has patented an improvement in the class of thill couplings in which the thill iron is secured to the clip bolt by means of a spring plate fastened to the under side of the thill iron by a screw bolt.

Mr. William Langdon, of Upland, Pa., has patented a spirit level whose stock consists of an oblong bottom supporting a slotted vertical tube at each end, a transverse horizontal slotted tube in the middle, and a superposed median horizontal slotted tube over and at right angles to the middle tube. This invention is intended to meet all of the requirements for a plumb and level indicator.

Mr. John C. Isaac, of Cornwall-on-the-Hudson, N. Y., has patented a corner stone for boundary lines, consisting of a cast iron post having on four sides dovetail grooves for receiving blocks inscribed with letters. These blocks are held in their places by an iron cap which is secured by a rod running through the base of the post.

An improved permutation lock has been patented by Mr. Fred. E. Arnold, of Chicago, Ill. This invention consists in certain novel details of construction and arrangement of a sliding bolt, gear wheels, and setting devices, whereby provision is made for securing the bolt to prevent it from being moved without a knowledge of the arrangement of the parts with relation to each other.

An improved cultivator tooth has been patented by Mr. Levi S. Wood, of Marion, Ia. The object of this invention is to furnish cultivator teeth so constructed as to cut shallow near the plants and deeper at a little distance from the plants, which may be guided close to the plants, will not cover small plants with soil, and will leave the soil loose and level.

Messrs. Gavin Rainnie and George J. A. Robinson, of St. John, New Brunswick, Canada, have patented an iron fence post of a body made U-shaped in its cross section, and having hooked lugs to receive the fence wires, the base cast hollow and solid with the body, and having holes in its top and bottom and ribs upon its inner surface to receive and bind the ground rods.

Mr. Samuel Levin, of Pittsburg, Pa., has patented an improvement in eyeglasses which are employed upon one eye at a time—such, for instance, as watchmakers', lithographers', and engravers' glasses—and which improvement is applicable also to goggles, eye-shades, etc. The improvement is designed to relieve the operator from the effort of holding his glass by the contraction of the muscles about the eye, and to avoid the use of bandages or ligature passing entirely around the head.

Mr. Anton V. Semrad, of Chicago, Ill., has patented an improved mangle, consisting of a table supporting two rollers, which are pressed down upon the clothes by a weighted box resting on the rollers.

An asparagus buncher, so constructed as to gauge the bunches, press the stalks together, and hold them while being tied, has been patented by Mr. John Weeks and Frank H. Weeks, of Brooklyn, E. D., N. Y. The invention consists in a bed plate, an upright plate, two stationary jaws, and two movable jaws, and mechanism for operating the movable jaws.

An improved register knob has been patented by Mr. Geo. W. Lewin, of Somerset (Fall River P. O.), Mass. The invention consists of a slide having a boss in combination with a register knob having a perforate shell, spring, and flanged washer, all held together by a screw and nut.

An improvement in fences has been patented by Mr. Lewis W. Berger, of Canal Winchester, Ohio. The object of this invention is to furnish fences so constructed that they can be easily and quickly set up, taken down, and moved from place to place, and which will allow any desired panel to be removed to open a passage way without disturbing the other panels.

Our Trade with Sheffield.

The report of our Consul at Sheffield, Eng., shows that a vast increase has taken place in the exports from Sheffield to the United States during the year ending with September. The exports of steel during the last quarter were valued at £101,428 as compared with £52,550 for the same quarter last year; and the cutlery exports for the same periods were respectively £74,104 and £50,504. For the year the steel exports amounted to £383,889, and the cutlery to £238,605. The total exports from Sheffield to this country for the year amounted to £1,066,411 as compared with £559,733 last year.

Mr. Vanderbilt has recently given a very heavy order for steel rails to one of the Sheffield firms for delivery next year.

The Oldest Scientific Society.

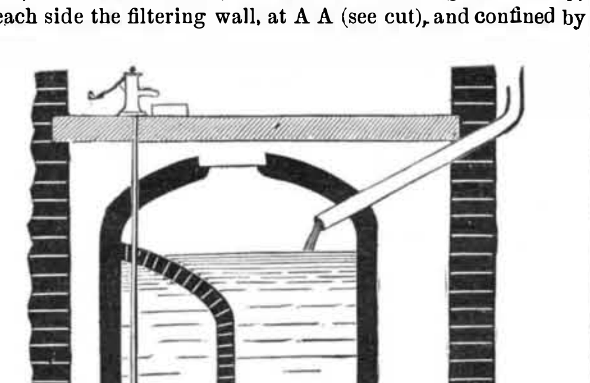
The Academy of the Lyncæi, according to M. De Laveleye, is the oldest scientific society in existence. It was founded at the beginning of the seventeenth century by four young men, who took as their symbol the Lynx—an animal then to be found in the Apennines—with the motto, *Sagacius ista*. The members "were to penetrate into the interior of things in order to know the causes and operations of nature, as it is said the lynx does, which sees not only what is outside, but what is hidden within." Their dream was nothing less than the organization of modern science based on the method of observation—the *church* of knowledge. The Academy was to have in the four quarters of the globe dwellings with sufficient endowments to maintain the members, who might live there in common. These dwellings were to be provided with libraries, laboratories, museums, printing presses, and botanical gardens—in a word, with everything necessary for study. Their observations were to be communicated by writing to all the members. The Lyncæi were to renounce marriage as a *mollis* and *effeminata requies*, and injurious to study; nevertheless, monks were not admitted. The Academy was reorganized in 1875, and has members of various nationalities. Among the English members are Gladstone, Freeman, Rawlinson, and Herbert Spencer.

FILTERING CISTERNS.

The charcoal for filters is probably most efficient if animal, *i. e.*, bone black; but as it is not always easily obtained, that ordinarily sold by the dealers, made from hard wood, pounded up fine, is good enough. If your sand or gravel is not clean, wash it in plenty of water. Sponges are not of much use, being perishable. The best material for rain water cisterns is brick, laid in hydraulic cement and plastered inside. No lime should be used for the plastering, but a mortar made of equal parts of cement and good, clean, sharp sand. This is rarely found clean enough to be used without first washing it. After the plastering is hard, it should be washed twice with a grout of cement and water, without sand, applied with a whitewash brush. If the ground is firm, and stands plumb without caving in, one layer of brick laid directly against the side of the pit is enough. In this case the form of the pit should be carefully trimmed to a true circle, and the walls trimmed plumb. Then the brick work can be laid directly against it, filling all small cavities between the brick and ground with cement, and not with earth. If the ground is not firm enough to stand in this way, a thicker wall will be needed, say eight inches. The earth that is filled around it should be puddled in with plenty of water, to insure a solid packing. Ramming the earth without puddling is not so good, and will not be likely to prevent the cistern from bursting when first filled with water. A very small crack will spoil it. The floor can be laid after the walls are plastered, so as to avoid stepping on it much after laying it. The floor should be dished like a saucer, to facilitate cleaning out.

For filtering, build a partition in the cistern by which any portion, say one-fourth, of its contents can be separated from the remainder. Insert the suction pipe or pump within this chamber, and allow the inlets to discharge outside of it in the larger part of the cistern. If the partition is built of one thickness of soft, porous brick the water will soak through it; but this brick partition should be domed over against the side walls to prevent any pollution of the filtered water by dust or spatterings from above. If the water is quite foul the pores of the bricks will be choked in time, and refuse to pass more water. In that case the partition must be renewed, or holes made near the bottom in which sponges, broken charcoal, or sand can be placed to do the work; and these can be renewed when found necessary.

If gravel and charcoal are used, they are deposited in layers, charcoal at bottom, and a few inches of gravel on top, each side the filtering wall, at A A (see cut), and confined by



FILTERING CISTERN.

dwarf walls on each side. Holes are left in the base of the filtering walls by omitting alternate bricks in the bottom course. The water is then filtered by passing down through one bed of charcoal and up through the other. The gravel is chiefly useful to put on top of the charcoal to protect it from wash.

This charcoal will need frequent renewal if there is much solid matter in the water. Hence two cisterns are convenient, so that one may be used while renewing the other.

The source of ice is often so questionable in its purity that it is doubtless the safer way to cool one's water for drinking without direct contact with the ice. Any metal that is difficult to corrode, like copper, is good to put the ice in, and if made double on the outside with an air space between the plates, it will not absorb much heat from the outside air. The very best material for holding the drinking water is glass, and if made thin, it will conduct the heat fast enough for all practical purposes, being immersed in the ice for such time as is found necessary. The cooling of the water can be much hastened, but the melting of the ice is also hastened, by putting a little salt in it, which makes a freezing mixture and cools off all the surrounding substances rapidly.

Lead pipe is not a desirable material inside of cisterns for drinking water. Iron is better, using gas pipe, coated inside with hydraulic cement. If this is carefully prepared and carefully handled while putting it together, it is nearly indestructible. It is used with success for service pipe in many New England cities, where it has been in use for many years, usually being adopted between the street mains and houses. —*The Plumber and Sanitary Engineer.*

HYDRAULIC CEMENT.

BY H. C. HOVEY.

It is well known that common mortar hardens by drying, and that under water it gradually softens till it is dissolved away. To facilitate its setting, as well as to cheapen its cost, sand is mixed with lime, in the proportion of three to one, with just enough water to make a paste. When this yielding substance is properly used in masonry it becomes hard and adhesive, filling the joints completely and uniting the bricks or stones into a compact mass that may endure for centuries. Hydraulic mortar, that will "set" under water, is made by the admixture of ingredients that will in some way protect the lime from chemical aqueous action. The oldest recipe for its manufacture is given by Vitruvius, the Roman architect, and many have been given since, until the making of artificial cements has become a subject of very great importance. It is claimed by antiquarians that the art, indeed, dates back to the Neolithic age; and that ancient pottery, instead of being hardened by exposure to heat, was made from a mixture resembling Portland cement, and hardening without being baked. Prof. E. T. Cox has carefully analyzed Indian pottery found in Western mounds, showing the material to be a skillful admixture of calcareous, silicious, and aluminous earths, in proportions varying but little from the modern cements in familiar use.

This communication, however, chiefly relates to what are known as natural cements, whose commercial value has been largely developed in this country during the past ten years, and is capable of much greater development.

It is, no doubt, quite mysterious to those who have not given the subject particular attention, that there should be a class of stones that, having first been calcined and then reduced to powder, can be used as a mortar without being mixed with other mineral ingredients; and that this mortar, instead of crumbling or dissolving under water, is actually hardened by that very means until it is as firm as the rocks it binds together. This fact is said to have been discovered by a Mr. Parker, who took out a patent about sixty years ago for what he called Roman cement, though made from septaria found on the Isle of Sheppey. Medina cement is produced from similar argillo-calcareous nodules found on the Isle of Wight. Satisfactory experiments with septaria were also made in France and Russia. The Portland cement is an artificial imitation of these natural ones, by mixing masses of chalk and clay in certain proportions, drying the substance, and then treating it by a process like that to which the natural nodules had been subjected.

It is now known that many limestones, heretofore rejected as poor, if not worthless, contain naturally the very impurities, so to speak, most desirable to form a mortar capable of hardening under water. The true proportion to form a silicate of lime and alumina is according to the following formula: Silicic acid, 20·00; lime, 41·40; alumina, 38·60.

The combining ratio is 100 of silicic acid to 398 of the earthy bases. But it is a curious fact that water limestones, widely differing from each other in the proportion of their chemical constituents, often seem to have for practical purposes nearly equal hydraulic properties. The explanation is that the combining ratio varies with the relative quantities of effective substances. For instance, if lime and magnesia form the base, instead of lime and alumina, the ratio of silicic acid to this base should be as 100 to 277; and if lime alone, as 100 to 200. The presence of iron, sulphur, soda, or other ingredients, will, of course, cause a further variation of the ratio.

The reader may be interested in an account of one or two of the chief cement works in this country that may be regarded as specimens of all, for there is no great divergence in the process of manufacture. I had an opportunity a few weeks ago to visit the Howe's Cave Lime and Cement Works, in Schoharie Co., N. Y. This interest has been developed since 1870, although something had been done in a small way prior to that date. The credit of the enterprise is largely due to Hon. J. H. Ramsey, of Albany. The kilns and mill are situated about 500 yards from the mouth of Howe's Cave, and at the foot of a bluff from 100 to 200 feet in height. Into the face of this bluff a tunnel has been cut, about 8 feet from floor to roof, and extending in for 800 feet, the rock on either side being honeycombed by lateral branches. The whole bluff is limestone, the upper strata belonging to the Pentamerus and Delthyris groups, abounding in crinoids, shells, and corallines. Excellent lime is made from this material in the usual way. The lower strata of water limestone at the foot of the bluff, and profitable for working up into cement, are three in number, and altogether but 5½ feet thick.

Pipes from an engine in the mill convey the power into the tunnel to drive two steel drills, each one inch and a half in diameter, by compressed air. Two men are required to manage a drill. After a quantity of stone is dislodged by blasting it is carted out over a tramway. From 75 to 100 tons is regarded as a good day's work. A kiln burner takes the loads, that have already been assorted in the mine, and deposits the material in four kilns, two of which are always in use, and both together able to burn 200 barrels a day. The kilns are 30 feet deep, each rigged with what is called a "kettle," through the bottom of which the calcined stone is drawn out and taken by an incline up into the mill. There it first goes into a "cracker," where it is crushed into pieces about the size of walnuts. Next it is pulverized between millstones into a light brown powder. This falls into barrels that stand on what are termed "packers," which jump them up and down by steam power, causing