W. MATHESIUS.

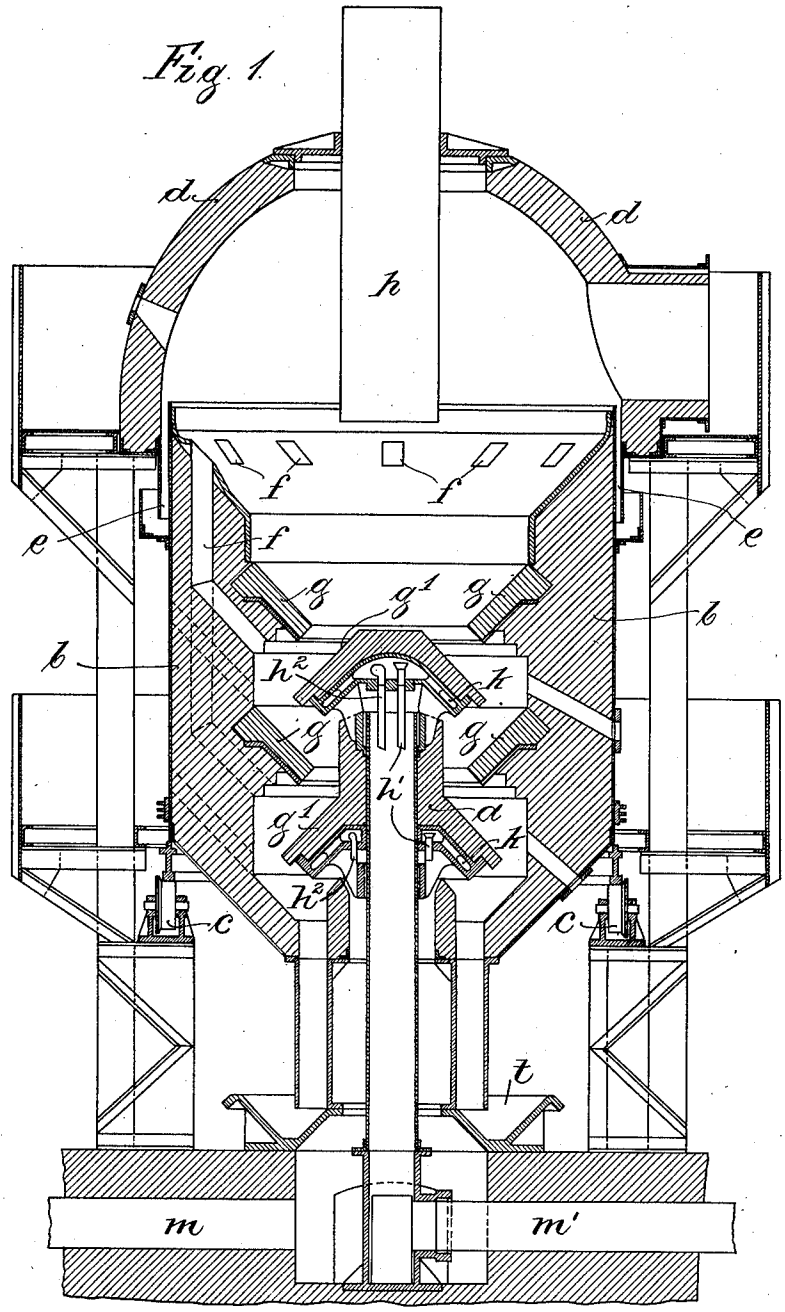
APPARATUS FOR THE TREATMENT OF SOLID BODIES WITH GASES.

APPLICATION FILED MAR. 16, 1910.

1,003,628. Patented Sept. 19, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



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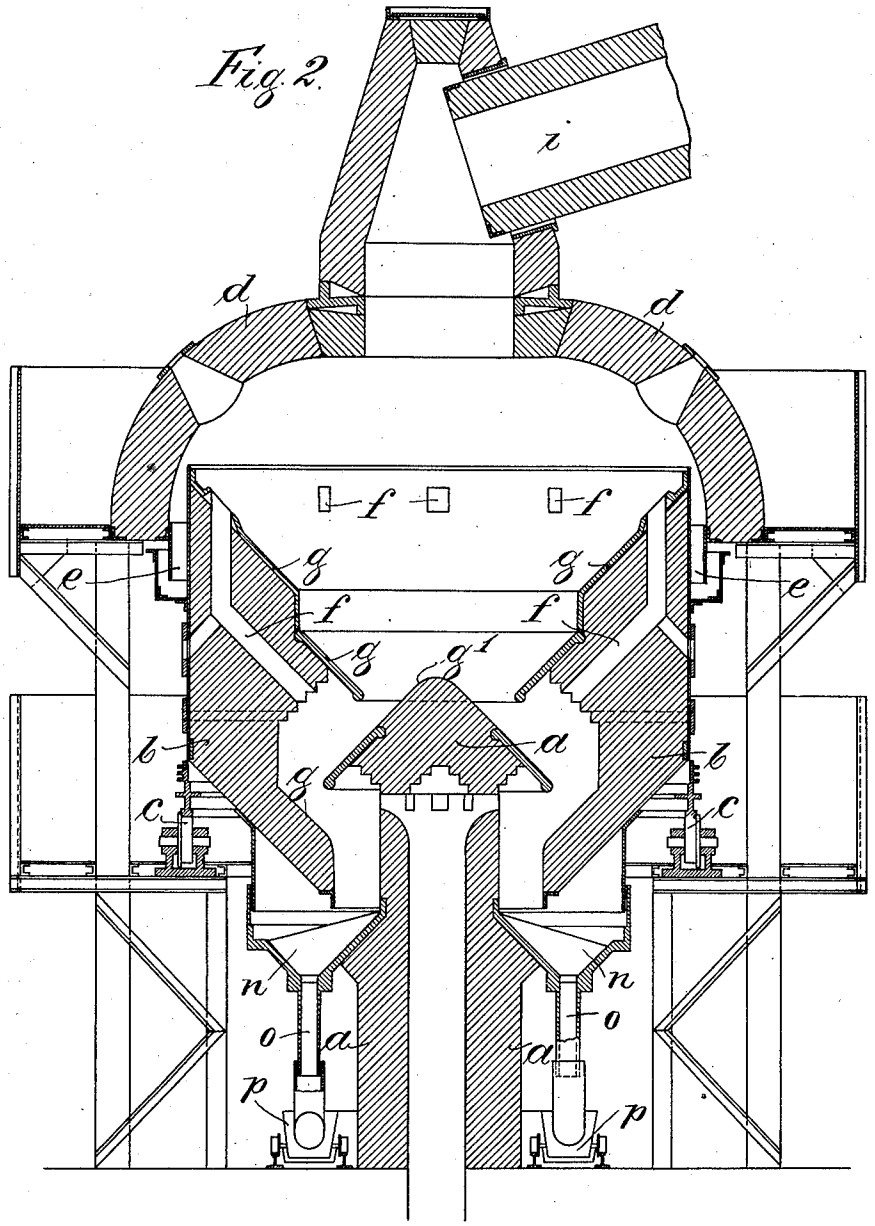
2 SHEETS—SHEET 2.

Fig. 2.



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APPARATUS FOR THE TREATMENT OF SOLID BODIES WITH GASES.

1,003,628. Specification of Letters Patent. **Patented Sept. 19, 1911.**

Application filed March 16, 1910. Serial No. 549,579.

To all whom it may concern:

Be it known that I, WALTHER MATHESIUS, a subject of the King of Prussia, and resident of 10 Carmerstrasse, Charlottenburg, near Berlin, German Empire, professor, have invented certain new and useful Improvements in Apparatus for the Treatment of Solid Bodies with Gases, of which the following is a specification.

This invention relates to improvements in apparatus for the treatment of solid bodies with gases.

The roasting of ores and the burning or coking of fuel of every kind in generators are two operations connected with the art of metallurgy, which, however different they may appear to be, yet rest upon the same basis and can be carried out with the same or similar apparatus. In both cases there is brought in question the imitation of a re-action between air or gas and solid bodies, which has to be continued for a longer or shorter period. In both cases the same metallurgical conditions hold good in practice. A certain re-action temperature must continuously be maintained within and, with the exception of special cases in roasting, coking or slagging of the solid bodies must be avoided as far as possible, since, generally speaking, air or gas can not react with conglomerated or slagged bodies. The apparatus also, in which both the aforesaid metallurgical operations are mostly conducted, possesses in common to a very great extent many prominent characteristic features in construction. It is usual to employ blast furnaces for both purposes and here the problem is to conduct the gases evenly through the material which may be either in pieces of varying size or in the form of powder and is piled in the oven or furnace. From these conditions arise two natural difficulties or disadvantages. 1. Every stream of gases, particularly when forced or sucked through finely divided or dust-like material, has the tendency of forming closed streams in chimney-like passages in the material, so that the gases pass through a portion only of the material, and 2. The nature of the re-action to be carried through being generally exothermic, easily sets up a local increase in temperature around the conglomerated solid bodies.

The object of the present invention is to avoid these disadvantages.

The invention is illustrated in the accompanying drawings, in which:

Figure 1 is a vertical section illustrating a form of furnace adapted for oxidation by roasting, and Fig. 2 a similar view illustrating a form of reducing furnace.

Referring to Fig. 1 of the drawings: The apparatus comprises in general three parts, viz. a stationary inner hollow core *a* by way of which air or other oxidizing gases are introduced into the furnace, a cylindrical outer shell *b* adapted to be rotated either continuously or intermittently upon rollers *c* guided in a circular track and driven by any suitable gearing, and a hemispherical or other stationary dome *d* adapted to collect the waste gases which pass therefrom to a suitable flue. The dome *d* and shell *b* are jointed in the usual manner by means of a water or sand seal *e*. The inner hollow core *a* is provided with one or more outer conical surfaces *g'* alternating with conical surfaces *g* carried by the outer shell *b*. The conical surfaces *g* and *g'* are formed by a series of projecting shelves and preferably the shelves *g'* are provided with water-cooled chambers *k* having water-pipes for conducting cold water thereto and for leading the heated water away. On the drawing, h^2 indicates the cold water conducting pipes and *h'* the pipes for conducting away the heated water, said pipes being led to and passing within the hollow core *a*.

In operation, the material to be oxidized is fed through the dome *d* by a feed tube *h* and slides or rolls down the surfaces *g* and *g'*, the oven being filled to about the level of the upper open ends of channels *f* in the outer shell *b*. Owing to the rotary motion of the latter the material is caused to roll and slide downward on the conical surfaces and, owing to the projecting lower ends of the latter, a free space is provided alternately exterior and interior of each conical falling layer of material so that the material falls perfectly freely and does not fill and choke the entire space as in the usual furnaces of this type in which the conical surfaces are formed by alternating >-shaped projections, so that local rises in temperature are avoided, while at the same time the material is maintained in sufficiently close contact as to prevent the formation of uninterrupted passages through the material. The falling material is met during its downward course

by the oxidizing atmosphere admitted to the hollow core *a* by way of pipes *m* and *m'*, the oxidizing atmosphere being delivered to the furnace below the different shelves *g'*, that is, at different heights, as will be readily seen from the drawing, and the waste gases after passing through the material being conducted to the dome *d* by means of the channels *f*. The finished product falls into the trough *t* which may be previously filled with water, sand or the like to form a seal, the finished product displacing the sealing medium and forming itself the seal and being removed from the trough *t* either mechanically or by hand as the oxidation in the furnace proceeds.

The reducing furnace shown at Fig. 2 is of substantially the same construction as the oxidizing furnace shown at Fig. 1 and operates as follows: The ore to be reduced is delivered by way of a rotary drum oven *i* or in other suitable manner and rolls down the conical surfaces in the manner described with reference to Fig. 1, being subjected during its downward movement to generator or other reducing gases, admitted to the hollow core *a*, the reduced ore collecting in the trough *n* and being conducted away therefrom through pipes *o* to suitable transporting means *p*.

The apparatus can be used for the production of metals such as cobalt, nickel, copper, tin and the like as well as for the reduction of iron from ores.

I claim:—

1. An apparatus for the treatment of solid bodies with gases, comprising, in combination, an inner hollow core forming an inlet for the gases, an outer shell, means for giving a relative movement thereto, conical shelves projecting from said inner core and conical shelves projecting from said outer shell and alternating with said conical shelves on the inner core, so as to give a rolling motion to the solid bodies on the shelves and from free spaces alternately exterior and interior of the conical falling layers of the solid bodies.

2. An apparatus for the treatment of solid bodies by gases comprising a stationary inner core and an outer shell capable of rotation about the axis of said inner core, alternating sloping walls provided both on said inner core and within said outer shell, and means for rotating said outer shell.

3. An apparatus for the treatment of solid bodies by gases comprising a stationary inner core and an outer shell capable of rotation about the axis of said inner core, alternating sloping walls provided both on said inner core, and within said outer shell, means for rotating said outer shell, a stationary dome and means for forming a joint between said dome and said rotary shell.

4. An apparatus for the treatment of solid bodies by gases, comprising a hollow inner core forming an inlet for the gases, conical surfaces on said core, passages in the core and below said conical surfaces for the passage of the gases, an outer shell having inner conical surfaces alternating with the conical surfaces on said core and means for giving a relative movement to said core and shell.

5. An apparatus for the treatment of solid bodies by gases, comprising a hollow inner core forming an inlet for the gases, a conical cap for said core adapted to provide passages for the gases between said cap and said core, sloping walls arranged around said core, an outer shell, means for giving a relative movement to said core and shell, sloping walls within said shell alternating with the sloping walls and conical cap on said core, outlet passages for the gases in said shell, a stationary dome adapted to close the upper end of said shell, means for forming a joint between said shell and said dome, means for feeding the material to be treated into said shell and outlets for the finished product, at the bottom of said shell.

6. An apparatus for the treatment of solid bodies by gases, comprising a hollow inner core forming an inlet for the gases, a conical cap for said core adapted to provide passages for the gases between said cap and said core, sloping walls arranged around said core, an outer shell, means for giving a relative movement to said core and shell, sloping walls within said shell alternating with the sloping walls and conical cap on said core, outlet passages for the gases in said shell, a stationary dome adapted to close the upper end of said shell, means for forming a joint between said shell and said dome, means for feeding the material to be treated into said shell, outlets for the finished product at the bottom of said shell, and means for cooling said conical cap and said sloping walls.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

WALTHER MATHESIUS.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.