in detail: the grain is introduced to the machine from the depot in any manner by which a continuous supply may be conveniently delivered into the feeder; then, when the first scale has received the principal part of its load, that scale falls through a portion of its descent, and in falling lifts a proportional weight equal to the partial load then in the scale, and at the same moment moves the feeder partly towards the second scale, which then begins to be filled while the first scale is receiving slowly the finishing part of its load. When the loading of the first scale is complete, that scale falls through the remaining part of its descent, and, in falling, releases the catch that till then had held it in position, whereupon the loaded scale immediately tilts and simultaneously shifts the full stream of grain over to the second scale, and moves the register figure. The operation thus described proceeds from scale to scale, alternately, as long as the supply of grain is continued. The flow of grain is never cut off or interrupted during the discharge of the scales.

What makes this invention specially interesting is the ingenuity with which a very severe accuracy in the weight of each charge is secured without any consequent loss of time. In ordinary weighing, if great exactness is aimed at, the last additions are made slowly; and this, in fact, is always necessary, if one would avoid inevitable overcharge. Accordingly, as much time is spent in adding the last few grains or the last few ounces, as the case may be, as it had required to introduce the great bulk of the load previously. But by employing two balances, side by side, with a bridge, or doubly inclined shoot, between them, the inventors have made it possible to keep up a steady flow from the source, and still to finish off each load by so gently growing an increase that it is impossible an error should occur of any sensible amount; while, in the meantime, the nearly empty scale receives the main stream and rapidly fills.

This balance cannot fail to make its way among our Western farmers, and among the large class of our citizens who are engaged in the transportation of grain.

The engraving will be understood without requiring particular description. The parts important to note are the two scale pans, of which the one on the right is in the position to receive, and the one on the left in the position to discharge its load; the doubly inclined shoot or bridge extending across above the scales, and the supply shoot appearing above the whole. This supply shoot is sustained by a branched iron support, which is single at the base, and which forms a vertical axis, around which the supply shoot has the slight lateral movements, above described, which change the manner of delivery of the grain.

It is obvious that this balance is applicable to many purposes, in which accurate and continuous weighing is necessary, as well as to the weighing of grain.

HYDRAULIC CEMENTS--THEIR ADAPTABILITY FOR USEFUL AND ORNAMENTAL PURPOSES.

A Paper, read before the Polytechnic Association of the American Institute, by Adolph Ott.

PART II.

The Portland cement, as most artificial cements are now called, is at present manufactured, in England, Germany and France, on the most extensive scale. It forms a sharp, crystalline powder of a gray color, with a bluish or greenish tint. Chemically speaking, it is principally a silicate of lime and alumina, averaging 80 equivalents of silica, from 12 to 25 equivalents of alumina, and from 210 to 230 equivalents of lime. In being mixed with water to a stiff paste, it soon solidifies, forming a stone of a pleasing light gray color, which in its best quality acquires a hardness and durability, equal to the best limestones. Like the English Portland stone, the solidified Portland cement presents a crypto-crystalline texture; and, having no cleavage whatever, it yields evenly to the chisel. But this property can easily be dispensed with altogether, on account of the fact that, while soft, it can be adapted to any form.

You will pardon me for speaking of a composition stone of mine, of which I claim, all other conditions being alike, that it will continue to increase in solidity, while a stone merely composed of a mixture of hydraulic cement and sand (the latter being the common admixture) will have attained its greatest degree of firmness. Of equal quantities of my stone mortar and of Portland cement mortar, the former will bear a greater quantity of sand, without acquiring less solidity, that is, it will be of greater binding qualities. The *Journal of Applied Chemistry*, in a late number, says of this stone: "Judging from the appearance of the samples which we have seen, and from the several tests to which they were subjected, we would say that the felspar artificial stone (which is its name) is equal in solidity to the best building stones; while it is unquestionably superior to the artificial stones we have examined."

As regards the materials used, in addition to the main ingredients usually employed for the making of artificial stone, they are felspar or felspathic minerals (previously vitrified), quicklime and flint, in definite proportions. The chemical reactions taking place by this intermixture may be explained as follows: Hydrate of lime will, though slowly, replace the potash or soda in the felspar, and form a compound of the formula of Portland cement, of great binding qualities. This reaction is especially induced by the presence of flint, which, like several others of the chalcedonic varieties of quartz, (according to Fuchs), consists partly of soluble silica, which, having a strong affinity for the potash or soda set free from the felspar, will form a hydrosilicate of potash or soda. But, aside from the formation of silicate of lime and alumina (hydraulic cement), the final result of these reactions is an insoluble compound, probably of the formula of pectolite or acophyllite. Thus nothing remains that might be washed out; and again, through the formation of a cement (similar in composition to Portland cement) within the substance of the stone mortar, a slow but steady increase of the firmness of the stone is secured.

To speak more particularly of the application of hydraulic cements, they are especially useful for the manufacture of building stone. In Europe, especially in England, numerous buildings of the kind have been erected; in London, for instance, the celebrated College of Surgeons, in Lincoln's Inn Fields. In this country, buildings constructed of cement stone, made by the process of George A. Frear, have been erected in Brooklyn, Toledo, Buffalo, Chicago, and New Orleans. In the various cities of the West, upwards of three hundred buildings have been constructed of this stone during the last three years; and they have satisfactorily stood the test of the severe climate, which is more severe in the West than on the Atlantic coast. In Brooklyn, fifty-nine buildings are in process of erection at the present time. The novel feature in the process of Mr. Frear is, as we learn, a newly discovered solution of shellac, which is used in combination with the ordinary materials. The compound, when in the mold, is submitted to a pressure of thirty tuns to the square foot, which pressure, according to Professor Vander Weyde, is equivalent to placing a mountain mass of the same material 4,000 feet high on the top of the stone to be hardened. Concerning the solidity of this stone, it was found at the Washington Navy Yard to withstand 6,000 pounds, without breaking, on a cube of 1¼ inches, which is 432 tuns per square foot. In regard to its deportment towards fire, we learn that the Frear stone stood the test of the great fire in Chicago better than any other building material in that city. Every stone left standing in the walls was found to be in perfect condition, and builders are now drawing away the blocks to be used in the re-erection of other structures.

Cement stones have also been largely employed for constructions in the sea, especially for harbor dams, breakwaters, and quay walling. We refer to the moles of Dover and Alderney, in England, of Port Vendre, Cette, La Ciotat, Marseilles and Cherbourg in France, of Algiers and Port Said in Africa, and to those of Cape Henlopen at the mouth of the Delaware. For the breakwater at Cherbourg (one of the most remarkable), artificial stone blocks of 712 cubic feet each were immersed. The harbor of Cherbourg being exposed to heavy gales, the largest blocks of natural stone which could be brought from the shore would be mere play balls of the waves. There are instances known where blocks of thirteen cubic yards were not only pushed far above the slopes, but also turned over at the head of the mole; hence the necessity of employing blocks of immense size. Such blocks can scarcely ever be obtained from quarries, to say nothing of the difficulty and expense of transporting them.

To speak of other uses of hydraulic mortar, I will mention that the beautiful fortifications before Copenhagen are wholly constructed of *béton* or concrete, an aggregate of gravel or broken stone, lime, and hydraulic mortar. Walling of *béton* for fortifications, according to competent artillerists, is far superior to any other work. This *béton* is more largely used for foundation walling, especially in water, for sluices, aqueducts, bridges, floors, sidewalks, terraces, roofs, cisterns, reservoirs, water pipes, etc. Entire buildings of two stories, with chimneys and cooking place, have been constructed solely of *béton*.

The first sluice which was entirely built of concrete is the Francis Joseph sluice on the Danube, in Hungary. This work forms a reservoir, the bottom and the sides of which consist of one piece. Its length is 360 feet, and width, 30 feet. Its construction, begun in 1854, was completed within ninety days, the work being pushed forward both night and day.

Of unusual interest in the line of structures of *béton*, because demonstrating their great strength, is the monolithic test arch of St. Denis, near Paris. This arch forms, like the Francis Joseph sluice, one piece. The material used is known at the *béton aggloméré, systême Coignet*, the last being the name of the inventor. The span of the arch is 196 feet, its elevation 19 feet, and length 49 feet. The stone possesses a fine texture, and is perfectly impervious to water.

M. Coignet's system of "monolithic construction" has also been applied for the erection of the aqueduct of La Vanne, which now carries pure water from the river of La Vanne in the department of the Aube and of the Yonne to the city of Paris. The distance from Paris to La Vanne is over 135 miles; and as there were hills, valleys, woods, rivers, etc. to be crossed, it is easy to understand that the construction of an aqueduct through that country required many fine works of engineering. The section which traverses the forest of Fontainebleau alone comprises three miles of arches, some of them as much as fifty feet in hight, and eleven miles of tunnels, nearly all constructed of the material excavated on the spot. So successful has M. Coignet been in his undertaking that other sections of the work, formerly intended to be built of masonry, of cast iron, and of boiler iron plates, have been allotted to him, to be made entirely of his *béton aggloméré*.

Hydraulic cement, instead of copper sheets, has been applied to cover the bottoms of ships. Railroad sleepers are being replaced by sleepers of cement. For ornamental work, (statues, fountains, etc), compositions of hydraulic cement have certainly a great future, since the most elaborate forms of art, of great durability and strength, may be most artistically and economically produced in them. For this purpose, only the very best qualities of cement can be used. By the admixture of proper colors, variously colored stones may be obtained. Although this industry, like everything new, had at first to struggle against suspicion and prejudices, it has gradually made its way by the excellence, beauty and durability of its products, and is now carried on in many places. In the Paris Exposition of 1867, there were statues of Socrates after Tabacchi, the bust of Raphael after Magni, and gothic church windows of immense size. Most in demand are, however, door and window caps, ashlars, stoops, window sills, door sills, chimney tops, bowls and tables for wash stands, etc. Artificial rocks, grottoes, inclosures for wells or springs, and cataracts for parks, gardens and hot-houses are also now being produced in cement. Parks which present not a single rock can thus be converted, within a few weeks, only into the most romantic and picturesque scenery.

Although it may seem that the application of hydraulic cements was exhausted, many new uses for it will doubtless be discovered. Scarcely any technical journal of importance reaches this side of the Atlantic without containing new information on this topic, and its literature amounts already to scores of volumes. In view of the paramount importance of artificial stone, is it not rather strange to see how little there is known concerning it in this country, while buildings of such stone have been erected in Europe for more than forty years? And with what feelings of surprise do we note the fact that the illustrious city fathers of this metropolis forbid the use of artificial stone as a building material, although its superiority over ordinary stone in point of economy, safety and health is a fact established beyond doubt! Might we not exclaim: "Science, forgive them, for they know not what they do?"

Influence of Medicines on Larvæ and Animalculæ in Standing Water.

Some time in August, having occasion to use rain water, I procured some from a barrel standing at the corner of the house. It had been standing there for a few days, and I at once observed that it was literally crowded with animal life. The mosquito *larvæ* and those of the gnat, and all the curious creeping, flying, swimming creatures that inhabit standing water during the summer, were revealed by a glass of moderate power.

It occurred to me to try medicines on the inhabitants of the teeming world, and watch the physiological effects. I poured into each of a row of goblets four fluid ounces of the water. To the first I added two grains of carbolic acid in solution. In five minutes every animal and animalcula was dead. Into the next glass I put one half grain of carbolic acid in solution. All were dead at the end of an hour.

Into the third glass were put two drops of chloroform. In two minutes every form of life was still, and on agitating the water the undissolved globules of chloroform caught up a large number of the dead forms, and rolled them up with itself. The minute forms of life, especially the microscopic ones, were all killed in less than a minute, when one drop of chloroform was added. Some of the larger forms remained at the top of the water, and did not seem to be affected with so small a quantity. Putting a gallon of water into a glass jar, I poured into it a drachm of chloroform, stirring the water with a spatula. Before the motion of the water had ceased, most of the lesser forms were dead, and were gathered into the globules of chloroform that were rolling at the bottom. Some of the larger *larvæ* lived for a little time at the top of the water, but soon afterwards they sunk to the bottom dead, and at the end of thirty minutes only one or two of the largest were alive, and no life could be discovered elsewhere with the naked eye, or by the magnifying glass.

Into another glass was put sulphuric ether, at first a few drops which seemed to have little effect; but when half a drachm was added, the larger forms died very soon, but the more minute lived for two hours. Into the next glass was put a drachm of Fowler's solution, liquid arsenite of potassa. At the end of an hour most of the smaller animalculæ were dead but the larger forms were alive at the end of two hours.

A solution of sulphate of morphia, five grains was put into another glass, and none seemed affected by it at the end of three hours. Into another was put a strong solution of common salt. The larger *larvæ* seemed affected by it in a short time, but many of the minute forms were alive at the end of three hours.

A solution of compound tincture of iodine, twenty drops, destroyed all appearances in three hours. A solution of soda sulphite destroyed the inhabitants of one glass in two hours. Ten drops of sulphuric acid seemed to have little effect on them. A large amount of alcohol only seemed to increase their activity. I repeated the experiment with chloroform several times, with the same uniform result. I did not have another opportnnity to repeat the experiment during the fall.

The most remarkable effect was produced by the chloroform and carbolic acid. It suggested itself to me that, for certain purposes, water might be purified in small quantities with either of these substances. The addition of a small portion of chloroform would not injure water for many purposes; the chloroform would remain at the bottom of the vessel, and the rest might be filtered for use. The small amount of carbolic acid would not injure the water for many purposes, and it might be put into standing water to prevent its being populated. In any light the experiments were interesting, and I hope to repeat them on some future occasion.—*P. J. Farnsworth, M.D., in the Medical and Surgical Reporter.*

* * *

A DELAWARE correspondent proposes to anchor balloons, and let the world turn under them, by which means he expects to sit still and yet travel a thousand miles an hour. He does not state what he anchors to, but we suppose it is what Archimedes sighed for when he stated that he could move the world if he had a proper fulcrum. Perhaps the spirit of Archimedes inspired the ingenious inventor with this brilliant idea, and pointed out the fulcrum.