at the present day may be really classed as experts in the technicalities of important industries. And with these demands for a higher standard of preparation the facilities for its attainment have been so multiplied that they are easily within the reach of all who have the disposition and the energy to avail themselves of the opportunities offered.

One peculiarity in the conduct of our leading industries, however, has operated rather to hinder the attainment of this higher standard of excellence among workmen in many cases. The ' division of labor " now carried out in such detail in most branches of business has given us great numbers of workmen who know only a small portion of a trade, and, unless the mechanic be ambitious to rise in his avocation, he becomes little better than a machine. Blacksmiths, machinists, carpenters, masons, painters, shoemakers, etc., are now divided into separate classes of workmen who are masters only of some specialty in their trade, rather than the whole trade, and but seldom endeavor to reach a practical knowledge of all the other departments of their own business. To illustrate from what is certainly one of the least complicated of our trades, in a modern shoe factory we find, besides the cutters, fitters, and makers of the uppers, there are different sets of men employed for lasting, heeling, trimming, burnishing, finishing etc., the finished boot or shoe in most cases being the work of six to ten hands, each of whom knows only how to do his particular part. This division of labor undoubtedly gives the best results in the aggregate for the community, but the ease with which workmen attain proficiency in one small item of a whole trade undoubtedly tends to check that ambition to excel which has thus far been the most marked characteristic of American mechanics.

"I have taken all knowledge to be my province," wrote Lord Bacon, in 1592, when he was only thirty-one years of age. The expression often occurs to us when we consider what is now expected from first-class mechanics as well as from professional men. Bacon excelled all other men of his day in a "knowledge of the mutual relations of all departments of knowledge," and his philosophy, more than that of any one else of his time, taught " the art of inventing arts." Taking his meaning in this sense, there are many to-day who might fitly say what Bacon said of himself. But this is preeminently a practical age, and, while it shows the best possible development of the Baconian philosophy, it requires, of all who would stand at the head in any department of the world's activity, an amount of practical knowledge of which he had only a general conception. The multitudes which now crowd upon each other in the competitions of life are of those who do not meet the call for that better culture and more complete preparation of which society can never have enough, and which the diversified industries and great enterprises of modern times will always find ample employment for. "There is always room at the top," said Daniel Webster, in reply to the inquiry of a young lawyer as to the chances of success in his profession, and only those who pursue their avocations, of whatever nature, with this in mind, are certain to succeed.

PATENT PANTS.

As showing the importance of some of the minor patents the recent litigation of Strauss *vs.* King, reported in another column, presents a curious example. This is a patent for placing a metallic rivet at the pocket seam of the garment. The defense was that the use of rivets to strengthen seams was very old and well known; therefore a patent could not be sustained specially for securing pocket seams in that way. Issue was joined, 475 pages of lawyers' briefs were prepared, 528 witnesses were examined, and 3,361 pages of printed testimony were taken. Judge Blatchford, of the U. S. Court, sustained the patent. Let no man now rivet his pocket seams without first opening his wallet and paying toll.

ARE RIVER WATERS SAFE?

A very interesting discussion lately took place before the Chemical Society of London, concerning the comparative purity of river waters, into which town sewage was allowed to empty, and concerning the use of such waters for domestic purposes. The discussion was occasioned by the reading of a very able and exhaustive paper by Prof. Tidy, descriptive of his elaborate experiments showing the rapid oxidization of various deleterious substances when introduced into running waters. He also cited many examples of the rapidity of this oxidization in natural river waters, whereby immense quantities of sewage were, during a flow of only a few miles, rendered inert by oxidization, and such river water rendered fit for domestic use. Indeed, we have near New York an example of this. The city of Jersey City is supplied by water taken by pumps from the Passaic River, at Bellville, a few miles below the city of Paterson, N. J. The river receives a large part of the sewage of Paterson, also the refuse stuffs of many manufacturing establishments, but during its short flow to Bellville these bad matters, so eminent chemists have certified, are so rapidly oxidized as to become inert or changed, rendering the water pure enough for city people to swallow; and they are now drinking lots of it in Jersey City.

In the discussion alluded to, Dr. Frankland combated the views of Prof. Tidy, and claimed that the latter was wrong in his proposition about the rapidity of the oxidization; that sewage was not got rid of in that easy manner; and he adduced many proofs showing that no such purification and change in river water took place as had been alleged by Prof. Tidy. The discussion closed in the following interesting manner:

The president, Prof. Roscoe, said that all must compliment Dr. Frankland on the complete, clear, and withal, good natured criticism, to which they had listened with so much interest. He would ask Prof. Huxley to say something on the subject of bacteria.

Prof. Huxley did not wish to take part in the chemical controversy, but it had struck him on reading over Dr. Tidy's paper that there was a good deal of what he might venture to call "biological turbidity" in it. To this turbidity he would, as far as was in his power, act as a filter. He would state briefly only what were demonstrable facts. Diseases caused by what people, not wisely, call germs, *e. g.*, splenic fever, pig typhoid, etc., are caused invariably by bodies of the nature of bacteria; they could be cultivated through twenty to thirty generations, and then when given to the ox or the pig would invariably give rise to the characteristic disease. We have no reason even to imagine that any body capable of causing disease by such means could be anything but a body having the nature of a bacterium. Now, bacteria are just as much plants as mushrooms or cabbages, or the *Wellingtonia gigantea*, so that we know under what conditions bacteria can live and what they will do. Bacteria can be sown in Pasteur's solution just as mustard and cress can be sown in the soil; in it they thrive, and the liquid becomes milky, and he would ask the president whether there was any known method by which, if one drop of this Pasteur's solution were placed in a gallon of water, its constituents could be estimated. (The president having answered that he thought it was doubtful, the speaker continued.) Every cubic inch of such water would contain 50,000 to 100,000 bacteria, and one drop of it would be capable of exciting a putrefactive fermentation in any substance capable of undergoing that fermentation. For purposes of public health, the human body may be considered as such a substance, and we may conceive of a water containing such organisms, which may be as pure as can be as regards chemical analysis, and yet be as regards the human body as deadly as prussic acid. I am aware that chemists may consider this as a terrible conclusion, but it is true, and if the public are guided by percentages alone, they may often be led astray. The real value of a determination of the quantity of organic impurity in a water is, that by it a very shrewd notion can be obtained as to what has had access to that water. If it be proved that sewage has been mixed with it, there is a very great chance that the excreta of some diseased person may be there also. On the other hand, water may be chemically gross and yet do no harm to any one, the whole source of damage being, in the belief of the speaker, in the diseased germs. As to the bursting of the envelopes by endosmosis, it was a question whether they had any; bacteria would be large if one-twenty-thousandth of an inch in diameter; moreover, ordinary water was full of them, and in it they could be shaken for an indefinite period without harm. As long as bacteria had nutrition, there was no reason to suppose that oxidation or endosmosis would affect them. If, however, they were deprived of nourishment and exposed to sunlight the case might be very different.

The secretary then read a few remarks which had been sent by Dr. Mills. Dr. Mills has calculated the ratio of

$$\frac{\text{Oxygen consumed}}{\text{Sum of organic } C + N}$$

and finds that it is not constant but varies in different streams. He does not think it possible to determine the peat in a water by its tint depth, owing to the difference of color. River water commonly contains a slimy or pectinous material, which tends to separate out on any substance which acts as a nucleus. This has, in the author's opinion, a most potent influence on the purification of river water. The oxygen theory of the natural purification of waters seems utterly untenable. The criticisms of the author coincide in several respects with those already advanced above by Dr. Frankland. In conclusion the author expresses his admiration of the patience with which Dr. Tidy has collected his facts, and of the meritorious accuracy of his analytical results.

Prof. Tidy, in his reply, relied mainly on the powerful testimony given in his behalf by the statistics of the last ten years. Notwithstanding the possible contamination of a large bulk of river water by a minute drop of a fluid containing germs, yet there were as many cases of fever in towns supplied solely by well water as in those supplied by river water; this holds good for towns all over England as well as in different districts of the same town. He took exception to the laboratory experiments of Dr. Frankland on oxidation; they were doubtless most interesting and satisfactory experiments as regards shaking fluids up in bottles, but they did not represent the flow of a river; there was no vegetation, no animal life. As regards the diminution of sodium chloride in the Severn, he contended that plants did cause a decrease in the quantity of sodium chloride in running water. As to the Shannon, he knew every inch of it, and perfect streams of black drainage entered into Loch Derg and elsewhere quite sufficient to account for the discrepancies noted by Dr. Frankland. He collected the samples of water himself, and did his utmost to collect them fairly. He had no interest whatever in commending any water. In conclusion, Prof. Tidy said, that although his paper might be considered in some respects an attack on Dr. Frankland, he wished to thank him for the freedom and the kind way in which he had met him at every turn, and expressed a hope that Dr. Frankland would join him in fighting the prevailing heresies on this question which tended so to upset the public mind.

ELECTRICAL PAVEMENTS FOR CITY LOCOMOTION.

The latest suggestion for the use of electricity as a motive power is to have the streets of cities paved with iron, either in blocks or so arranged that the pavement will form continuous electrical conductors, divided into suitable sections, each section to be charged with electricity by a stationary steam engine and dynamo machine of proper size. On the electrical pavements thus provided, wagons, carriages, fire engines, omnibuses and other vehicles, each provided with an electrical driving wheel, and taking electricity through the wheel from the pavement, may be run, in any desired direction, with more ease and certainty than by the present system of horse locomotion, although that system would not necessarily be interfered with, as those who preferred to use horses could of course do so. Iron pavements could doubtless be made that would be quite as serviceable as the present stone blocks. The subject presents a fine opportunity for students of electricity to exercise their head gear.

Skin Grafting from the Dead.

Dr. J. H. Girdner, house surgeon at Bellevue Hospital, has obtained some remarkable and valuable results in skin grafting during the past year. One patient who required such treatment refused to furnish grafts from his own arms or body, owing to the pain involved; and, unwilling to ask another to subject himself to a pain which the person to be benefited was unwilling to submit to, Dr. Girdner tried the experiment of taking skin grafts from a corpse. The doctor says:

"I cut a piece of skin from a patient who died in the wards a few hours before, first taking care to inquire whether the cause of death was due to a poisonous disease or not. I then cut the cuticle into small pieces, which I laid on the granulated surface of the ulcers, and bandaged the leg up very firmly. In three days the graft began to show signs of life, a perfect union having taken place, and in a week a splendid skin, smooth and elastic, had grown over the ulcerated part, making a complete cure and leaving no scar behind. Since that time I have treated upward of fifty cases with invariable success. I have grafted the skin of an Irishman on a negro, and I have grafted the skin of a negro on an Irishman with ease. In both cases the skin lost its original color and changed its hue to suit the wearer.

Slave-Making Ants.

It may interest such persons as take pride in physical prowess to know that on the battle field ants distinguish themselves quite as signally as do human beings. Mrs. Mary Treat, in the *American Naturalist*, thus describes a contest which she witnessed between slave-making ants and black ants: The former were the aggressors, and victorious. The two columns were one hundred and twenty feet apart. An idea of the numbers constituting the ranks of the slave-makers may be gathered from the fact that on the war path, one hundred and twenty feet in length and a foot wide, they "were not thinly scattered, but a vast moving phalanx." The blacks, a grand army on their own territory, would not flee. The battle field was about twenty-five feet in circumference. A roar, announcing the beginning of hostilities, lasted for five minutes, "whereas the battle lasted four or five hours before the reds gained possession of the vast nurseries of the blacks," and it took two days to carry the pupæ and prisoners to their own dominions.

The Indestructibility of Matter.

This is capable of ready demonstration by preparing a couple of glass tubes of equal weight, each being filled with pure oxygen, and containing a few particles of carbon, free from appreciable amount of ash; that prepared from the fine loaf sugar gives very good results. The tubes are of precisely equal weight, and are hermetically sealed. By heating one of them the charcoal is caused to burn, and ultimately to disappear; the tube and contents, however, is of course found still to balance the other tube (which has not been heated), being of precisely the same weight as it was at first.

Earthquake Warnings.

In a recent lecture on the possibility of foretelling earthquakes, Professor Palmieri expressed the belief that by means of seismographic stations, telegraphically connected, for registering and reporting preliminary earth tremblings, it would be possible to foretell earthquakes just as tempests are now foretold, and to issue warnings to threatened districts about three days in advance. He did not expect to live to see such a system in operation, but he hoped and in a measure expected that posterity would be benefited by its universal and permanent establishment.

The Watch Trade of the United States.

The Watchmakers' and Jewelers' Guild of the United States held a convention in Chicago the second week in May. In his address, as President of the Guild, Col. R. E. P. Shurley said that the demands of the trade now amount to 3,000 watches a day. Of this number the large manufactories of the United States produce 1,530 a day, as follows: The Waltham factory, 750; the Elgin, 500, Springfield, Ill., 80; Hampden Watch Company, 90; Howard, 20; Lancaster, 50; Rockford, 40. The number produced by smaller establishments was not estimated. The great body of American watchmakers are native born.