

Percentage Moisture Content of Timber.	Temperature.		Percentage Relative Humidity.
	Dry Bulb.	Wet Bulb.	
	° F.	° F.	
60	115	109	80
40	120	112	75
35	125	115	70
30	130	117	65
25	135	119	60
20	140	121	55
etc.			

per cent.<sup>1</sup> This temperature and humidity are maintained until the sample board on re-weighing has its m.c. reduced to 35 per cent., when the temperature would then be raised to 125° F. and the humidity decreased to 70 per cent. When the board, after re-weighing, has its m.c. lowered to 30 per cent., the corresponding temperature and humidity would be altered to 130° F. and 65 per cent. respectively. These operations are repeated until the m.c. of the timber has fallen to the required percentage, after which the kiln is gradually cooled and the humidity increased to about 60 per cent. before the timber is withdrawn from the kiln. The maximum temperature may reach 185° F. and the humidity be reduced to 45 per cent., before the m.c. of certain timbers has been lowered to 14 per cent. Instruments for automatically recording the temperature and humidity of the circulating air may be used instead of the ordinary dry-and-wet bulb thermometer.<sup>2</sup>

(a) (ii) *Overhead Internal Fan Compartment Kiln.*<sup>3</sup>—The maximum width is 16½-ft., the maximum height (to the false wood ceiling which is suspended from the roof) is 9 ft. and the length varies from 10 to 40-ft. Uniform circulation of the hot moist air is promoted by fans fixed centrally along the length of the kiln above the false ceiling at 5-ft. intervals. The heat is provided by means of 1-in. internal diameter steam pipes which are distributed over the space above the false ceiling on both sides of the fans. A 1-in. steam spray pipe, perforated with ⅜-in. holes at 12-in. intervals and fixed centrally and immediately below the fans, provides the required moisture. The hot air is circulated from the top, down the outer sides of the stacks, through the stacks, and up between the stacks to the fans. A certain amount of the moist circulated air is allowed to escape through outlets at the roof, and fresh air is admitted at the floor level through openings in a central duct. The temperature and humidity can be automatically controlled. It is considered that this kiln is one of the most efficient and economical types.

<sup>1</sup> It is sometimes advocated to warm up the kiln to approximately 10° F. above the initial dry bulb temperature and maintain it for about two hours before lowering it to the initial temperature.

<sup>2</sup> Portable electrical moisture meters are now available for rapidly and conveniently determining the m.c. of timber stacked in kilns. The small electrode of one type is simply clamped to the timber and the m.c. is read directly on the dial of the meter. It is then removed. Further readings are taken as required until the required m.c. is registered on the meter.

<sup>3</sup> Full particulars of this kiln are given in "The Overhead Internal Fan Kiln," Forest Products Research Laboratory Leaflet, No. 10.

Another type of internal fan kiln has the fans, heating pipes and sprays below the floor level.

(a) (iii) *Tunnel or Progressive Kiln.*—This somewhat resembles the tunnel kiln used for brick-burning and described on p. 10, Vol. II, in that the kiln is in the form of a tunnel along which travel trucks piled with timber. The maximum width of the kiln is 16-ft., it is from 6 to 10-ft. high and it may be 100-ft. or more in length. It is kept filled with loaded trucks which are gradually moved forward at a uniform rate during the drying process. It is usual for one truck of seasoned timber to be removed at the discharge end and one truck of green timber to be added at the opposite end daily. Steam from sprays fixed in a duct below the floor at the discharge end provides the requisite humidity. The air, heated by steam or hot-water pipes placed below the floor for about two-thirds of its length from the discharge end, rises between the timber and circulates along the tunnel towards the inlet end before returning below the floor for re-circulation. The flow of the hot moist air in the kiln is thus in the opposite direction to the movement of the timber. Fresh air is admitted at the discharge end and mixes with the re-circulated air. The air gradually decreases in temperature and increases in humidity as it circulates round the timber towards the inlet end, and hence it is sufficiently cool and moist when it comes into contact with the unseasoned or green timber. Some of this moist air escapes at the loading end and is discharged up a chimney which produces the necessary draught to promote circulation. Alternatively, the circulation may be promoted by a fan fixed in the duct. Whilst this kiln is economical, it is best suited for drying thin timber of uniform size and quality. It is not used extensively in this country.

(b) *Natural Draught Compartment Kilns.*—This type of kiln is approximately 12-ft wide, 9-ft. high and 30-ft. long; it has a duct below the floor extending the full width and length of the kiln. The timber may be piled as shown at A and B, Fig. 3, or it may be stacked on trucks which remain stationary during the process. A group of steam pipes for heating the air extends centrally along the duct, and the necessary humidity is provided by steam from jets immediately above it. The kiln is so called because the circulation depends upon natural means; thus, the air after traversing the hot pipes passes upwards between the two piles and transversely through the piles, when it takes up moisture from the timber and, becoming denser, descends between the piles and the walls for re-circulation. Fresh air as required enters the duct from the outside and an equal amount of saturated air escapes at the floor level through vertical flues situated in the side walls. This simple type of kiln is very economical, but the circulation is uncertain and not easy to control. It is best suited for small-sized timber which has been partly seasoned.

3. *Combined Air and Kiln Seasoning.*—It is a common practice to reduce the m.c. of timber to approximately 20 per cent. by air seasoning before subjecting it to further treatment in a kiln. This considerably reduces the kiln-drying period (see p. 12), especially for certain hardwoods. The kiln output is therefore substantially increased.