No. 708,615. Patented Sept. 9, 1902.

# A. M. BEAM.

## ORE ROASTING APPARATUS.

(Application filed Apr. 1, 1901.)

(No Model.)

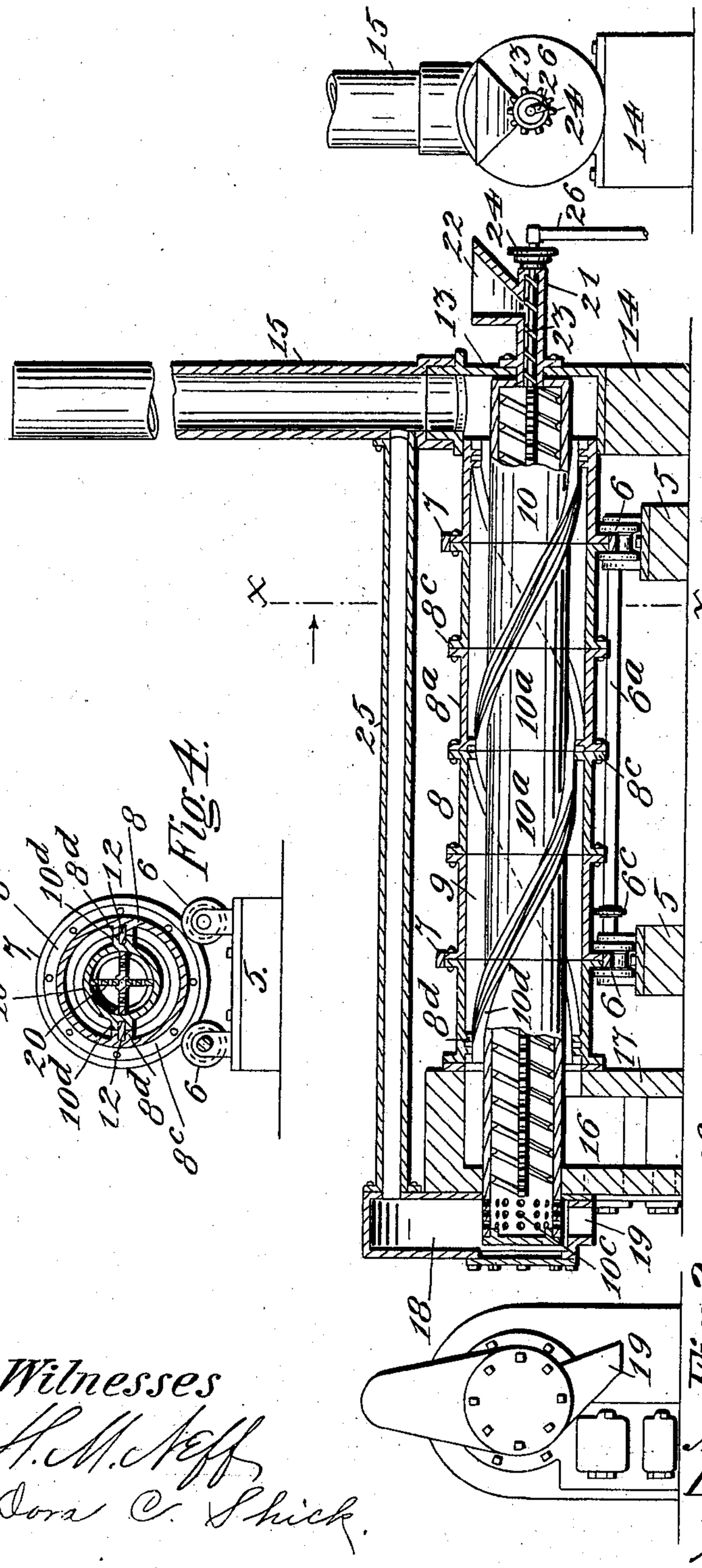

Fig. 1.

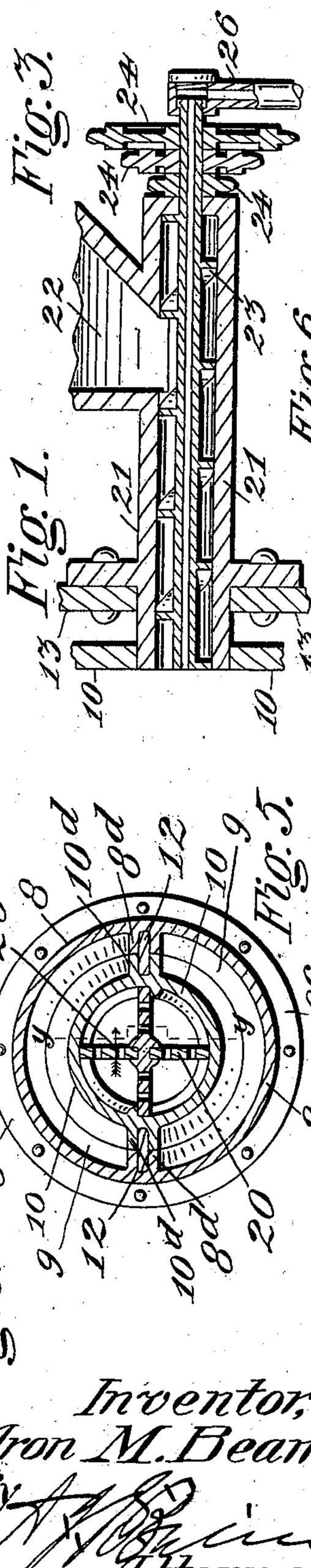

Fig. 6.



Fig. 4.



Fig. 5.



Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## ORE-ROASTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 708,615, dated September 9, 1902.

Application filed April 1, 1901. Serial No. 53,980. (No model.)

*To all whom it may concern:*

Be it known that I, ARON M. BEAM, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Ore-Roasting Apparatus; 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 ore-roasting apparatus; and it consists of the features 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 taken through my improved ore-roaster, the conveyer being shown partly in section, taken on the line *y y*, Fig. 5, and viewed in the direction of the arrow. Fig. 2 is a rear end elevation of the same. Fig. 3 is a front end elevation of the apparatus. Fig. 4 is a cross-section taken on the line *x x*, Fig. 1. Fig. 5 is a cross-section showing the parts on a larger scale. Fig. 6 is an enlarged section taken through the feed-screw.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a suitable foundation, upon which are mounted suitable bearings in which are journaled flanged wheels 6, engaging circular tracks 7, surrounding and made fast to a rotary cylindrical shell 8, composed of sections $8^a$, provided with exterior flanges connected by bolts, as shown at $8^c$. Passing through the shell 8 and separated therefrom by an annular chamber 9 is a cylindrical conveyer 10, composed of sections $10^a$. The sections of the shell 8 are provided with interior spirally-arranged ribs $8^d$, while the sections $10^a$ of the conveyer are provided with corresponding exterior ribs $10^d$. The two sets of ribs engage each other and are longitudinally grooved to receive a tongue 12, which securely fastens the shell and conveyer together. The connected ribs of the shell and the conveyer form two spiral partitions located in the annular or concentric chamber 9, whereby the heat from the furnace is caused to pass around the said chamber in spiral paths, thus retaining it for a longer period in contact with the conveyer through which the ore to be roasted is traveling, as hereinafter explained in detail. Both extremities of the conveyer 10 protrude beyond the shell 8. The forward extremity extends into a hollow head 13, mounted upon a suitable stationary support 14, and incloses a chamber communicating with the stack 15. The rear extremity of the conveyer after leaving the shell 8 passes above and through the fire-box 16 of the furnace 17, which may be of any suitable construction adapted to furnish the necessary degree of heat. The extreme rear end of the conveyer is perforated, as shown at $10^c$, and extends into a chamber 18, having a depending discharge-chute 19, through which the roasted ore passes after having traveled spirally through the conveyer its entire length.

The interior surface of the conveyer is provided with spiral ribs or threads of suitable pitch to cause the ore to travel through the conveyer at such a rate of speed as will be suitable for roasting purposes. The interior of the conveyer is also provided with a number of radial perforated partitions 20, four being shown in the drawings, through which the pulverized ore must pass as it is traveling through the conveyer. These partitions keep the ore mass separated and partially suspended and cause it to be carried upwardly, whereby it is continually sifting through the partitions and falling toward the lowest point of the conveyer, and thereby exposed to the action of the heat to much better advantage while traveling through the conveyer than if the partitions were not employed. Secured to the hollow head 13 at the front end of the apparatus is a pipe 21, provided with a hopper 22, communicating at its inner extremity with the front end of the conveyer. In this pipe is located a feed-screw 23, which forces the ore into the conveyer against the pressure of the gases. The feed-screw is journaled in the forward extremity of the pipe and protrudes therefrom, being provided with a number of ratchet-wheels 24 of varying sizes, which may be connected with

any suitable power for operating the feed-screw.

Two of the wheels 6 upon which the shell 8 is mounted are connected by a shaft $6^a$, provided with a sprocket-wheel $6^c$. When the apparatus is in use, power is applied to the sprocket-wheel to rotate this shaft and turn wheels 6, which impart a rotary movement to the shell 8 and the conveyer 10, connected therewith, as heretofore explained. The shell and ore-conveyer constitute a double cylinder journaled at its extremities, its two members rotating in unison. The feed-screw and conveyer being in rotation, the ore passes from the hopper 22 to the feed-screw and is thence carried to the conveyer, which by virtue of its spiral ribs or threads causes the ore to travel from the front to the rear end of the conveyer, from which it is finally discharged through the perforations $10^c$. During the passage of the ore through the conveyer the heat and the products of combustion from the fire-box 16 are passing through the concentric chamber 9 in the spiral paths formed by the spiral partitions connecting the shell and the conveyer, as heretofore explained. The products of combustion issuing from the forward extremity of the chamber 10 pass into the stack.

The ore in the conveyer is roasted by the heat to which it is subjected from the surrounding chamber. The perforated partitions materially aid or hasten the roasting process by dividing and agitating the ore mass, whereby it is prevented from packing within the conveyer, as heretofore explained. The gases resulting from the roasting operation pass upwardly through the perforated extremity of the conveyer into the chamber 18, whence they may be taken and condensed if they contain metallic values or valuable by-products which it is desired to recover, or these gases may pass directly to the stack by way of a conduit 25.

The stem of the feed-screw is hollow, and both extremities are open for the introduction of atmospheric air under pressure, the air being forced through the stem of the screw into the conveyer or central chamber, in which the roasting operation takes place. The presence of the oxygen of the air is necessary to the proper performance of the roasting function. The outer extremity of the feed-screw stem is suitably connected with a conduit 26, through which the air passes.

Having thus described my invention, what I claim is—

1. In an ore-roasting apparatus the combination with the source of heat, and a stack, of a shell mounted to rotate, a conveyer located therein and connected to rotate therewith, the relative size of the shell and conveyer being such that a chamber surrounding the conveyer is formed, said chamber being in communication with the source of heat at one extremity and with the stack at the other extremity, but having no communication with the interior of the conveyer, a spiral partition located between the shell and conveyer to cause the heat to travel in a spiral path through the intervening chamber, means for feeding the ore to the conveyer at one extremity, and means for discharging the ore therefrom at the opposite extremity.

2. In an ore-roasting apparatus, the combination of a cylindrical shell mounted to rotate, a conveyer passing through the shell, a space surrounding the conveyer being left within the shell, the shell and the conveyer being respectively provided with interior and exterior spirally-arranged ribs connected to form spiral partitions within the intervening chamber, the said chamber communicating with a source of heat at one extremity and with a stack at the opposite extremity, suitable means for rotating the shell and conveyer which are connected to revolve in unison, means for feeding the ore at one extremity of the conveyer, and means for discharging the roasted ore at the opposite extremity.

3. In an ore-roasting apparatus, the combination with a furnace and stack, of a rotary shell, a cylindrical conveyer passing through the shell and of such size as to leave a concentric chamber between the shell and conveyer, said chamber being in communication with the fire-box of the furnace at one extremity, and with the stack at the opposite extremity, the parts being so arranged that the interior of the conveyer has no communication with the said chamber, the shell and conveyer being respectively provided with interior and exterior spirally-arranged, longitudinally-grooved ribs, and a tongue connecting said ribs whereby the shell and conveyer are made to rotate together.

4. In an ore-roasting apparatus the combination with a furnace and stack, of a chamber communicating with the fire-box of the furnace at one extremity, and with the stack at the opposite extremity, a conveyer passing through said chamber and provided with interior, spirally-arranged ribs or threads arranged to cause the ore to travel therethrough, and a longitudinally-disposed perforated partition located within the conveyer and through which the ore must pass as it travels therethrough, means for rotating the conveyer, means for feeding the ore to one extremity of the conveyer, and means for discharging it at the opposite extremity.

5. In an ore-roasting apparatus, the combination with a furnace and stack, of a combustion-chamber communicating at one extremity with the furnace and at the other extremity with the stack, a revoluble conveyer located in said chamber and provided with spiral threads or ribs formed on its interior, longitudinally-disposed perforated partitions located in the interior of the conveyer, and a feed-screw for feeding the ore to the conveyer, the opposite extremity of the conveyer being perforated to allow the ore to escape.

6. The combination with a furnace and

stack, of a shell composed of sections suitably connected, a conveyer located within the shell and also composed of sections, the shell and the conveyer being connected by spiral partitions to rotate together, an annular chamber being formed between the shell and conveyer, said chamber communicating at one extremity with the furnace and at the other extremity with the stack, but having no communication with the interior of the conveyer, means for feeding the ore to the conveyer at one extremity, and means for discharging it at the opposite extremity.

7. In an ore-roasting apparatus the combination with a furnace and stack, of a rotary shell, a conveyer located within the shell and connected to rotate therewith, a chamber formed between the shell and conveyer, and communicating with the furnace at one extremity and with the stack at the opposite extremity, but having no communication with the interior of the conveyer, means for feeding the ore to the front end of the conveyer, the opposite extremity of the conveyer being constructed to discharge the ore, and a chamber into which the discharge extremity of the conveyer protrudes, for receiving the gases resulting from the roasting operation, said chamber having a discharge-opening at the bottom for the ore, and an escape-opening communicating with its upper portion through which the gases may be carried to any desired location.

8. In an ore-roasting apparatus, the combination with a furnace and stack, of a shell mounted to rotate, a conveyer passing through the shell, an annular chamber located between the shell and conveyer, the conveyer and shell being connected to rotate together, the chamber between them being in communication at one extremity with the fire-box and at the other extremity with the stack, but having no communication with the interior of the conveyer, a hollow head into which the front extremity of the conveyer protrudes, a screw feed-conveyer connected with the said head for feeding the ore to the rotary conveyer, the rear extremity of the rotary conveyer being perforated, and a chamber surrounding said rear extremity, and having a discharge-opening below, and an escape for the gases above.

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

ARON M. BEAM.

Witnesses:
A. J. O'BRIEN,
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