Artesian Wells.

An artesian well, properly speaking, is a well like those in the Province of Artois, in France, which are narrow, tubular openings into deep, water-bearing strata, reaching water which is under sufficient pressure to be forced through the tube to or above the surface of the ground. The name is often applied to deep bores in which the water rises to a point more or less below the surface, and from which it has to be pumped.

In any case, where water rises into the bore to a height greater than that at which it is struck, the rise is due either to pressure from a higher fountain-head, or to the expansive power of gas contained in the water. Sometimes it is due to both forces.

The pressure which causes the rise is the pressure of water confined under an impervious stratum of rock or earth having a certain inclination or pitch from the horizontal line. The impervious stratum may pass down the hill at one side of a valley and turn up at the other side, so that a positive head is produced at any point below where the stratum begins to dip.

In other cases, the impervious stratum may pass on down a steep, long incline, the flow of water through it being greatly impeded by friction against the sand, gravel, or other loose material of which the water-bearing stratum is composed.

In this case, without the more positive head that exists in the first instance, water finds a freer exit through the open bore than through the sand and gravel, and rises in the well.

Whatever the conditions may be, the rule applies that water, under a head or pressure, seeks the easiest outlet, and, if confined, will rise as high, or nearly as high, as the head at the higher part of the inclined water-bearing stratum or distant elevated reservoir.

The action of confined air in causing water to flow from a well, is the same as that which is developed when a bottle of soda-water is uncorked, the expansion of the gas blowing the water out of the mouth of the bottle.

The "blowing wells" of the oil and salt regions are wells discharging by the pressure of natural gas—either of gas confined in the water or oil, or of gas confined in chambers, bringing pressure to bear on the surface of the liquid.

The elements of the work of boring the hole to reach the water are illustrated in the use of the post-hole auger and the rock-drill. A hole may be bored through earth or soft, disintegrated rock by the use of a revolving auger-like tool, and it may be continued through the rock by the use of a chisel-drill worked up and down like the "jumper" drill of a stone quarry.

The oldest bores of this character were probably made in China more than two thousand years ago. These wells were probably sunk after rock was reached, by the use of a chisel-drill suspended by a rope of bamboo fibres, and supported by a spring-pole of bamboo strong enough to hold the drill some distance above the point of working.

With ropes connected to the end of the spring-pole, by which it is pulled down, or by the jumping of a man on a platform on the spring-pole, the drill is made to strike its blow, recoiling with the aid of the spring-pole when tension is released.

This is substantially the principle of modern drilling with the chisel drill and its various modifications, and is the one used in the Pennsylvania oil regions, where the churning movement is imparted to the drill by a working beam attached to the shaft of a steam-engine by a crank and pitman.

After the completion of the well, the same appliances are used for pumping the oil. In the artesian wells now bored, it has the great drawback that it becomes necessary at frequent intervals to withdraw the drill, and sink what is called a sand-pump. This is a long, metal bucket, having at its bottom a valve opening inward. This is worked up and down in the bore until it becomes sufficiently filled with the powdered rock and water, when it is drawn to the surface.

An important improvement was made when the combined drill and sand-pump was introduced. The drill in this apparatus is suspended, not by a rope, but by a series of iron pipes screwed together at their ends. The drill itself is screwed fast to the lower end of the pipe, and is hollow. There are, near the lower end of the drill, and at intervals up the pipe, valves opening upward. As the drill is dropped, "sludge"—that is, water and crushed rock—enters the lower valve, and little by little works its way upward. Each valve in turn helps to raise the mass without bringing so much pressure on that at the bottom as to compact it immovably in the tube.

As the drill and tube are much heavier than the sludge, they drop faster in the descending movement, and the sludge, caught by the valves, gradually works toward the top, where it overflows. The well is thus self-cleansing in its construction, and the drill need be removed only so often as is necessary for sharpening, the interval depending on the hardness of the rock.

If the necessary water to form a movable sludge has not been developed in sinking the well, water for that purpose is poured in from the surface.

Another very successful method of drilling with a tool supported by hollow pipes is by the use of the water-jet. In this case, the water is forced down, under more or less pressure, through the rods and through the tool nearly to its point, so as to create a strong upward current in the bore outside of the tool. The flow in this case is necessarily of sufficient velocity to carry up the crushed rock with it, the sludge flowing off at the surface of the ground as in the former case. Here, also, it becomes necessary to withdraw the tools only for sharpening.

Another very important improvement in well-boring lies in the use of the casing as a means for carrying and working the tool. For this process, the lower end of the casing is furnished with cutting teeth, or for work in very hard rock, with cutting diamonds. The casing is revolved by steam-power. Its whole weight is borne on the cutting edge, and the working is rapid and true. The boring of five hundred and eighty feet in ten hours has been effectod by this appliance.

The casing, whether used for revolving the tool, or only as a casing, has its bottom length perforated like a sieve, so that when the final water-bearing stratum is penetrated, the water flows freely into the pipe.

In all well-sinking with any form of chisel-drill it is necessary that the tool shall be turned constantly, so that it shall not strike twice in the same place, and so that it shall secure the boring of a round hole. This rotating movement is applied either to the rope suspending the common jumper, or to the pipe used in drilling with a water-jet

One of the most useful forms of the drill is made in two parts, which are hinged within the drill-rod, and which are so formed that when they strike an obstruction they spread out, making a fan-shaped bit of a diameter wider than the outer diameter of the casing, which may thus be lowered without resistance.

When the tool is raised against the lower edge of the casing, its hinged wings are closed together with a sheer movement, and become narrow enough to be drawn out for sharpening.

When, in using the revolving process, a very hard formation is reached, a chisel-drill may be used in connection with the revolving process, both working together, but independently.

The use of artesian wells is increasing enormously as population spreads over the comparatively arid regions of the West. Generally water may be found and brought at least near enough to the surface for economical pumping. It often flows with great force.

In Aberdeen, Nebraska, the flow of an artesian well has so powerful a head that it is used instead of steam for driving the engine by which the sewage of the town is pumped to irrigation fields.

In fact, we are, in our recent work in this country far surpassing all that has been done elsewhere.

Among the most famous wells in Europe is one at Aire, in Artois, which has been flowing steadily for over a century at the rate of fifteen thousand gallons per hour, and the water rises eleven feet above the mouth of the well.

At Lilliers, in the Pas-de-Calais, France, there is a well which has been flowing since the year 1126 The famous Grenelle well of Paris is almost eighteen hundred feet deep, and flows at the rate of twenty thousand gallons an hour, with a maximum temperature of eighty-two degrees Fahrenheit.

A well at St. Augustine, Florida, is fourteen hundred feet deep and twelve inches in diameter. It flows at the rate of over four hundred thousand gallons per hour, at a temperature of eighty-two degrees Fahrenheit, and with a pressure sufficient to form a jet fountain forty-two feet high above the mouth of the well. A well at Louisville, Kentucky, over three thousand feet deep and only three inches in diameter, flows at the rate of nearly fourteen thousand gallons per hour.—*Youth's Companion.*

Through Nature up to God.

BY MARY LOWE DICKINSON.

Up through the hush of dim cathedral arches,
In countless temples, rings His praise to-day;
For thee, the drooping boughs of shivering larches
Between thee and the skies, make place to pray.

Far off, the echo of unnumbered voices—
The whole world's prayers—makes murmur like the sea;
Think ye the God, whom mighty praise rejoices,
Hath not a listening ear for thee, for thee?

Bends He to hear the tide of music, swelling
From countless multitude and eager throng,
And answers not the silent love, up swelling
From hearts whose sobs are changing to a song?

Full sweet and still may be the solemn shadow
Of His own house, where faint souls find Him near—
But look! His smile is on this sunlit meadow,
And every green leaf whispers, God is here!

O sore, sad heart,—and eyes so dim with weeping,—
He hears thy call; and sky, and cloud, and sod,
And stream, and leaf, all safe in His dear keeping,
Answer,—Come, hide thyself with us in God.

Let the great world go by. In this safe hiding
It shall not jar thee with its strife and noise.
Hide thee in Him,—then He in thee abiding,
Shall make thy soul with nature to rejoice.