THE EFFECT OF BOILING TEST SPECIMENS OF PINE WOOD IN LINSEED OIL.

The following experiments were made in order to determine the effect of boiling wood in linseed oil, also to determine if this wood, would acquire sufficient advantages over wood of the same kind not so treated, to indicate its use in ordinary building construction.

Discussions, or experiments, on this subject could not be found in any of the numerous works which treat of buildings and building material; with the exception of a notice in Thurston's Engineering Materials, pp.601, where Mr. G.C.Corliss simply states that wood is not only well and uniformly seasoned but considerably strengthened by boiling in oil, a result which was confirmed by the following experiments.

Apparatus, All the tests were made on a Biehle Bros. hydraulic testing machine having a capacity of 100,000 pounds. The pieces tested were held in the customary manner, using a self-adjusting disc. Great care was exercised, both in selecting and preparing the specimens used and in applying the strains as well as in getting correct readings.

Methods and Materials.

For use in the experiments a well seasoned piece of pine lumber was chosen which was entirely free from knots and other imperfections. Pieces 16" long, with a cross-section of one square inch (full) were cut from this after which each piece was planed to a cross-section of one square inch.

These pieces were then placed in a pan and covered with raw linseed oil (commercial), Heat was applied until a temperature of about 125° C. was reached, when an even temperature was maintained until the oil had soaked clear through the pieces. The reason for not allowing the heat to be increased was to avoid danger of charring the fibers. As stated by Mr. Corliss, " the temperature should be kept somewhat below 250° F." consequently 125° C. was taken as the temperature. From time to time a piece of wood was taken from the oil and sawed in two to ascertain if the oil had soaked through. After the pieces were thoroughly saturated with the oil they were removed and experimented upon as follows:

1. Six pieces were cut to the required lengths (as given below) and were immediately subjected to the test.

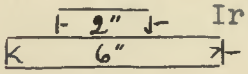
2. Six pieces were allowed to dry in the open air for six days and then tested.

3. The remaining pieces were placed over the boiler in the Machine Shops, and allowed to throughly dry and then were tested.

Tests.

The tests were made for resistance to longitudinal and to transverse compression, these being the cases most frequently met with in practice. Attempts were made to make tensile tests also, but as the wood was quite soft after leaving the oil, it was found impossible to clamp the ends sufficiently to hold when the strains were applied. Shearing tests were also abandoned owing to similar difficulties.

Tests were also made upon pieces placed under conditions similar to those found in beams. In these the pieces were allowed to rest upon two knife-edged supports placed six inches apart, the load was then applied at the centre and gradually increased until the beam failed. In the compression tests (transverse) the experiments were conducted as follows: A piece of iron two inches long and one square inch in cross section, was placed lengthwise upon the piece to be tested, said piece being six inches long.



Iron

Specimen. The load was then gradually increased until the iron was imbedded 1/10" into the wood. For making measurements a pair of bow-spring dividers set to 9/10" were used, care being taken to make these measurements frequently and accurately. For the experiments on compression parallel to the fibres, the load was gradually applied and increased until the piece failed, specimens were two inches long. See Table.

From the above experiments I deduce the following conclusions:

1. It is evident that the timber is materially weaker soon after being taken from the oil than before and does not recover its original

strength until a considerable time has elapsed and the wood has become throughly dry; i.e.,the oil has been completely oxidised.

2.That the strength is materially increased after the wood again becomes thoroughly dry, about 8% gain being the average for all tests.

Mr.Corliss gets about 10% for pine. Oak, from 10 to 50%. Ash and beech as high as 40%.

Advantages of using wood that has been boiled in oil.

Increased strength averages about 8%.

Increased durability both for ordinary and underground purposes.

Increased safety from attacks of insects,etc.

Less liability to decay by dry rot. Wood not required to be painted, natural wood being the finish. Would stand weather and action of gases better.

It is quite probable that the durability of timber in situations exposed to dampness,and to attacks of dry rot, would be sufficiently increased to fully compensate for the cost of treatment. This might be of great importance in structures which could not be renewed without temperary disuse. It is also further probable that kerosene oil might be preferable to linseed oil in this respect and that the temporary loss of strength might not occur. Also that some chemicals might be mixed with the oil to increase strength and durability of the wood and to lessen its inflammability.

<u>Disadvantages of using wood so treated.</u>

Additional cost of oil and labor.

Increased weight.

Increased inflammability.

Danger of putting recently treated beams,etc. into a building, because of its temporary loss of strength, disastrous effects or results might follow especially if the structure is building rapidly.

Additional cost of seasoning timber a second time. Loss of time and use of capital by waiting for timber to dry.

Additional cost of foundation and perhaps wall, to accommodate the greatly increased weight of lumber after the absorption of oil.

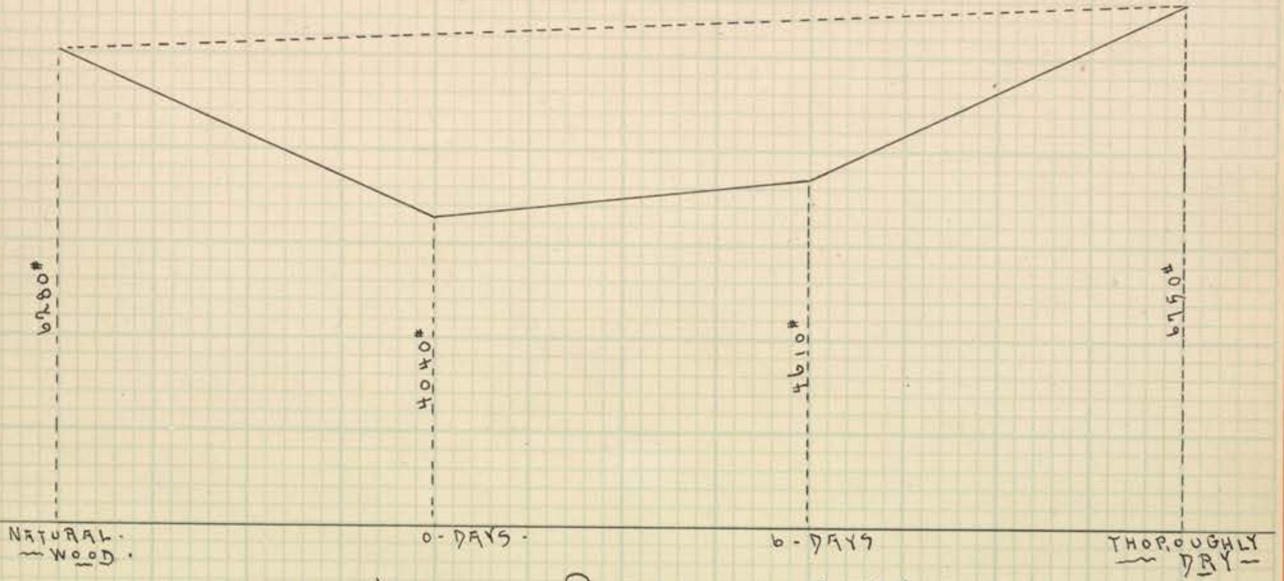
Original cost of plant for treating wood with oil,especially of a metal trough that could be used for twenty feet and longer timbers.

From the above results and facts the question now arises; would, the slight increase in strength be sufficient to introduce wood previously boiled in oil into buildings and to compensate the many serious disadvantages arising from this treatment. To me there seems to be but one answer- No.

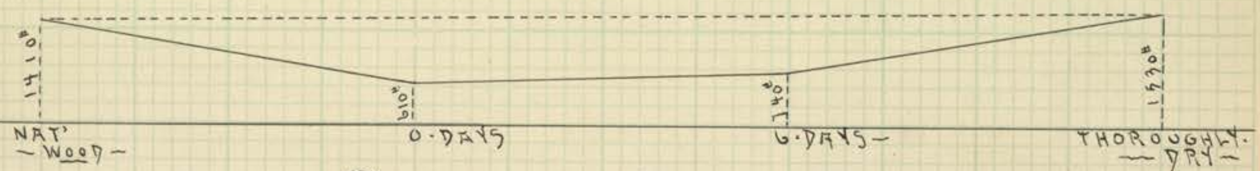
Table of Results:— Expressed in lbs-per-sq-in.

No. of Pieces	Time of Drying (Days)	Compression Parallel with Fiber without Oil:—	With Oil.	Transverse Compression without Oil:—	With Oil.	Beams:— without Oil.	With Oil.
1	0	6490	4120	1500	710	940	Bent too easily. Knife edges cut into specimen too much:—
2	0	6410	4090	1410	590	870	
3	0	5980	3880	1470	630	880	
4	0	6370	3965	1380	460	790	
5	0	6190	4020	1420	610	810	
6	0	6270	4200	1300	670	869	
Average:—		6285[1]	4040	1410[1]	610	860[1]	
7	6		4680		710		970
8	6		4590		740		1000
9	6		4570		780		910
10	6		4500		690		940
11	6		4610		730		870
12	6		4690		800		840
Average:—			4610		740		920
13	Thoroughly dry.		6900		1520		1120
14			7000		1500		1090
15			6460		1490		1040
16			6810		1560		980
17			6720		1560		970
18			6600		1540		1060
Average:—			6748[2]		1530[2]		1040[2]

— Gain of about 8%:— in averages 2 above those marked 1.



— Compression :: Parallel with fibre —



— Transverse :: Compression —

— Beam —