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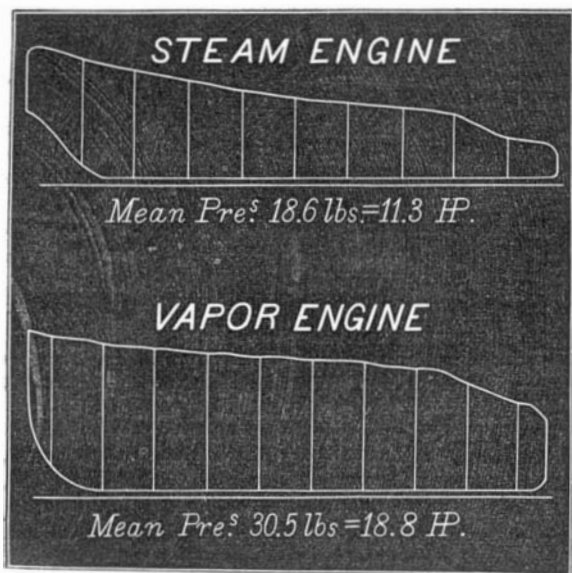
GREAT REDUCTION IN COST OF STEAM POWER-- REMARKABLE RESULTS.

A trial is being made at the Atlantic Works, in Boston, of Ellis' method of using the latent heat in exhaust steam to produce power by the vaporization of bisulphide of carbon, which, according to information furnished us, is showing very surprising results. The remarkable statement is put forth by the inventor that the fuel, now required to produce one hundred horse power, will, with a proper application of the heat in the exhaust steam, produce two hundred and sixty-six horse power; showing a gain of one hundred and sixty-six per cent amount of power obtained by the use of this method, which has been once before referred to in journal. (See Vol. XXIV., page 79.)

It is claimed that the exhaust from an engine of one hundred horse power can be taken to an adjoining building and used to heat a bisulphide of carbon boiler, which will furnish vapor sufficient to drive an engine of one hundred and sixty-six horse power to its full capacity. No back pressure or other injurious effect is produced on the first engine by using its exhaust to heat the boiler of the second one; or, by coupling these engines together, a machine of two hundred and sixty-six horse power is obtained, driven by the same fire previously required to produce one hundred horse power; as evidence of which, the subjoined indicator diagrams have been sent us.

For the purposes of experiment, two new engines, made from the same patterns in the same manner, are used, the arrangement of the engines being shown in the accompanying engraving.

They are ten inches internal diameter, and twenty-four inches stroke, with single valves. One of them is run by steam in the usual manner, and its exhaust is passed through the flues of a vaporizer, on its way from the cylinder to the atmosphere. This vaporizer is filled with a mixed volatile liquid, consisting principally of the bisulphide of carbon. The heat of the exhaust steam is sufficient to convert this liquid into vapor very rapidly under a pressure of 45 to 50 lbs. to the inch, and will carry the pressure up to 65 lbs. At this point the temperature on the vaporizer becomes equal to that of the exhaust steam, and no more heat will be imparted to it.

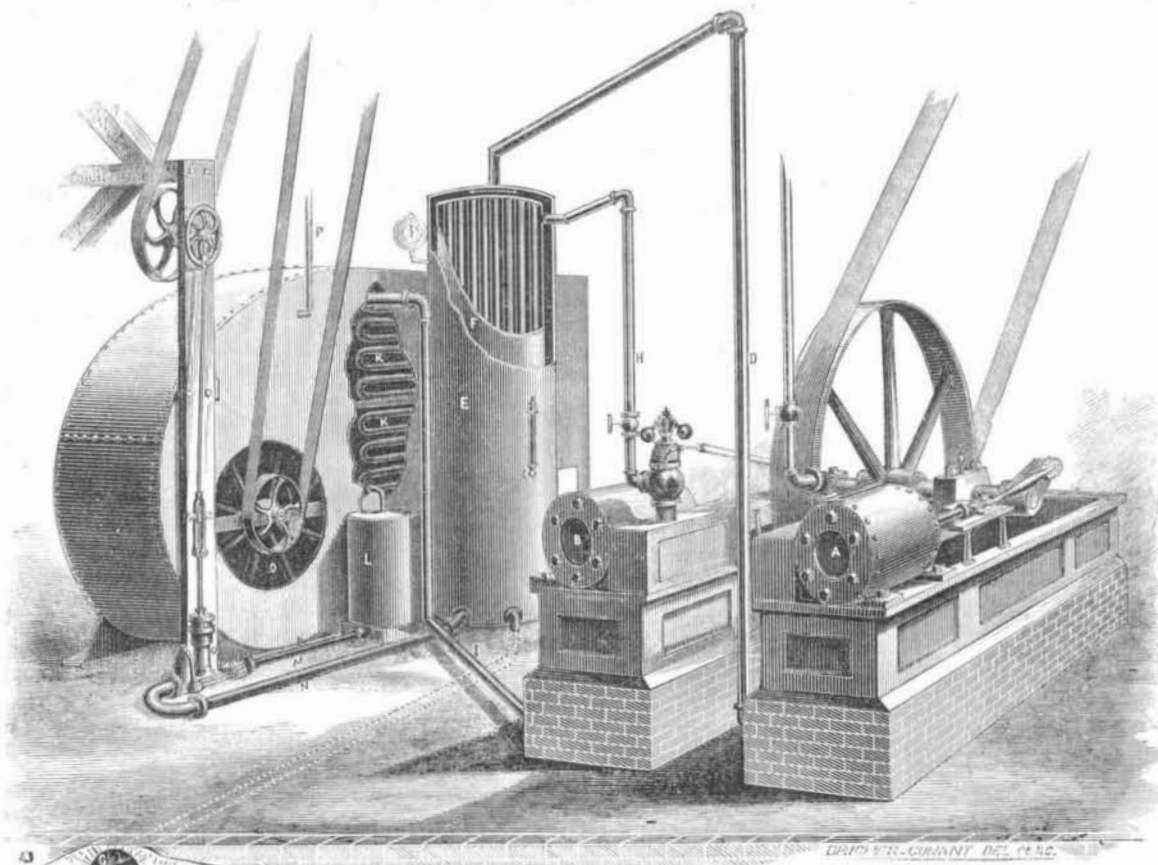


This vapor is used, in place of steam, to drive the second engine under a pressure of 45 to 50 lbs., as the temperature in the vaporizer is low enough at this pressure to completely condense the exhaust steam and absorb its latent heat, producing a larger amount of effective power than when used at a higher pressure; the vapor is superheated to the highest point that exhaust steam will carry it by passing it through

a superheater, surrounded by exhaust steam, in its passage from the vaporizer to the cylinder.

The annexed diagrams, taken from these two engines at the same time, while at their regular work, by Mr. Snell, the mechanical engineer at the Atlantic Works, are the ones referred to as showing the amount of power developed by each.

It will be seen that the vapor engine, whose boiler was heated entirely by the exhaust from the steam engine, gave 18.8 horse power, while the steam engine gave only 11.3 horse power; and that the same fire, required to produce 11.3 horse power with steam used in the usual manner, produced 30.1 horse power when the heat in the exhaust steam was used in the method described, showing a gain of one hundred and sixty-six per cent in power, as above stated.



ELLIS' COMBINED STEAM AND BISULPHIDE OF CARBON ENGINE.

The exhaust vapor is condensed in a coil of inch iron pipe, over which a blast of air is thrown by a blower; a small jet of water is commingled with this blast by means of a perforated pipe that sprinkles a slight shower of water into the current of air as it passes over the coil; this water, being evaporated and absorbed by the heated air, carries away the latent heat of the vapor very rapidly, producing a complete condensation with a very small amount of water. The condensed liquid is pumped back into the vaporizer continuously, only thirty-five gallons of it being used to fill the vaporizer and run the engine continuously. It is claimed that not more than half a gallon of liquid is lost in running a twenty horse engine ten hours, and it costs only one dollar per gallon, making the cost, of running twenty horse power by this process, fifty cents per day. All the exhaust steam is condensed by this process, and pure hot water furnished for the steam boiler, dispensing with a heater and avoiding all scale and sediment in the steam boiler.

It is claimed that engines now in use can be arranged to use this process and made to produce more than double the power with the same fuel, or the same power with less than half the fuel, as may be desired. The steam from salt blocks sugar evaporators, etc., can be used to produce power by this process equally as well as the exhaust from an engine.

Where two establishments, using steam power, are near each other, the exhaust steam from one can be taken to heat the boiler of the other, and no fuel, fireman, chimney, fire box, or grate, will be required for this latter boiler; and its engine will run continuously, like a water wheel, without attention, as long as the supply of exhaust steam is furnished. There will be no risk of an explosion, as the heat of the exhaust will not carry the pressure in the boiler above 65 lbs. under any circumstances, and if all the liquid should be evaporated out of the boiler, no injury would be done, as it would not be overheated or injured by the heat of exhaust steam. The vapor engine does not require any oiling of the cylinder, valves, or rods, the fluid evaporated lubricating the parts, so that the friction and wear are, it is claimed, considerably less than that of a steam engine.

The Ellis Vapor Engine Company, of Boston, are manufacturing engines and fixtures constructed on this plan, and guarantee them to produce as much power as any other engine made, with less than half the fuel. Further information can be obtained by addressing them at 100 Summer street, Boston.

The trial engines can be seen running at the Allaire Works in Boston, at all times. We give these statements as they have been made to us, simply remarking that the results claimed are theoretically possible, and that the practical difficulties which prevented their realization by previous experimenters have been ably met, and seemingly overcome, by the inventor and patentee, Mr. J. H. Ellis, who has protected his improvement by a number of patents, obtained through

the Scientific American Patent Agency, in this country and Europe, and who now has other applications pending. The results shown by the indicator diagrams are certainly very remarkable, and will at once challenge the attention of engineers.

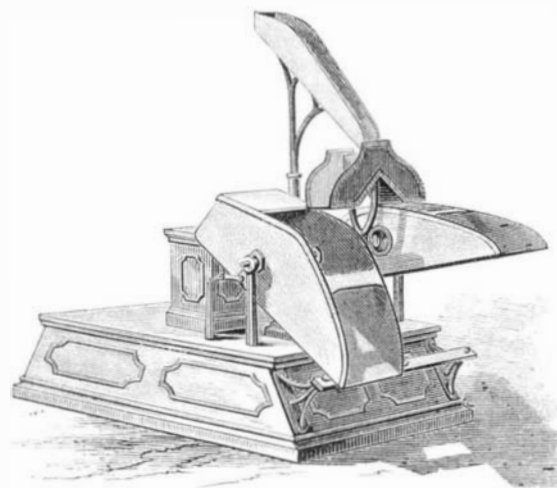
Novel Railway Signal.

Men are now engaged in erecting novel danger signals at every bridge and tunnel on the Hudson River Railroad, to warn brakemen, who are compelled at times to run along on the tops of trains, of their near approach to such dangerous places. A pole is erected by the side of the track, and an arm projects from it at the top over the track. From this arm hangs a wire fringe, low enough to strike a brakeman on the front piece of the cap or against the face if he is standing up as the train passes. This perceptibly notifies him that he is only one hundred feet from the bridge or tunnel, and must lie down at once. The blow inflicted by the fringe is momentarily a stinging one, but produces no evil results.

This is a novel way of compelling brakemen to protect their own lives. Cannot some ingenious inventor now devise something to make them careful of the lives of others?

POOLEY'S AUTOMATIC GRAIN WEIGHER.

An apparatus which, says Dr. Barnard's Report, attracted a great deal of attention of American visitors to the Paris Exposition, particularly of gentlemen from our agricultural districts, was a balance exhibited by Henry Pooley & Son, of Liverpool, for weighing grain and at the same time recording the weight of the grain which has been weighed. This



balance, called by the inventors the automatic grain weigher is self-acting throughout. The only force employed in the several acts of loading, weighing, discharging, and recording, is the weight of the commodity in process of being weighed. The results of any given period of work are exhibited upon the register.

To describe the mode of action by this novel machine more

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 tons 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 1½ inches, which is 432 tons 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 Venere, 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 artillerymen, 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, système 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 height, 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 animalculæ 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 opportunity 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.