Annals of Warsaw University of Life Sciences - SGGW
Forestry and Wood Technology № 82, 2013: 140-144
(Ann. WULS - SGGW, For. and Wood Technol. 82, 2013)

# Historic feature of wood fire protection

MARIUSZ CYRANKOWSKI, JAN OSIPIUK, PAWEŁ CZARNIAK, ŁUKASZ SPYCHAJ
Department of Mechanical Processing of Wood, Warsaw University of Life Sciences - SGGW

**Abstract**: *Historic feature of wood fire protection.* Fires were the most horrible plague of Polish villages, destroying them completely, which in case of complex and combustible land development was a common phenomenon. Therefore, there is nothing strange about the fact that men facing such a serious problem which constituted a direct danger to life, started to look for ways to avoid fires. Because of the fact that methods of "fire swearing" and other superstitions e.g. prohibition to spit into fire or prohibition to borrow fire did not bring any results, man was forced to find other methods of wood fire protection. The paper presents the simples methods of wood fire protection in olden times.

*Keywords*: fire, fire protection, wood

According to historic sources, in the territory of two ancient civilizations – in China and Egypt – measured aiming at limitation of intensity of combustion of construction materials were already known and applied. The Chinese applied a clay solution on wood or put a clay layer on it, which postponed the combustion of wooden constructions and limited the fire spreading, facilitating the rescue. In Egypt 3000 years ago, the reed and grass used for roofs was previously soaked in sea water. Mineral salts crystallized during drying made the roof resistant against combustion from the falling sparks. Mentions on use of fire protection measures from Roman times were left by Aulus Gellius, who, when describing the siege of Piraeus by Sulla in 86 BC stated that: "Siege machines started the assault. The defendants tried to burn them with all methods in vain, because the wood was resistant to fire, as it was previously soaked in the alum solution". This is how the properly used fire protection measures contributed to the conquest of Athens. Alum was one of the oldest preparations also recommended for wood protection. In 15$^{th}$ century in Europe, paints with addition of whiting, lime slurry and painting chalk, started to be used for painting the decorations and inflammable thin wooden elements, as it was observed that these addition delay the inflammation of materials and limit their combustion rate. The same objects painted with oil paints ignited much faster and with quick spreading of fire, they led to disasters. The role of fire protection measures on scientific basis was defined by the French chemist Gay-Lussac, who announced in 1821 in "Yearbooks of Physics and Chemistry" a vast treaty on this matter, at the same time providing with a range or recipes which could be successfully used even today. Before Gay-Lussac, this issue was discussed in 1658 by Sabattini, in 1735 by Wild, in 1740 by Fagot, in 1821 by Brugnatelli and others (Lindner J., 1962). From 1825, sodium and potassium water glass started to be recommended. It was used independently or with fillers for a long period of time, as practically until World War II, and constituted the basic ingredient of fire protection agents. Water glass activity consists in its melting in fire and formation of foamy coating. It is a purely mechanic activity. This amorphous colloid shall be applied on wood in thick layer, so that the coating could be formed.

Wood protection through saturation with a diluted solution did not bring any positive results, and it was difficult to perform in result of insufficient penetration of the colloidal solution into the wood. The basic disadvantage of water glass was its low resistance to atmospheric conditions, especially the wash out of coating by water. The second problem was the fact that in time, the water glass influenced by carbon dioxide with air was physically and chemically changed. Destruction started already after a few weeks. Initially, small, white, easily wiped off efflorescences were formed on the coating surface, which gradually increased. In unfavourable storage condition (sequences of drought and humidity), the coating started to crack already after six months. Then, the characteristic formation of foam during fire and protective properties were considerably decreased, however the effectiveness of preparation was still high. Protective mixtures were made of water glass with addition of various pigments. Fuchs recommended to use clay, chalk or glass powder. These admixtures, by creating an incombustible, strongly adhesive coating on rough wood, fulfil purely mechanical role hindering the combustion of wood. Another method of wood protection known already in ancient times was wood firing. The carbonized layer considerably delayed the combustion of the middle layer, and it made the elements less prone to negative influence of external factors e.g. rot or attack of insects. This knowledge was passed from generation to generation, and together with development of civilization, it was applied in various branches of technology. The wood firing started to be applied on an industrial scale in the second half of the 19th century in France and Austria for protection of railroad ties. Also contemporarily, at the beginning of the 20th century, this method was applied in order to increase the durability of wood already inbuilt in construction. Only dry and healthy wood was fired, and the carbonized surface had to be quickly saturated with hydrophobic agent e.g. with creosote oil. The simplest method of firing was placing the rotating wooden element in open fire. The disadvantage of this method was the lack of control of the depth of fired layers and difficulty in processing of objects with big dimensions. Taking into consideration the necessity to regularly fire the surface and with assumption that in result it should provide with layer changed with heat processing not thicker than 0,5-2 cm, the purpose was to form as good and as effective device as possible, especially that the demand on durable wood was constantly increasing. A special example of such demand were the railroad ties for intensively developing railways. In order to meet these needs, Lapparent discovered a device used by French Railway Paris – Orleans. A mixture of hydrogen and carbon oxide, so called water gas was burnt in it, which enabled the receipt of flame to feed the blower. The device consisted of a furnace [A] equipped with upper key [A ′] used for its filling and lower key [A ″]for removal of ash. A pipe was connected to the furnace [E] equipped with double blower with manual driving lever. Water gas was obtained thanks to injection of water to the furnace filled with incandescent coal. The railroad ties [K] for carbonization were located on rollers, thanks to which they were moved in the flame in two directions. The casing presented on the figure [L] was used to force the flame's "flow" on the entire wood surface. In Lapparent's device, it was possible to fire 72 railroad ties within 12 hours, at the same time using 1,5 kg of fuel for one tie. This heat gun was used also to prepare the telegraphic poles. In order to additionally increase the effectiveness of this method, the constructor suggested to scrub the obtained fired surface with pumice and additionally cover with mesh and flax varnish, at the end of the process. Lapparent's device was presented on fig. 1.

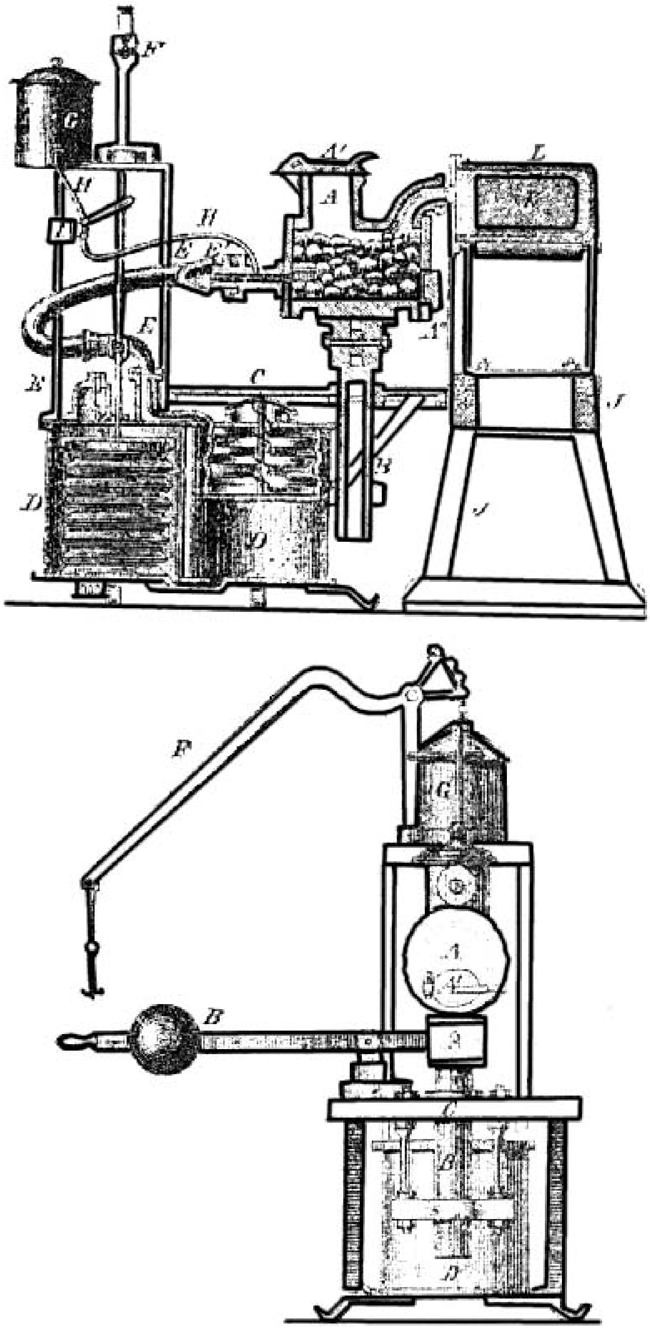


**Fig. 1** Lapparent's device

Another effective device for railroad ties firing was Rigol's construction fig. 2 consisting of an iron drum divided into 30 sections (for two ties each). On one side of the drum there was a furnace [F], on the other, the combustion gases were removed through stack [C]. The drum was rotated in a permanent manner with crank and every 1/30 of the rotation, on each side, at the rollers placed at the bottom of the drum, a finished fired tie was slid out which was immediately put in a container with cold water to harden it. Then, another element for processing was placed in the free space.

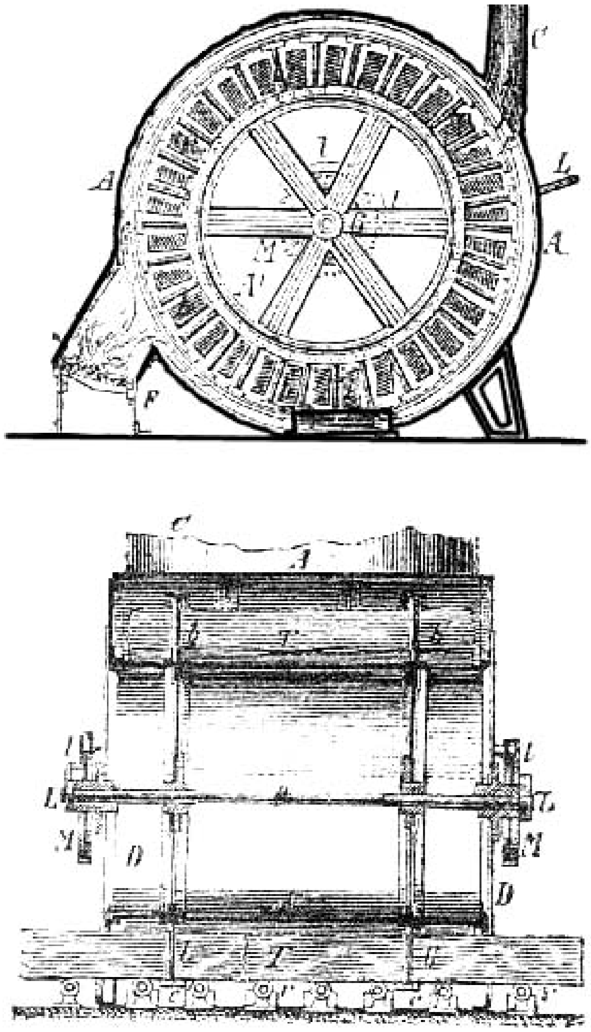

**Fig. 2** Rigol's device


SUMMARY

Since people started to use wood as a construction material, the fire, previous friend of man, became also a dangerous element for them, often destroying the entire possessions of human life. Therefore, fire protection of wood became an important element of the process of creation of new objects. The first measures of fire protection were created in result of the observation skills and drawing conclusions. Three thousand years ago, the Egyptians observed that reed and grass used for roofs got more resistant to inflammation from sparks from furnaces and chimneys once soaked in sea water. The mineral salts crystallized during drying made the roof more resistant. The next centuries brought new methods of fire protection of wood. Clay, alum, water glass, whiting, lime slurry and painting chalk were added to the paints, wood firing was applied. Moreover, the methods of use of natural wood resistance and linings and coatings were elaborated. In the last century, especially in its second half, we observed a very quick development of chemical agents for fire protection of wood.


REFERENCES:


1. FOJUTOWSKI A. 2001: Ochrona budynków przed korozją biologiczną. Wyd. Arkady, Warszawa.

2. LINDNER J. 1962: Środki ogniochronne. Wyd. Ministerstwo Obrony Narodowej, Warszawa
3. LINDNER J., STRUŚ W. 1976: Bezpieczeństwo pożarowe budynków. Wyd. Ministerstwo Obrony Narodowej, Warszawa.
4. LINDNER J. 1974: Zabezpieczenie przeciwpożarowe budynków. Wyd. Arkady, Warszawa.
5. METZ L. 1953: Przeciwogniowe zabezpieczenie drewna. Państwowe Wydawnictwa Techniczne, Warszawa.

**Streszczenie:** *Rys historyczny zabezpieczenia przeciwogniowego drewna*. Pożary były najstraszniejszą plagą polskich wsi, niszcząc je doszczętnie, co przy gęstej, palnej zabudowie było częstym zjawiskiem. Nic, więc dziwnego, że człowiek stając przed tak poważnym problemem, który bezpośrednio zagrażał jego życiu zaczął szukać sposobów na uniknięcie pożarów. Ponieważ metody „zaklinania ognia" oraz różne inne zabobony, np. zakaz plucia w ogień, czy zakaz pożyczania ognia, oczywiście nie przynosiły żadnych rezultatów człowiek zmuszony był do wyszukiwania innych metod do ochrony drewna przed ogniem. W pracy przedstawiono najprostsze sposoby zabezpieczenie przeciwogniowego drewna w dawnych czasach.

Corresponding authors:

Mariusz Cyrankowski, Jan Osipiuk, Paweł Czarniak, Łukasz Spychaj
Faculty of Wood Technology,
Warsaw University of Life Sciences – SGGW,
02-776 Warsaw,
Nowoursynowska 159,
Poland
e-mail mariusz_cyrankowski@sggw.pl
e-mail: jan_osipiuk@sggw.pl