It has been found by the experiments conducted that the success of the continuous flow method depends upon maintaining good activated sludge at all times in the tanks treating the fresh liquor. By aerating the sludge to a higher degree than the whole body of the liquor, air is saved because only 25 per cent. of the entire mixture is thus given an additional aeration.

The plant can treat 1,600,000 gallons of sewage per day with a 4-hour period of aeration and with a 25 per cent. activated sludge content. From present indications it will be able to treat the sewage satisfactorily, when the temperature is 50° F. or over, at a much higher rate, but this is yet to be determined on the large scale. In order to overcome some of the effects of low temperature it is designed to pass the condensing water from the present sewage station adjacent to the new plant through coils of pipe hung to the inside perimeter of the two sludge tanks, inducing circulation by a circulating pump built in the condenser discharge line. This water is now discharged into the river at a temperature of about 100° F.

The power plant for producing the air necessary for operating the plant consists of two positive pressure rotary blowers each having a capacity of 2,400 cu. ft. of free air space per minute compressed to 6 lb. pressure and belt-driven from two alternating current variable speed motors each of 75 b.h.p. Only one unit will be required for operating the plant. Two are provided to avoid possible interruptions.

THE HOLDING POWER OF NAILS.

ONE of the rarest subjects dealt with in print is the holding power of nails in wood, and especially in hard woods. The nailing of soft woods, such as pine, is supposed to come to people like walking with all the proportions of length and thickness of nail for the size of wood to be put together. The nailing of hard woods is not so common, as hard woods are often framed or bolted together. As stated in the Indian Textile Journal, from which the following notes are taken, the subject seems to have had the minimum of study, for it is hard to discover the reasons that determine the size of nails or screws among woodworkers. A glance at the interior of any coasting boat will show that although every nail is clinched, a length of 3 inches is allowed for that purpose, while the spread of the head barely amounts to one inch. The waste of iron in nails alone cannot be less than from 20 to 25 per cent. Hard woods are more common in tropical than in temperate countries, and as they are frequently joined with nails, some system should be adopted to obtain the best results. It is useless to ask the carpenter to go into calculations about nails: he cannot do it, but he can make a simple experiment that will enable him to avoid splitting the wood.

A nail holds itself in place in two ways: by friction of its sides against the wood, and when clinched, by the resistance of the clinch which resembles a second but smaller head. The combined resistance of sides and clinch represent the total holding power of the nail. Square nails are usually tapered on two sides and parallel on the other two; the tapered sides should bear against the end grain of the wood, crushing it gradually as the nail enters; and when it is fully driven it bears uniformly against this end grain crushing it without splitting. All woods when soaked in water or when green may be nailed with less risk of splitting than when they are dry, but there are limits to the depth that a long nail may be driven into any wood before it begins to bend, that is to say, where the friction of the wood overcomes the driving power of the hammer. When a nail begins to bend it shows that a hole must be made beforehand; and the size of the hole is a matter of some importance. Its object is to reduce the friction so as to allow the nail to be driven without bending, but if made too large, the holding power of the nail will be reduced and clinching will be a very imperfect remedy. If many nails of one size have to be driven, as in boat building, it is advisable to experiment on a piece of wood of the necessary thickness in order to find out the right size of hole that will avoid splitting the wood, or bending the nail. When wire nails of a large size are used in drilled holes, the size of the hole should be such as will ensure a good fit; and if the nail is to be clinched it should be softened at the point by heating to redness. The wire nail is hard drawn to enable it to be driven without bending in soft woods, but it does not clinch well for this reason, and therefore needs softening.

The holding power of nails and screws may be ascertained by a simple experiment. The nail may be driven into an upright post leaving the head projecting just enough to be seized by a nail-puller. This instrument is then attached and weights added to the outer end until the nail begins to move. A bag loaded with stones will serve the purpose. The nail-puller consists of two levers formed by the extended handle and the projecting foot, and if the weight in the bag is multiplied into the length of the handle in inches and divided by the exact length of the foot measures from the nail to the point of contact of the foot with the post, the result will be the holding power in pounds of the nail.

Nails that have rusted after being driven have an increased holding power, but if rusted before use they tend to make a slightly larger hole than a smooth nail, because of their rougher surface. In cases where clinching would be liable to split the wood, nails may be cut and riveted over a small washer. This makes a strong and durable joint. There is also a way of clinching a nail within the wood that is at times useful. The point is filed away on one side to a wedge shape and then bent over the filed part until the point is level with the side of the nail. A hole is drilled to the size of the nail which is inserted with the filed surface parallel with the grain of the wood. When driven, the point takes the form of a hook and has a strong hold upon the wood. The point of this nail should be heated and softened so as to facilitate the turning of the point.

Nails driven in wood that is expressed to alternate wetting and drying are liable in time to work loose. The wetting swells the wood and increases its dimensions across the grain, and as the nail is inelastic it is moved, a space forming at the point equal to the amount of swelling of the wood. When the timber dries the nail does not return to its original place, and if tapered it tends to move outward each time that the wood is wet and dried. It is for this reason that wood structures bolted together and exposed to the weather require screwing up at intervals.

Screws offer an even more interesting subject for experiment, for it will be often found that if the hole for a screw is carelessly drilled it has less holding power than a nail. The holes for screws in hard wood should be very carefully made in two sizes: for the neck and the screw, respectively; and the point of the screw-driver should be of the shape of the notch in the screw and not a chisel point as is usually seen.