became visible, and greatly disfigured the object, and those lines could not again be covered with silver. By the old plan, every portion of a figure which was "undercut," *i.e.* in which the external parts overhung the internal ones, as the mouth or ear of an animal, for example, required to be made of several pieces, whilst by the new method such parts could be made entirely in one piece with the whole figure, and be coated with the precious metals all over, without any seam or joining. A great scope for the extension of beauty and taste in designs of metallic figures and vessels thus commenced, which has gradually extended itself to electro-plated articles of a very moderate price, such as tea-pots, coffee-pots, cream-jugs, sugar-basins, &c., the base of which consists of Britannia metal; and the electro process has thus enabled persons of limited incomes to enjoy the use of articles of elegant design previously inaccessible even to the wealthy.

The next event of importance in the history of electro-plating consisted in the applicatiion of magneto-electricity instead of electricity from a voltaic battery to depositing purposes. In August, 1842, J. S. Woolrich took out a patent for the use of a magnetic-electric machine instead of a voltaic battery for electro-plating. This machine, which is in use at Mr. Fearn's electro-gilding works, Birmingbam, and various other places, consists of a revolving wheel containing at its outer edge a number of short bars of soft iron, upon which are wound coils of insulated copper wires, giving to the bars the appearance of a series of reels; the wheel is surrounded by a set of powerful steel magnets, which are immovable, and fixed in a case, and have their ends, or poles, all pointing towards the wheel, so that as the wheel revolves, each of the reels of wire with its iron core, passes in succession between and very close to the poles of each magnet. As each of these coils approaches a magnet, a current of electricity is developed in one direction, and as it leaves the magnet a current is produced in the opposite direction, and similarly with the whole of the coils. All the corresponding ends of the coils are connected with the axle of the wheel, from which the positive electricity of all the spirals is collected by a metal spring which presses upon the axle and conveys the current onwards to the depositing solution; and all the opposite ends of wire are connected with an apparatus on the axle called a communicator or break, and this apparatus collects all the negative electricity of those ends and transmits it to another spring which conveys it to the plating vat. And thus, by quick rotation of the wheel, a rapid succession of electric impulses are generated, which are employed for plating purposes in the same manner as the ordinary voltaic current. The above machine is a very convenient source of electricity where a cheap motive power is at command, and where the quantity of electricity required is not very great.

The surface of silver deposited from the ordinary cyanide of silver and potassium plating solution has a frosted or snow-white appearance, which in many cases has to be burnished and made bright by mechanical means. This, with articles of highly figured design, and also with the interior of certain articles that required to be made bright, was a great disadvantage, as the process of burnishing is tedious, and with the interiors of vessels also very awkward to perform. As with the difficulty in the early period of the electro-process in obtaining thick deposits of firm silver, a little circumstance was the cause of that difficulty being overcome, so was it with this obstacle, and it happened as follows:—In the process of copying figures for electro-typing by a mixture of wax and resin, the surface of the wax is covered with a film of phosphorus by means of a solution of phosphorus in bisulphide of carbon. It was observed by Mr. Millward, at Messrs. Elkington's establishment, that when these prepared wax moulds were put into the cyanide of silver-plating solution for the purpose of receiving a coating of silver, other articles, such as spoons, forks, &c., which were being plated in the same vat, and especially those nearest to the wax moulds, acquired a coating, more or less perfect, of *bright* silver, which occurred sometimes in patches, and sometimes extended all over the articles, instead of the ordinary snow-white deposit. This circumstance attracted attention, and induced Mr. Millward to try the effect of adding bisulphide of carbon alone to the plating liquid. Considerable success soon resulted; but at this juncture the secret escaped, and in consequence thereof a patent was taken out, March, 1847, by Mr. Millward and a person of the name of Lyons, who had acquired a knowledge of the secret, for producing bright deposited silver by means of bisulphide of carbon. This process has been constantly employed ever since, and is now in extensive use, and with its aid the silver is rendered very bright and the amount of burnishing required very considerably reduced, but it has the disadvantage of making the deposited silver much harder. Bright copper had been observed about two years before bright silver, and occurred whenever a large number of phosphorized wax moulds were put into a solution of sulphate of copper to receive an electro-deposit of copper. Other substances possess the quality of imparting brightness to deposited silver, but none in so satisfactory or eminent a degree as bisulphide of carbon: among these may be mentioned bicarbonates of the alkalies and many organic compounds, and it is probable that the brightness depends upon a *gaseous* body being dissolved in the plating liquid.

No important improvement in the electro-deposition of silver has since been made; and the process at present in use may be briefly described as follows:—A certain quantity of pure or virgin silver in a granulated state is taken, allowing about one ounce for each gallon of plating solution required (the actual proportions, however, in use by manufacturers vary from a quarter of an ounce to two or three ounces of silver per gallon), a warm mixture of four parts of pure and strong nitric acid and one part of water, contained in a capacious vessel of glass or stoneware, is placed in a warm situation, where the air-fumes may readily escape without injuring persons or furniture; and small quantities of the silver are added, from time to time, as fast as it dissolves, care being taken not to add it in too large quantities at a time—otherwise waste will ensue—until nearly all the silver is dissolved. It is advisable to employ a deficiency of the acid mixture in the first place, and to add more of it towards the end of the process,