TABLE 1. RELATIVE EVAPORATION RATE FROM WATER SURFACES DUE TO AIR MOTION

	Large Area	Med. Area (25 sq. ft.)	Small Area
Still air	1	1.5	3
250 ft. v.p.m.	3	3.5	4
800 ft. " (any area)		4.5	
1000 ft. " " "		4.8	
2500 ft. " " "		8.1	
4000 ft. " " "		12.6	

is not close enough to him for intimate contact, he waits for the arrival of small quantities over a system of freight-clogged railroads. Furthermore, as the freight leaving New York, in the direction of the coal mines, interferes with the arrival of the coal by clogging the line, so the gases given off from the oxidizing surfaces further retard and dilute the effects of diffusion in a drier.

Where the problem is one of evaporation instead of oxidation, these conditions still hold good, though not quite to the same extent unless the moisture has to be *pulled from a material which gives it up reluctantly.* Tables 1 and 2 give the relative effects of increased temperatures and of increased velocities of air over water evaporating surfaces. They are the application to our own use of figures by Box and Dalton, modified in accordance with the results of our own tests.

If the air velocity and the temperature are both increased, the relative evaporation rate is a product of both factors.

If the moisture of liquid to be evaporated is easily accessible to the air in the drier (i.e., not held inside of a fibre, or by capillary attraction, or by a deliquescene material) there is no economy in holding a higher working temperature than 212 to 220 deg. fahr., provided an ample volume of heat is supplied. *An excess of heat above what is required to* evaporate the liquid will only superheat its vapor, which is ordinarily needless, unless to preclude any possibility of recondensation to the detriment of the material being dried. *Speed may count for more than economy in the drier,* when the output of a plant can be doubled with no additional overhead cost. Then the working temperature in the drier can be raised to advantage. When I say *working temperature of a drier,* I mean the *maintained* temperature and not the air supply temperature. Of course, in a progressive drier the working temperature at one end is the temperature of the entering air and at the other end, is that of the effluent air.

The time for drying any material is, as before stated, governed by the temperature, volume of air and the proper contact. The term "contact" covers the rapid motion of the air over the surface of the material. In other words, given the highest temperature which the material will stand, and with a proper amount of heated air supplied to the oven, if it is moved over the surface of the material so as to get equal distribution and good contact with the drying surfaces by means of a stiff velocity, the time of drying will be reduced to a minimum.

TABLE 2. RELATIVE EVAPORATION RATE FROM WATER SURFACE DUE TO HEAT

32° F. temp. of water and air	1
52°	2
72°	4
92°	8
112°	16
132°	27
152°	44
175°	71
195°	135
212°	165

To get this desired velocity of air over the surface without having to supply an excessive amount of air, we use where possible agitator fans *within the driers.* In some cases 5 or 6 of such fans to one air supply fan, which handle the air over and over until it has reached all surfaces and has picked up all the water vapor it can carry or has given up all *the oxygen it can readily give.*

Another point in favor of uniform distribution and high velocities is that if the gases given off are explosive or inflammable, the more quickly they are removed the better. An explosive gas with a small amount of air in a dead space is almost sure to ignite spontaneously as soon as the proper mixture is reached at high temperature. The same gas if kept in motion will not readily ignite, and *if it does, it simply flashes without* explosive effect.

The gases given off from the lower surfaces in an oxidizing oven, particularly if the oven is overloaded or packed too closely, will, if allowed to stand, often disssolve and wipe off clean the coated surfaces from the goods above, in the case of japans, and if the colors are light linseed oil mixtures, these gases will always discolor them if not removed quickly. The tendency of these gases is to cling to the surfaces from which they emanate and prevent the air reaching them.

In any drying system where there are no critical temperatures, the admissible maximum working temperature is that above which the actual gain in speed, or output due to the increased temperature, is less in proportion than the increased cost of operation due to the increased temperature. Within the same temperature limits of the material, many materials produce much better results when dried quickly at high temperature, as follows:

Linseed oil bright colors dried at low temperature will fade, while if baked in moving hot air *they will hold.*

A material carrying oleic or fatty acids and ferments, if dried slowly, will not give up all of either, while under the high heat all the ferments are given up and all but a trace of the fatty acids. Ferments alone, even if not entirely drawn off by high heats, lose their power to act.

In the case of some fruits or vegetables, a relatively low temperature at high velocity is better than too high a temperature, but too low a temperature and too long a time, give a tough product.