MITCHELL DRYERS LTD

Rotary Dryers

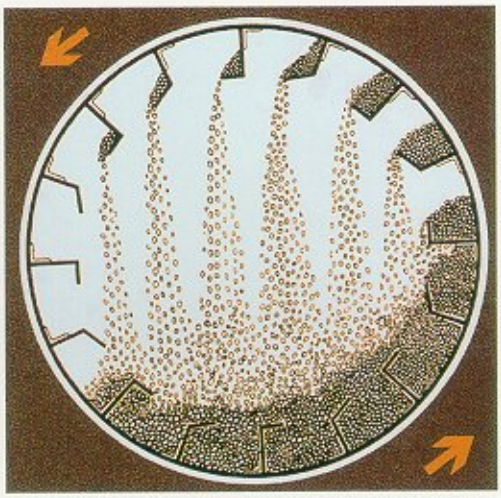
Mitchell Dryers Limited

Direct Fired Rotary Dryers

The basic rotary dryer consists of a sloped revolving steel shell through which the wet material is fed. Drying is effected by blowing a current of warm air through the shell which heats the material and evaporates the moisture. The operation is made more effective by the incorporation of lifting flights, which cascade the material through the volume of the shell, making for better contact with the drying air.

Since the process gas stream is brought into direct contact, the heating of the material and evaporation of the moisture depends on heat transfer between the hot gas and the wet solid. The hot gas removes the evaporated moisture and carries it from the dryer. The Mitchell range of direct heated rotary dryers vary in size from pilot plants for laboratory studies to units of typically 3.2m diameter and 25m long, with this latter size able to evaporate in the order of 15 Tonnes/hour of water. Larger sizes are also possible. A variety of heating sources can be provided:-

- ☑ Gas.
- ☑ Oil.
- ☑ Coal.
- ☑ Steam.
- ☑ Thermal fluid transfer.
- ☑ Hot waste gases.



As the shell rotates, the material is constantly brought into contact with the hot air.

Direct Fired Rotary Dryer 1m dia x 4.5m

Direct Fired Rotary Calciners

Direct fired rotary calciners are used in processes requiring roasting, oxidising, reducing or heat treatment at temperatures above those normally used for drying. The oil or gas burner is mounted to fire directly into the end of the shell with counter-current flow being the normal arrangement, although parallel flow is sometimes required.

Operating temperatures of up to 1650°C can readily be achieved in the larger size units. At these higher temperature levels it is usual to incorporate two types of lining material, with high temperature refractory bricks on the inside and a layer of insulating bricks adjacent to the steel shell. On the smaller size units a single layer of castable refractory is normally provided.

Heat is transferred to the material by direct convection and radiation from the gases and also by conduction and radiation from the hot refractory lining. Rotational speeds are much lower than with rotary dryers and it is not usual to fit lifting flights or disturbers inside the shell. The material is in direct contact with the refractory at the floor of the kiln and is gradually carried forward by the rotational action and a slight slope.

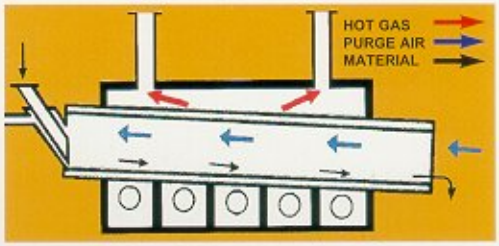
Direct Fired Calciner 3m dia x 50m

Continuous rotary kilns of this type are used widely for the calcining of such materials as phosphates, ores, iron oxide, inorganic salts and refractory powders.

Indirect Fired Rotary Dryers

With indirectly heated dryers the products of combustion do not come into contact with the material being dried. Heat is transferred to the wet material by conduction and radiation through the dryer shell. In this type of dryer most of the shell is enclosed in an insulated steel jacket. There are two alternative methods of supplying heat to the shell.

One method uses a separate combustion chamber with the gas ducted to the heating jacket. A hot gas fan is normally employed with the majority of the gases being re-circulated. Alternatively, separate burners can be positioned along one side of the jacket to fire hot gases into the space



immediately adjacent to the shell. This method of heating permits the highest shell temperatures to be reached.

We are able to provide a choice of heating systems.

- ☑ Gas.
- ☑ Oil
- ☑ Electric
- ☑ Steam

Indirect Fired Rotary Dryer plus Cooler 0.9m dia x 5.5m

Indirect Fired Rotary Calciners

As with indirectly heated rotary dryers, these calciners are used for materials which are too fine or too low a density to be handled in direct fired units. They are also used for applications where contact with the products of combustion is not permitted or a special atmosphere is required; for example the volume of the shell can be filled with an inert atmosphere - or any other gas to suit specific needs.

Indirect Fired Rotary Calciner 1.1m dia x 4m

Rotary Coolers

Air Coolers

The material to be cooled is introduced into the shell, lifted and cascaded by internal flights through the cooling airstream which flows from the opposite end.

Counter-current flow enables the product temperature to approach closely that of the ambient air stream. The exhausted air from the cooler can be fed into proceeding dryer stages as an economy measure.

Water Coolers

Water is normally applied externally to the shell by means of spray pipes. The cold cylinder walls in turn cool the material inside. The support treads and drive are mounted towards the ends of the shell and the centre portion enclosed by a shroud which contains the water pipes.

A water spray cooling section is often incorporated at the end of an indirectly heated rotary calciner, a single shell serving both operations.

Rotary Air Cooler 3.4m dia x 17m

Steam Tube Dryers

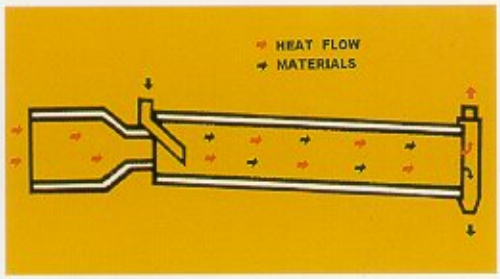
Steam Tube Dryers, which are continuously operated, are used for drying a wide range of materials from fine powders to large particulate solids. The dryer consists of a horizontal rotating shell fitted with a large number of heating tubes. Although the tubes normally carry steam, hot oil or water can also be employed. As the shell rotates, the tubes are brought into contact with the material which cascades onto the floor of the shell. Heat transfer is by conduction through the tubes. Evaporated moisture is removed by a purge of air drawn through the dryer.

Steam Tube Rotary Dryer 2.8m dia x 19.6m

Direct Fired Rotary Dryers and Calciners are available in two configurations depending on the nature of the material to be dried.

Parallel Flow

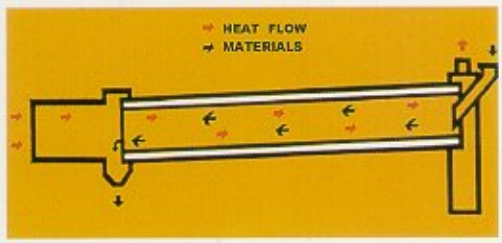
Drying air is introduced at the same end of the shell as the feed material. Thus only the wettest material is in contact with the highest temperature air. The large temperature difference between the wet material and the drying air facilitates rapid evaporation whilst maintaining the product temperature as low as possible. Parallel flow is therefore particularly suited to the handling of heat sensitive materials, and higher drying air temperatures are generally possible than with counter-current airflow. The more rapid initial drying with



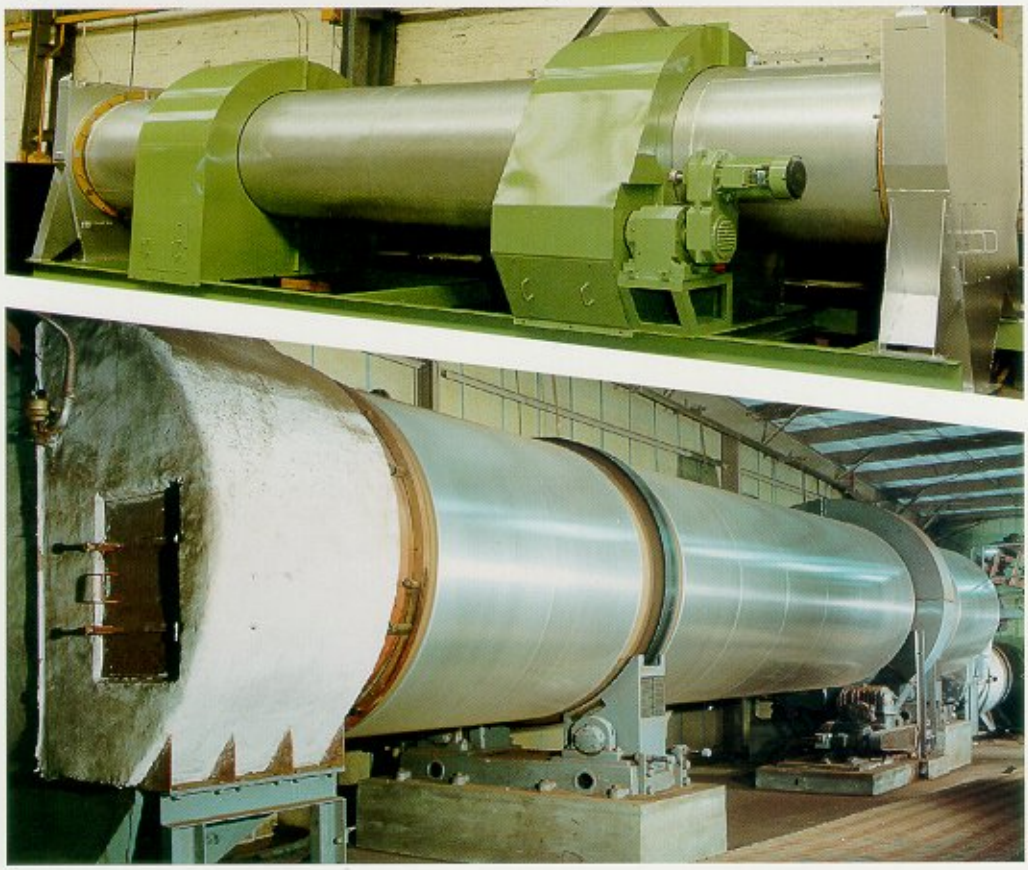
parallel flow is also advantageous when handling materials which tend to be sticky or cohesive, enabling this phase to be passed through more rapidly.

Counter Current Flow

The warm air enters the dryer at the opposite end to the feed material. Counter-current flow therefore brings the highest temperature air into contact with the product as the final traces of moisture are being removed, and this helps to ensure the lowest possible moisture content. The product temperature is therefore normally higher than with the equivalent parallel flow dryer and this system can be used where it



is desired to discharge the material at a high temperature.



Above: Rotary Dryer 1.2m dia x 7.2m

Below: Rotary Dryer 2.0m dia x 12.2m