THE SOURCES OF SPRINGS AND RIVERS.

BY JAMES B. TIBBITS.

In our observations in mountains and hilly regions, and not unfrequently in level positions of country, we find small streams of water issuing from the earth, and after passing alone over a certain portion of country uniting with each other and forming large streams, which, again uniting with others still larger, form our largest rivers. In traveling over many parts of our own country, especially the broken parts of New York, Illinois, Wisconsin and Iowa, we find many excellent and never-failing springs; some of which discharge several hogsheads of water a minute and are apparently never affected by heavy rains or long-continued drought. Some issue from the foot of a hill or bluff, others pour their waters from its rocky sides, while yet others are found nearly or quite on a level with the summit itself; the waters of each finally uniting in the great body of the Mississippi. Not only in this but in nearly all countries of the earth, the same process of nature is continually going on, and all the known large streams of water on the globe have run their lengthened course from the earliest period of the world's history to the present time.

Now the question is, whence do rivers receive so constant a supply of water? Various answers and theories have been advanced in the explanation of this singular phenomena. Some on seeing a spring issue from the side of a hill suppose that it must have a fountain-head still higher than itself. This doubtless is often the case, but we sometimes find springs on the tops of hills and mountains which are higher than any of the surrounding country. Others say that the principle of the siphon enable us to account for springs which are sometimes found on the tops of mountains; but this cannot be, for the principle of the siphon requires a fountain-head higher than the point of discharge, however high or low the water may be carried between that fountain-head and that point of discharge. Others say that the question is satisfactorily solved by a consideration of the effects of evaporation. By the heat of the sun the particles of water are drawn up into the atmosphere from the surface of the ocean and float in the air in the form of clouds or vapors. These vapors are carried by the wind over the surface of the land, and are again condensed into water on the tops and sides of mountains, and, gliding down into their crevices and caverns, at length break out into springs, several of which meeting in one common valley become a river. This is the most popular and perhaps the most satisfactory theory that has yet been advanced.

It is reckoned that on the Eastern continent there are about four hundred and thirty rivers which fall directly into the ocean or into the Mediterranean or Black sea, and on the Western continent about one hundred and forty-five which discharge their waters directly into the ocean. That a vast quantity of this water is furnished to these rivers by the process of evaporation and condensation, we have almost constant proof. But is the supply sufficient for the demand? This is a question that can never be determined with any degree of accuracy. Theory and not practice must be brought into requisition. We will admit that many small streams are nearly, if not wholly, supplied by this means; but such streams during long-continued drought are dried up and entirely disappear, leaving nothing but a dry and sandy bed; while during a heavy fall of rain their waters are swollen and their banks overflown. Larger streams during wet seasons or heavy falls of rain are high and their banks are submerged, but this surplus or surface water, as it might be called, soon runs off and then the river is left at its common size to pour its complement of water into that mighty reservoir which has received the waters of all the earth since time began. That many or most of the larger rivers of the globe would still continue to flow (but in a less than their present size) if the process of evaporation was entirely stopped, there is to my mind not a doubt remaining. Well and truly has the inspired naturalist declared that all the rivers run into the sea, and yet is the sea not full. Unto the place from whence the rivers came thither do they return again. But the question is how do they regain their former source? As much water as is necessary to water and fertilize the earth is raised in the form of vapor and carried by the winds through the atmosphere and is distilled over the earth in the form of dew and rain, and if there is a surplus, which there generally is, it finds its natural channels—the rivers—and is again carried back and again emptied into the ocean. But that portion of water which is the main and reliable source of rivers is carried there through the earth and rises up. Hence those never-failing springs; hence the rush of those mighty waters which we see continually flowing on and on, and never stopping, and yet "the sea is not full." It is a principle of hydrostatics that the surface of all waters which have a communication while they are at rest, will be perfectly level. Now the ocean is the great leveler. That is the unit or starting point from which all calculations as to hight are made. According to the above-named principle, whenever we penetrate the earth to a level with the ocean (except when local causes prevent) we find water. This is abundant proof that all waters beneath the surface of the earth have a communication with the ocean, which fact, I believe, is not disputed or even doubted. Now after these facts are established, I contend that the diurnal motion of the earth or the centrifugal force caused by its daily revolution, aided perhaps by capillary attraction, is sufficient to throw the water to the surface, and thereby cause the prerpetual flow of those streams of water which we see continually issuing from the earth—from the side of the valley to the top of the mountain. How can we for a moment doubt this, when we consider that the surface of the earth in its daily revolution is carried through space at the rate of more than a thousand miles an hour? If the motion of the earth is sufficient to cause those great ocean currents which are known to exist, such as the Gulf Stream, &c., why should we not consider it not only possible but altogether probable that its centrifugal force is sufficient to cause water to issue from various points of its surface, more especially from the sides and tops of mountains or high elevations of land (where the temperature will admit), from the fact that the higher the elevation the greater the space it would pass through in a given time, and consequently the greater the centrifugal force exerted upon that particular point? This theory, I think, is particularly illustrated in the case of the river Nile, which flows for the distance of sixteen hundred miles without receiving the smallest tributary. It is true, that this great river annually overflows the adjacent country, and then settles down within its banks, but it is not reasonable to suppose that from the great excess of rain that falls during that portion of the year, there is enough water left in the mountains to supply it during the remainder of the year, especially when we consider the comparatively small extent of country from which the Nile derives its source. "But" says one, "if your theory be true, the water would everywhere tend to the surface, and the earth instead of being a fit habitation for man, would not only become, but always would have been, a quagmire." Water has its natural channels through the earth as blood has its natural channels through our bodies—destroy the internal arrangement of our bodies and it is not easy to conceive what a deformity man would become; transform the earth into a sponge and its wet surface would become uninhabitable.

A Formula for a Castor-Oil Electuary.

Many persons' stomachs revolt at taking castor oil in an undisguised form. To overcome this repugnance, it has been the practice to administer it in the shape of an emulsion, which involves a large increase in bulk of the dose to be taken, as well as the employment of a considerable quantity of gum or the yolk of an egg, to form the emulsion. To disguise the castor oil, to give it in a condensed form, and to diminish, as much as possible, the quantity of the excipient, the following formula has been devised:—Take of castor oil, 3 ounces; white soft soap, 1 drachm; simple sirup, 1 drachm; oil of cinnamon, 6 drops. Rub the soap with the simple sirup in a mortar, and then add gradually the castor oil, with constant trituration, until it is thoroughly incorporated with the above ingredients. Finally, mix with the electuary thus formed, the oil of cinnamon, or any other essential oil that may be preferred. By these means, a gelatinous electuary will be formed, which is rather palatable than otherwise, and nearly equals, bulk for bulk, castor oil in strength. The quantity of potash present in a dose of this electuary is only a homœopathic dose, and, consequently, not likely to produce a bad result in any case, even when its use should be contra-indicated.—*Septimus Piesse.*

Deodorization of Sewage.

A late number of the London *Journal of Gas-Lighting and Sanitary Improvement* contains a report of Dr. Letheby, on the deodorization of sewage at Northampton, where there is an establishment for the purpose. About 100,000 gallons of drainings from the sewers are received at the works daily. Lime and the chloride of iron are used for defecation; ten bushels of the former and sixty pounds of the latter are used for 100,000 gallons of sewage. The two substances are mixed with water in separate tanks, and the solutions flow over in graduated quantities, into a common discharge pipe, whence they pass into the sewage as it flows from the outfall of the town into the subsiding tanks. Here the solid matter precipitates, and the comparatively clear water runs away by an overflow at the opposite end of the tank, into the outfall-ditch. After working continuously in this manner for about a fortnight or three weeks, the solid matter, in a slushy condition, is drawn up from the bottom of the tanks, and run into prepared pits, where it is mixed with about its own bulk or ashes. This gives consistence to the material, and converts it into a solid compost, which is sold for manure. Respecting this mode of deodorizing the sewage, Dr. Letheby says:—

"The chloride of iron should be dissolved in water, and allowed to run by a graduated stream into the sewage before it reaches the lime. A contrivance should also be used for effecting a perfect mixture of the iron solution with the sewage. This having been accomplished, the sewage should then receive its dose of lime-liquor, and be again well agitated, so as to be thoroughly mixed. In this manner, a heavy, clotty precipitate will be produced, which will rapidly fall in the subsiding tanks, and leave the supernatant liquor clear, and perfectly inoffensive. The proportion of chloride of iron and lime should be about 4.5 grains of the former, and 14 or 15 of the latter to a gallon of sewage. The total for a day's working with 100,000 gallons of sewage would be about 64 pounds of the former, and about 200 pounds of the latter. The quantities should be so regulated that the super natant liquor at the outfall should be clear, colorless, and but faintly alkaline. With this modification of the process, I am of opinion that the sewage works may be conducted and managed so as not to be at all offensive or injurious to those who reside in the neighborhood."

Thus we have a scientific method described for converting the ammonia and phosphate of lime in the sewers of our cities into a portable fertilizing material.

The Resources of Pennsylvania.

The committee appointed to confer with the Auditor-general, in relation to the publication of a map showing the railroads, canals and navigable waters, coalfields, iron factories and oil districts in Pennsylvania, have reported that the State has twenty-five hundred miles of railroad and about a thousand miles of canals, ten thousand square miles of bituminous coal land, four hundred square miles of anthracite, affording nine and one-third million tuns of anthracite, and sixty-seven million bushels of bituminous coal of the tunnage of 1860. Her improved lands' cash value was $662,500,707, agricultural implements, $22,442,842.

Of the total products of iron ore in 1860 in the United States, which were two million five hundred and fourteen thousand two hundred and eighty-two tuns of iron mined, there were one million seven hundred and six thousand four hundred and seventy-six tuns mined in Pennsylvania. The total product of bar iron in the United States in 1860, was four hundred and six thousand two hundred and ninety-eight tuns, of which two hundred and fifty-nine thousand seven hundred and nine tuns were made in Pennsylvania. Pennsylvania contains ninety-three anthracite furnaces, one hundred and fifty charcoal and coke furnaces, one hundred and ten refining forges and ninety-one rolling mills.