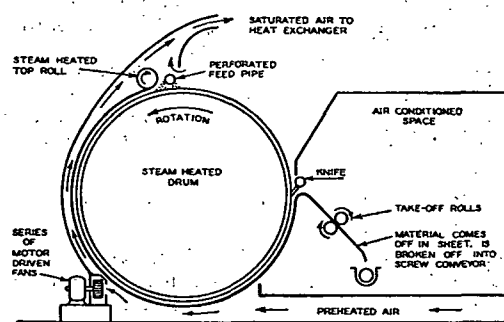


FIG. 9. DRUM DRYER⁴

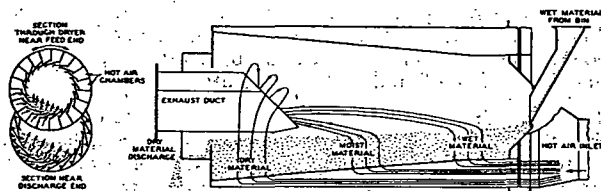
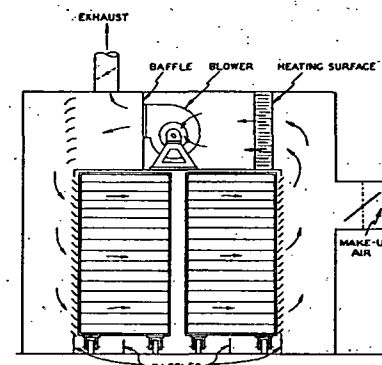
densers. The water is removed by vaporizing from the solid directly to the gas without ever becoming liquid.

Convection Drying

A limited amount of convection drying takes place in almost any dryer such as those described in the preceding paragraphs. However, to be classified as a convection dryer the principal source of heat is the heated air or other gases circulated in the dryer. There are a number of mechanical means of accomplishing this circulation of air or gases, each of which has some particular virtue. Brief descriptions of some important types of convection dryers follow:

Rotary Dryers. These dryers are cylindrical drums usually having internal flights, as shown in Fig. 10, which cascade the material being dried through the air stream. The drums may be heated directly or indirectly and the air circulation may be parallel or counter flow. A variation is the rotating louvre type dryer, which introduces the air beneath the flights thus securing very intimate contact.

Cabinet and Compartment Dryers. These are generally considered batch dryers wherein each charge is dried to completion before removal.⁴ A wide range includes types from the heated loft with only natural convection, and usually poor and non-uniform drying, to the self contained units with forced draft and properly designed baffles which give positive results. It is also possible to evacuate some of the systems for low temperature drying of delicate or hygroscopic materials. These dryers are usually loaded with material spread in trays to increase the exposed surface.

FIG. 10. CROSS SECTION AND LONGITUDINAL SECTION THROUGH ROTARY DRYER⁴FIG. 11. COMPARTMENT DRYER, SHOWING TRUCKS, WITH AIR CIRCULATION⁴

The trays are loaded directly into the dryer or may be stacked on trucks which are wheeled in. (See Fig. 11).

Tunnel Dryers. Tunnel dryers are a modification of the compartment dryer and as a rule are continuous or semi-continuous in operation. Heated air or combustion gas is usually circulated by means of fans although a few natural draft units are still in use. The material is handled on trays or racks on trucks and moves through the dryer either intermittently or continuously. The air flow may be parallel, counter flow or a combination of the two, obtained by center exhaust. Further, the air flow may be across the surface of the trays or up or down through the bed or in any combination of directions. By reheating the air in this type of dryer or recirculating it a high degree of saturation is achieved before exhausting the air. This reduces the waste of sensible heat.

A variation on this type dryer is the strictly continuous type having one or more mesh belts which travel through the dryer carrying the product, such as Fig. 12. Innumerable combinations of temperature, humidity and air direction and velocity are possible. The labor requirement is low on such a dryer as it can be loaded and unloaded mechanically. There is the disadvantage of hot air leaks at the entrance and exit although these can be minimized by means of baffles or inclined ends where the material enters and leaves from the bottom.

Spray Dryers. In recent years the spray dryer has become important for the drying of liquids in many fields, especially in the food industry.

The liquid is atomized by means of pressure nozzles, air jets or centrifugal bowls into the air stream of a tower or chamber. Inlet air tempera-

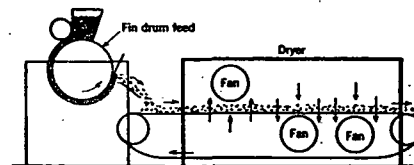


FIG. 12. SECTION OF CONTINUOUS DRYER, BLOW-THROUGH TYPE