tivation of the soil, where now conducted upon true principles of economy, are largely indebted to the discoveries of chemists, and it is well known that some, productive of no inconsiderable gains, could not be worked profitably but for the appliances thus obtained. At the same time, in the more speculative walks of science, it is with her help that astronomers, now learned in the laws which govern the composition and relations of the rays of light, and using the spectroscope, are enabled to determine the primary constituents of planets which lie beyond the limits of space reached by the best optical instruments employed by their immediate predecessors.

Electricity, but recently deemed a pursuit only for the amusement of the curious, has been enlisted as an additional servant, obedient to man's behests, and exhibits its tractability to perform offices of the most various kinds. The years 1793-4 witnessed the contention between Galvani and Volta,* which established the distinction between animal and contact electricity, and now we hear of electro-magnetism, diamagnetism, magneto-electricity, magno-crystallic action, diamagnetic polarity, and hundreds of other wondrous things which wait on Dr. Tennant like attendant Ariels on the magician Prospero. The electric light irradiates the blackness of darkness with its peculiar effulgence. The telegraph wires, conveyed by land and under the sea for hundreds of thousands of miles, flash messages everywhere—already almost round the globe—a circuit which it is expected will be complete in less than three years; and powerful magneto-electric machines worked by steam generate heat which yields a current of electricity used to produce a chemical change in the precious metals, and deposit gold and silver on moulds with a delicacy and precision incapable of achievement by the hands of the most practised goldsmith.

Steam, substituted for the uncertain powers of water and of wind, and for the muscle, sinew, and nerve of man and beast, saved from waste, or called from a dormant state into existence as a labour agent, and directed at will, now accomplishes more work than could be performed by the united operation of the adult male members of the human race; and the daily growth of perfection in the construc-

* Galvani attributed the contraction of the muscles of the frogs' legs to animal electricity. Volta accounted for the phenomenon by the contact of the heterogeneous metals, zinc, &c., with the muscles. Galvani replied by showing that the contraction may be produced without metals. Volta retorted by producing electricity *without frogs*.

tion of machinery, as also the adaptation and adjustment of each kind to its special duty, so augments the power of production, in a ratio of such velocity, as to set completely at defiance the sobriety of calculation of what it may reach within the next fifty years.

Or take the advance of engineering science in the improvement of means of locomotion, from the canals of Brindley, Rennie, and Telford, to the railroads which now traverse continents, scale mountain ranges on gradients, within our memory deemed impracticable,* perforate Alps through tunnels excavated by methods of applying the forces of water and of air, as new as they have proved effectual. It may be observed incidentally that this process is now being worked at Walhallah, near the Tangil mines of Gipps Land. Also to cross straits and rivers by such bridges as those of Menai, of Montreal, of Friburg, or Niagara, or valleys by such viaducts as the Indre, Nogent Sur Marne, or of Congleton, or our own highly creditable Moorabool, only 66 feet shorter than the great wrought-iron tubular Britannia bridge.†

Or consider the progress made in providing for means of accelerated intercourse on the ocean, the highway of nations, from 1802, when the first steam-tug was launched on the Clyde, and compare her lilliputian apparatus with the engines used in many a Cornish mine, or those which worked the pumps, with cylinders 144 inches in circumference, employed to drain the lake of Haarlem. Or contrast the first steam passenger vessel, the "Comet," which plied on the same river in 1812, with the "Great Eastern," 619 feet long, or 87 feet longer than St. Peter's, at Rome, registering 18,914 tons, with a capacity of 25,000, built of iron, a species of engineering Cosmos, containing within herself an example of almost every improvement in construction known when she was built, moving through the water under two independent systems of propulsion, paddle-wheels and screw, of the power equal to the combined strength of 8400 horses, as large, in fact, as 350 vessels of the size of that in which Christopher Columbus ventured to cross the Atlantic.

* The Semmering between Gratz and Vienna, 1 in 40; the Bhor Ghaut, between Bombay and Poonah, 1 in 37; the Blue Mountains, between Sydney and Bathurst, 1 in 30; Mont Cenis, 1 in 13.

† 1. Menai, 570 feet long, — feet above the water; 2. Britannia, 1488 do., —do.; 3. Montreal, 6592 do., — do.; 4. Friburg, 880 do., 180 do.; 5. Niagara, 800 do., 350 do.; 6. Indre, 2463 do.; 7. Nogent S.M., 2722 do.; 8. Congleton, 2870 do.; 9. Moorabool, 1426 do.