the drying much beyond the equilibrium point of the material in use, as over-drying is liable to produce undesirable physical changes in the material, and such over-drying also unnecessarily prolongs the time and increases the cost of the operation.

Fig. 2 shows the equilibrium moisture content of cotton and paper for a dry-bulb temperature of 70 F and various relative humidities. Tables 1 to 7,[2] inclusive, give the hygroscopic regain, or reabsorption to equilibrium after drying, for a number of organic and inorganic materials that will ordinarily contain less than their equilibrium moisture content when removed from the dryer. Loss of hygroscopic moisture, or drying, is accompanied by the absorption of heat and a resultant cooling effect at the surface of the material. Regain, or absorption of hygroscopic moisture produces, on the other hand, a release of heat corresponding to the latent heat given off by the condensation of an equivalent quantity of water-vapor.

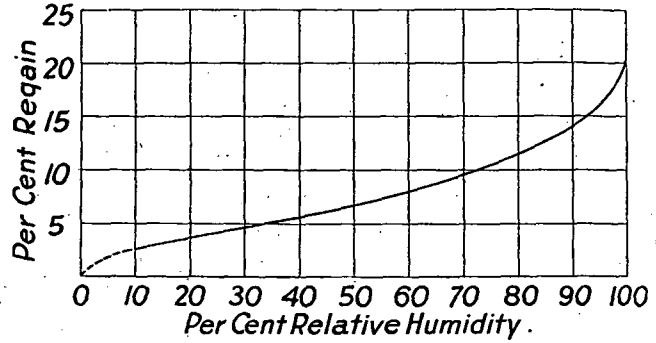

FIG. 2. REGAIN CHART FOR COTTON (SEA ISLAND) AND PAPER (CELLULOSE) AT 70 DEG.

CONTROL OF THE DRYING OPERATION

Circulation Control

Circulating air or gas currents must have a sufficient velocity over the surface of the material being dried to transfer the heat required for evaporation, with the exception of that provided by conduction and radiation and at the same time to carry away the water evaporated. The volume needed for moisture removal will correspond roughly with the volume needed for heat transfer. A third requirement is that the velocity should be sufficient to carry away the film or layer of nearly saturated air that is apt to remain in close contact with the evaporating surface and whose high vapor pressure will retard further evaporation. During the saturated surface drying stage, the drying rate will vary directly with the velocity of circulation over the material. When the stage of subsurface drying is reached the velocity of circulation becomes of less importance, since the drying cannot proceed any faster than the moisture vapor can transfuse from the interior to the surface.

Circulation is expressed either by the rate of air flow over the material per minute, or by the number of air changes in the dryer per minute or

[2] *Drying and Processing of Materials by Means of Conditioned Air*, by D. C. Lindsay.

TABLE 1. HYGROSCOPIC REGAIN OF NATURAL FIBRE TEXTILE MATERIALS[a]

THE NORMAL MOISTURE CONTENT EXPRESSED IN PER CENT OF DRY WEIGHT AT VARIOUS CONDITIONS OF RELATIVE HUMIDITY. ALL OBSERVATIONS TAKEN AT APPROXIMATELY 75 F

PER CENT RELATIVE HUMIDITY	ABSORBENT COTTON	WOOL WORSTED	RAW CEVENNES SILK	JUTE	HEMP MANILA	HEMP SISAL	COTTON INDIAN	COTTON EGYPTIAN	COTTON AMERICAN	COTTON CLOTH	LINEN
5	3.05	2.95	2.15	1.65	1.65	2.30	1.50	1.50	1.50	1.35	1.00
10	5.50	4.95	3.80	3.05	3.00	3.50	2.50	2.50	2.50	2.35	1.75
15	7.65	6.45	4.70	4.35	4.00	4.30	3.20	3.20	3.20	3.15	2.30
20	9.65	7.58	5.50	5.50	4.70	4.85	3.75	3.75	3.75	3.80	2.95
25	11.45	8.50	6.20	6.50	5.30	5.30	4.15	4.25	4.15	4.30	3.40
30	13.25	9.30	6.80	7.40	5.85	5.70	4.60	4.70	4.60	4.80	3.80
35	14.95	10.10	7.40	8.20	6.40	6.17	5.05	5.05	4.90	5.25	4.20
40	16.55	10.90	8.00	8.85	7.00	6.70	5.50	5.50	5.25	5.70	4.55
45	18.00	11.70	8.45	9.55	7.70	7.35	6.10	5.90	5.60	6.35	4.95
50	19.20	12.60	9.25	10.35	8.45	8.00	6.70	6.40	6.05	6.80	5.30
55	20.25	13.55	9.80	11.10	9.25	8.80	7.40	6.90	6.55	7.35	5.70
60	21.15	14.50	10.45	12.00	10.10	9.60	8.00	7.40	7.10	8.00	6.10
65	21.95	15.50	11.30	13.00	11.00	10.40	8.90	8.10	7.80	8.75	6.55
70	22.65	16.55	12.20	14.15	11.90	11.30	9.85	8.80	8.55	9.55	7.10
75	23.32	17.75	13.30	15.40	12.80	12.20	10.85	9.70	9.50	10.50	7.75
80	24.10	19.30	15.00	16.75	13.80	13.15	12.00	10.90	10.60	11.45	8.50
85	25.00	21.05	16.50	18.40	14.85	14.15	13.45	12.60	12.15	12.50	9.40
90	25.85	23.95	19.50	20.00	15.95	15.30	15.45	14.70	14.10	13.70	10.35

[a] For Sources of Original Data, see *Drying and Processing of Materials by Means of Conditioned Air*, by D. C. Lindsay.

TABLE 2. HYGROSCOPIC REGAIN OF ARTIFICIAL TEXTILE FIBRES COMPARED WITH CRUDE CONSTITUENTS AND NATURAL SILK[a]

THE NORMAL MOISTURE CONTENT EXPRESSED IN PER CENT OF DRY WEIGHT AT VARIOUS CONDITIONS OF RELATIVE HUMIDITY. ALL OBSERVATIONS TAKEN AT APPROXIMATELY 75 F

PER CENT RELATIVE HUMIDITY	VISCOSE ARTIFICIAL SILK (RAYON)	RAW CEVENNES SILK	NITROCELLULOSE	CELLULOSE ACETATE
5	------	2.15	1.75	0.50
10	------	3.80	2.60	1.00
15	------	4.70	3.75	1.20
20	------	5.50	4.85	1.75
25	7.90	6.20	6.00	1.90
30	8.75	6.80	6.50	2.00
35	9.00	7.40	7.00	2.05
40	9.90	8.00	7.55	2.30
45	10.90	8.45	8.10	2.45
50	11.10	9.25	8.70	2.50
55	12.00	9.80	9.90	2.60
60	12.50	10.45	10.80	3.00
65	13.20	11.30	11.75	3.15
70	15.00	12.20	12.30	3.40
75	17.00	13.30	13.20	3.75
80	19.00	15.00	13.90	4.00
85	22.30	16.50	15.00	4.85
90	24.80	19.50	16.40	5.20

[a] For Sources of Original Data, see *Drying and Processing of Materials by Means of Conditioned Air*, by D. C. Lindsay.