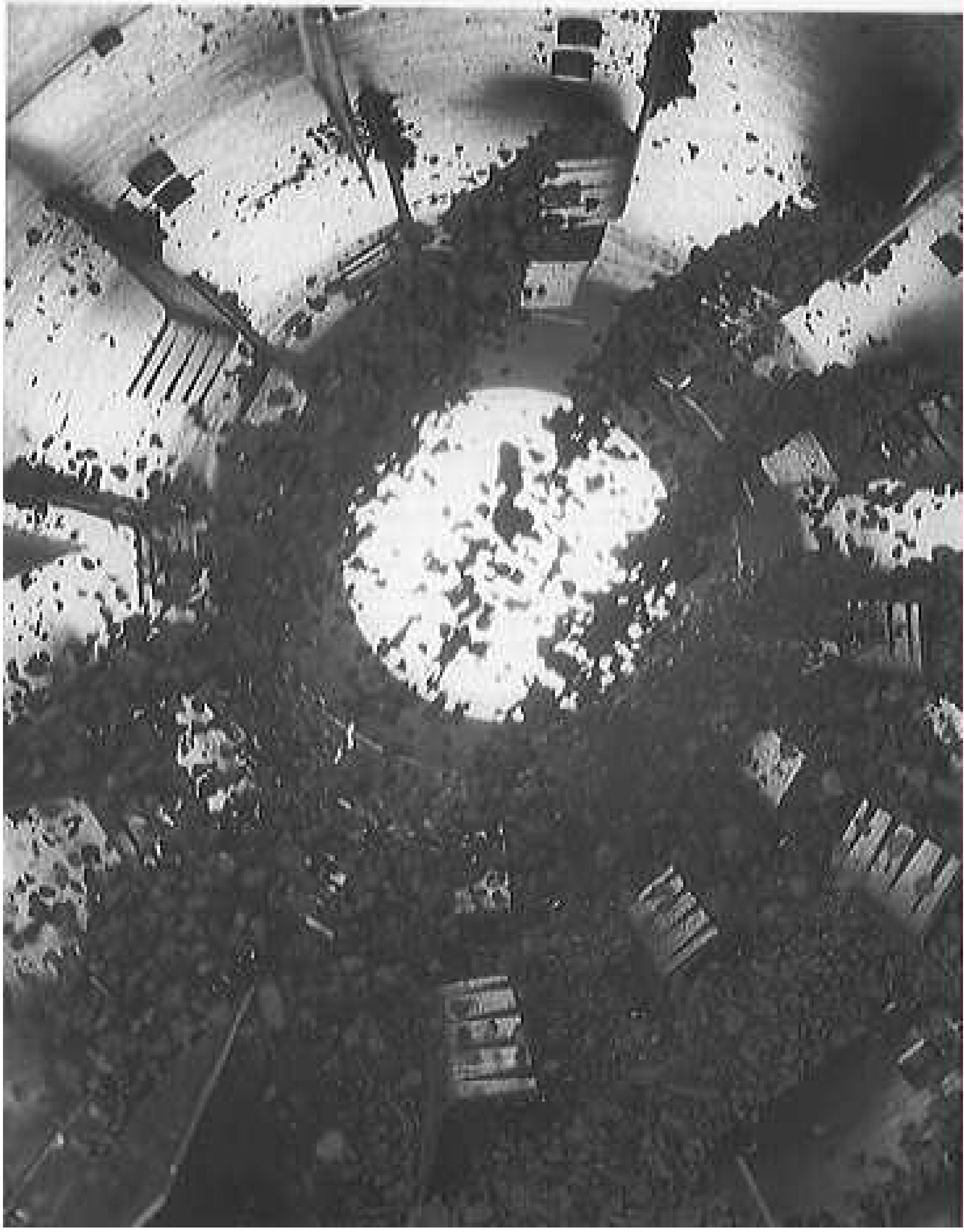
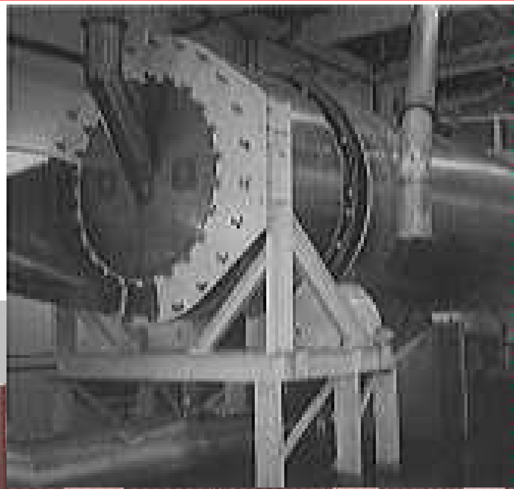
simondryers
Process Drying Technology

DRYERS



ROTARY DRYERS



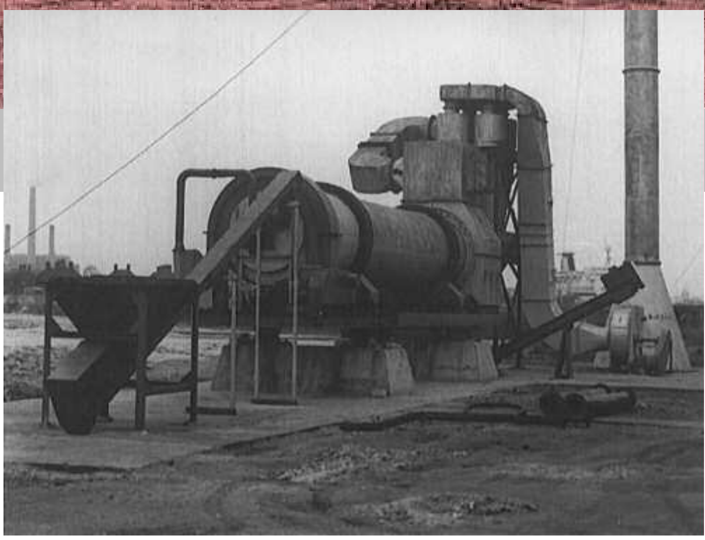
For the continuous drying, cooling, roasting and heat treatment of particulate solids, Simon Rotary Dryers provide the simple solution. Capable of handling large tonnage throughputs and built to withstand the rigours of 24 hours per day 365 days per year operation with minimum downtime the Simon Rotary Dryer meets all the requirements of the world's major material processors.

Drying, roasting or heat treatment is achieved by passing the material being processed through a rotating cylinder through which also passes a current of hot air. Lifters or flights fitted to the internal surface of the cylinder lift and cascade the material through the hot air stream.

The air stream can be directed through the cylinder either in the same direction as the material (co-current) or in the opposite direction (counter-current). Co-current systems are used in most general drying applications. Counter-current systems are more efficient in terms of energy input but give rise to high product temperatures, with the associated handling problems.

Similarly, cooling may be effected by passing the material to be cooled through a rotating cylinder through which flows a current of cold air or which is externally cooled by means of a water bath or spray nozzles.

The drying air may be heated either directly by means of oil, gas or solid fuel burners or indirectly by means of suitable heat exchangers using steam or other heating media. Drying temperatures range from below 100°C up to 700°C.



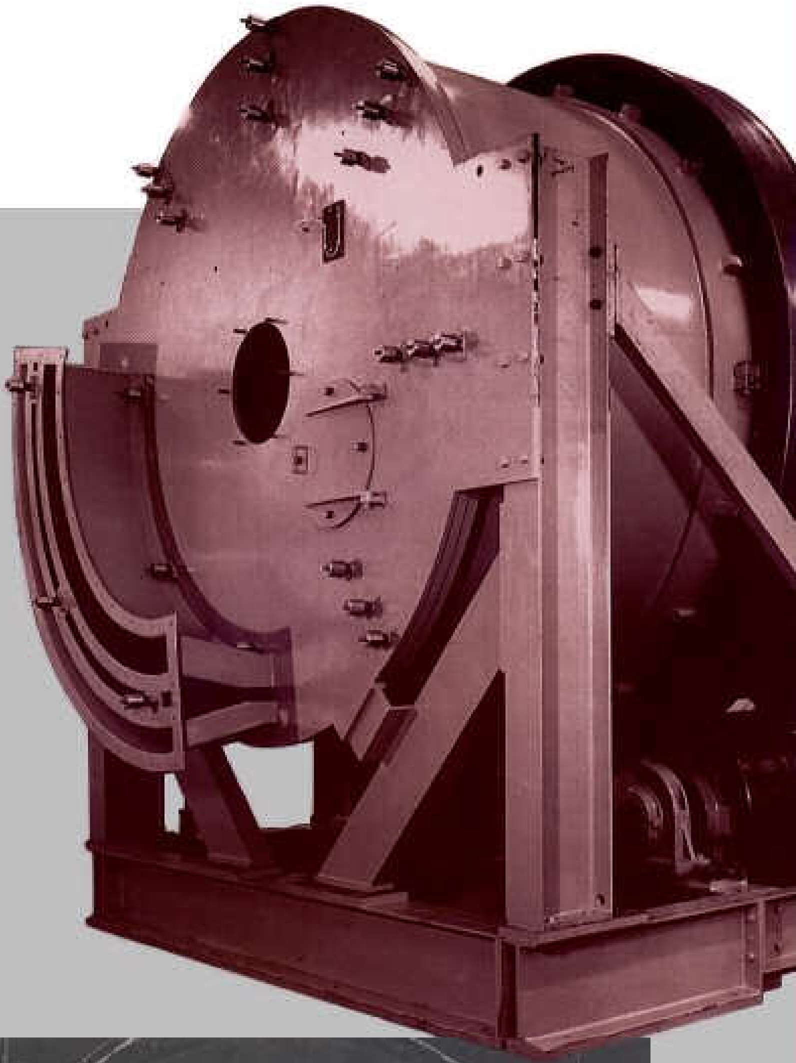
For high temperature processes it is necessary to use either direct fired refractory lined drums or special high alloy steel drums rotating within a refractory lined combustion chaber. Such units operate at temperatures ranging from around 600° C to in excess of 1000°C

The exhaust gas stream from any drying operation inevitably includes a significant amount of fine particles. This fine particle carryover may be collected by passing the gases through high efficiency cyclones, or bag filter or wet scrubber or a combination of any or all of these, depending upon the nature and quantity of dust involved.

The exhaust gas stream from any drying process may also contain a substantial quantity of waste heat energy. Some of this energy may be recovered by passing the exhaust gas stream, after suitable cleaning, to a heat recovery unit. Such units are designed not only to remove heat directly from the exhaust gases but may also be designed to condense out water vapour or other volatiles to recover latent heat. Clean warm air from the heat recovery unit can then be ducted to the dryer inlet air heater thus reducing the overall energy input of the drying process.

In addition to Rotary Dryers and Coolers, of both cascade and louvre type construction, R.Simon (Dryers) Ltd. design and manufacture Rotary Granulators, Coating Drums and Rotary Reactors, in a standard range of diameters from 1 Metre to 3.5 Metres and larger as required, with ancillary equipment to suit individual client's specifications.

ROTARY LOUVRE DRYERS



For the continuous drying of particulate solids, especially where very low product moistures are required without high air or product temperatures, Simon Rotary Louvre Dryers are often an economic alternative to the conventional rotary dryer. Furthermore, because of the way in which the material is moved within the dryer drum significantly less product breakdown occurs. All units are designed and built to the same high standards as the basic Simon Rotary Dryer to withstand the rigours of 24 hours per day 365 days per year operation with minimum downtime.

Drying is achieved by passing the material being processed through a horizontal rotating cylinder, fitted internally with a series of louvres so arranged that the drying air passes through a moving bed of the material to be dried. The rotation of the drum imparts a rolling action to the bed of material so that intimate mixing and contact with the drying air is achieved without lifting and dropping the material through the drying air stream.

Because of this intimate contact between material and air the drying efficiency of the rotary louvre dryer is significantly greater than that normally achieved with a conventional rotary cascade dryer.

The dryer drum is generally designed and manufactured to the same mechanical specification as the Simon Rotary Dryer, except that the internal flights are replaced with internal louvres. These louvres can be arranged to give multistage drying or drying and cooling within the same dryer drum.

The drying air may be heated directly by means of an oil or gas burner firing into a refractory lined combustion chamber and annulus between the combustion chamber and outer casing. Alternatively, the air may be heated indirectly by means of an air to air, steam to air, thermal oil or electricity heated heat exchanger. Typical drying air temperatures range from 100 C to 700 C.

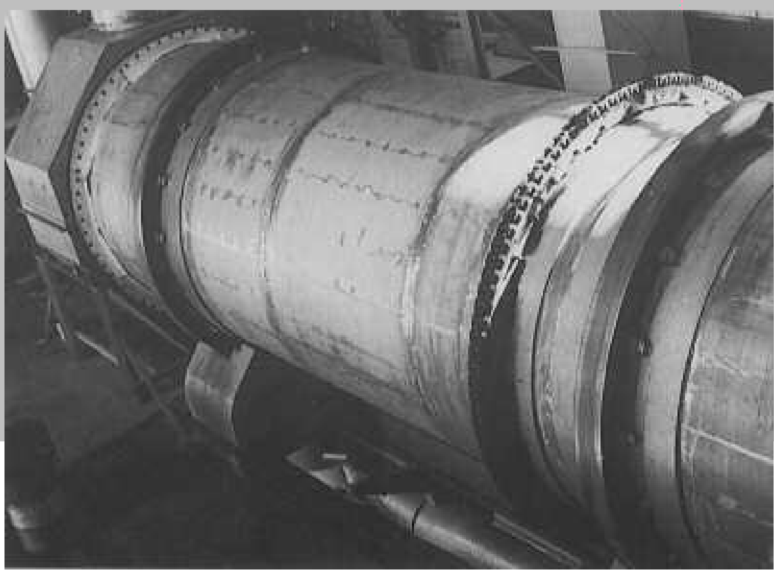
Because the drying air stream is directed through a bed of material it is blown by a fan into the dryer through a fixed head-plate which, as the air is at a positive pressure, is fitted with spring loaded friction seals to prevent drying air losses. Exhaust gases are drawn from the dryer by the exhaust air fan with ducting to the gas cleaning equipment.

Material flow through the dryer is controlled by the varying the depth of the bed of material in the dryer. This is achieved by means of bolt-on discharge rings or, where large variations in throughput or complete emptying of the dryer drum are required, a multivane type discharger may be fitted.

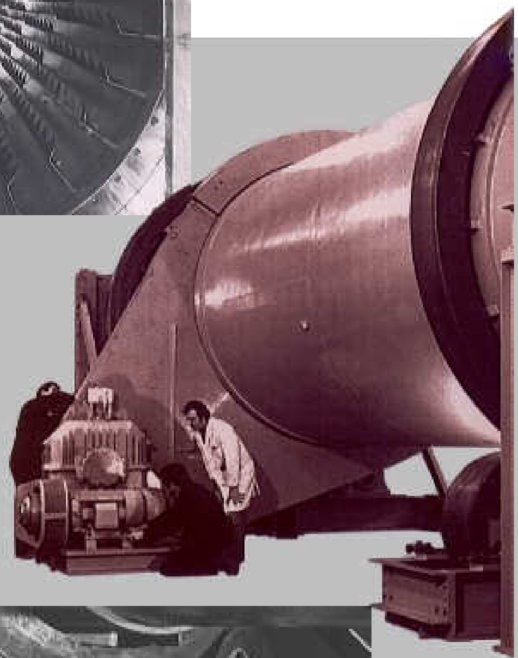
ROTARY LOUVRE COOLERS

Cooling is effected by passing the material to be cooled through a horizontal rotating cylinder, with internal louvres to the same basic design as the Rotary Louvre Dryer, in which a current of cold air is directed through the moving bed of material.

R.Simon Rotary Louvre Dryers and Coolers are available in a range of sizes from 600mm dia. by 1.8M to 3.5M diameter by 14.0M.



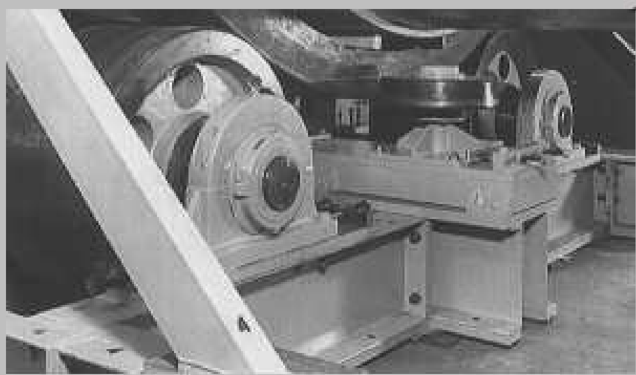
DRYERS IN DETAIL



DRYER DRUM

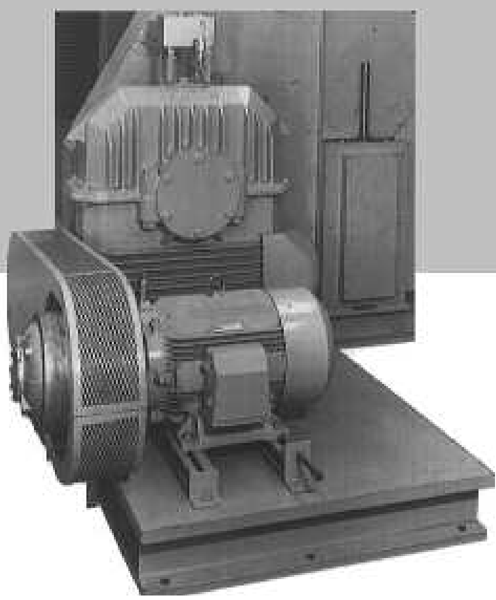
The dryer drum may be fabricated in carbon, stainless or other alloy steel plate with external reinforcing bands for fitting of tyres and drive rings. Flights and lifters, or louvres in Rotary Louvre Dryers, are welded or bolted internally to provide the required degree of contact between the material and the drying air. Design of the dryer drum internals is often critical and the number, size and shape of the lifters or louvres will vary in line with any variations of the physical properties of the material being processed.

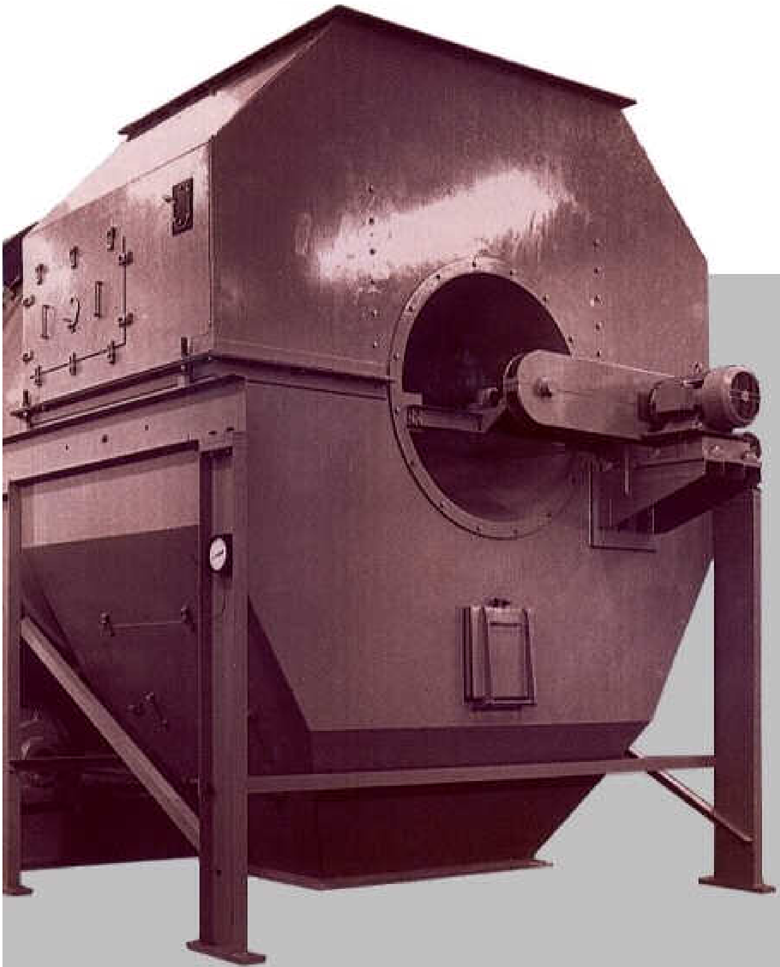
The drum is fitted with cast iron or steel tyres, the quantity and dimensions being dependant upon the total load. Each tyre runs on a pair of support roller assemblies comprising forged or cast steel support rollers with shaft mounted spherical roller bearing plummer blocks. Each assembly is supported on fabricated carbon steel roller support frames, one of which carries horizontally mounted locating rollers to limit any lateral movement of the dryer drum. All roller assemblies are fitted with safety guards and lubricators where appropriate.

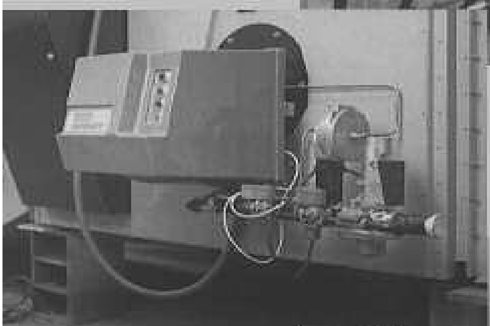


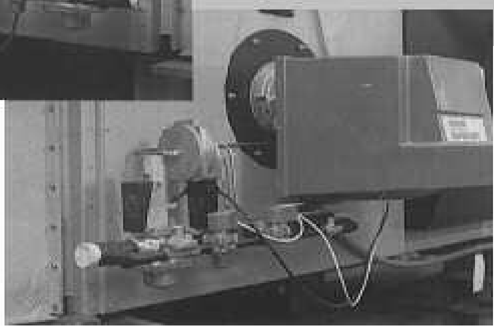
The dryer drum is rotated by an electric motor through V-belts, gearbox, pinion and either heavy duty chain to a chainwheel or spur gear drive ring bolted around the dryer drum. For high temperature operation the drive ring is secured to the dryer drum by tangent plates to allow for differential expansion.

All drive components are mounted on a common baseplate with guards as required. Integral low speed auxiliary drives can be supplied for emergency or maintenance purposes.









END ENCLOSURES AND SEALS.

Both ends of the drum may be enclosed by carbon or alloy steel fabricated hoods with air inlet/outlet chutes and suitable seals between the hood and the dryer drum.

Where slight ingress of air is acceptable simple labyrinth type seals are used. These comprise of a flexible fabric element, bolted to a stationary endplate and positioned between two steel rings welded to the dryer drum.

Where leakage of air is unacceptable, friction seals are provided, comprising a stationary ring or rings of semi-rigid compressed fibre or non-ferrous metal loaded onto the machined surface of the rotating element by springs, pneumatic or hydraulic cylinders. For processes involving hazardous materials multiple seals are used with inert gas or vacuum purging of the seal assembly.

AIR HEATER

In direct fired systems, the drying air is heated by an oil or gas burner firing into a refractory lined combustion chamber with dilution air being introduced through an annulus between the combustion chamber and air heater outer casing. Burner systems for a range of fuels can be provided. All gas and oil burners are supplied with complete valve trains, spark ignition, modulating control and flame failure control panel.

In indirect systems, heat may be transferred to the drying air by means of air to air, steam to air or thermal oil to air heat exchangers or finned tube electric heating elements.

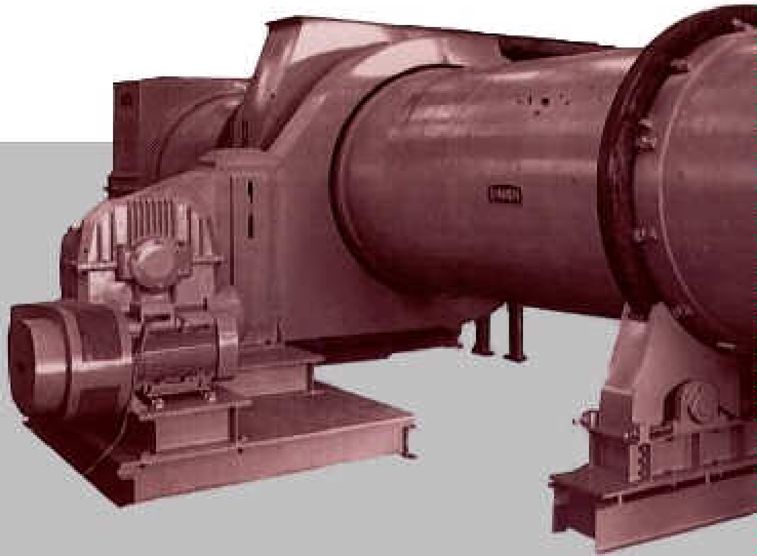
For some applications, particularly where the direction of material and air flow are counter-current, the burner may be mounted onto the inlet end hood or endplate to fire directly into the dryer drum.

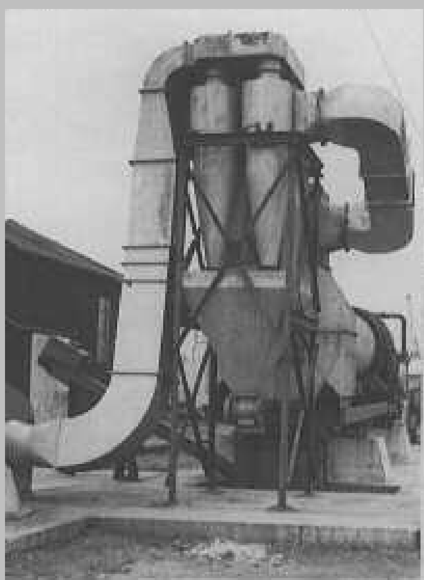
AIR HANDLING SYSTEM.

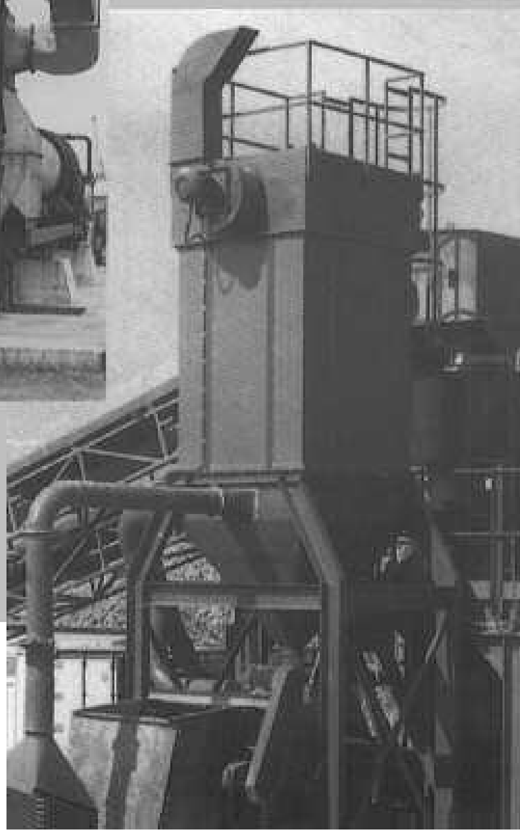
In Rotary Cascade dryers the flow of air through the dryer is induced by a centrifugal fan located at the air outlet end of the dryer. In Rotary Louvre dryers the drying air is provided by a centrifugal fan located up stream of the air heater with filters at the fan inlet, as required. The exhaust air is removed by a second centrifugal fan located at the outlet end of the dryer. All fans are supplied complete with electric motor, V-belt drive and drive guard, all mounted on a common baseframe for ease of installation.

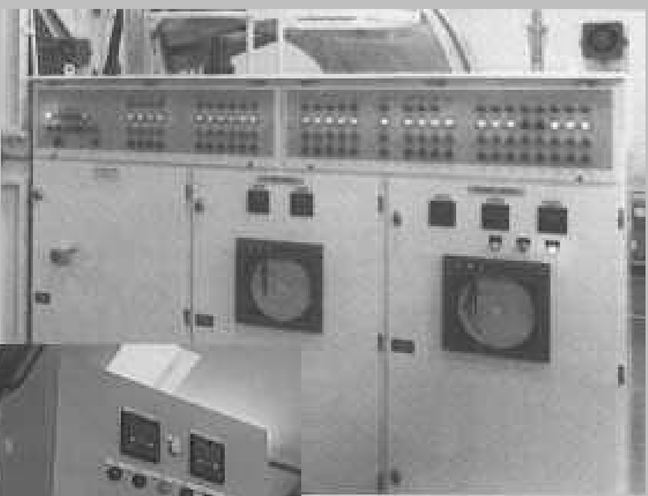
The exhaust air from the dryer is ducted via carbon or alloy steel ducting from the dryer to the cyclone, fan, dust collector or fume scrubber and, where required, exhaust stack. Butterfly type dampers mat be fitted in the exhaust air duct to provide for control of the air flow through the system and test/sampling points are also provided for pressure, temperature and emission measurement.

Particles entrained in the exhaust gas stream may be removed by passage of the gases through high efficiency cyclones, bag filter or wet scrubber or a combination of same, depending upon the nature and quantity of dust involved. All dust outlets are fitted with either rotary seals or double flap discharge valves to prevent excessive ingress of air. Materials of construction for the dust collection equipment are in line with overall plant requirements.









PROCESS CONTROL

For any system there is a relationship between the product moisture content and exhaust air temperature. Therefore product moisture can be controlled through control of exhaust air temperature. This control is achieved by regulating the flow of fuel to the burner by means of a temperature controller with a thermocouple located in the exhaust air duct.

Also, to achieve optimum performance the dryer must operate as close as possible to design conditions and with constant evaporative load. Any variation in evaporative load due to variations in feed rate or moisture content results in a corresponding variation in exhaust air temperature which in turn increases or decreases burner output. This raises or lowers the inlet air temperature. Thus the evaporative load may be controlled by measurement of inlet air temperature using a second controller with temperature probe located in the inlet air duct and output signal to a variable rate feeder.

This two step approach generally provides for adequate control of the drying process. When a more sophisticated control system is required it is sometimes possible to control dryer performance from direct measurement of either product or feed moisture content, or both.

In addition, high and low temperature safety interlocks, with or without alarms, may be provided and output signals from controllers may be fed to continuous chart recorders. All control instruments together with the necessary motor control gear, relays, overloads etc. are housed in a control cabinet, prewired for the correct sequential start-up and safe operation of the plant.

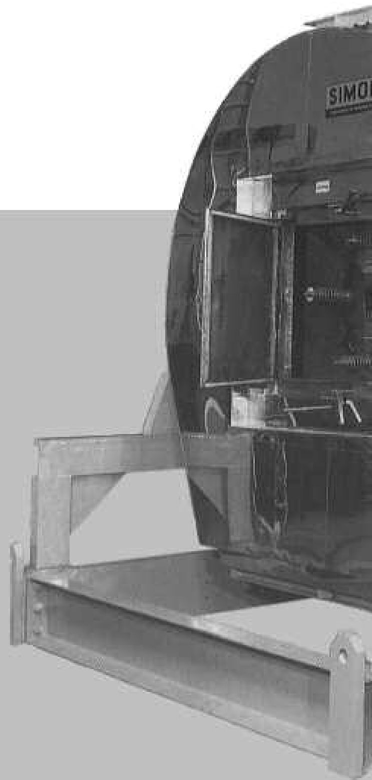
DRYER DESIGN

The size of any rotary dryer is determined by first calculating the amount of heat required to achieve the desired reduction of moisture at the design throughput. This quantity of heat must be transferred from the drying air stream to the material being processed at a rate dependant on, amongst other parameters, the air inlet and outlet temperatures and the velocity through the dryer drum. The diameter of the dryer drum is therefore related to the quantity of air required for drying.

The length of the dryer drum is related to the time required to effect the transfer of heat from the drying air stream to the material being processed and the time required to effect the transfer of the mass of water evaporated from the material to the drying air stream. The rate of heat transfer is also affected by both the drying air and material inlet and outlet temperatures.

Such calculations are carried out by computer, using programmes developed from data available through our long experience in handling a wide variety of different materials. Data may also be provided from test work utilising our pilot plant dryers either at our works in Nottingham or at the client's own production facilities.

Having determined the basic dimensions of the dryer and the design capacities or ratings for the burner, exhaust air fan, dust collection equipment etc. in this way, further computer programmes are employed to produce mechanical specifications for the equipment, including dryer drum plate thicknesses, tyre dimensions, support roller loadings, shaft and bearing capacities and drive power requirements.



ROTARY COOLERS

For the continuous cooling of particulate solids Simon Rotary Coolers are designed and manufactured to the same high standards and general mechanical specification as the Simon Rotary Dryer.

Cooling is achieved by passing the material to be cooled through a rotating cylinder through which also passes a current of cold air. Lifters or flights fitted to the internal surface of the cylinder lift and cascade the material through the cooling air stream.

The cooling air stream can be directed through the cylinder either in the same direction as the material (co-current) or in the opposite direction (counter-current). In many instances it is possible for the cooler to be an integral part of the dryer drum.

In addition, cooling may also be effected by passing the material to be cooled through a rotating cylinder which is externally cooled by a water bath or water spray system.

OTHER ROTARY EQUIPMENT

Having the capability to design and manufacture rotary dryers and coolers leads to the capability for design and manufacture of a whole range of rotary equipment. Typical examples would be granulating drums for the fertilizer industry, coating drums for the chemical and agricultural industries and mixer/reactors for bulk pigment manufacture; in a range of diameters from below 1 Metre to 3.5 Metres and above, with ancillary equipment to suit individual client's specifications.

MATERIALS PROCESSED

Activated Carbon
Ammonium Chloride
Ammonium Nitrate
Ammonium Phosphate
Apple Pomace
Asbestos
Aspirin
Ball Clay
Bark
Bicarbonate of Soda
Bone Char
Bone Meal
Boric Acid
Bran
Brazil Nuts
Breadcrumbs
Brewers Grains
Calcium Alginate
Calcium Citrate
Calcium Fluoride
Carbon Black
Cattle Food (various)
Cellulose Acetate
Cellulose Chips
Cement Clinker
Cereals
Charcoal
China Clay
Chocolate Powder
Citrus Waste
Coal
Coke (Metallurgical)
Coke (Petroleum)
Copper Sulphate
Copper Ores
Cork
Cryolite
Dextrose
Diamond Concentrates
Dicalcium Phosphate
Diatomaceous Earth

Fertilisers
Flaked Maize
Flour
Foundry Sand
Fullers Earth
Grain
Gravel
Ground Mica
Herring Meal
Ilmenite Ore
Iron Ore
Iron Oxide
Kaolin
Kernels
Lactose
Lignite
Lime Sludge
Limestone
Magnesite
Maize (cooked grits)
Melamine Crystals
Mustard Seed
Naphthalene
Nickel Sulphide
N.P.K.
Nuts
Ochre
Ore Concentrates
Oxalic Acid
Peanut Kernels
Peat
Penicillin Residue
Phosphate Rock
Polymer Chips
Polyvinyl Beads
Potash Crystals
Potassium Dichromate
Potassium Perchlorate
Potassium Permanganate
Potato Snack Products
Pyrites

Quartz Sand
Rice
Rubber Pellets
Rusks
Sago Flour
Salt
Saltpetre
Sawdust
Sawmill Refuse
Seaweed
Seed Corn
Silica Sand
Sludge
Soap Flakes
Soda Crystals
Sodium Acetate
Sodium Alginate
Sodium Dichromate
Sodium Ferro cyanide
Sodium Nitrate
Sodium Sulphate
Soya Bean Meal
Starch
Sugar (Beet)
Sugar (Cane)
Sugar (Confectioners)
Sulphate of Ammonia
Sulphonite Press Cake
Superphosphate
Terylene
Tin Ore
Tobacco
Urea Formadehyde
Vegetable Refuse
Vermiculite
Wheat (Cooked)
Wood Chips
Zeolite Crystals
Zinc Carbonate
Zinc Ore Concentrate
Zinc Oxide

simondryers
Process Drying Technology

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OTHER SIMON PRODUCTS

- Drum Flakers
- Drum Dryers
- Tubular Dryers, Coolers & Conditioners
- Laboratory and Pilot Machines