

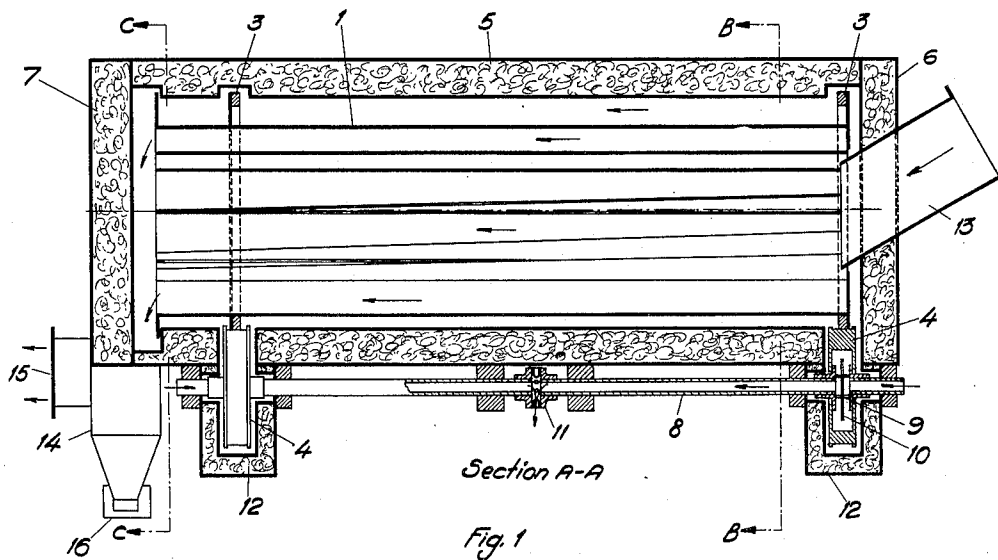
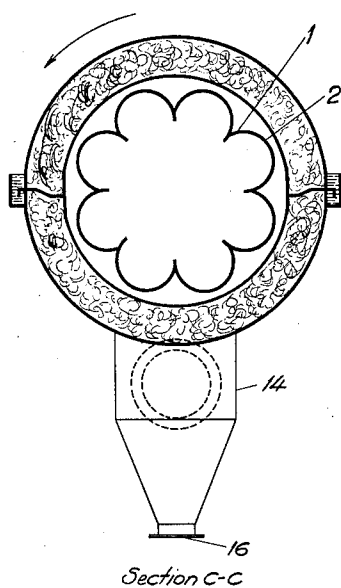
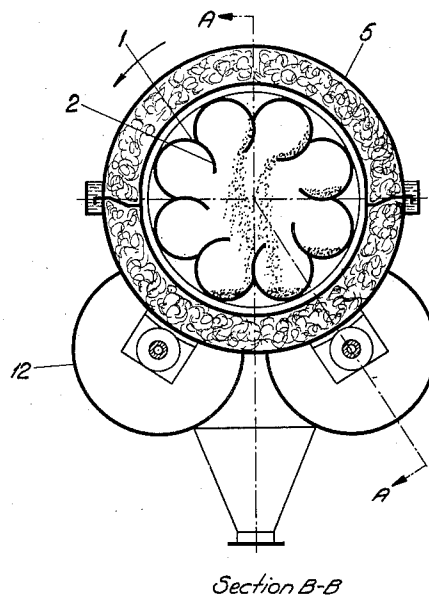
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ROTARY FURNACE FOR TREATING PULVERIZED ORE WITH GAS

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ROTARY FURNACE FOR TREATING PULVERIZED ORE WITH GAS

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6 Claims. (Cl. 263—33)

The present invention has for its object a rotary furnace of the drum type especially for treating pulverized ore with reducing gases, and in which the ore can be intimately mixed with the reducing gases at a comparatively high temperature.

A further object of the invention is a furnace of the above mentioned type provided with means for avoiding the sticking of the ore or reduced metal of the reduction temperature.

The invention also has for its object means for feeding the goods through the furnace with a different speed according to the size of the ore grains.

According to the invention the goods being treated are given an alternating sliding and falling motion combined with a longitudinal motion through the furnace. In order to prevent sticking at the sliding surfaces inside the furnace, all sliding surfaces inside the furnace are curved in such a manner that the sliding motion becomes quite continuous only interrupted at intervals by a falling motion. As the sticking will not be avoided if the surfaces mentioned are formed of ceramic material, the sliding surfaces in the furnace according to the invention are formed by a high grade heat resistant metal or alloy, also able to withstand the action of the reducing gases used in the process. For this purpose an alloy of iron with chromium and a comparatively high nickel content has proved to be especially suitable.

As investigations have shown that the reduction in time is shorter for smaller particles, the particles according to the invention are fed through the furnace with a different speed according to their size in order to obtain uniform final condition. This is accomplished by regulating the velocity of the gas stream through the furnace, to cause a deviation at the falling motion of the grains, this deviation being larger for the smaller grains. In other furnaces of the above type the feeding through the furnace is accomplished only by giving the furnace a slight slope, but the deviation accomplished in that way is equal for all the grains.

By our invention a selection of the grains is obtained during the feeding motion, because the deviation at the falling motion is influenced by the gas stream which will act more efficiently on the smaller grains. The time of treatment of the smaller grains will therefore automatically be shorter than for the larger grains, so that all grains will be uniformly treated.

In the accompanying drawing, Fig. 1 shows a

longitudinal section through a furnace embodying the invention and Fig. 2 a cross section through the furnace at the inlet end. Fig. 3 is a cross section of the outlet end.

In all the figures, 1 is a drum of a preferably heat resisting alloy formed by cylindrically bent sheets 2 welded together and forming pockets open towards the axis of the drum. At the ends, rings 3 are welded to the drum, by means of which the drum rests on the driving wheels 4. The drum is covered by a stationary heat insulating cover formed by a cylindrical part 5 and end covers 6 and 7 at the inlet and outlet end respectively. The driving wheels 4 are mounted on hollow shafts 8, the wheels also being hollow so that cooling air or water can be passed through the shafts and the wheels. The cooling medium enters at the ends of the shafts and passes through holes 9 in the shafts into the hollow wheels, in which it passes round a circular sheet or disk 10 in order to come in contact with the peripheral parts of the wheels and leaves the shaft for example at the coupling 11. On account of this cooling arrangement the wheels can be wholly enclosed in the same insulation cover as the drum. In the form illustrated, the wheels are enclosed in separate insulating covers 12 communicating with the cover enclosing the drum.

In the end cover 6 the inlet tube 13 for gas and ore is rigidly mounted, the tube 13 extending into the rotating drum. The reducing gas is delivered from a special generator not shown on the drawing, and in this generator the gas is given a suitable composition and temperature, so that any special heating of the drum is unnecessary. The flow of the gas through the drum is indicated by the arrows.

According to the special form of the inner surface of the drum and according to the direction of the rotation shown by the arrows, the ore at the rotation of the drum obtains a sliding motion in a direction perpendicular to the axis of the drum alternating with a slightly deviated falling motion across the drum. At the outlet end the ore and gas are separated in the separator 14 in a manner not shown on the drawing, the gas leaving through the tube 15 as indicated by the arrow and the ore being discharged through the outlet 16.

Due to the comparatively high speed of the gas stream in the drum (about 3 m/sec.) the ore particles at the falling motion are given a speed component in the direction towards the outlet end, with the effect described above. According

to the special form of the sliding surfaces, the ore sand is in a state of continuously sliding, whereby the risk of sticking is effectively avoided.

The longitudinal cylindrical pockets forming the drum are open towards the axis of the drum, this opening being gradually enlarged towards the outlet end, so that the cross section of the drum at this end will be that shown in Fig. 3. Due to this arrangement the time for the sliding motion is shortened towards the end of the process. This falling motion will therefore take place more frequently towards the end of the process. The falling ore will form a series of curtains and on account of above arrangement these curtains will not only be more dense towards the end of the process, but will also form a series of helical surfaces, whereby the gas stream will strike against the curtains at an angle, thus making the contact between the ore and the gas stream more intimate.

The arrangement of the drum inside a stationary heat insulating cover has the advantage that the drum need not carry the weight of the insulating material. This is of extremely great value, as the tensile strength of the metal forming the drum is very low at the operating temperature.

We claim as our invention:—

1. A furnace of the rotary horizontal drum type for treating ores with hot gases, comprising an inlet charging said furnace at one end with ore, means to receive and separate the ore and gases at the other end, said inlet serving also for passing the hot gases as a blast into the furnace in the same direction as the ores, and means for effecting an alternating falling and continuously sliding motion of the ore inside the furnace consisting of a plurality of continuously curved sliding surfaces arranged inside the furnace, and forming ore-receiving pockets that decrease in capacity uniformly towards the discharge end of the furnace.

2. A furnace of the rotary horizontal drum type for treating ores with hot gases, an inlet for charging said furnace at one end with ore, means to receive and separate the treated ore and gases at the other end, said inlet serving also for passing the hot gases as a blast into the furnace in the same direction as the ores, and means for effecting an alternating falling and continuously sliding motion of the ore inside the furnace consisting of metal parts with a curved surface, said parts being made of a high grade heat resisting metal or alloy and forming internal ore-receiving pockets each having an ore capacity that de-

creases gradually towards the discharge end of the furnace.

3. A furnace of the rotary horizontal drum type for treating ores with hot gases, an inlet for charging said furnace at one end with ore, means to receive and separate the treated ore and the gases at the other end, said inlet serving also for passing the hot gases as a blast into the furnace in the same direction as the ores, means for effecting an alternating falling and continuously sliding motion of the ore inside the furnace, a stationary heat-insulating casing surrounding the drum of said furnace, and means for rotating the drum independently of said casing.

4. A furnace of the rotary horizontal drum type for continuous reduction of pulverized ores by means of hot reducing gases, comprising a revolving cylindrical drum of heat resisting material, pockets located inside the drum and open towards the axis of the drum and extending from one end of the drum to the other, the openings of the said pockets being wider towards the discharge end of the furnace, a common inlet for the ores and gases at one end of the drum, a common outlet for the reduced metal and the gases at the other end and a separator for separating the reduced metal from the said gases after the delivery from the furnace.

5. A furnace of the rotary horizontal drum type for continuous reduction of pulverized ores by means of hot reducing gases, comprising a drum formed of cylindrically bent sheets of heat resisting sheet material, pockets inside the said drum formed by parts of the said sheets, the said pockets having openings disposed towards the axis of the furnace and being wider towards the discharge end of the furnace, the edges of the said pockets forming an angle with lines parallel to the axis of the drum.

6. A furnace of the rotary horizontal drum type for continuous reduction of pulverized ores by means of hot reducing gases, comprising a drum of heat resisting sheet material having longitudinally extending internal pockets, a common inlet for the ores and reducing gases at one end of the drum, a common outlet for the reduced metal and the gases at the other end of the drum, a separator for separating the reduced metal from the reducing gases after delivery from the furnace, a stationary heat insulating casing enclosing the said revolving drum, and means for rotating the drum within said casing.

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