they were to be injected, with alkaline carbonates and silicates, a study was made in the experiments of the influence upon the quality of the pine wood of a mixture of the following products:

Pine tar.

Alkaline carbonates (sodium or potassium).

Sodium silicate.

In order to study the conditions of the experiments the temperature of the bath was varied and in a more restricted manner also the proportions of the chemical products applied were varied.

The experimenters used a bath of pure pine tar heated up to 60, 80 or 110° C. They then, at analagous temperatures, made use of pine tar to which one of the following ingredients had been added:

| | |
|---|---|
| Sodium carbonate..... | 2 grammes per litre of tar |
| | 4 grammes per litre of tar |
| Sodium silicate ..... | 4 grammes per litre of tar |

The results obtained did not show any appreciable superiority of the one or the other bath composition.

Raising the temperature of the bath, on the other hand, produced a marked increase (12 per cent.) in the strength of the specimens which had been kept dry; but it had no appreciable effect on specimens which had been preserved in water.

The objection to this process was the high price of the pine tar. Attempts were then made to replace this product by a low price hydrocarbon, and the heavy coal tar oil which is used in the works of the city of Paris for impregnating wooden pavements was employed. The impregnation was effected under the same conditions as with the pine tar at temperatures lying between 112 and 140° C. With the highest temperature applied the strengths became the same as with the bath of pine tar, at the lowest temperatures, however, the strength was equal or even inferior to that of the ordinary crude blocks. This showed the possibility of employing the heavy tar oil in the place of a vegetable tar, but only on condition that the temperature of the bath be raised up to something between 115 and 140°, and probably best to 125 or 130°.

As an improvement had been realized by the application of a complex bath (liquid No. 7, heavy oil, sodium carbonate), steps were taken to find the cause of this amelioration, and the experiments were recommenced by adding successively to the heavy oil some carbonate of soda (liquid No. 8) and some silicate of soda (liquid No. 9).

The strengths which, in the case of blocks treated with the mixture of sodium carbonate and silicate, had remained inferior or at the best equal to that of the crude blocks, underwent a sensible increase when the wood was treated alone with carbonate and, more still, when treated alone with the silicate. This result appeared at first decidedly contradictory.

The contradiction may, however, vanish when attention is paid to the temperatures of the different impregnations. The liquid No. 7, bad at a relatively low temperature of 120 or 115°, becomes excellent at 140°, the liquid No. 8, mediocre at 112°, becomes better at 120°. The liquid No. 9 finally, which is practically equivalent to the preceding in the case of balks which have been impregnated at 120°, is, on the contrary, decidedly more favorable in the case of balks impregnated at 140°.

It appears then that, in the cases studied, the nature of the chemical constituents of the baths used for impregnation has little importance, and that the temperature of the bath is the essential feature. To verify this hypothesis it was sufficient to compare the very large number of experiments conducted from the point of view of temperature. The strengths found for the blocks which had been kept in the dry were as follows:

| | | Mean strength. |
|---|---|---|
| | Non-treated blocks | .....323 kg/cm² |
| Temperature of bath | 80° | .....337 " |
| | 90° | .....347 " |
| | 100° | .....330 " |
| | 110° | .....358 " |
| | 120° | .....345 " |
| | 140° | .....487 " |

Fresh experiments were conducted by heating blocks in baths up to 150 and 200°, care being taken to make the bath simply of tar or heavy oil, in order to verify the correctness of the previous conclusions relative to the usefulness of the mineral constituents.

The temperature of 200° was not exceeded because at that temperature the wood begins to visibly undergo disaggregation. The escape of the constitutional water leads to the production of numerous fissures, parallel to the fibres, which would certainly not be unobjectionable, if it were only on account of the facility which the cracks provide for water to enter into the wooden paving.

The new baths studied gave sensible improvements over those previously applied, as the following figures will show:

| Temperature of the bath. | Mean strength. |
|---|---|
| 150° | 516 kg/cm² |
| 200° | 536 kg/cm² |

It was therefore concluded that up to 200°, the limit of temperatures admissible for impregnation baths, a rise in the temperature of the bath will lead to an increase in the strength of the pavement. It appears, however, that, with regard to the improvement of the strength, little would be gained by heating the wood above 130 or 140°. The inconvenient production of cracks or fissures, which allow the water to penetrate from outside, and the heavy expense incurred by heating the wood to very high temperatures would render it advisable to limit the temperature of the bath to these figures.

As a further experiment some wooden blocks were heated in a dry air stove, at the same time that other blocks of the same balks were being heated in a heavy oil. The temperature was the same in the two cases, 200°. There was the increase of the strengths in both cases, though less marked in the former than in the latter. The result was, however, sufficient to put aside the hypothesis of an improvement of the wood simply by the action of the oil. It would therefore appear that the improvement is, to a large extent, at least due to the dehydration of the wood and to a transformation of its fibres wholly owing to the action of heat.

It would moreover appear that experiments conducted a few years ago in America (related in the work of Petsche: Wood, page 272) have established that, after heating wood up to a temperature ranging from 150 to 260° under a pressure of from 10 to 14 kg. per cm. square, a blackish antiseptic mixture is formed which remains imprisoned in the wood and which contains acetic acid, acetone and tarry matter. Should it be these substances which increase the strength of the wood? It would be premature to form more than hypothesis as regards this point.

However that may be, heating in the dry state, such as was employed in the Municipal Laboratory for certain blocks could not practically be applied, because the blocks of wood heated in the dry would lose their water more rapidly than when heated in oil and would begin to split. At 200° moreover they would undergo a very sensible superficial carbonization. It was therefore concluded that it must be the