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THE SCIENTIFIC AMERICAN SUPPLEMENT
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CURIOUS HYDRAULIC EXPERIMENTS.

A disagreement recently occurred in Germany between the Government and a number of manufacturers relative to the classification of certain water courses used by the latter for power purposes. Among other questions was one which involved the determination of the source of the waters of the Aach, the settlement of which was important as affecting the interests of the manufacturers and also from a purely scientific point of view. A French hydrographic engineer was charged with the work, and in his report is detailed the curious way in which the problem was solved.

The Danube River, proceeding from the Black Forest, flows nearly directly from west to east, while the waters of the Rhine move in parallel direction, but inversely, from Lake Constance to Bâle. The altitude of the two streams differs, the relative difference being about 800 feet, and the Danube, in the region referred to, being some 2,000 feet above the sea level. The distance separating the rivers is about 18 miles. The river Aach is a tributary of Lake Constance, and rises near the village of the same name, at a point 9 miles from the Danube and at an elevation some 500 feet lower than the level of the latter. The spring from which the Aach flows is one of the largest in Europe, and its yield is about 1,350 gallons per second. The Danube flows over a calcareous bed, the inclination of which is exactly the same as that of the ground from the Danube to the source of the Aach. The calcareous soil ceases beyond the above named source, and the bed of the river enters the alluvial earth which surrounds Lake Constance. The limestone of the Danube Valley is composed of irregular layers diversely inclined, very friable, stratified, split and divided. The soil is so permeable that it absorbs the greater number of the springs and streams which rise between the Aach and the Danube.

For many years it has been noticed that the Danube loses a portion of its water in this region, and that during dry seasons even the greater part of its flow disappears in crevices or veritable holes in its bed. The owners of factories situated on the Danube, in order to retain their water supply, stopped up these leaks, but in so doing they were at once opposed by the manufacturers whose works were located on the Aach, the latter claiming that the water lost by the Danube fed the Aach, and to check the waste from one river to the other was to interfere with their just enjoyment of the smaller stream. The question, however, was to prove that the assertion of the Aach manufacturers was a true one, namely, does the water from the Danube, by some subterranean infiltration, supply the Aach, located as already stated 9 miles away?

The first plan suggested was to make the Danube water salt. This was proposed by Professor Knop of Karlsruhe, and accordingly 22,000 lbs. of salt were placed in a hole in the bed of the great river. Then water from the source of the Aach was obtained every hour for several days, and this on being analyzed revealed the presence of the salt.

In order to get still better proof, M. Ten Brink decided to take advantage of the wonderful coloring power of fluorescine. This substance is the phtaline of the resorcine obtained by treating at 374° Fah. a mixture of phtalic acid and resorcine. Its formula is $C^{20}H^{12}O^5$, according to the equation of its formation $C^8H^4O^6$ (phtalic acid) + 2 ($C^6H^6O^2$) (resorcine) = $C^{20}H^{12}O^5$ (fluorescene). It is the first of a series of superb coloring matters, according as there is introduced into its constitution bromine, iodine, or chlorine, and its coloring power is so great that 1 part of fluorescine in 20,000,000 parts of water is quite sufficient to be recognized.

On the 9th of October last, at 5 o'clock in the afternoon, fifteen gallons of a solution of fluorescine were thrown into one of the orifices in the bed of the Danube. On October 12, the observers stationed at the source of the Aach observed the coloration of the water. It had, therefore, taken about 60 hours for the colored water to traverse the soil and reappear. It is stated that the Aach as it gushed from its springs presented a magnificent intense green, which in the sun exhibited more or less fluorescent reflections ranging from light green to brilliant yellow. The intensity of the dye augmented from morning until evening of October 12. Its effects were quite visible until about 3 P.M. on the 13th, when it gradually disappeared.

The experiment was certainly a most remarkable one. Its repetition in other localities may prove of great value in the study of subterranean water courses, while it offers a new method of geological investigation worthy of general attention

THE PARIS EXPOSITION.

The bill appropriating $150,000 for the purposes of our representation at the Paris Exposition, and providing for the appointment of twenty assistant commissioners at $1,200 each, in addition to the Commissioner General, has at length, after amendment by the Senate, passed the House of Representatives. Our participation in the show thus being secured, the work of official preparation and organization is now being rapidly pushed forward. Ex-Governor McCormick has been appointed Commissioner General. The assistant commissioners have not yet been named, but they will be designated by the President, under advice of the Secretary of State. Over 700 applications for these positions have already been received. The appointments are allotted among the different States, and also among the various business interests which it is desired to have officially represented, so that the selection of these gentlemen will be made from among the most prominent names in the country. A number of honorary commissioners are also to be appointed.

Offices of the American Commission will soon be opened in New York, Philadelphia, and Washington. Three United States vessels will transport the goods for exhibition, namely, the Supply, 750 tons freight capacity, to sail from New York February 1; the Constitution, 1,200 tons, to sail February 15; and the Wyoming, of 250 tons, to sail March 1. We are informed that some 800 cases of American goods are all ready for shipment. The French Minister at Washington has also given assurance that the time fixed by the regulations of the Exposition for the allotment of space will be extended in favor of American exhibitors. The arrangement of the American section will, it is stated, be confided to Mr. Henry Pettit, late superintending engineer of the Centennial Buildings, now in Europe. The headquarters of the Commissioner General in New York are in room 24, Post Office building. He proposes to sail for Europe about March 1. It is hardly necessary to add that those of our readers who intend taking advantage of the facilities offered for dispatching contributions should lose no time in completing their preparations, as a large number of intending exhibitors, who have been holding off to see whether Congress would make the appropriation or not, are now rapidly sending in their exhibits, so that it seems probable that the accommodations in the vessels mentioned will not suffice to meet all the demands.

RUBIES AND SAPPHIRES, ARTIFICIALLY PRODUCED.

MM. Fremy and Feil have recently exhibited to the French Academy of Sciences some magnificent specimens of crystallized silicates, and of corundum, which substances form the basis of the so-called oriental gems, notably rubies and sapphires. The process consists in heating to a red heat for a long period a mixture of aluminate of lead and of silex. Some sixty pounds of these ingredients were treated for twenty days in a glass furnace. The aluminum disengaged little by little, and thus colorless corundum was produced. To this was added 2 or 3 per cent. of bichromate of potash, the material then assuming the color of the ruby, while the addition of oxide of cobalt produced the sapphire. It is stated that in density, hardness, brilliancy, color, and even, as M. Janettaz has discovered, in crystallographic and optic properties, these artificial gems exactly coincide with the natural ones. The crystals exhibited are not microscopic, as were those which have resulted from similar efforts to produce jewels by chemical means—but on the contrary are large enough to be cut by lapidaries and to adapted for watch-making. The discoverers do not intend to patent their process, which was the result of a purely scientific investigation, but give it freely for any industrial uses to which it may be applied.

THE EDUCATION OF A CIVIL ENGINEER.

In an address on the education of a civil engineer Mr. C. Graham-Smith, of Edinburgh, gives much valuable advice, which by slight changes can be made of much use in this country. The term engineer has a very extended application; it includes, among others, men who drive locomotives, attend to the engines of steamboats, look after gas and water arrangements, design and put together mill gearing and machinery of every description, besides those who study it more particularly as a science. It is useless, therefore, to attempt to define an engineer.

Ambition and hope, combined with a strict sense of duty, are necessary antidotes to the self-denial and hardships required to be gone through in endeavoring to overcome all difficulties to be met with in the engineering world; for it must be borne in mind that the word impossible has long been banished from the engineer's vocabulary. Engineers may at any moment be called upon to carry out any of the following works: Railways, roads, canals, docks, piers, breakwaters, landing stages and other harbor works, water, sewage, and gas works. Numerous others of equal importance might be given. In the first instance the engineer will probably be required to report on the project, looking at it from an engineering, and perhaps financial, point of view, and generally to prepare preliminary plans and estimates. More accurate plans, levels and estimates must afterwards be made, to be in turn superseded by the working plans and sections. In performing the foregoing, it will be necessary to have:

First, A sound constitution, proper mastership of his own language; the power of dealing with all classes of men, both individually and collectively, and the tact of readily ascertaining the merits and abilities of those whom it is thought of employing in various capacities in the carrying out of an undertaking.

Second, Command of those theoretical and practical sciences which bear on or affect his profession.

Third, A good mechanical training.

Fourth, A general knowledge of engineering works and special information for the carrying out of each class.

Fifth, The tact of ascertaining and arranging facts, as well as surveying, mapping, and calculations of all kinds.

Parents should fully consider the following questions before allowing a boy to think of becoming a civil engineer.

Is he physically and intellectually capable of undertaking the studies?

Is he possessed of the necessary foresight, self-denial, self-reliance, and indomitable perseverance?

After going through the ordinary high school system of education, he must be sent forthwith to a good mechanical works, to go through a regular pupilage, for it is a delusion to suppose that the requisite mechanical knowledge can be