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, indi-
cating 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 pre-
pare the borax paints at the Forest Products Labora-
tory 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 con-
taining 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 somewhat superior in fire
retardance to the paints containing other pigments.
<table>
<thead>
<tr>
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<th>Percent by weight</th>
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<tbody>
<tr>
<td>Pigment:</td>
<td></td>
</tr>
<tr>
<td>White lead</td>
<td>41.0</td>
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<tr>
<td>Titanium-calcium</td>
<td>30.0</td>
</tr>
<tr>
<td>Lithopone</td>
<td>24.0</td>
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<tr>
<td>Zinc oxide</td>
<td>21.0</td>
</tr>
<tr>
<td>Borax</td>
<td>32.0 35.0 39.5 50.0</td>
</tr>
<tr>
<td>Raw linseed oil</td>
<td>22.8 30.8 32.3 24.8</td>
</tr>
<tr>
<td>Turpentine</td>
<td>3.6 3.6 3.6 3.6</td>
</tr>
<tr>
<td>Japan drier</td>
<td>.6 .6 .6 .6</td>
</tr>
</tbody>
</table>

1Basic 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.