

per foot for wells not over 900 feet deep, since the engine—the only costly part of a well-borer's outfit—is furnished by the employer. The well is bored of an enlarged diameter, and tubed as far as the "bed rock." Beyond this, a diameter of $3\frac{1}{2}$ to 5 inches is the usual capacity. On the completion of the boring to the requisite depth, the hole is tubed with iron to some point below the place of influx of fresh water. This is generally the carboniferous limestone; and here some sort of packing is introduced around the tube for the purpose of shutting off communication between the inside and outside of the tube. The strong brine rises to within 5 or 10 feet of the surface, and sometimes overflows—in one instance rising in a tube as high as 17 feet. In all cases, however, a pump is introduced into the well for the purpose of securing an adequate supply.

The water is pumped at an expense of about three cents per barrel of salt, into vats or cisterns elevated about five feet, and having generally a capacity of 20×30 feet and 6 feet deep, holding consequently about 26,000 wine gallons each. Two of these vats are requisite for each block. In the cisterns, the water is allowed five or six days to settle—that is for the iron to be precipitated—a process which is generally facilitated by sprinkling in the brine a small quantity of limewater.

The kettles are arranged in two close parallel rows, and supported by walls of brick and stone, forming an arch with a longitudinal partition—or more properly two arches, in the mouths of which the fires are built. A chimney, from 50 to 100 feet high, rises at the back extremity of the arches, and thus the heat is made to pass under each kettle of the double series. The arches are inclosed in a house 120 feet by 40, or thereabouts, with a shed running the whole length of each side, divided into large bins for the reception of the salt. At the Bay city works the bins occupy a separate building, into which the salt is wheeled and emptied. This arrangement permits an opening to run the whole length of the block on each side, for the admission of air to drive the steam from over the kettles.

After settling, the brine is conveyed into the boiling house in logs, which run along the arch above the kettles, resting on the middle wall which separates them; and from these logs supplies are drawn as needed, into the kettles.

It may be of interest to note that kettles are not manufactured at Bay city, but by a firm recently from Chatham, Canada West.

The fuel employed is generally a mixture of hard and soft kinds, for prices varying from \$1 31 to \$1 50 per cord. Hard wood, consisting of maple, beech, hickory, ironwood and birch, is exclusively employed at the East Saginaw works, and costs, delivered, \$1 75 per cord. One block, including the engine, consumes about six cords of hard wood, or six and a half cords mixed wood, in twenty-four hours.

The brine, of course, evaporates much the most rapidly in the front kettles, immediately over the fire. These have to be filled once in three to five hours, and the back ones once in fifteen to twenty-four hours. Settling pans are introduced into kettles just filled, for the purpose of receiving any impurities precipitated by the application of heat. Occasionally milk, blood, or some other animal sub-

stance is employed to promote the clearing of the brine. Generally, also, some skimming is needed; and the more when the brine is purified in the manner just mentioned. The contents of the kettles are reduced by boiling to one-fourth or one-fifth the original quantity, when the salt, crystallized and fallen to the bottom, is transferred to baskets supported over the kettles, where it is allowed to drain.

The baskets at first used were of the Syracuse pattern; but these being found too small, a new style, patented by a Michigan man, and of larger size, is now generally employed. These cost forty cents each.

The baskets of salt, when moderately drained, are emptied into the bins, where the salt lies fourteen days to complete the drainage.

In the meantime, the kettles are replenished with brine and the same process is repeated. After a kettle has been boiled down two, three or more times, the accumulation of bitters needs to be thrown out. Some prefer to do this after every kettle full. The bitters are thrown into a conduit which runs at a convenient distance, and are thus carried out of the block.

The work is thus prosecuted day and night for the period of two to five weeks—the boilers and firemen succeeding each other in relays every twelve hours. At the end of this time the rapid evaporation and great heat of the front kettles has caused an incrustation to be formed upon the bottom from one or two inches in thickness. This must be removed, or it acts as a false bottom, permitting an interval to form between it and the kettle, thus rendering the bottom of the kettle liable to be melted out. In the Syracuse works this crust contains so much gypsum as not to be readily soluble, and is picked out with iron tools, to the great danger to the kettles. In the Saginaw works the crust is almost pure salt, and is at once loosened and removed by the simple introduction of fresh water, which is obtained from a second set of logs introduced for the purpose. The fires are permitted to go down on Saturday night. During Sunday the arches cool. On Monday any needed repairs are attended to, and on Monday night the fires are rekindled.

The amount of salt produced in twenty-four hours from a block of a given number of kettles, varies with the strength of the brine, the state of the atmosphere, the quality of the fuel, and the attention of the firemen. At Portsmouth, in good summer weather, 40 barrels are made per day from 50 kettles.

The packing of the salt is done for three cents a barrel. The barrels used cost from twenty-four to twenty-six cents—the price varying with the quality. Elm barrels with pine heads are generally employed; but at some of the works pine is used exclusively. These barrels are manufactured in stave and barrel factories opening in the vicinity, and are admitted to be a superior article for salt packing. No objection exists against elm staves, provided they are cut narrow; otherwise they are somewhat liable to warp on exposure to the weather, and might in some cases endanger the package. The tidy appearance of the packages of Saginaw salt has everywhere recommended it to notice.

The solar manufacture is yet in its inception.