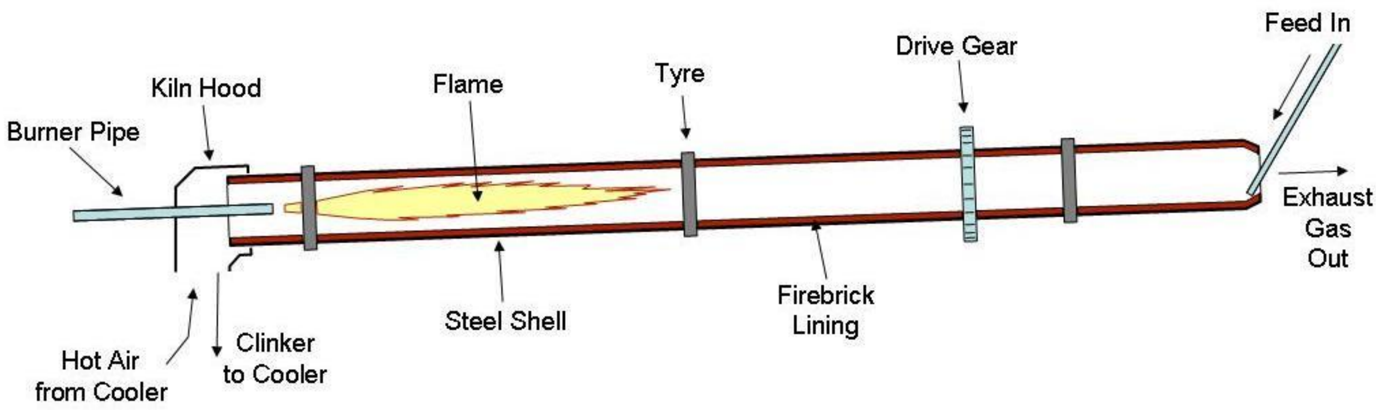
Rotary Kiln

Brief Introduction of Rotary Kiln

A rotary kiln is a pyroprocessing device used to raise materials to a high temperature (calcination) in a continuous process. Materials produced using rotary kilns include: Cement, Lime, Refractories, Metakaolin,Titanium dioxide, Alumina, Vermiculite,Iron ore pellets

They are also used for roasting a wide variety of sulfide ores prior to metal extraction. In addition, in the aspects of environmental protection, it has 20 years of history that developed countries use rotary kiln burning hazardous waste, garbage. This not only makes waste minimization, harmless, and will use waste as a fuel that saving of pulverized coal to achieve the purpose of rational utilization of the waste.



The kiln is a cylindrical vessel, inclined slightly to the horizontal, which is rotated slowly about its axis. The material to be processed is fed into the upper end of the cylinder. As the kiln rotates, material gradually moves down towards the lower end, and may undergo a certain amount of stirring and mixing. Hot gases pass along the kiln, sometimes in the same direction as the process material (co-current), but usually in the opposite direction (counter-current). The hot gases may be generated in an external furnace, or may be generated by a flame inside the kiln. Such a flame is projected from a burner-pipe (or "firing pipe") which acts like a large bunsen burner. The fuel we use for this is gas, or pulverized coal.

Construction

The basic components of a rotary kiln are the shell, the refractory lining, support tyres and rollers, drive gear and internal heat exchangers.

- **Kiln Shell**

This is made from rolled mild steel plate, usually between 15 and 30 mm thick, welded to form a cylinder which may be up to 230 m in length and up to 6 m in diameter.

- **Refractory Lining**

The purpose of the refractory lining is to insulate the steel shell from the high temperatures inside the kiln, and to protect it from the corrosive properties of the process material. It may consist of refractory bricks or cast refractory concrete, or may be absent in zones of the kiln that are below around 250 ℃. The thickness of the lining is generally in the range 80 to 300 mm. A typical refractory will be capable of maintaining a temperature drop of 1000 ℃ or more between its hot and cold faces. The shell temperature needs to be maintained below around 350 ℃ in order to protect the steel from damage, and continuous infrared scanners are used to give early warning of "hot-spots" indicative of refractory failure.

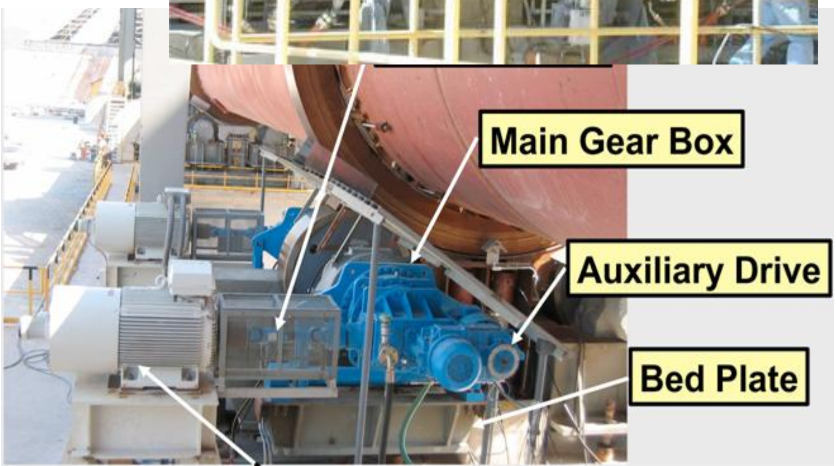
- **Tyres and Rollers**

Tyres, sometimes called riding rings, usually consist of a single annular steel casting, machined to a smooth cylindrical surface, which attach loosely to the kiln shell through a variety of "chair" arrangements. These require some ingenuity of design, since the tyre must fit the shell snugly, but also allow thermal movement. The tyre rides on pairs of steel rollers, also machined to a smooth cylindrical surface, and set about half a kiln-diameter apart.

The rollers must support the kiln, and allow rotation that is as nearly frictionless as possible. A well-engineered kiln, when the power is cut off, will swing pendulum-like many times before coming to rest. The longest kilns may have 8 sets of rollers, while very short kilns may have only two. The bearings of the rollers must be capable of withstanding the large static and live loads involved, and must be carefully protected from the heat of the kiln and the ingress of dust. In addition to support rollers, there are usually upper and lower "retaining (or thrust) rollers" bearing against the side of tyres, that prevent the kiln from slipping off the support rollers.

- **Drive Gear**

The kiln is usually turned by means of a single Girth Gear surrounding a cooler part of the kiln tube, but sometimes it is turned by driven rollers. The gear is connected through a gear train to a variable-speed electric motor. This must have high starting torque in order to start the kiln with a large eccentric load.



The speed of material flow through the kiln is proportional to rotation speed, and so a variable speed drive is needed in order to control this. When driving through rollers, hydraulic drives may be used. These have the advantage of developing extremely high torque. In many processes, it is dangerous to allow a hot kiln to stand still if the drive power fails. Temperature differences between the top and bottom of the kiln may cause the kiln to warp, and refractory is damaged. It is therefore normal to provide an auxiliary drive for use during power cuts. This may be a small electric motor with an independent power supply, or a diesel engine. This turns the kiln very slowly, but enough to prevent damage.

- **Other equipment**

The kiln connects with a material exit hood at the lower end and to ducts for waste gases. The gases must be drawn through the kiln, and the preheater if fitted, by a fan situated at the exhaust end.

In preheater installations which may have a high pressure-drop, a lot of fan power may be needed, and the fan is often then largest drive in the kiln system. Exhaust gases contain dust and there may be undesirable constituents such as sulfur dioxide or hydrogen chloride. Equipment is installed to scrub these out before the exhaust gases pass to atmosphere.

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