TECHNICAL NOTE NUMBER 249

FOREST PRODUCTS LABORATORY UNITED STATES FOREST SERVICE

MADISON, WISCONSIN APRIL 1941

FIRE-RETARDANT PAINTS CONTAINING BORAX

No paint can be expected to protect wood effectively against long exposure to fire temperatures. The function of fire retardant coatings is to retard the spread of small fires, and they offer the possibility of complete protection against fires of small size that might otherwise quickly develop beyond controllable proportions.

No satisfactory fire retardant paint for exterior use is known to the Forest Products Laboratory nor can the paints for interior use be recommended for very exacting appearance requirements. Paints have been developed for interior use, however, that afford protection against the small fire where appearance is not of major importance. The most successful of the paints of this type developed by the Forest Products Laboratory are paints containing borax in addition to various pigments. The formulas for these paints are still in the experimental stage and the final limits of their performance are not known. The evidence thus far available, however, shows that they stand high in fire-retarding properties and the formulas are being made public for trial use during the period that will be required to bring out fully their advantages and limitations.

The properties of the borax-containing paints in controlling the spread of fire have been measured by the fire-tube test, which has been widely used in such work. In this test, wood specimens measuring 40 by 3/4 by 3/8 inches are coated with the preparation under test and, after suitable conditioning, are suspended in a metal tube and placed in contact with an 11-inch Bunsen flame for 4 minutes. The loss of

weight of the specimen and temperature at the top of the tube are recorded at regular intervals. By this method of test an uncoated specimen loses approximately 80 percent of its weight, being reduced to a mass of loose charcoal. A specimen given an adequate coating of the best type of borax paint loses only about 18 percent of its weight under the test described, indicating considerable capacity of the coating to resist flame spread.

Borax alone does not produce so satisfactory a coating as when it is combined with pigments. The pigments aid in providing better brushing qualities and hiding power. The method used thus far to prepare the borax paints at the Forest Products Laboratory is as follows:

Borax, ground in a pebble mill and screened through a 200-mesh sieve, is mixed with raw linseed oil by grinding in a pebble mill to produce a stock preparation containing two parts of borax to one part of oil by weight. This borax-oil mixture is used for compounding with various pigment-oil pastes by hand mixing or by mixing in a paint mill. A few preparations have been made by grinding all of the ingredients in a pebble mill, but the hand method is preferable for small batches. Turpentine and drier are added before use.

Typical paints tested are represented by the formulas at the top of the next page.

Although tests to date have not been made with paints containing pigments other than those in the table, it seems probable that others could be used. Presumably, colored pigments for tinting paints containing borax must be alkali resistant.

More tests have been made on the white lead paint containing borax than on any of the others, and it proved to be some what superior in fire retardance to the paints containing other pigments.

	Percent by weight			
Pigment:				
White lead[1]	41.0			
Titanium-calcium		30.0		
Lithopone			24.0	
Zinc oxide				21.0
Borax	32.0	35.0	39.5	50.0
Raw linseed oil	22.8	30.8	32.3	24.8
Turpentine	3.6	3.6	3.6	3.6
Japan drier	.6	.6	.6	.6

[1] Basic lead carbonate.

Although this paint did not stand up under outdoor exposure it resisted all but the most severe conditions of humidity indoors without serious loss of effectiveness in preventing the spread of flame.

From the standpoint of hiding power and brushing qualities, an unusually high percentage of borax is undesirable, but fire-retarding effectiveness is lost or decreased if the borax content is dropped too low. It is apparent that a balance must be maintained between paint quality and fire retardance. A minimum of at least 25 percent by weight of borax appears necessary.

To obtain maximum fire protection, heavy applications of the paint (3 or 4 thick coats or at least 8 gallons per 1,000 square feet) were found necessary. This is about twice the amount of paint ordinarily applied to woodwork. Coatings of ordinary thickness undoubtedly would provide protection against comparatively weak fires.

Fine grinding of the borax and subsequent milling in oil are necessary for smoothness, consequently

the home preparation of borax paints is practical only when a lumpy, rough coating is not objectionable from the appearance standpoint.

Although borax is a chemically active material, no serious alterations from this cause of either paint in the can or of the coating have been observed to date.