, which would, until eliminated, injure the ality of the acetate.

Acetic acid is sufficiently powerful to expel e carbonic acid in limestone, but the neutral- ion process causes thereby a strong effer- escence, so that it must be accomplished in ge, deep tanks in which the effervescing ture will not boil over. If instead of lime- se burnt lime is used, the effervescence is ily reduced; but in either case it is import- t that the amount of basic material (lime) ot in excess. In other words, it should be sufficient to neutralize the acetic acid— ich it does first—and not enough to take up erward the acid elements of the tar, which, ng lighter than the acetate of lime, rise to surface during the reaction and should be ored by skimming. The clarified solution en evaporated in large shallow pans, yield- as a residuum crude acetate of lime. Over- ting during the evaporation decomposes acetate, so that a slow, steady and uniform t is necessary, and for this purpose the off ses from the retorts in which the wood is tilled are used whenever practicable. The de residuum is a gray, odorless mass, con- ing about 75 per cent. of pure calcium tate, and forms a standard article of com- erce. It is purified by dissolving in water, ering through bone black, and concentrates evaporation to a specific gravity of 1.16, en the sale crystallizes in small, odorless edles, which are principally used as material the production of acetone.

Acetate of lime appears in commerce in ee grades of purity, the highest of which is worth in large quantities 2.50 marks a gram (27 cents a pound); the medium, 6 marks (18 cents a pound), and the lowest de 1.38 marks (15 cents a pound). Its owing importance as a commercial product ll be inferred from the fact that the exports acetate of lime from Germany in 1898 were 9,300 kilograms; in 1899, 1,005,700 kilo- ams, and in 1900, 15,378,600 kilograms ,295,000 pounds), of which last 1,382,140 nds went to the United States.

When soda is used as the neutralizing base product is acetate of soda, and the process roughout is in general similar to that when e is employed. The acetate of soda has nous uses, but its crystals disintegrate when osed to the air, and for this and other sons it is less important in Germany than tate of lime. Both are, however, used as a ans of extracting acetic acid from the raw od vinegar, after which they are decomposed various processes to obtain the crystallized tic acid. When pure acid is to be obtained a large scale the soda acetate is preferred, the acetic acid obtained from calcium acetate tains impurities which are difficult to arate. In either case, however, the acetate decomposed by the action of a mineral acid ficiently powerful to displace the acetic acid om combination with the base, by which cess the former is isolated. Pure acetic id is used for many purposes, amongst ers making edible vinegar. When prepared this purpose it must be carefully cleansed om empyreumatic impurities, which give it a disagreeable, smoky flavor. It is then made to table vinegar by dissolving in twenty es its volume of water.

C—DIRECT DERIVATIVES FROM THE ACETIC ACID.

The most important is acetone, a colorless liquid which is used as a solvent in aniline and several other branches of chemical manufacture, especially in the production of smokeless powder and other explosives. Acetone is obtained by separating acetic acid into three elements—acetone, carbonic acid and water. For this purpose the acetic acid is neutralized with lime, and the acetate thus formed is heated in a retort with a stam leading to a coal condenser. On account of the low boiling point of acetone (560°), this coil must be kept at a very low temperature in order to produce complete condensation. In the industrial process the acetate of lime is dried, finely pulverized and then put into the retort, where it is heated until the acetone has passed over, when the residuum is withdrawn and again used for making fresh acetate of lime, with which the operation is repeated. Acetone of 56° to 58° purity is now worth about 50 cents a kilogram (22.6 cents a pound), and, like acetate of lime, is a standard commercial product.

The next valualbe derivative for acetic acid is wood alcohol or methyl alcohol, called in German "Holzgeist," a colorless, volatile and inflammable liquid, which boils at 66.3° C. and has a specific gravity of 0.800. It burns with a bluish flame of low illuminating power, dissolves resins, gums and essential oils and is extensively used in the manufacture of lacs and varnishes and for the denaturalization of spirits which are to be used for industrial purposes (in order to render them unfit for imbibation). The exports of wood alcohol from Germany in 1899 amounted to 6,703,620 pounds, valued at $652,354.

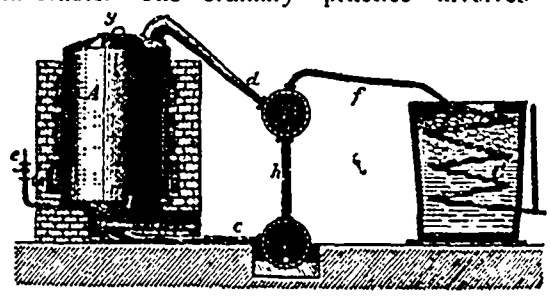
Among the other useful products of wood distillation is oxalic acid, an important substance used in dyeing and cloth printing, which was formerly prepared by oxidizing sugar, but is now much more cheaply obtained from sawdust by the action of alkalies.

III.—APPARATUS FOR WOOD DISTILLATION.

Since the commencement of wood distillation as a practical industry nearly fifty years ago many changes and improvements have been made in the machinery employed, which for economical practice requires to be adapted to the kinds of wood to be worked, the quantity to be treated at each operation, and according to which of the distillates, tar or acid, is regarded of first importance. Wood is a bad conductor of heat, so that, in the construction of all retorts, the problem is to secure as prompt and as thorough a distribution of heat as possible throughout the mass, combined with such dimensions as will render the charging of the retort with wood and the withdrawing of the charcoal reasonably convenient. All plants for wood distillation combine substantially the features which are shown in the following model, which is a simple, upright retort, with a capacity of 8 cubic meters (about 2½ cords) of wood.

In this figure, the retort A is made of ordinary or of galvanized boiler plate, set in brick masonry, with a pital flue b, so that the fire introduced at the furnace a is drawn by the chimney draft round and round the outer shell of the retort, which is filled with wood, and the charcoal discharged through the manhole y. To quicken the heating of the charge to 100° C.—at which temperature the development of gases begins—superheated steam is turned in through the pipe e. The crude inflammable gases which are first generated are discharged downward into the fire through a pipe not shown in the drawing. As the heat increases the steam and gas pipes are closed and the distillates begin to pass over. The tar flows downward through the pipe c, the acid gases pass upward through the beak d into the drum B, where the tarry vapors condense and are carried downward to the tar tank (lower B), which is kept cool by partial immersion in water. The pyroligenous acid gas, nearly freed from tarry impurities, passes on through f and the cold coil C, where it is condensed and pours out in the form of raw wood vinegar. These are the rudiments of the process.

In anticipation that the European process of making charcoal with recovery of the tar and acid products might have a practical interest for charcoal manufacturers in the United States, an engineer familiar with this industry has been consulted, and he has obtained from several German manufacturers of apparatus and fixtures for these purposes, estimates of the cost of equipment for a plant of the standard capacity, viz., 75 cubic meters (2,649 cubic feet) of wood daily. In practice it has been found most economical to set up the distillation plant as near as possible to where the wood is cut; in other words, at the point where all conditions of transportation for raw material and products are most favorable. The ordinary practice involves



APPARATUS FOR WOOD DISTILLATION.

the distillation of hardwoods—beech or oak—and the recovery of charcoal, tar, raw wood vinegar and methyl alcohol. The charcoal, or first product, is ready for market upon being withdrawn from the retort. The tar is sent as raw material to chemical factories, where it is worked up as a separate industry. The methyl alcohol is also a commercial product and is usually sold in its crude state, but the wood vinegar is usually consumed on the spot for the production of acetate of lime, which, as already explained, is a convenient vehicle for recovering and transporting the pure acetic acid contained in the wood vinegar, which for this purpose is treated with ordinary limestone. Assuming, therefore, that a firm or company in the United States should wish to establish a modern German plant of this kind, and for that purpose to obtain the necessary machinery in this country, the calculation would be somewhat as follows.

Distilling apparatus complete, without buildings, for treating 75 cubic meters of wood daily, would cost here 105,000 marks ($24,990). If the capacity were increased to 100 cubic meters the cost of plant would be about 130,000 marks ($30,940). If greater capacity is desired it would be advisable to duplicate the same apparatus instead of further increasing the size of the unit.

If beech wood is used, the raw vinegar obtained will be from 40 to 45 per cent. of the weight of the wood, and the vinegar should yield 9 to 12 per cent of acetic acid. Assuming that this is to be recovered on the spot, a plant for the daily production of 1,200 kilograms (2,640 pounds) of acetate of lime would cost, exclusive of buildings, about 15,000 marks ($3,570). This assumes that the raw pyroligenous acid is to be treated with ordinary limestone, a process which involves no technical difficulties. So far as can be ascertained, the apparatus for the industry involves few or no essential features which are covered by patents, so that a modern scientific plant, once established and its success demonstrated, could be duplicated to any extent which supply of material and the market for its products might require.