C. W. DRAPER.

FURNACE.

APPLICATION FILED FEB. 14, 1908. RENEWED DEC. 9, 1910.

997,973.

Patented July 18, 1911.

2 SHEETS—SHEET 1.

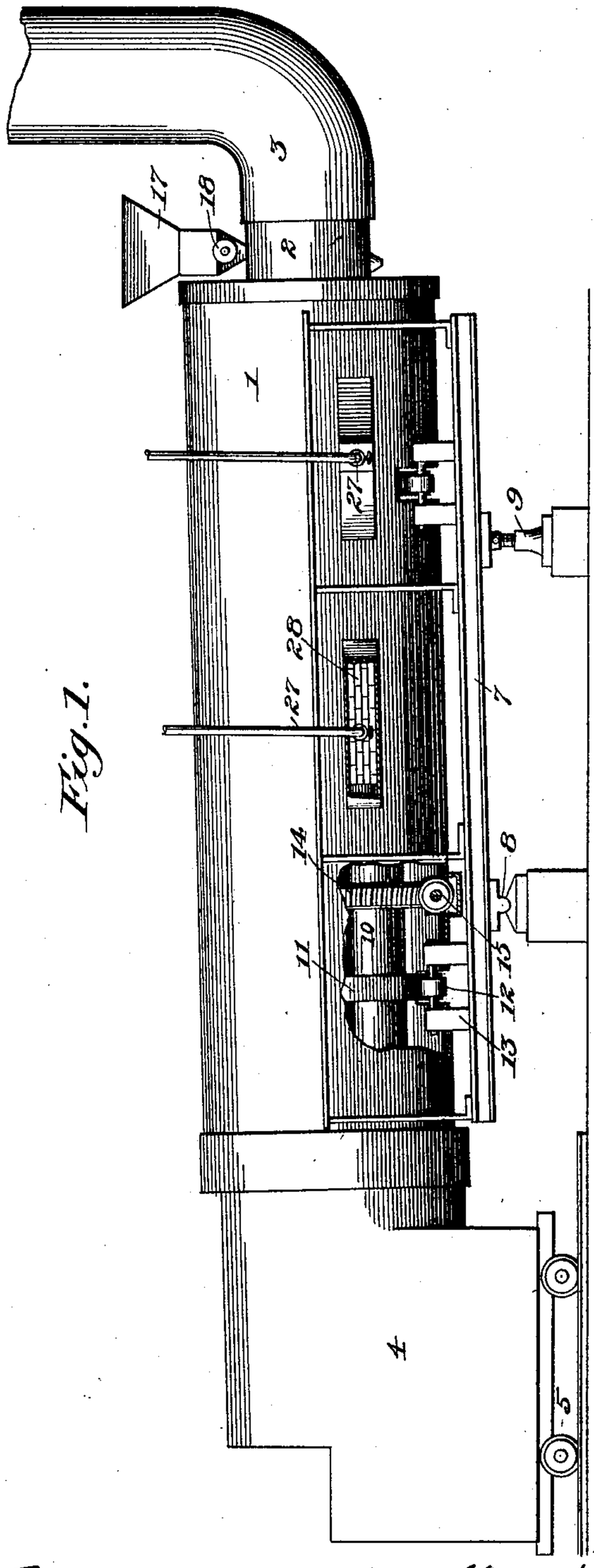

Fig. 1.

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N. P. Leonard.

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2 SHEETS—SHEET 2.

Fig. 4.

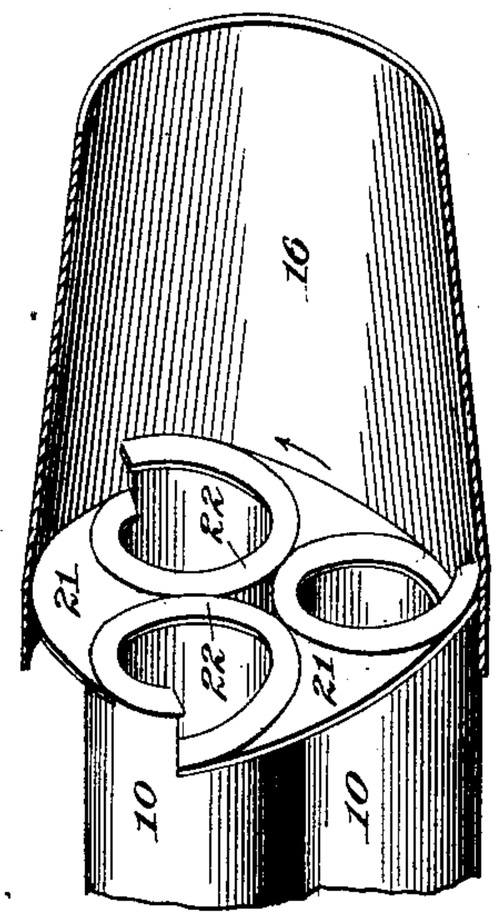


Fig. 3.

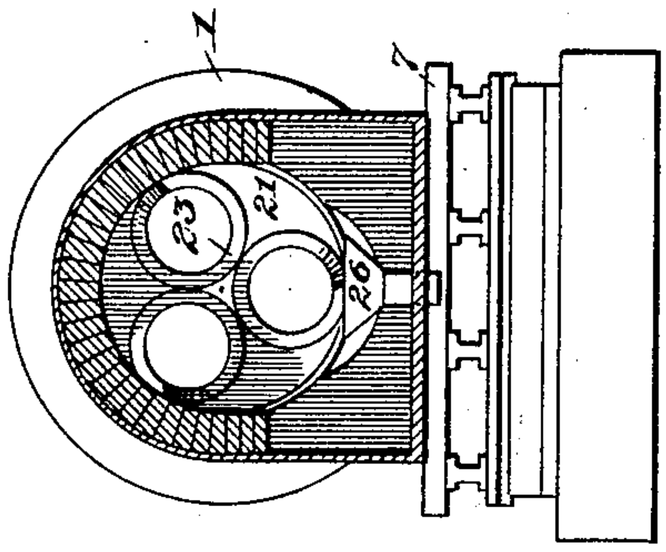
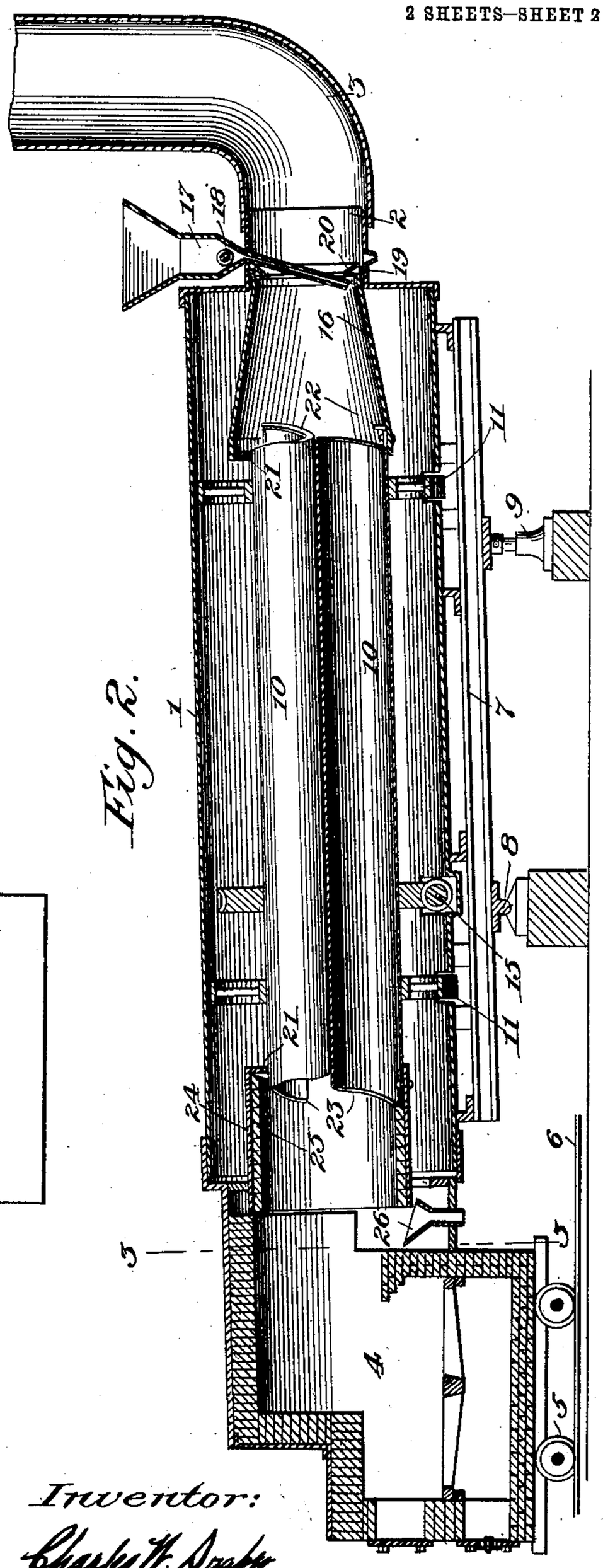


Fig. 2.



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UNITED STATES PATENT OFFICE.

CHARLES W. DRAPER, OF WASHINGTON, DISTRICT OF COLUMBIA.

FURNACE.

997,973. Specification of Letters Patent. Patented July 18, 1911.

Application filed February 14, 1908, Serial No. 415,846. Renewed December 9, 1910. Serial No. 596,506.

To all whom it may concern:

Be it known that I, CHARLES W. DRAPER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

The object of this invention is the provision of a furnace adapted for continuous operation and presenting particular advantages for the roasting or reduction of ores, or for the accomplishment of reactions, requiring substantially uniform temperature conditions. The construction affords a more uniform distribution of heat than it has been possible to secure heretofore, and is more economically operated with respect both to power and heat requirements.

For a full understanding of the invention reference is made to the accompanying drawings, wherein:

Figure 1 is a side elevation of a preferred construction of roasting furnace embodying the invention; Fig. 2 is a vertical longitudinal section of the same; Fig. 3 is a vertical transverse section on line 3—3 of Fig. 2; and Fig. 4 is a fragmentary perspective view showing the construction of the tubes at their charging ends.

Referring to the figures, 1 represents a cylindrical casing or envelop, usually of sheet metal, and provided if desired with any usual protective and heat-insulating sheathing or lining (not shown). The forward end of the casing 1 is prolonged into a cylindrical flue 2 leading to a stack 3. A furnace 4 of any desired type and adapted for the combustion of solid, liquid or gaseous fuel is disposed adjacent the opposite end of the casing. The furnace is illustrated as mounted on a track 6, being movable with respect to the casing for affording access to the latter. The casing 1 is carried by a frame 7, pivoted at or near its rear end as indicated at 8, and provided at or near its forward end with means 9 for adjusting its inclination as desired.

Mounted within the casing 1 is a battery or group of parallel tubes 10, shown as three in number, this number being increased or reduced in accordance with the capacity required and the conditions of operation. The tubes 10 are encircled by bands or wheels 11 of open construction, which are supported by rollers 12 carried by standards 13 mounted on opposite sides of the frame 7. A worm wheel 14 operated by a worm 15 encircles and is secured to the battery of tubes 10 for imparting a rotary movement thereto. At the forward end of the tubes is secured an apron 16 which preferably converges toward the flue 2 and is revoluble therein. The ore is fed to the apron 16 through a hopper 17 having a feed-regulating roller indicated at 18. The flue 2 is provided with an internal peripheral flange 19 engaging a flange or collar 20 on the forward end of the apron 16, the construction guarding against the direct passage of gases between the casing 1 and the flue 2, and also acting as a retaining device for the ore fed to the apron. As best shown in Fig. 4, metallic plates 21 are fitted around the group of tubes 10 and between the same and the interior walls of the apron, in such manner as to prevent the direct passage of the gases between the casing and the apron. A plate or other obstruction may be applied between the tubes of the battery, but is not ordinarily required.

In order that ore fed to the apron 16 may be progressively delivered to the interior of the several tubes 10 the forward ends of these terminate on a curved line describing a single complete turn of a helix and are provided with helical flanges 22, the construction being such that when the battery of tubes is rotated in the direction indicated by the arrow, Fig. 4, the ore passes into the interior of the tubes in their lowermost position and is retained by the flanges 22 in all positions. The rearward inclination of the tubes insures the regular progression of the ore, the thickness of the ore bed in the tubes being governed by the adjustment of the screw or jack 9. As shown, a similar construction and arrangement of flanges 23 is applied also to the rear end of the tubes 10 to insure the delivery of the ore only when the tubes are in their lowermost position. The ore is discharged from the tubes onto a rotary apron 24 carried thereby and preferably lined with firebrick 25, and is delivered thence to a discharge hopper 26. Plates 21 similar to those before described are applied between the apron 24 and the tubes 10.

The heated products of combustion from the furnace 4 traverse successively the rear apron 24, the several tubes 10, the forward apron 16, the flue 2 and the stack 3, passing also between the tubes 10 in case the central

channel is unobstructed. In the absence of other heating means there will be a progressive reduction in the temperature of these products and a corresponding inequality in the heating of the ore. In order to avoid this, auxiliary heating means are provided as shown in Fig. 1. These auxiliary heating means comprise in the construction shown two burners 27 for hydrocarbon fuel, mounted upon the casing 1. The flame from these burners is directed toward or against the battery of tubes 10, these being preferably protected from injury by baffles or belts 28 of firebrick or other refractory material, these baffles being either mounted upon the tubes 10 and rotatable therewith, or carried by the casing 1 and spaced from its interior wall; in either case they serve to divert and distribute the flame laterally within the casing. The products of combustion from the burners 27 pass rearwardly around the tubes 10, thence into the rear apron 24 where they mingle with the products of combustion in the furnace 4. The number of burners 27, as well as their distribution on one or both sides of the casing will depend upon the dimensions of the furnace, the number, capacity and distribution of these burners being such as to supply to the interior of the tubes 10, through the walls thereof, a quantity of heat substantially equal to the loss of heat by the products traversing the tubes.

As above stated, in the absence of the exterior envelop or casing and the heating means therein there will be a progressive fall in the temperature of the gases traversing the tubes: but by the provision around these tubes of a gaseous envelop the temperature of which decreases in a direction opposite to that of the gases within the tubes, the loss of heat may be compensated with substantial accuracy, and a uniform temperature may be maintained throughout the entire length of the interior tube or tubes. This effect is the same in principle whether one or several interior tubes be employed, and whether these be rotatably mounted or other means be employed for causing the ore to traverse them, but in practice is more perfectly applied to a plurality of tubes by reason of the greater surface afforded for the transfer of heat.

The substantial uniformity of heat distribution thus secured is in many cases of the highest importance in practice. In addition to this feature the furnace presents the advantages that it operates with relatively small expenditure of power owing to the more perfect balance of the charge, as compared with a single rotary tube; and that owing to the relatively large surface and small depth of ore exposed to the heated products of combustion it operates with a high degree of heat-economy.

While I have described the construction as applied to an ore-roasting furnace, it will be obvious that it may be applied or adapted to the conduct of any reaction requiring substantially uniform heat conditions.

I claim:

1. In a furnace, a tube, means for causing ore and heated gases to traverse the same in opposite directions, a casing surrounding said tube, and auxiliary heating means in said casing, said casing venting into said tube.

2. In a furnace, a revoluble tube, means for causing ore and heated gases to traverse the same in opposite directions, a casing surrounding said tube, and auxiliary heating means in said casing, said casing venting into said tube.

3. In a furnace, a tube, means for causing ore and heated gases to traverse the same in opposite directions, a casing surrounding said tube, and auxiliary heating means adapted to establish a flow of heated gases through said casing in reverse direction to the flow within said tube, said casing venting into said tube.

4. In a furnace, a revoluble tube, means for causing ore and heated gases to traverse the same in opposite directions, a casing surrounding said tube, and auxiliary heating means adapted to establish a flow of heated gases through said casing in reverse direction to the flow within said tube, said casing venting into said tube.

5. In a furnace, a plurality of tubes, means for causing ore and heated gases to traverse said tubes in opposite directions, a casing surrounding said tubes, and auxiliary heating means in said casing, said casing venting into said tube.

6. In a furnace, a plurality of tubes, means for causing ore and heated gases to traverse said tubes in opposite directions, a casing surrounding said tubes, and auxiliary heating means adapted to establish a flow of heated gases through said casing in reverse direction to the flow within said tubes, said casing venting into said tubes.

7. In a furnace, a plurality of tubes mounted as a revoluble unit, means for causing ore and heated gases to traverse said tubes in opposite directions, a casing surrounding said tubes, and auxiliary heating means in said casing, said casing venting into said tube.

8. In a furnace, a plurality of tubes mounted as a revoluble unit, means for causing ore and heated gases to traverse said tubes in opposite directions, a casing surrounding said tubes, and auxiliary heating means adapted to establish a flow of heated gases through said casing in reverse direction to the flow within said tubes, said casing venting into said tubes.

9. In a furnace, a casing, and a plurality of tubes mounted therein as a revoluble unit,

each tube terminating in a helical flange providing between the turns of the helix a lateral inlet for ore.

10. In a furnace, a casing, and a plurality of tubes mounted therein as a revoluble unit, each tube terminating at opposite ends in helical flanges providing between the turns of the helixes lateral passages for ore.

11. In a furnace, a casing, a plurality of tubes mounted therein as a revoluble unit, each tube terminating in a helical flange providing between the turns of the helix a lateral inlet for ore, means for causing ore and heated gases to traverse said tubes in opposite directions, and auxiliary heating means for said casing.

12. In a furnace, a casing, a plurality of tubes mounted therein as a revoluble unit, each tube terminating in a helical flange providing between the turns of the helix a lateral inlet for ore, means for causing ore and heated gases to traverse said tubes in opposite directions, and auxiliary heating means adapted to establish a flow of heated gases through said casing in reverse direction to the flow within said tubes.

13. In a furnace, a tube, a combustion furnace communicating directly therewith, means for passing ore through the tube, and independent heating means applied to the exterior of said tube.

14. In a furnace, a plurality of tubes mounted as a revoluble unit, a combustion furnace communicating directly therewith, means for passing ore through the tubes, and independent heating means applied to the exterior of said tubes.

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

CHARLES W. DRAPER.

Witnesses:
EUGENE A. BYRNES,
CHARLES H. POTTER.