CHAPTER XXXII.

FIRE FROM STEAM PIPES.

THERE is much diversity of opinion as to whether wood, in its *simple* state, painted or unpainted, or its charcoal, will take fire from the heat of steam, *unsuperheated*, at any ordinary pressures. Steam can be made so hot by superheating that it will ignite wood, and its pressure may be made so high its heat will be sufficient to ignite wood; but these are not ordinary conditions of steam any more than they would be ordinary conditions of air, and air also can be warmed either by superheating or pressure until it will ignite wood. What evidence, therefore, have we that steam at ordinary conditions will ignite wood or other woody fibres?

I have known tampico fibre that was used in the manufacture of brushes to fall between the heating pipes of the drying room, in which there was almost constantly 60 pounds pressure of steam, and although it was as fine as bristles, and was packed in between pipes, it did not take fire. I have also used pine laths on the upper side of the shell of a horizontal boiler, to maintain a space, when turning the arch of brickwork over the boiler, and in years afterwards, when resetting the same boilers, I found these laths in good

condition and not charred, although they were subject to the heat of 60 pounds pressure of steam and in heavy and close contact with the iron of the boiler, with 4 inches of brickwork as a covering to the laths, which, of course, prevented any great loss of heat through or from the outer surface of the wood.

The forging and the lagging of engine cylinders with wood furnish apparently good evidence against the ignition of wood by steam pipes at ordinary low pressures and at the ordinary condition of steam.

Superheated steam, however, and very high-pressure steam can undoubtedly ignite wood. I have seen the hair, felt, and canvas burned off the pipes of a heating apparatus for 20 or 30 feet from the boiler by the water becoming low or the boiler nearly empty and the steam becoming superheated.

In all construction, therefore, care should be taken to guard against the contact of the steam pipes with wood, as the general danger is undoubtedly increased by the omission to do so.

Some charcoals will ignite at a much lower temperature than others, and it is a well-known fact that the lower the temperature at which charring occurs, the lower the temperature of ignition. The question is, however, whether the temperature of charring can ever become so low as to cause the temperature of ignition to become equally low, or nearly as low.

The question has been discussed in the technical schools and societies and by the insurance companies without any definite conclusion. I think, however, it is well to perpetuate a diagram (*Fig.* 124) that appeared in the *Scientific American* about twenty years ago, which "Mr. Stahl, a student of the graduating class of

the Stevens Institute of Technology, prepared, at the request of Professor Thurston, in which the vertical scale is one of temperatures of preparation of charcoal, and the horizontal scale is one of temperatures of ignition, and the curve shown contains the points of correspondence as given in the table.

"It will be seen that the curve is apparently nearly hyperbolic. The lowest temperature of preparation was 500° Fahr., but it is seen at a glance, even that at 350°, the temperature of steam under a pressure of over 125 lbs. per square inch, the temperature of preparation and of ignition cannot coincide unless some marked change of law should occur at so low a temperature, carrying the curve, which here represents that law, abruptly inward to reach the point A. It is needless to state that such a phenomenon would be quite improbable, and is probably impossible."

The foregoing was the editorial comment that appeared with the diagram.

When the writer first saw the above he was induced to make some crude experiments in the same direction.

The pine laths that I before mentioned I enclosed in a retort, and to prove this wood was not charcoal, I placed it in a retort and drove off gas that burned with nearly as much light as illuminating gas when it leaves the retort.

I inclosed a two-inch cube of white pine wood within a small gas pipe retort, with a bit of solder (one-third tin and two-thirds lead) and a bit of sheet lead, and placed the retort in a boiler tube for five days, boiler going day and night. At the end of that time the wood was pure charcoal, the solder was melted, and the lead was not, which goes to show pure charcoal

can be made at a temperature between 440° and 612° Fahr.; it being understood that the melting point of this solder is given at 441° Fahr. and that of the lead 612° Fahr.

To prove the above was pure charcoal, *i. e.*, that all the hydrocarbon was driven off, I raised the temperature of the retort to about 1,200°, but could not drive off any more gas.

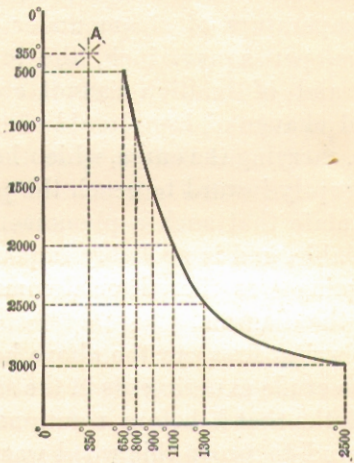

Fig. 124.

I then inclosed pine laths against the shell of a horizontal boiler, and covered them with a course of brick on edge. The pressure of steam in this boiler was from 40 to 60 pounds day and night for about 2½ years, except one day a month for cleaning. The ends of the laths that came out to the air and flush with the brickwork were not near as dark as hemlock tanned leather, and the darkest part I could find which

was entirely covered with brick was not as dark as roasted coffee. This goes to show charcoal cannot be made at 300° Fahr., after 2½ years, under the most favorable circumstances, with a furnace fire only 5 feet beneath it.

In experiments on the ignition of charcoal, I found that the charcoal made in a boiler tube would not redden at the melting point of lead (612° Fahr.), but would at a lower temperature than zinc (770° Fahr).

My mode of operation was this way. I passed a gas pipe through a fire and blew pure hot air through the pipe. I also prepared myself with long, slender strips of solder (half and half, and one-third tin and two-thirds lead), and with strips of lead and zinc, and pine shavings, and small pieces of the laths and charcoal.

The pure charcoal would not redden in the same blast that just melted the lead, but did in a blast which melted it rapidly. When held in a blast which melted solder (one-third tin and two-thirds lead, melting temperature about 500° Fahr.), it showed no signs of fire or redness.

The lath, which was 2½ years in contact with the boiler under a course of brick, would become charcoal in a temperature which melted half and half solder, but would not get a spark on it until I increased the temperature to where the needle of lead bent and dropped. It was the same with a nicely prepared splinter of white pine, and I could see no deviation in the action from the splinter of the lath; they all became charred in the blast which melted half and half solder, but would not take on a spark until the lead melted.

With a blast that fused a metal 19 parts tin, 31 lead and 50 bismuth, melting temperature about 212° Fahr., I could not turn tissue paper brown.

Gunpowder held in the blast which melted the lead did not explode until after the lead melted. It gave off a slight blue sulphurous light first, then the lead melted, and an instant after the powder exploded.

Illuminating gas will not take fire from a cherry red poker, but will from a bright red one.

The gas of wood, crude petroleum, soft coal, or any other hydrocarbon, will not take fire when escaping hot from the retort. With a cherry red poker I have tried the three mentioned.