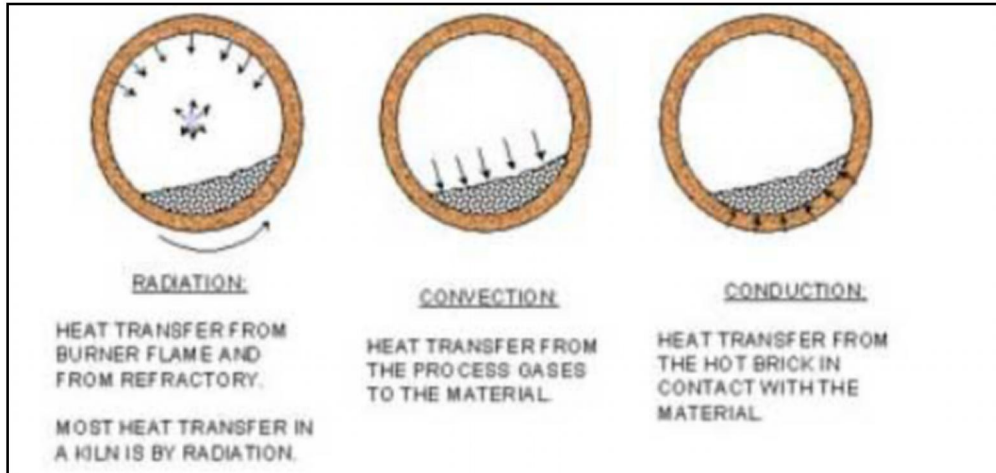




A **ROTARY KILN** is a *Direct Fired, Refractory Lined* equipment for high temperature applications where it is necessary to change the 'state' of the material in a continuous process or in batch type process. Since this process usually requires a long residence time, the length to diameter ratio is often in excess of 10:1 in a continuous kiln. In most cases an oil or gas burner fires directly into the discharge end of the unit. The material is heated in three ways - by radiation from the burner flame, conduction from the refractory lining and convection by contact with the hot gases. They are also used for roasting a wide variety of ores.

PRINCIPLE

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



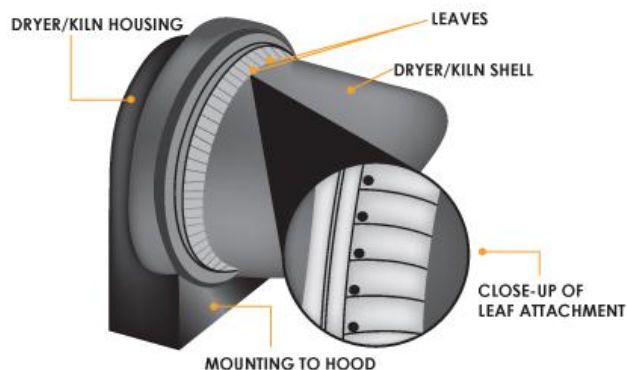
kiln. Such a flame is projected from a burner-pipe. The fuel for this may be gas, oil or pulverized coal. Solids retention time in the kiln is an important factor and is set by proper selection of diameter, length, speed, slope and the internal design.

CONSTRUCTION

The basic components of a rotary kiln are the refractory lined shell, support tyres and rollers, drive gear and burner system. A typical Rotary Kiln is cylindrical shell, slightly inclined from the horizontal and supported on two or more tyres, which in rotate on rollers. One of the tyre is fixed by a set of thrust rollers to take care of the thrust load during kiln movement. The drum assembly along with tyres is rotated by a girth gear/pinion arrangement.



SEALING ARRANGEMENT



To maintain proper control of the volume and the temperature of the gases flowing through the kiln, it is necessary to limit the leakage of the external cold air in to the kiln where the rotating shell enter at the feed and discharge hood. Seal rings are provided at both ends between the hood and shell for this purpose. Various types of seal rings are used which include spring loaded rubbing type where two finished metal surfaces are in contact under spring pressure and spring plate type.

TYRES & SUPPORT 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 wedge 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 support 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. Depend on size and capacity an additional tyre can be provided with a set of support rollers. Kilns usually rotate at 0.5 to 2 rpm. The bearings of the support 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.



BEARINGS & DRIVE COMPONENTS

Bearings are uniquely designed for this application. The most common are the anti-friction or spherical roller bearings. These bearings have become standardized and perform excellently in almost any condition.

Rotary Kilns are normally gear driven through girth gear mounted over the shell on gear support base, assembled on a section of the shell away from the shell end where high temperature is encountered. To compensate the thermal expansion, the girth gear is mounted on a tangential spring plates attached to the shell.



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. The refractory selected depends upon the temperature inside the kiln and the chemical nature of the material being processed. Mostly refractory is installed as solid block to fit in to different areas tightly in round formation from sliding or falling out. There are many types of bricks in different composition and have different properties such as insulation value, maximum temperature and resistance to wear. Areas where brick cannot be used liquid refractor called castables are used with anchor support. Also provided insulation material under the brick and this extra layer helps to reduce the heat transfer to the shell. A typical refractory will be capable of maintaining a temperature drop of 1000°C or more between its hot and cold faces. The shell temperature needs to be maintained below around 350°C 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.



FIRING SYSTEM

The hot gases may be generated in an external furnace, Hot Air Generator (HAG), or may be generated by a flame inside the kiln. Such a flame is projected from a burner-pipe. The fuel for this may be gas, oil or pulverized coal. The fuel could be mixed with air before or in the burner. The flame temperature is a factor of fuel type, fuel/air ratio and other burning conditions.



SCRUBBER & DUST COLLECTION

Exhaust gases from an oil fired kiln contain certain proportion of very fine dust, entrained in the air stream while in contact with materials being calcined 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.

A Dust Collector of high efficiency cyclone type is used to trap the fine dust. Very fine particles which escape the dry collector may be recovered by means of a wet collector in the form of a sludge or alternatively by means of Bag Filter.



ROTARY COOLER

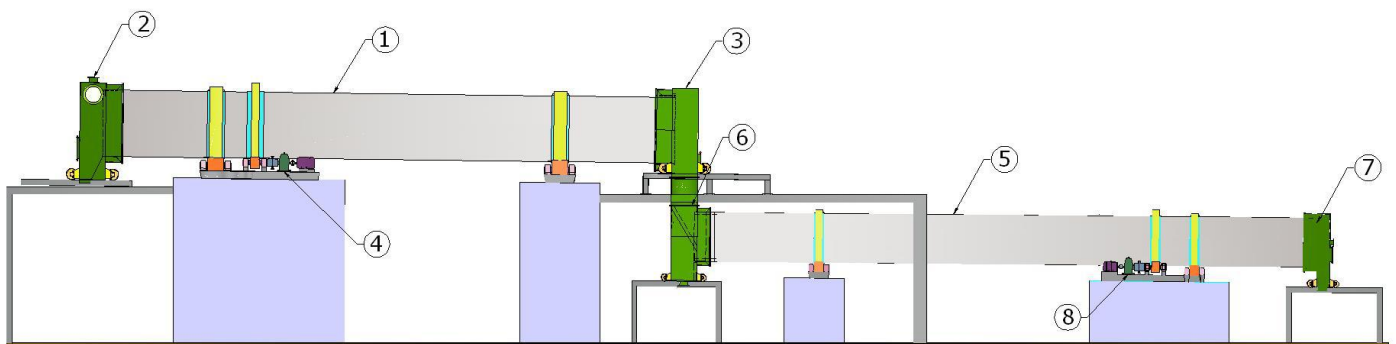
ROTARY COOLER is a part of Rotary kiln system used to lower the temperature of the hot products discharged from the kiln to a temperature approaching ambient. The Rotary Cooler is installed beneath the Rotary Kiln and interconnected with the kiln discharge hood. The construction is similar to Rotary kiln with a cylindrical shell inclined to the horizontal with tyres, support rollers, feed hood and driven by girth gear & pinion. A part of the cooler shell is castable lined to take care of the shell from the hot discharge.

The Rotary Cooler operates in counter-flow, the hot gases being substituted by ambient or chilled air, which is in direct contact with the hot material. For high temperature applications the material is cooled to a temperature approaching ambient by continuous water spray over the shell and operates on the principle of heat transfer through the rotating cylinder wall which is continuously irrigated by a series of external water sprays mounted over the unit. The water is partially evaporated as steam while the excess is collected from the bottom of the unit and re-circulated. The material thus cooled is discharged from the other end of the shell.



ROTARY CARBONISER (KILN) FOR ACTIVATED CARBON UNITS

Rotary carbonisers (kilns) are used in Activated carbon units for the steam activation of carbon granules (charcoal) at a controlled temperature. The kiln is unique in design with a spiral wound cooling coil arrangement fixed over the discharge end of the shell to lower the product temperature during the discharge through cooling coil. The system is



LAYOUT OF ROTARY KILN AND ROTARY COOLER

1) ROTARY KILN
5) ROTARY COOLER

2) FEED HOOD OF ROTARY KILN
6) FEED HOOD OF ROTARY COOLER

3) DISCHARGE HOOD OF ROTARY KILN
7) DISCHARGE HOOD OF ROTARY COOLER

4) DRIVE ARRANGEMENT OF ROTARY KILN
8) DRIVE ARRANGEMENT OF ROTARY COOLER

complete with moveable type feed hood for easy maintenance, rubbing type, spring loaded sealing arrangement at both ends of the carboniser to seal and to control the atmospheric air entry in to the burning zone through adjustable damper valve provided on the feed hood, Steel casted girth gear with back-up plate to take-up the expansion during operation, cone at discharge end for free flow of flue gas through flue gas pipe etc.

APPLICATION

Rotary kilns are used for the calcinations of Titanium dioxide, Illeminate, kaolin, Barium Carbonate, Magnesium Carbonate, Silica Gel, Lime, Activated Carbon, Vermiculite, Barium Sulphide, Magnesium Oxide, Petroleum Coke, Clay, Gypsum, Alumina etc.