treatment, an estimated annual saving of five million board feet would ensue. The practice of preservative treatment will also create a new and increasing market for many timbers not formerly used, and timber consumers will more easily break away from their former custom of adhering closely to a few well-known kinds and disregarding others which may be equally as good in other respects but lack durability. Moreover, there will be an increasing realization that by the use of cheaper woods properly treated with preservatives, as good or better results can be obtained, together with the reduction of the annual cost. This last item, the saving in dollars and cents, is the all-important factor of wood preservation. As soon as the consumer fully understands that his annual expenses can be actually reduced by these methods, it is only natural to conclude that a strong effort will be made for their adoption.

Wood preservation is an exceedingly complex subject, and upon considering it many problems arise for solution. There has been a great deal of thought given to it, and it has undoubtedly made rapid strides during the comparatively short time it has been practised in this country. Nevertheless, it is still far from being on a sound scientific basis. The experiments that have been made show very clearly that each different species of wood, and wood of the same species but differing in the character of growth, present an entirely different set of problems. They differ greatly in the receptibility of different preservatives and they differ in the kind of preparation necessary for treatment and in their action in contact with the preservative, and after. The kind and condition of wood to be treated and the conditions under which it is to be used are very important factors in determining the kind of treatment that is best. The effect of the preparation and of the preservative on the mechanical properties of the wood are also very important, and must be carefully considered before any treatment is decided upon. Present practices are now largely determined by the experience derived from preceding years rather than an intimate knowledge of the theory of the subject. This latter feature, however, is most important and is at the present time receiving much deserved consideration. The Forest Service in its laboratory now being erected at Madison, Wis., expects to study very comprehensively the different theoretical questions arising in this work, and it is hoped that this will result in extending our knowledge of the action of different preservatives and the way they should be applied to each species of timber to secure the best results.

During the early period of wood preservation in this country, the expense of the treatment and the necessary apparatus and the lack of reliable information regarding the results prevented to a great extent its extensive adoption. As the demand for it increased and more reliable figures were obtained regarding the actual increase in life from various treatments, the economic results were better understood. This led to a larger development, and at the present time there are over sixty wood preserving plants operating in the United States, with an output, in 1907, of one and one-fourth billion feet.

Preservatives.

Of the many antiseptics which at one time or another have been proposed for the preservation of timber, two different classes may be made: (1) Antiseptic salts and various substances, such as zinc chloride, corrosive sublimate and copper sulphate; and (2) antiseptic oils, of which creosote, or dead oil of coal tar, is most generally used. The most common preservatives in general use are zinc chloride and creosote, and both are excellent antiseptics. It may be said, however, that the principal value of zinc chloride is its cheapness and its ease of transportation, for it can be hauled in the form of a solid and dissolved at the treating plant. The principal defect of zinc chloride is its liability to leach out of the timber when exposed to moisture either in the soil or in the atmosphere. It readily dissolves in water and so its subsequent leaching out is merely a question of time, and the wood is left once more subject to attack. Its use, therefore, is limited to less moist situations. Creosote, on the other hand, is practically insoluble in water, so when a high grade of oil is used and injected into the timber, decay will be postponed almost indefinitely. Its principal disadvantages are its higher cost as compared with zinc chloride, and its limited supply and the subsequent difficulty in getting a good grade. In treatments for many structural purposes, such as piling and timber in wet situations, and especially where a long life is desired, creosote undoubtedly has demonstrated its ability to give the best results. Upon examination of certain timbers that have resisted decay for a long time, it has been learned that it is the heavier constituents of the oil that have remained in the wood, and it is therefore concluded that these constituents are to be depended upon in preservation work. For this reason, it is considered advisable that when specifying for creosote the heavier fractions should be called for.

Treating Processes.

Treating processes as practised to-day may be divided into two general classes: those which use pressure, and those which treat without pressure. Both of these may be subdivided into what is known as full cell and empty cell processes. The pressure process is too general and too well known to need description here. It is the more widely used of the two and without doubt the more effective for work on a large scale, and where a variety of woods must be treated. Pressures above 175 lbs. per square inch are seldom exceeded in these plants, as with proper preparation practically all woods can be treated with this pressure, and for many woods less is needed. The quantity of treated wood required determines the volume and size of the apparatus used and its cost. A plant of this kind having a capacity of about 3,000 ties per day would cost about $40,000 to install. Within the last year or so there has been introduced a plant in which only a medium amount of pressure is used. This type may be called a medium pressure plant. In it pressures ranging from 50 to 100 lbs. per square inch are used. It is principally adapted for use by mining companies or city traction companies, where woods of a porous nature not especially resistant to the entrance of the preservative are used. Such a plant would usually be of a much less capacity than the ordinary plants, on account of being designed for the treatment of special classes of timber for local use, and can be built more cheaply on account of being of lighter construction. A plant of this type, with a capacity of 1,500 ties per day, would cost, approximately, $20,000 to install.

Plants which treat without pressure are rightly called non-pressure plants. This type of plant is not the open-tank proper like that used in the treatment of butt telephone poles, but a closed cylinder similar to those of the pressure and medium pressure plants, but made of very much lighter material, usually ¼-inch iron. The Forest Service has done much to develop this latter plant, because this process has filled a real need, a need which the pressure process could not fill. The development of this non-pressure process is due very largely to the heavy expense involved in the purchase and installation of the pressure plant, an expense which confines such plants to large commercial companies or to com-