question at large. Our aim here, and so far, has been almost limited to removing what we are compelled to call rubbish, out of the way; but we hope to pursue this subject (which we are satisfied is one of the most important that can engage the serious attention of English statesmen and Englishmen at large at this moment) with the fulness it demands hereafter.

It is with a real sense of responsibility, therefore, that in our last article on this subject we felt compelled, with entire plainness of speech, to point out what appear to us the fallacies on the subject of technical education comprised in Dr. Percy's late letter to the *Times*. Nothing is further from our wishes or intention than to utter a word personally disrespectful to that gentleman; but the very fact of his scientific reputation, and of the prominent position which he occupies as a metallurgical teacher and author, give a weight to whatever may pass from under his pen which leave no option to an honest journalist when dealing with such a subject as the present, to waive every other consideration in favour of truth alone. —*London Engineeer.*

PLATING OR COATING METALS WITH METALS.

Not very long ago, and quite in the remembrance of most who are likely to read this journal, the principal manufactures that might have been described under the above title were the manufacture of tin plates, of tinned culinary utensils, and the operation of Sheffield plating. The process of "galvanizing" (coating iron with zinc by immersion in the molten metal) has materially interfered with that of tinning, and the introduction of the principles of electro-deposition, to produce articles of beauty at a cheap rate, and to serve many useful purposes, has altered the condition of the Sheffield plating trade to such an extent that it only exists to produce certain articles of large consumption and well-defined form.

Great changes can also be traced in the theory and practice of electro-deposition itself. Smee, in his admirable work, laid down the "laws" of electro-metallurgy, as he was pleased to term them, in which the evolution of hydrogen during the time of deposition was made to determine the character of the deposit obtained; he also put forward certain views relating to the deposition of alloys in which the use of intense battery power was pointed out as a possible means of accomplishing that purpose. Now, it is found that, by the use of alkaline solutions, many deposits can be obtained in a reguline form during the evolution of hydrogen, and that, also, from certain alkaline solutions, brass and other alloys can be electro-deposited in a reguline form, without the use of more battery power than is necessary to compensate for the want of electric conduction in the solution employed.

In the five years that are comprised between the years 1861—1865, inclusive, the increase of knowledge (practical and theoretical) does not appear to have been very great in relation to the subject at the head of this paper. The chief attempts at improvement have been made in the practical details of the tin-plate manufacture. The use of ordinary resin as a flux, above the molten metal, is provided for by special arrangements by Messrs. Banks and Morgan, in their patent specification: Messrs. Morewood and Whytock employ ordinary resin, in conjunction with tallow, by using a plurality of coating baths worked in connection, by the aid of machinery. With a view to economy of material and of working, rollers, guides, and other machinery, are employed in certain inventions. Some inventors set forth improvements in the fluxes used (independent of the above-mentioned resin), comprising potassium, ammonium, zinc, tin, and cadmium chlorides. H. J. Madge manufactures a cheap alloy for coating iron plates, by using lead and antimony, with perhaps, a small quantity of tin, instead of tin alone. Messrs. Nurse use an annealing pot with a double case. Lastly, George Tomkins coats-lead and terne plates by pouring the melted metal over the plate, and uses an alloy of nickel, zinc, and lead.

Electro-gilding has made but little practical progress during this time. The ordinary solution of gold trichloride in potassium cyanide is used by Martin Miller to gild wire, and by Kuhlmann to ornament metal. The depositing solution employed by Moore contains potassium ferro-cyanide, "pearl potash," potassium iodide, sodium carbonate, copper cyanide, silver cyanide, and "fine gold;" it is said to give a rapid, durable, and richly colored deposit. J. B. Thompson prepares iron or steel articles for electro-deposition by tinning, and then pickling and washing them; he also ornaments silver surfaces by electro-gilding them with a polarized paint brush containing the electro-depositing solution.

In electro-silvering, the following are the principal points that appear:—Martin Miller employs a solution of silver chloride dissolved in potassium cyanide to coat wire. Moore uses electro-magnetic force, but does not state his silvering solution. Weil's solution for previously coppered articles is made by means of silver nitrate, hydric tartrate, ammonia, and potassium cyanide; this solution gives an adherent and either brilliant or dead coating.

All the solutions for electro-coppering are evidently intended to coat iron or other easily oxidable metals. Miller uses a mixture of copper carbonate, potassium cyanide, and potassium or sodium carbonate, to coat wire; the alkaline portion of the solution is first boiled, and then the copper carbonate is added, the mixture being kept boiling until ammonia is freely given off. Wallcott charges a strong potassium-cyanide solution with copper by electrolysis. Weil's electro-coppering solution is formed by adding a solution of cupric sulphate to a solution containing sodic potassium tartrate and sodium hydrate. Thompson deposits copper (on an article already electro-coated with iron) by means of a solution of hydrated cupric oxide in sodium hyposulphite.

Among the other inventions that may be mentioned are the following:—Marshall prevents the fracture of metals owing to their crystallization, by coating their bearings with soft metal, by running the molten metal on to the inclosed bearing. Le Chatelier deposits aluminum by electrolysis of fused sodic aluminum chloride. Bennet tins lead pipes, that are made by hydraulic pressure, by the