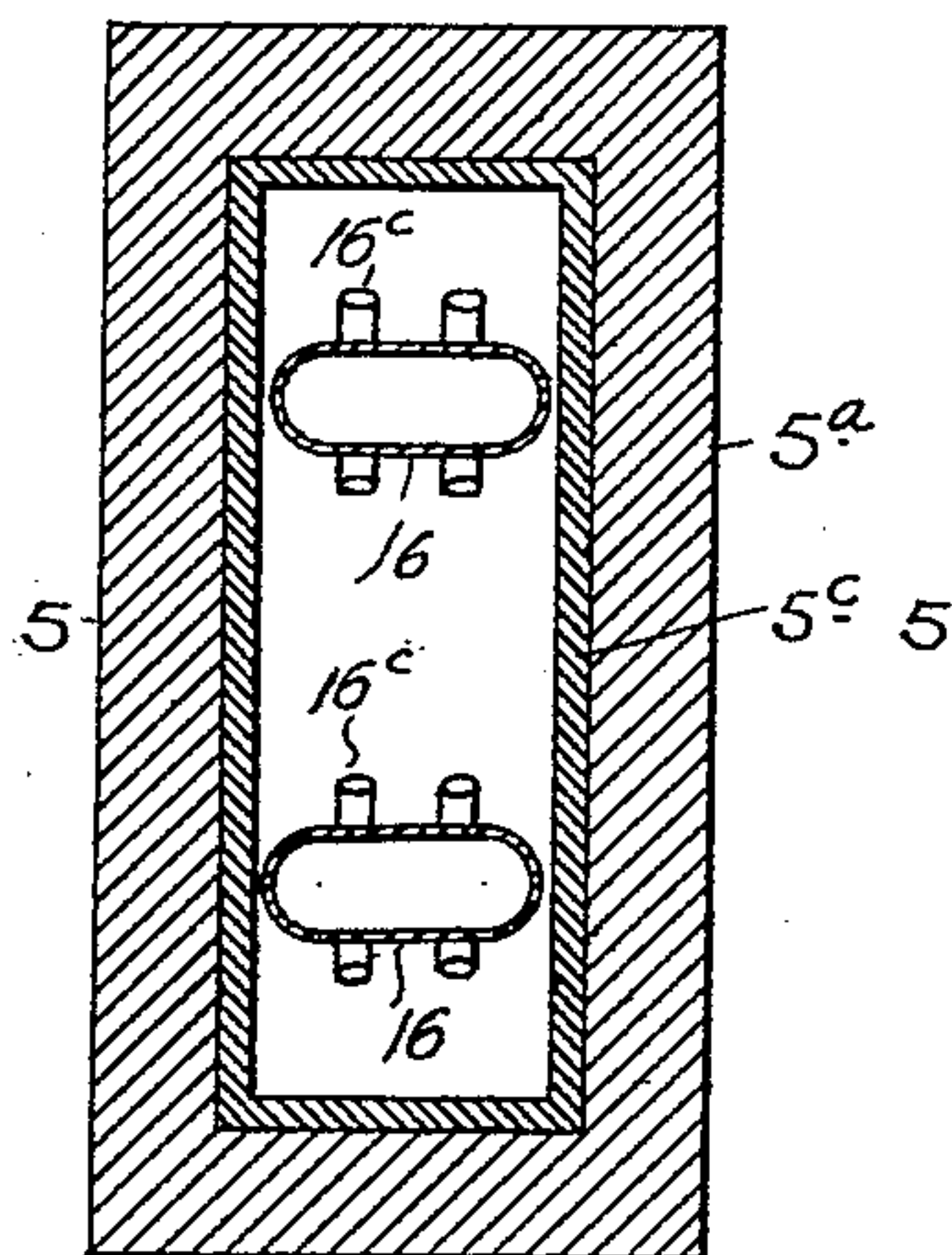


FIG. 5.

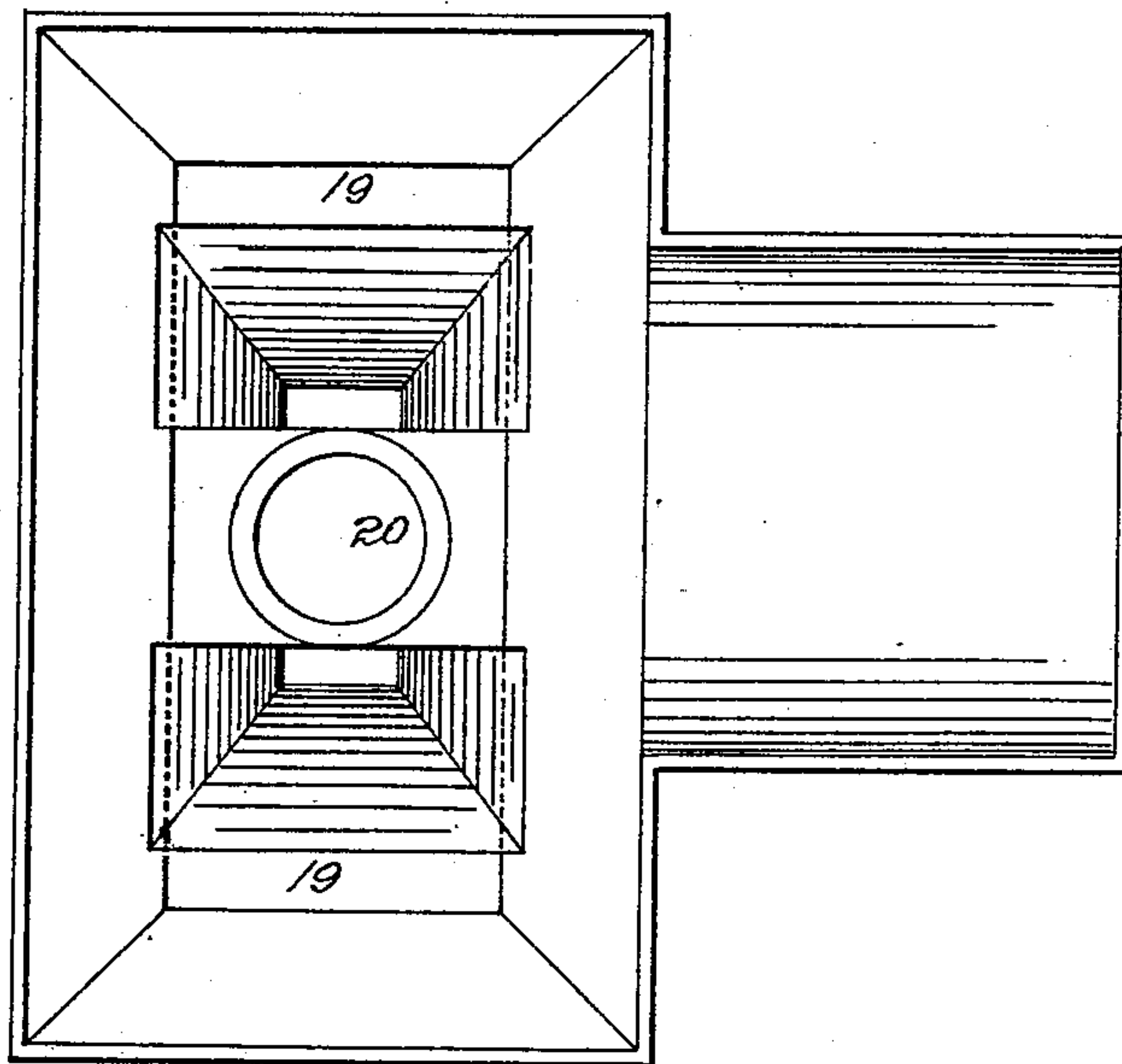


FIG. 6.

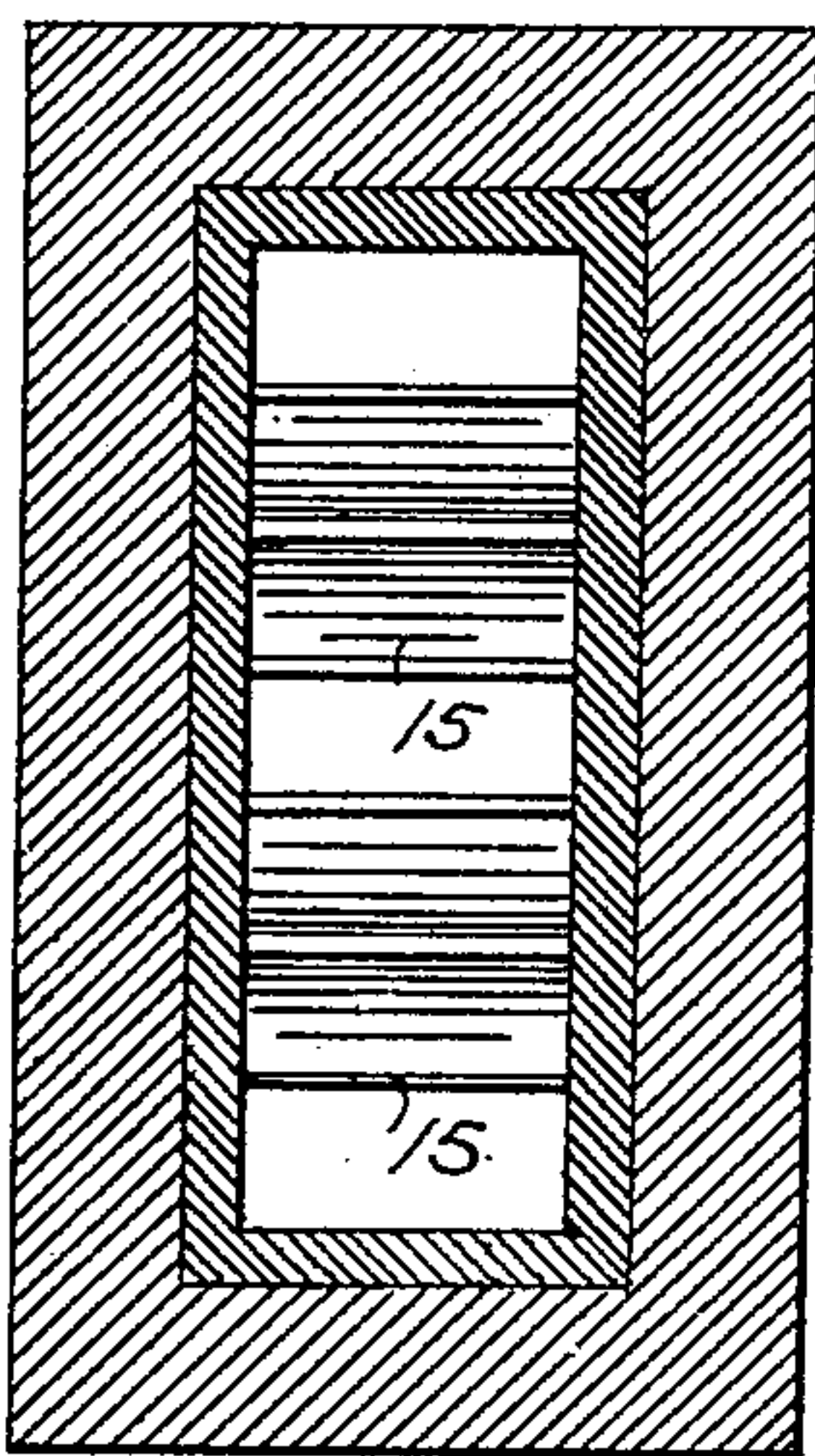


FIG. 4.

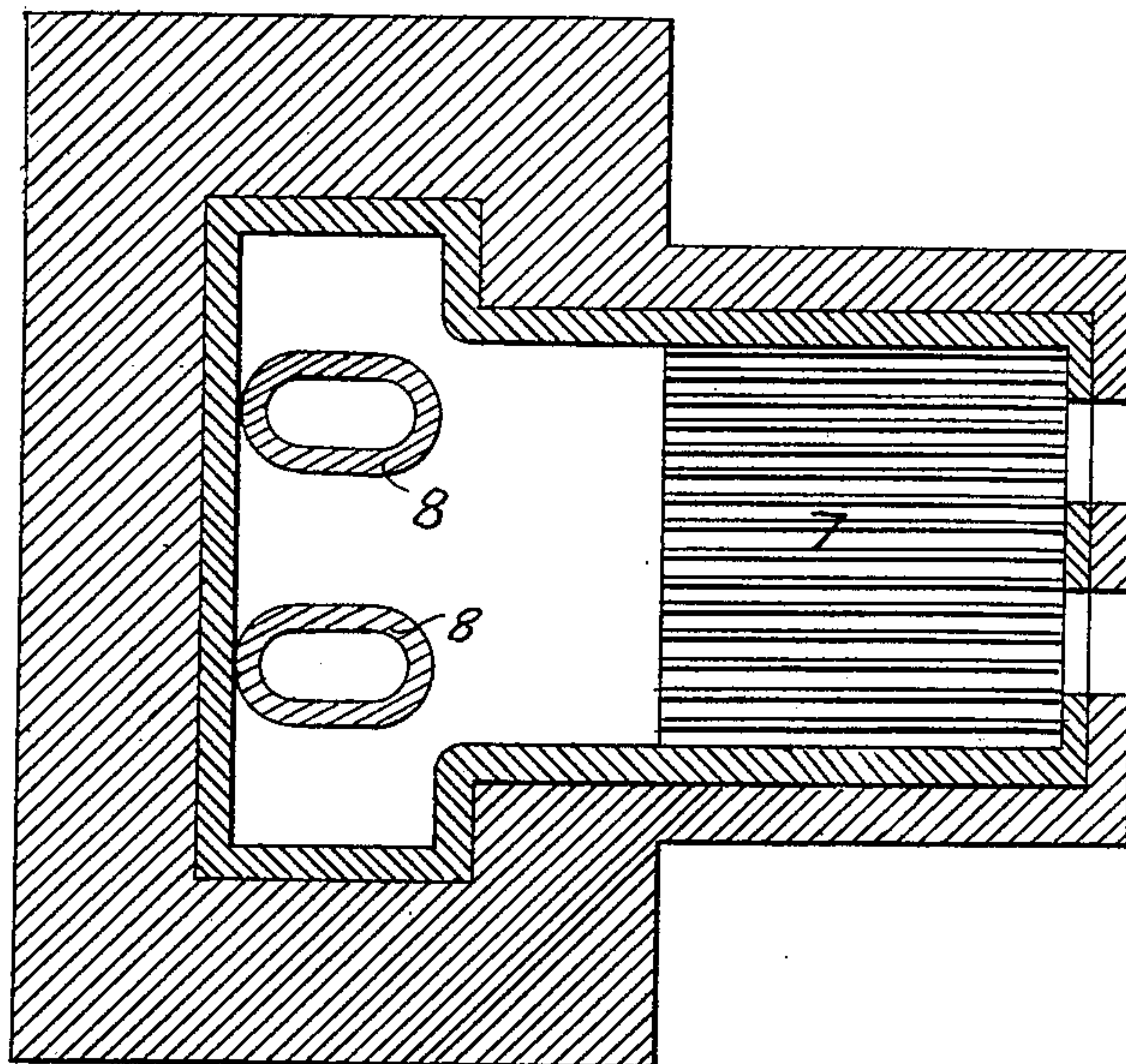


FIG. 3.

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VERTICAL AUTOMATIC DRYING AND ROASTING FURNACE

SPECIFICATION forming part of Letters Patent No. 640,715, dated January 2, 1900.

Application filed June 3, 1899. Serial No. 719,200. (No model.)

To all whom it may concern:

Be it known that I, JOHN STOVEKEN, a citizen of the United States of America, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Vertical Automatic Drying and Roasting Furnaces; and I do 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in automatic roasting or oxidizing furnaces of the upright stack or vertical type adapted for roasting or drying ores.

My object is to provide a device of this class which shall be simple in construction, economical in cost, and continuous in operation and which shall possess the highest degree of efficiency in the performance of its functions.

To these ends the invention consists of the features, arrangements, and combinations hereinafter described and claimed, all of which will be fully understood by reference to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a vertical longitudinal section of my improved furnace, taken on the line X X, Fig. 2. Fig. 2 is a similar section taken on the line Y Y, Fig. 1. Fig. 3 is a cross-section taken on the line A B, Figs. 1 and 2. Figs. 4 and 5 are horizontal sections taken on the lines C D and E F, respectively, Figs. 1 and 2. Fig. 6 is a top or plan view of the furnace.

Similar reference characters indicating corresponding parts in these views, let the numeral 5 designate the upright structure of the furnace, whose outer wall 5^a is preferably composed of common brick, having an inner wall or lining 5^c of fire-brick. The chamber 6 inclosed by the upright walls communicates at the bottom or lower extremity with a fire-box 7, which supplies heat for roasting or drying purposes. As shown in the drawings, the upright portion of the furnace is rectangular in cross-section and double—that is to say, arranged to support two up-

right columns of ore, having two feed-openings at the top and two discharge-openings at the bottom. It must be understood, however, that I do not limit the invention to the double structure, as the single form is equally within the scope of the invention.

The bottom of the vertical oxidizing-chamber where the ore is discharged is trough-shaped, as shown at 27, the bottom of each trough being provided with an outlet-opening, into which the ore is discharged by an upright cast-iron pipe 8, suitably supported above the opening by a channel-beam 4. (See Fig. 2.) Each discharge-opening in the bottom of the furnace communicates with a chamber 9, in which is located a table or platform 10, over which passes an endless drag-chain 12, supported by wheels 13, which are propelled by any suitable power. The chain 12 travels in the direction indicated by the arrows in Fig. 2 and carries the roasted ore into a trough 14, from which it may be removed in any suitable manner.

The upper extremity of each discharge-pipe 8 is funnel-shaped and located directly below a series of inclined shelves 15, extending crosswise of the furnace and supported by the vertical walls thereof, a sufficient space being left on both sides of the shelves to allow the heat to pass upward in the vertical chamber from the bottom to the top. These shelves 15 are arranged in two rows and located on opposite sides of a central vertical line passing through a discharge-pipe 8, the individual shelves on opposite sides of this line being staggered or alternately arranged with reference to each other, whereby the ore in passing downward will slide from a shelf on one side to the next lower shelf on the opposite side, these two shelves occupying a position preferably at right angles or approximately at right angles to each other. By this arrangement the ore which was underneath or in contact with the shelf on one side is uppermost or exposed to the heat when it reaches the opposite shelf, whereby the ore is evenly roasted or oxidized. These shelves 15 extend from the top of the discharge-pipes 8 to pipes 16, forming muffles in the upper portion of the roasting-chamber. The lower shelves are preferably composed of fire-clay and the upper ones of cast-iron, though any suitable or

desirable material may be employed for this purpose. The muffle roast-pipes 16 are preferably provided with interior inclined ledges 16^a, and they may be provided with openings 5 located at suitable intervals from which lead upwardly-projecting tubes 16^b, which permit the escape of the vapor from the ore in the muffles. These outlet orifices and tubes may be used or not, as desired. As shown in the 10 drawings, the muffle-pipes are constructed of sections or lengths of different diameters, these sections increasing in size from the top downward, whereby the passage of ore therethrough is facilitated. They are supported 15 by suitable horizontal beams or bars 17, whose extremities are supported by the vertical walls of the roasting-chamber.

Into the top of each muffle-pipe 16 projects an inlet-pipe 18, whose upper extremity communicates with a hopper 19, projecting above 20 the top of the furnace. One of these hoppers is located on each side of the central stack 20, through which the products of combustion escape from the roasting-chamber. The portion 21 of the vertical wall (indicated by dotted lines in Fig. 1) is constructed separately 25 from the body of the wall, whereby the bricks may be readily removed to form an opening giving access to the furnace-chamber when 30 for any reason such access may be necessary or desirable. On opposite sides of the central ore-supporting shelves 15 the walls of the furnace are provided at suitable intervals with short upwardly-projecting ledges 22, whose 35 function is the deflection of the heat inwardly toward the central ore-supporting shelves 15, whereby the roasting or oxidizing efficiency of the structure is enhanced.

As shown in the drawings, the top of the 40 furnace is closed except where the smoke-stack and the ore-inlet pipes are located.

In using the furnace a fire sufficient to produce a heat of the desired intensity is made in the fire-box 7, whereby the heat passes 45 therefrom upward through the vertical oxidizing-chamber 6, around the ore-supporting shelves 15 to the muffles 16. The ore fed into the top of the furnace through the hoppers 19 passes thence through the inlet-pipes 18 into 50 the muffle roasting-pipes 16, and thence downward through the ore-shelves 15 and the discharge-pipes 18 to the bottom of the furnace, and thence through the openings therein to the platform 10, which forms a stop for the 55 ore, which then begins to accumulate and pile upward in the furnace until there is a central vertical column of ore extending upward from the bottom to the top of the roasting-chamber, filling a pipe 8, covering the shelves 15, and 60 filling a muffle-pipe 16. If the furnace is of double construction, as shown in the drawings, there are two of these columns of ore formed in the furnace, one being substantially a duplicate of the other. Hence in describing the use and operation of the furnace 65 only a single column will be referred to.

It is evident that the pipes 8 and 16 may

be made of fire-clay instead of iron. In fact, with some classes of ore iron could not be used. Hence it will be understood that I do not limit 70 myself to any special material in the construction of any part of the furnace.

Access may be gained to the ore-supporting shelves from the outside of the furnace through horizontal openings 25, formed in the 75 vertical walls and normally closed by removable cast-iron plugs 26. These openings may be utilized to prevent the ore from clogging the furnace and also to remove samples of the ore for the purpose of learning its condition 80 during the roasting operation.

The operation of the furnace is as follows: After the roasting-chamber has been once charged with ore the drag-chain at the bottom is put in motion and the bottom of the ore 85 column removed more or less slowly, according to the nature of the ore. The roasting of some ores requires much more time than others. Hence the motion of the drag-chain will depend upon the character of the ore treated. 90 The longer the time required for the roasting of the ore the slower will be the travel of the chain; but in any event the movement of the drag-chain is continuous, and the column of ore is continually moving downward to take 95 the place of the ore carried away by the chain, the ore being fed in at the top to maintain the height of the column or keep the furnace continually and evenly charged to the limit of its capacity. The ore is continually moving 100 downward at a speed to allow it to be properly roasted while passing from the top to the bottom of the furnace. The bottom of the ore column belonging to the first charge of ore will not be sufficiently roasted, since it has 105 fallen directly from the top to the bottom of the furnace and has not been sufficiently exposed to the oxidizing or roasting atmosphere. Hence the first ore removed by the drag-chain will need to be returned and passed again 110 through the furnace; but after this the ore taken from the bottom of the column is properly roasted and the operation is continued without interruption.

Having thus described my invention, what I claim is— 115

1. The combination with a vertical ore-roasting chamber having an ore-inlet at the top and a discharge-opening at the bottom, of means for maintaining a vertical column 120 of ore between these two openings, and in a central position in the roasting-chamber, whereby the heat is allowed to pass upward around the ore, said means comprising inclined shelves supported by the furnace- 125 walls, and located in the lower part of the furnace, and muffles supported in the upper part of the furnace, the wall of the chamber being provided with openings opposite the ore-supporting means to permit access to the column of ore, and detachable plugs normally closing said openings.

2. The combination with a vertical ore-roasting chamber having an ore-inlet at the 130

top and a discharge-opening at the bottom, of means for maintaining a vertical column of ore between these two openings and in a central position in the roasting-chamber, 5 said means comprising inclined shelves supported by the furnace-walls and located in the lower part of the furnace, muffles supported in the upper part of the furnace, and inclined, deflecting ledges attached to the inner walls of the furnace and adapted to direct 10 the heat toward the central column of ore.

3. The combination with a vertical ore-roasting chamber having an ore-inlet at the top and a discharge-opening at the bottom, 15 of means for maintaining a vertical column of ore between these two openings and in a central position in the roasting-chamber, whereby the heat is allowed to pass upward around the ore, said means comprising inclined shelves supported by the furnace-walls and located in the lower part of the furnace, and a muffle-pipe located in the upper 20 part of the furnace-chamber and provided with orifices and upwardly-projecting tubes leading therefrom. 25

4. The combination with a vertical ore-roasting chamber having an ore-inlet at the top and a discharge-opening at the bottom, of means for maintaining a vertical column 30 of ore between these two openings and in a central position in the roasting-chamber, said means comprising inclined shelves supported by the furnace-walls and located in the lower part of the furnace, and a muffle-pipe located in the upper part of the furnace-chamber and having inclined, staggered, inwardly-projecting ledges said muffle being 35 also provided with orifices and upwardly-projecting tubes leading therefrom.

5. The combination, with a vertical ore-roasting chamber, having an ore-inlet at the top and a discharge-opening at the bottom, of means for maintaining a vertical column of 40 ore between these two openings and in a central position in the roasting-chamber, where-

by the heat is allowed to pass upward around the ore, said means comprising inclined shelves supported by the furnace-walls and located in the lower part of the furnace, and muffles supported in the upper part of the 50 furnace.

6. In a vertical roasting-furnace, the combination with a vertical oxidizing-chamber having an inlet-opening at its top and a discharge-opening at its bottom, of means for 55 supporting a central, vertical column of ore in said chamber between said openings, said means comprising a vertical discharge-pipe located in the bottom of the chamber, inclined shelves located above said pipe and a 60 vertical muffle-tube located above the shelves, the ore-column-supporting means being so located as to leave room for the hot air to pass upward from the bottom to the top of the furnace. 65

7. The combination with a vertical ore-roasting chamber having an inlet-opening at the top and a discharge-opening at the bottom, of means for maintaining a vertical column of ore between these two openings and 70 in a central position in the roasting-chamber, whereby the heat is allowed to pass upward around the ore, said means comprising inclined shelves supported by the furnace-walls and located in the lower part of the 75 furnace, and muffles supported in the upper part of the furnace, a chamber located below the discharge-opening of the furnace, a platform or table located in said chamber and forming a support for the ore column, 80 and an endless drag-chain passing over said table or platform for removing the ore at the base, and causing a continuous downward movement of the ore column.

In testimony whereof I affix my signature 85 in presence of two witnesses.

JOHN STOVEKEN.

Witnesses:

A. J. O'BRIEN,
NELLIE G. DANIELS.