Water-power was used almost exclusively in saw-mills until 1835, after which year steam was rapidly substituted, until at the present time it is as difficult to find a water-power saw-mill as it is to find a gate or muley.

The use of the circular as the main saw of a mill is of compara­tively recent origin, the experimental point in its introduction having been passed only about the year 1855. Since that time it has rapidly reached the highest efficiency. Driven by engines of from 25 to 100 horse-power the circular saw-mill, under proper management, turns out from 20,000 feet per day for smaller to 50,000 and 60,000 feet per day for larger mills, in addition to running the double-edgers and trimming saws, requisite for trimming off the rough edges' and bad ends of the lumber produced.

The modern saw-mill stands upon the banks of a river or pond, at an elevation usually of twelve feet from the level of the land to the saw-floor. The logs are floated from the forest (often many hundred miles distant from the mill) down the river, in lengths as desired. Piling driven at convenient distances in the water serves to hold the long pieces of timber, which, secured to the piles by heavy chains, form a strong “ boom,” floating into which the logs are penned or “ boomed ” until required. From the rear end of the mill, at the second story or saw-floor, a “jack ladder ” is constructed of heavy timber, the lower ends resting in the bottom of the stream upon a bed of timber heavily weighted. Upon the sides of the jack ladder are laid ribbons of iron forming a track for the log car, which, strongly constructed and with its top cross sections or “bunks” heavily studded with /\-headed bolts, is run under the water at a depth to allow the log to float over it in such manner that, as the chain running to the “ bull-wheel” in the mill is wound up, the spikes of the car catch upon the under-side of the log or logs, which thus load themselves and are hauled up the incline to the mill floor. Here they are rolled upon skids leading to the saw-carriage, and are soon running rapidly their course of manufacture. Loaded upon the “ head-blocks, ” by a quick motion of a lever upon the standard, the “setter ” inserts an iron “dog,” which holds the log firmly in place ready for advancing to the saw. This is accomplished by one of several methods :—(1) by rack and pinion worked by “cone feed,” in which a belt is moved upon two parallel cones to impart a more rapid or a slower motion to the pinion shaft; (2) by “rope feed,” a rope, usually of wire, being attached to each end of the mill carriage, and passing over pulleys in the floor to a drum beneath, so arranged as to be under control of the sawyer in its feeding movement or in reversal to “ gig ” the carriage back to its first position ; or (3) by “steam feed.” This is the more modern and rapid means employed, and is sometimes termed “ lightning feed.” A steam cylinder of 8 or 10 inches diameter is laid upon the floor of the mill beneath the saw-carriage, its piston connecting with the carriage. Steam being admitted to the driving end of the cylinder (the length of which is according to the length of timber to be sawed, sections being added or removed at pleasure) the saw carriage is driven with lightning speed, both in the cutting feed and reversing “ gig. ” Thirty ordinary cuts per minute, on 12 inches feed to the revolution of the saw, may be attained with this adaptation. As the limit of capacity for work with a circular saw is practically the ability of the operators to remove the lumber, 60,000 to 70,000 feet per day is no unusual cut, while a rate of 100,000 feet per day has been maintained (for a short period) by a single circular. The lumber as it drops from the saw falls upon “ live rolls,” a series of iron or wooden rollers connected by chain belts, which carry it within reach of the “edger,” who rapidly passes that portion which requires “ edging ” or splitting through the “ double-edger, ” to a carriage or truck on which it is pushed to the piling ground, or, in some mills, to another series of live rolls which take it to the front of the “trimmer,” an ingenious arrangement of table, beneath which are several saws which advance or recede at the operator’s pleasure, cutting the lumber to even and uniform lengths, or trimming off such defects as may exist in the end of the piece. Ordinary lengths are 12, 14, 16, and 18 feet, and by use of the trimmer all superfluous ends are removed, leaving each piece of uniform length with its fellows. The waste of the log, consisting of the “ slabs ” and edgings, are carefully gone over, and such as are suitable for that purpose go to the “ lath” machines, where they are cut into strips four feet in length, 3/8 inch thick, and 11/2 inches wide, for lath and plaster work. In the sawing of logs, imperfec­tions are often discovered in the timber, unfitting it for ordinary uses, and in many mills it is customary to saw such timber into “ cants ” of usually six inches thickness. These cants are turned over to a “butting saw,” where they are cut into lengths of 16 inches (in some localities 18 inches) and turned over to the shingle mill to be manufactured into shingles. Shingles are tapering pieces 3/8 inch thick at one end, and inch at the other, and are used as a roof covering in lieu of slating or tiles. They are laid in uniform courses, with 41/2 to 5 inches of the butt end laid to the weather, and are good for from 20 to 30 years’ wear upon a roof. An

adjunct to the circular saw is often found in a top or upper saw, overhanging the main circular a little in advance of its track, for the purpose of enabling larger logs to be handled than the diameter of an ordinary circular will permit. The upper saw cuts into the top of the log in a line with the cut of the lower or main saw, thus increasing the depth of the cut. In California, where logs of 8 and 10 feet diameter are not unusual (larger logs being quartered by the use of gunpowder or other explosive, timber as much as 20 and even 25 feet in diameter being found in the redwood forests), an ingenious arrangement of four saws placed one higher than the other, some horizontal and others vertical, permits the handling of huge trees which until recently were not considered available. A thoroughly modern saw-mill embraces all which has been said regarding the circular, with the addition of the “gang” feature, for, while a majority of the saw-mills of North America are single “circulars,” many of them have a rotary upon each side of the mill floor, the log-jack being in the centre of the building rolling its logs either to the right hand or the left. The larger mills have in addition to the rotaries from one to four gangs. In these cases the log usually goes first to the circular, where the slabs of two sides are removed, leaving a flat cant, which is then transferred to the gangs. These mills are fully equipped with all the modern patent improvements. The logs are drawn from the water by an endless chain running in a V-shaped log slide, the chains being provided either with spikes or concave chairs which hold the log from slipping back. One log follows the other in endless succession. O11 its arrival at the log deck on the mill floor, the manipulation of a lever causes an arm or arms to rise through the floor against the side of the log, which is partially raised and thrown with considerable force upon the skids leading to the saw carriage. When one log has been sawed, another is loaded by the simple touch of a lever in the hands of the sawyer, causing arms to rise in the skids under the log, which is thrown upon the carriage ready for the saw. When the first slab has been removed, the sawyer’s touch of a lever brings through the floor the “ nigger,” a piece of strong timber, iron-bound and with sharp teeth or spikes protruding from its front face. Its motion tends slightly forward as it advances to a height of five or six feet above the floor, its spiked surface catching the side or face of the log, turning it instantly to any desired position. If the log is simply to be “canted” for the gang the two opposite sides or slabs are removed, and as the last cut is complete a hook thrown over the rear end of the cant prevents its return with the saw carriage and it drops upon rolls which move it so far out of the way of the returning carriage with its fresh load as is necessary to start it in an opposite direction to the gang which is to complete its manu­facture. Until now, and until it shall emerge from the gang, no hand of man has necessarily touched the log. Machinery guided by human intelligence has done all the work. When the log reached the carriage it was dogged, not with the old-fashioned lever dog driven by a mallet, but by the simple movement of a lever. It was brought to its proper position before the saw by nicely adjusted set works, which graduated its position to one- eighth of an inch. After the slab was removed, if another cut was required the same set works moved it forward with lightning quickness, leaving it at the exact point, to a nicety, requisite for the production of just the thickness desired for the next piece. From the water to the pile in the millyard hands have necessarily been employed in actual handling of the product only at the edger and the trimmer, and in assorting the qualities upon the tram-car which removes it from the mill. Machinery, guided by human intelligence, has done all the heavy work. A mill answering closely to our description was recently burned at Bay City, Michigan, the yearly production of which for several years past has been 40,000,000 feet of lumber, besides shingles, lath, pickets, &c., cut from the slabs and waste. The total production of the saw- mills of the United States approximates 26,000,000,000 feet annually.

The “band” saw-mill is rapidly working its way into public favour because of the economy attending its use. The band saw is a long ribbon of steel, six to eight inches in width, running over large pulleys above and below, the upper pulley running almost vertically above the lower, the saw acting as a belt between the two and as the driving power to the upper wheel. These saws are very thin and have a manufacturing capacity of from 30,000 to 40,000 feet per day, with the consumption of 25 to 40 per cent. less power than is required for the ordinary circular saw of the same daily capacity for work. The main advantage found in the use of the band-saw is in the saving of timber (20 per cent.). The set works do not differ from those of rotary mills, and either cone, rope, or steam feed may be used in connexion with it.

A useful adjunct to the many saw-mills, which produce more waste than can be consumed in raising the necessary steam, is the “slab-burner ” or “hell,” a large circular brick furnace often 50 feet in height by 25 feet internal diameter, erected . conveniently near the saw-mill, into which by chain carriers leading to an opening at a sufficient height from the bottom, the sawdust,