

the centre of the retort, there is a shaft with arms attached, and the slots in the plates extend from the shaft to the circumference. The bottom of the retort is cone-shaped and fitted with an air tight box for the charcoal. When in operation, the wood is fed in at the top and is caught by the revolving arms of the rotating shaft and is carried over the hot horizontal plate until a slot is reached, the chips drop to the next plate and again are carried over the surface of the plate until it drops to the top of another, and this continues until the wood has been converted into charcoal and falls into the box. The gases pass upward through a passage surrounding the central shaft to a condenser. The control of the temperature, within a mechanical retort, is difficult and the yields of acetic acid and methyl alcohol much lower than in systems Nos. 1 and 4.

(c) The fire-brick beehive Kiln was introduced principally for the production of large quantities of charcoal for iron smelting. It proved uneconomical, inefficient in the production of condensable products, and offered difficulties in the control of its operation. In America, these installations were located chiefly in Michigan.

(d) From the retort system of steel, described under (a), there was developed the large steel oven having a much greater capacity, and into which the wood is conveyed loaded on small cars. These retorts were, formerly, rectangular steel ovens resting upon brick supports, with rollers to permit of expansion. The general practice, at present, is to suspend, by means of hangers, large rectangular retorts, 40-50 feet long, 8-9 feet wide, and 8 feet high, over furnaces. The expansion is taken care of by the free movement of the hangers. The bottom of the retort is protected, from the direct action of the fire, by firebrick arches and flues and the hot furnace gases circulate round the retort in such a manner that their heat is utilized to the fullest degree. The front, through which the laden cars enter, is closed by doors, and similar doors exist at the rear for the removal of the cars, when the carbonization is complete.

Cooling Charcoal.

The hot charcoal, from the cylindrical retorts (a), is drawn out by means of rakes and is placed in air tight coolers for 60-112 hours. In the case of the oven system, the air tight coolers are usually placed in double couples in the open, and are constructed of steel plates in the form of a tunnel. The first pair take the charcoal charge direct from the retort and holds it for twenty-four hours. It then passes to the second pair where the charge remains another twenty-four hours, and finally is exposed in the air for from forty-eight to sixty hours. This is necessary to ensure freedom from spontaneous ignition before the charcoal is loaded on cars or disposed of to the general public. Notwithstanding these precautionary measures, many cars of charcoal ignite during transportation and are destroyed.

Furnaces and Condensers.

The heating of retorts has been a subject of much technical investigation. The furnaces are generally designed to attain three purposes, protection of the metal of the retort, economical application of the heat, evolved in the furnace, to the distillation process, and further the utilization of the waste gases of combustion for evaporation and drying. The metal of the retort should be protected from the fire by fire-brick arches and flues. The hot furnace gases circulate round the retort in such a manner that they impart the heat efficiently to it. The exit combustion gases, on leaving the retort chamber, frequently, have a temperature of about 750 degrees F. and therefore contain much valuable heat capable of utilization.

The original type of condenser, used to condense the gaseous products given off in the distillation process, was a series of large copper or cast iron pipes of diminishing diameter, placed in tanks filled with water. This water was continually renewed by the introduction of cold water at the bottom, the warm flowing off at the top. The size of the condenser was such, that all the condensable gases, (which enter at a temperature of