No. 803,530. PATENTED OCT. 31, 1905.

G. GRÖNDAL.

FURNACE FOR BURNING CEMENT, &c.

APPLICATION FILED APR. 2, 1904.

3 SHEETS—SHEET 1.

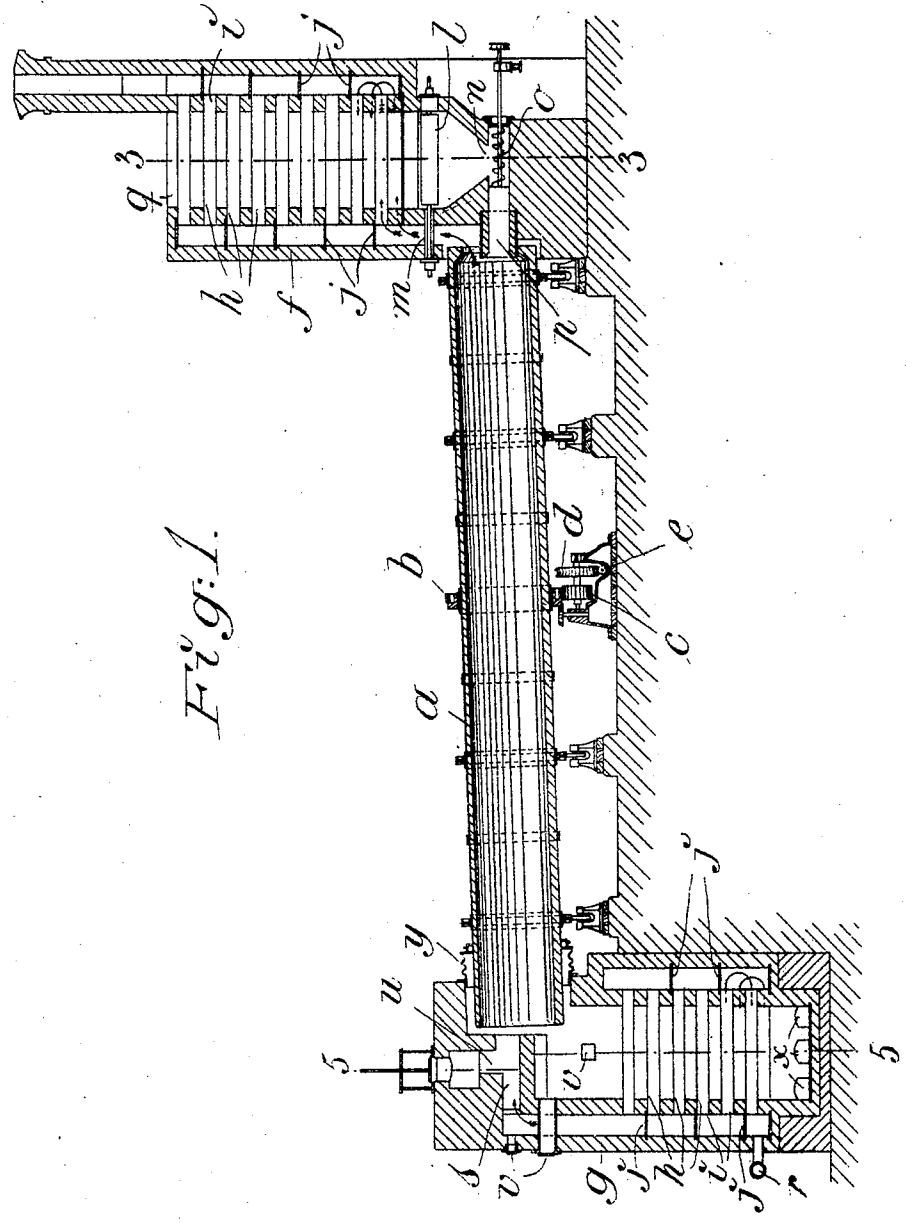


Fig. 1.

WITNESSES:
F. W. Wright
E. W. Collins

INVENTOR
Gustaf Gröndal
BY Howson and Howson
ATTORNEYS.

No. 803,530. PATENTED OCT. 31, 1905.

G. GRÖNDAL.

FURNACE FOR BURNING CEMENT, &c.

APPLICATION FILED APR. 2, 1904.

3 SHEETS—SHEET 2.

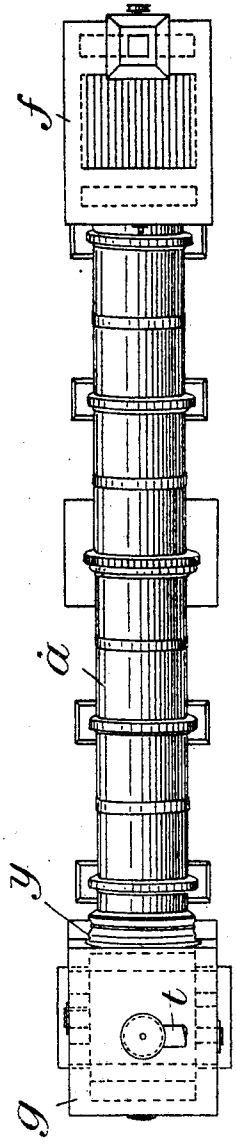


Fig. 2.

WITNESSES:
F. W. Wright
E. W. Collins

INVENTOR
Gustaf Gröndal
BY
Howson and Howson
ATTORNEYS.

No. 803,530. PATENTED OCT. 31, 1905.

G. GRÖNDAL.

FURNACE FOR BURNING CEMENT, &c.

APPLICATION FILED APR. 2, 1904.

3 SHEETS—SHEET 3.

Fig. 3.

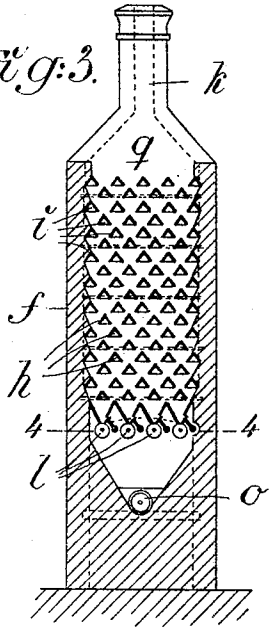


Fig. 5.

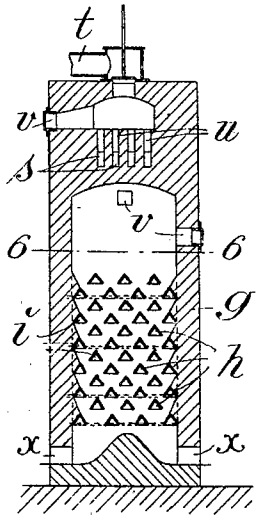


Fig. 4.

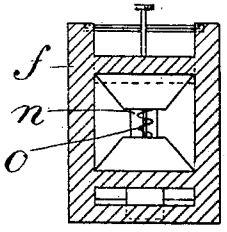
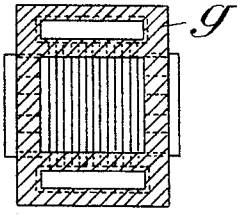


Fig. 6



WITNESSES:

F. W. Wright

E. W. Collins

INVENTOR

Gustaf Gröndal

BY

Howson and Howson

ATTORNEYS.

UNITED STATES PATENT OFFICE.

GUSTAF GRÖNDAL, OF DJURSHOLM, SWEDEN.

FURNACE FOR BURNING CEMENT, &c.

No. 803,530. Specification of Letters Patent. Patented Oct. 31, 1905.

Application filed April 2, 1904. Serial No. 201,304.

To all whom it may concern.

Be it known that I, GUSTAF GRÖNDAL, a subject of the King of Sweden and Norway, and a resident of Djursholm, Sweden, have invented a new and useful Improved Furnace for Burning Cement or for other Purposes, (for which I have applied for a patent in Sweden December 23, 1903, No. 2,383,) of which the following is a specification.

This invention refers to a furnace for burning cement and for other purposes, such as for producing iron sponge, and calcining or roasting.

The furnace comprises a cylinder or drum of cylindrical or polygonal cross-section, which is slightly inclined to the horizontal. The higher end of the cylinder communicates with the interior of a vertical furnace for the preliminary heating, or it may be drying, of the raw materials and for collecting dust which may escape from the cylinder. The lower end of the cylinder communicates with the interior of a vertical shaft in which the product delivered from the cylinder may be cooled and in which the air or gas necessary for combustion in the cylinder may be preheated.

In the accompanying drawings there is shown, by way of example, a furnace constructed according to the invention.

Figure 1 is a longitudinal vertical section; Fig. 2, a plan; Fig. 3, a vertical section on line 3 3 of Fig. 1 looking toward the right, and Fig. 4 a horizontal section on line 4 4 of Fig. 3. Fig. 5 is a vertical section on line 5 5 of Fig. 1 looking toward the left, and Fig. 6 a horizontal section on line 6 6 of Fig. 5.

The drum *a*, which is cylindrical, is arranged in a manner well known in the cement industry and is capable of being rotated by any suitable mechanism, which in this case comprises a toothed ring *b* on the periphery of the cylinder, gearing with a toothed wheel *c*, on the shaft of which there is fixed a worm-wheel *d*, driven by a worm *e*. The vertical furnace *f* and shaft *g* are of rectangular cross-section and have two opposite walls built double. Through the inner walls and transversely through the shaft of the furnace *f* and through the shaft *g*, respectively, passes a number of angle-irons *h*, having slightly acute angles and arranged horizontally in quincunx order, with the angles upward. Under the ends of the angle-irons are perforations *i* in the walls, so that when the furnace or shaft is filled with material there will be a channel under each angle-iron extending between the chambers formed between the double walls. These chambers in the walls have partitions *j*, those in one chamber being each on a plane higher than that in which is the corresponding partition in the other chamber, so that there is formed a continuous passage to and fro up through the furnace. The higher end of the cylinder opens into the lower part of one of the said chambers of the furnace *f*, and the upper part of the other chamber in this furnace opens into the chimney *k*. The bottom of furnace *f* is also formed by angle-irons, and the spaces between them are closed by rollers *l* beneath them. The shafts *m* of these rollers extend outside the furnace and are turned in any suitable manner. On the side toward which the upper surface of each roller rotates there is an opening along the roller covered by a shutter which is carried by arms from a shaft extending outside the furnace. All these shafts can be turned from the outside in any suitable manner, so as to adjust the shutters, and thereby regulate the delivery of the material. This adjusting device, which is identical with the device described in the copending application, Serial No. 150,441, may, however, be changed for any other suitable device, if desired. The chamber beneath the rollers is funnel-shaped and has an opening *n*, through which the material falls onto a conveyer *o*, which feeds it into the drum *a* through a channel *p*, opening into the drum.

q is the mouth of the furnace.

The lower end of the cylinder *a* extends into the upper part of the shaft *g*. Through the pipe *r* air (or it may be combustible gas) is supplied and passes to and fro up through the shaft, as in the furnace *f*, escaping through the channels *s*. Combustible gas (or air) is supplied under pressure through the pipe *t* and enters the channels *s* through the openings *u*, the gas mixture thus formed passing into the cylinder *a*, where it burns.

v v are spy and cleaning holes.

x x are discharge-openings.

For certain requirements shaft *g* may have adjustable discharge-openings similar to those in the furnace *f*.

The ends of the cylinder *a* should fit closely against the furnace *f* and the shaft *g*, respectively. As an example there is shown a pack-

ing consisting of a sleeve of corrugated sheet-iron *y* at the lower end of the cylinder *a*. At the higher end of the cylinder no packing device is shown.

By varying the proportion of gas to air an oxidizing, reducing, or neutral flame may be obtained in the cylinder, according to the requirement for which the furnace is intended.

In working the furnace the raw materials, which preferably should be in the form of grain or powder, are charged through the mouth *q* in the furnace *f* and pass down through this furnace exposed to the hot gases passing through the channels and coming from the cylinder *a*, which gases are thereby cooled. If dust accompany the gases from the cylinder, it is completely deposited as the gases pass over the large surface of charged material under each angle-iron. In the cylinder the material is treated in the known manner or as the case requires at the prevailing temperature. The finished product is delivered into the shaft *g*, where it is cooled by the air or gas passing through it from the pipe *r*, the said air or gas being thereby itself heated before entering the combustion-chamber of the cylinder *a*. The cooled product is removed through the openings *x*.

I claim—

A furnace for burning cement or reducing or calcining ores comprising a hollow rotating cylinder or drum slightly inclined to the horizontal, a vertical furnace located above the upper end of the cylinder, a shaft located under the lower end of the cylinder, a device for making a gaseous mixture at the lower end of the cylinder and a feeding device under the said vertical furnace conveying material therefrom to the cylinder, the construction of the said vertical furnace and shaft being such that air or gas may pass from the lower part to the upper part thereof in horizontal passages leading to and fro therethrough.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAF GRÖNDAL.

Witnesses:
GUSTAF AFFSEN,
MD. JÄNSTRÖM.