The adoption of the Report was moved by Mr. A. J. Turner, seconded by Mr. F. Whitteron, and carried.

The President then delivered the following address :—

PRESIDENTIAL ADDRESS, JANUARY, ~~1899.~~ 1900.

Ladies and Gentlemen,—

It has been your good fortune for some years past to listen to Presidential Addresses, delivered by men of ability and learning, to which I make no claim—and it was with the greatest reluctance that I allowed myself to be placed in the Presidential Chair, knowing that there were many members of this Society better fitted for such a responsible position, so that the members have only themselves to blame, for any deficiencies and short-comings on my part during my term of office. However, it is satisfactory to learn by the Council's report, that our roll of membership has largely increased, but I regret to say that the active members are decreasing gradually, by death and other causes, so I take this opportunity of appealing to the members to throw more interest into the Society, by coming forward and filling those places. Our financial position is good, and last but not least, the Society is comfortably housed in suitable quarters, for which the members are largely indebted to the Council of the Technical College. I also take this opportunity of thanking the members of our Council for the able assistance and advice received from them during the past year.

The selection of a subject for my retiring address this evening, I can assure you, was no easy task, because on looking back for some past years, I find that your past Presidents have all given addresses on special subjects, particularly in their own professional line, and which they were well qualified to handle. I, having no special subject, have therefore, to ask your kind indulgence this evening, if I should somewhat weary you. As I have said before, for some years past your Presidential addresses have been on special subjects, diverting from the time-honoured custom of reviewing the progress of science, in its various branches, and as the world has made such marvellous progress and development of late, I felt that I could not but revert again to the old custom, by making some brief allusions to the advancement and progress of science.

Workers, in all branches of science, labour under great disadvantages when they are located at great distances from the centres of scientific research and thought, and out of reach of seeing experiments and hearing discussions of the various learned societies, or of even getting access to what has been published in the various journals. Scientific books on all subjects of course reach us in due time, but books in these times are out of date almost as soon as they leave the publishers' hands, therefore, for one to be up to date in the march of progress, it is absolutely necessary to have access to all scientific publications which are published, both in our own and all foreign languages. No doubt the question will at once suggest itself to you, why does not this society supply that want ? The answer is, we have not sufficient funds ; and unfortunately our Society does not include in its membership workers in all branches. Therefore I think this is a matter well worth the consideration of those entrusted with the management of our Public Library, and let us hope that therein will be found all monthly publications of scientific interest, both of pure and applied science, no matter in what language they appear. A long felt want has lately been put forth, under the joint direction of the Physical Society and the Institution of Electrical Engineers of London, in the form of science abstracts, the abstractors being men of well known scientific ability. It contains short extracts from all recognised scientific journals and publications, with a concise reference and index, which at once points out to the reader where he can see the full detailed article or paper. But as I have already inferred, they are at present entirely beyond our reach. Of course, there are societies here, devoted to special subjects, that no doubt are able to place before their members up to date literature in their own particular branch, but this, for the Royal Society, embracing as it does all sciences, is simply out of the question. In fact there are too many societies for such a small community as Brisbane, and I think much better and more work would result if a number of these would throw in their lot with us and work with one common end—the general advancement of science. Each could have its own section, its special meetings if necessary, also, as now, its own president and secretary. Such an arrangement would go a long way towards securing a good financial position, better attendance at meetings, and above all, tend to bring about a closer intercourse of followers of various scientific works and thought, which is the object and aim of this society.

Various attempts have been made from time to time to classify the sciences ; but, without success. Herbert Spencer classifies them thus—Abstract Science, Logic and Mathematics, Abstract Concrete Sciences, Mechanics, Chemistry, Physics and Concrete Science, Astronomy, Biology, Geology, Sociology, etc. It was Sir J. Herschell who said in connection with this subject, "Science is a whole, whose source is lost in infinity, and which nothing but the imperfectness of our nature obliges us to divide. We feel our nothingness in our attempts to grasp it, and bow with humility and adoration before the Supreme Intelligence, who alone can comprehend it." No science rests on a firmer basis than mathematics, which, being founded on demonstrative evidence, may be accepted as absolutely true. The results in logic, which, like mathematics, being a deductive science, are much less certain ; still logic is essentially the science of the art of proof. All other sciences are to a large extent inductive, these resting on probable evidence, and continually approaching nearer and nearer to it, as scientific methods improve. Thus, sciences vary in the distance they have moved towards perfection ; in mental and physical science, the former can largely be studied by reflection in our own mental operations, the latter requires observation, experiment and comparison of facts obtained, inductive and deductive reasoning, all ending in as wide a generalisation as the obtained facts will admit. No one can be a truly scientific student unless he places truth as a prima importance, and is prepared to sacrifice all preconceived ideas and elaborate opinions, whenever he finds them to be in error. No expenditure of time, money, or even life, is considered extravagant, if the sacrifice be made for the discovery of new truths. The early stages in the evolution of science go back to remote periods of antiquity. Moral science, a department of mental science, reached some degree of maturity first in primitive man, in a desire to ascertain what his conduct should be to his fellows and God or Gods. Mental science or the investigation of the thinking and feeling mind came next, but even up to the present time has made but slow progress. Physical science had really commenced, although in its infancy, when ancient myths of observation were formed, many of which were hypothesis to account for natural phenomena, its progress being slow until the eighteenth century, since which time its progress has been rapidly increasing. Prior to this, the greatest advances were in astronomy and physics, then in chemistry, botany, etc., geology not attracting much attention until the beginning of the present century. The nineteenth century has been so prolific in scientific and mechanical inventions that doubts may be expressed as to whether the rate at which discoveries and inventions are now introduced will continue, or whether we are becoming too clever and are likely to come to a full stop. But as science knows no finality, so also will invention know no finality, as circumstances increase, and mankind's dominion over the earth, sea, and air, becomes more pronounced, new wants will arise and new means of supplying old ones will be devised. The time was when science was cultivated only by the few, who looked upon its application to the arts and manufactures as almost beneath their consideration. This they were content to leave in the hands of others who, with only commercial ends in view, did not aspire to further the objects of science for its own sake, but thought only of benefitting by its teachings. Progress could not be rapid under these conditions, because the investigator into pure science, rarely pursues his investigations beyond the physical and chemical principle, while the simple practitioner is at a loss to know how to harmonise new knowledge with the stock of information which forms his mental capital in trade. The world owes much to those ardent students of nature, who in their devotion to scientific research, do not allow their aims to travel into the region of utilitarianism and self interest: but it is not to them that we can look for present progress in practical or applied science, it is to the man of science who also gives his attention to practical questions, and to the practitioner who devotes part of his time to the prosecution of strictly scientific investigation, that we owe the rapid progress of the day, the advancement of which has rendered theory and practice, or science and art, so interdependent that an intimate union between them is a matter of absolute necessity for future progress. Theory and practice must go hand in hand. Although it may be somewhat heretical to say, in these days of division of labour, I see no reason why a Bachelor of Arts should not be able to make a door, or a B.Sc. work and attend a lathe. Science and art naturally stand to each other, as cause and effect. Professor Abbe of the U.S.

Weather Bureau, gives the following very pretty illustration, of how a simple mechanical act has its relation to physical science:—"Everywhere one is confronted with the laws of force. If you strike a smart blow upon the head of a cold chisel, and make a cut into a piece of soft iron, you are doing one of the simplest mechanical operations, and yet you are awakening a long series of reactions that invade nearly every branch of physical science. First, the muscles respond to the eye and the will, the hammer moves with great acceleration, and strikes straight and hard, the energy of the blow comes from the chemical transformation going on within the workman's body, suggesting problems that belong to the profoundest depths of Biology. Secondly, the stroke of the hammer calls forth a clear and cheerful sound from the head of the chisel, a musical ring, with all its problems in acoustics. Thirdly, the hammer, the steel chisel, the soft iron and the chips, become warm and hot, under repeated blows, suggesting problems in Thermo Dynamics, radiation and conduction of heat. Fourthly, the edge of the hard chisel becomes dull, but a deep gash is cut in the soft iron, eventually the edge of the chisel breaks, all of which results are explained by the study of the science of elasticity, as applied to the flow of solids and the exhaustion of metals. Fifthly, a better chisel is picked out and the hammering goes on all day without harm to the tool, proving that its chemical and physical properties differ from the one that is easily broken. If the anvil be of stone, and both it and hammer be insulated and connected with an electrometer, every stroke would be seen to produce electricity." Thus we see in such a simple operation the manifold and intricate connection between the sciences and arts, so we see how all practice has its theory, and the better man is he who takes, as it were, both into his confidence, and runs them harmoniously together. It has been said, and it is a truth incapable of being gainsaid, that science must be joined to practice in the advancing competition of the world, in order that a nation may retain the strength and energy of manhood. It is certain that the prosperity of a country depends mainly on the extent and variety of its natural products, and the manner in which they are utilised: Such being the case, what a great future awaits this colony of Queensland, a country which contains, one might say, the whole list of elements known to science, awaiting development by enterprise and capital, where both can be employed in peace and security, while at the same time it is being so lavishly expended in foreign lands where the danger of losing both is a factor always to be reckoned with. Our pastoral, agricultural, and mining capabilities know no bounds, and yet so little has been done to give our rising generations that rightful and necessary amount of scientific education, to enable them to utilize and make the best uses of that which nature has so abundantly bestowed upon them and placed at their disposal. It is true a small beginning has been made in the Agricultural College, where the farming youth can learn the science of his own industry, and it is gratifying to learn that at last we are to have a University and School of Mines, and let us hope that, when these are an established fact, no niggardly hand will guide them in the selection of management, and that we shall be in a position to impart to the students learning at least equal to those of older colonies. While remarking on this subject, it may not be out of place to state that the thanks of the Queensland public are due to those gentlemen who formed the committee of the Brisbane School of Arts in former years, who undertook and successfully supplied a want of secondary education, by the nursing under very great difficulties to maturity the Brisbane Technical College, which is now rendering such good service in the cause of technical education. But the limited means at their disposal, and want of adequate accommodation and apparatus, is very discouraging to those who give their time and labour in carrying on the work, a work which deserves, and is entitled to, as much sympathy and support, as either the Agricultural College, University, or a School of Mines.

The rapid progress of applied Chemistry in recent years has so combined itself with every industry that no prosperous, well-regulated manufactory is now without its chemical or physical laboratory, according to the arts or occupation for which it is designed to benefit. Chemistry is concerned with the most common acts of our ordinary life, and it is literally true that there is not a moment in which we do not hold the infinite in our hands. Of chemists themselves, the men who have studied the various forms of matter, and have gradually and surely brought it to the point and perfection it has reached at the present time, belonged to various nations. In our own country we had Professor Black, the most methodical of men ; Priestly, erratic, but original and full of new discoveries; Dalton, essentially a thinker, rather than experimenter ; Davy, the most brilliant and enthusiastic of English workers; Cavendish, the careful worker and founder of many branches of experimental chemistry ; Graham, the atomist and forerunner of the physical chemist of to-day; and Faraday, the perfect type of scientific student of nature. France produced such men as Lavoisier, the founder of scientific chemistry, one of the greatest names in the history of science, and who, by his own countrymen, was sacrificed to the guillotine; Dumas, also a Frenchman, a most enthusiastic chemist and brilliant writer, who lived at the time when organic chemistry began. Germany, also claims a fair share, Liebig, a monument of honour to his nation; Humboldt, a worker in all science ; Wöhler, one of the greatest workers in organic chemistry ; and Hoffman, the greatest organic chemist ; not forgetting Professor Bunsen, who has so recently passed away. Sweden also stands in the front rank of chemistry, by the labours of Schele and Berzelius. Italy can justly be proud of Avogadro and Cannizzaro, and their works. Russia can also put forward its claim to representation, and among chemists none more distinguished for accurate imagination than Mendeleeff. Of course there are very great numbers of other distinguished names, but the few will suffice to show that science knows no nationality. Research of late has chiefly been confined to investigations in organic compounds and in high and low temperatures. Six new elements have been discovered and isolated, viz. :—Argon, Helium, Crypton, Neon, Metargon, and Victorium, the former five being gases from the atmosphere and mineral sources, the latter an earthy mineral found associated with the Yttrium Groups. Thus, the list of elements is gradually increasing, notwithstanding the ideas held by most leading scientists a few years back, that as time would enable us to obtain more perfect appliances and analysis, they would most likely disclose that some of the so-called elements would be found to be compounds, and hydrogen was looked upon to play an important part in their composition ; but, up to the present the stablity of the elements has not been shaken, although hydrogen has been liquefied and solidfied, and found to be similar in appearance to frozen water ; and in it we have, owing to the enormously low temperature of solid hydrogen, a new weapon for further investigation.

Synthetical Chemistry has made great strides since Berthelot's discovery of the formation of acetyline with its elements, carbon and hydrogen, in 1862, and it is to this branch of chemical science, that we are indebted at the present time for about 180 compounds of the hydro-carbon series, which are capable of being formed by direct union of their elements; also by the great variety of beautiful colours and shades, used in calico and other printing, it is estimated that a saving of between two and three million pounds annually has been effected by the artificial manufacture from tar waste products, to the calico printers and dyers. This industry which was at one time almost entirely in English manufacturing hands, has practically now become a German industry, for the simple reason that the German manufacturer is either a trained chemist or has the good sense to understand that the problems at the root of the industry are to be trusted only to those with a sound scientific knowledge. This is one of the many instances in which Germany, if not actually outstripping, are running the English manufacturers very closely, more especially in chemical industries, and the reason is not far to seek, when we learn the amount of money, care and attention that is bestowed on Technical Education in that country—indeed some large employers make it compulsory that all their apprentices shall attend Technical Classes, at least two evenings per week, to learn the science of their own particular industry. Thus are produced workmen who are ever on the alert to improve and cheapen the cost of his own products, instead of mere automatons. It is gratifying to learn that, after having discovered the primary cause of our neighbour's prosperity, we have taken the hint, and by similar means are widely establishing universities, technical schools, and national physical laboratories, where sound theoretical, practical and scientific education can be obtained by all seeking it. The deficiency of such knowledge or theory by a large majority of inventors, and the enormous waste of time, energy and money, bestowed upon useless and impossible contrivances, must be glaringly apparent to anyone who studies the patents record of various nations, which might have been saved, had the inventor understood the fundamental principle of Thermo Dynamics, Jules' Law, that the unit of heat can only do 772 foot pounds of work, and inventors proposing to violate that law must either be deficient in theory, or lending themselves to fraud. It is now about twenty years past, in 1878, when scientific interest was awakened by the experiments, then being carried out by Cailletet of Paris and Pictet of Geneva, in the liquefaction of the gaseous elements. Very little having been done since the time of Faraday. Up to that date, although a number of the more dense gases were liquefied by him, some five or six resisted all attempts and ingenuity of the time, and some of these were looked upon as being beyond the possibility of liquefaction, so were thought to be permanent gases, until Pictet demonstrated the fact by liquefying oxygen and so upsetting the theory of permanency. He reasoned that if permanent gases are not capable of liquefying, we must conclude that their atoms do not attract each other, and this does not conform to the law of cohesion. Since the time of these researches and experiments, gas compression and liquefaction has become a large industry. It has completely revolutionised the aerated water manufacturing, and a large business is done in compressed ammonia for the frozen meat trade, compressed oxygen and hydrogen, both for lighting and inflating military balloons, and nitrous oxide so familiar to those who have occasion to visit the dentist. Hydrogen, as was to be expected, being the lightest element, was the last of the gases to yield, and it is to Professors Dewar and Ramsay that we owe much for their labors in that direction. Hydrogen has not only been liquefied but frozen solid. Much speculation was indulged in as to what solid hydrogen would be like, it was expected by some to be metallic in appearance, something like mercury, but it turns out to be very much like ordinary ice, its temperature being 247° below zero Centigrade, or 26° above absolute zero, it boils at 238° below zero, or 35° above absolute zero. Air at once liquefies and freezes on the outside of a tube containing boiling hydrogen, the exact temperature not yet being definitely settled, owing to the difficulty of constructing a reliable thermometer, but these figures are very nearly true. Absolute zero being 273° Cent. below zero, the certainty of there being a real zero was deduced from the fact that a regular rise or fall in the temperature of a gas, produces a corresponding increase or decrease in the volume, and when it was noted that a gas could be doubled in volume by raising the temperature from the artificial zero, of the Centigrade scale, to 273° Cent. the converse result was apparent. Hence, it was pointed out that if a rise in temperature of 273° Cent., would increase the volume of gas by an amount equal to the original bulk, a similar decrease in the original volume would require a reduction of the temperature to 273° Cent. below zero, or equal to 459° below ice temperature, Fahrenheit, which is agreed to be the real absolute zero. This is not a creation of the imagination by any means, a gas exists in that particular state owing to the molecules causing vibrations—more heat more rapid the vibrations, less heat less vibrations, no heat no vibrations, the point to which a gas can be cooled, until it can shrink in volume no further. When Fahrenheit devised the scale of our ordinary thermometer in 1714 he appears to have concluded that a mixture of chloride of ammodia and snow, produced the most intense cooling effect possible, and so named the temperature thus obtained zero, but observations prove that in Siberia it might fall to 90° below this preconceived lowest point, while the mercury of the original Fahrenheit thermometer would freeze at 39° below zero. Alcohol was afterwards used for low temperature recording, so that recent discoveries clearly point out that the real zero must be placed very much lower down the scale. The thermometers used in recording these low temperatures are the platinum resistance, based on the curious effect of intense cold increasing the conductivity of the metal.

Liquid air, of which we have heard so much of late, and the revolution it is to play in the near future as a motive power and powerful explosive, has yet to be brought within the limits of commercial success and usefulness. A power that may be obtained at next to no cost, must be taken with the proverbial grain of salt, and looked upon in the light of the Keely motor. Still there is no doubt that there is a large and useful sphere open to it, owing to its great expansive power, being 800 times its own volume, and the material to be had for the taking, and at the present time a large amount of machinery is being erected, to supply this article for cold storage and other purposes, for which it is proposed to supply it at 9d. per gallon, with possible reductions to half that amount. Thus we have that which was only a short time back a chemical curiosity of the laboratory produced only by the drops, followed by larger quantities available for experimental purposes, and now we have the announcements among the articles of the month, of the completion of commercial plants to supply thousands of gallons per day. The story of liquid air is but a repletion of that of aluminium, and calcium carbide, once a rarity in the laboratory, then a rare material, at so many shillings per ounce, almost ranging with precious metals, and then, all at once, brought by methods of practical Electro Chemistry, into the market as a commercial product, with innumerable applications in the Arts. Aluminium, a beautiful metal, and one of the most plentiful on the earth, is steadily working its way into the arts and manufactures, just so surely and steadily as its cost of production is lessening, The metal was first isolated by Wöhler in 1827, but remained as one of the rare metals until 1855, when Deville and Bunsen reduced small quantities by Electrolysis, but the process was found to be far too costly (£20 per lb.) to be of any commercial value. From this time up to 1884, numerous furnace smelting and reduction by sodium methods, were employed, which gradually reduced the cost to 70s. per lb., still a prohibitive price ; but through the introduction of modern electric machinery driven by water power, such as Niagara, the electrolitic process has again been reverted to, and that which cost, forty years ago, 400s. per lb., is being now made by a similar process by modern appliances at 1s. 4d. per lb., thus making it bulk for bulk, corresponding in price to brass, and taking its place with the common metals. The tensile strain in relation to weight, pure aluminium is as strong as steel of over 80,000 lb. per square inch. The total production of this metal in the year 1882 was only 83 lbs., but since that date to the present time has risen to something like 4,000,000 lbs. per annum. The greatest use is as alloys with other metals, particularly copper. The lightness of aluminium, its non-corrosive properties, and the fact that it is antiseptic, renders it a most suitable metal for surgical and optical instruments.

Artificial Lighting.—Of all that trends to the comfort and well-being of mankind, good artificial light stands pre-eminent. Imagine us to-day being suddenly reverted back to the use of the old tallow and wax candle? why, life would become unendurable. The ruddy lights and picturesque shadows faithfully handed on to us by Rembrandt's pictures, point very clearly to what our poets called the dim glimmer of the taper. The advancement in artificial lighting has played no small part in the advent of science and civilization. A few years before the introduction of coal gas, Argand by his improvement in burners for oil lamps, enabled our Fathers to appreciate for the first time the comforts of a white light; and thus the oil lamps replaced in a great measure the candle. But it was not until 1848, when Dr. Lyon Playfair called attention to the oozing of petroleum from the coal seams, then with the discovery of mineral oils in America and Russia, which brought forth the birth of present kerosene oil lamps, which has steadily improved until it has now about reached the climax of perfection. Prior to the introduction of electric lighting, improvements in gas and gas-burning were few and far between, and it was only by Act of Parliament that gas companies were compelled to supply consumers with an article of standard light and quality, in fact, gas companies the world over did just what they pleased; but within the past sixteen years a great change has come over the scene, electric light companies having given them a shock that has awakened them into a new life and activity, meaning better quality of gas, new and improved burners, and cheaper rates; and one of the chief factors in enabling them to hold their own is that beautiful invention now so familiar to us all, the Welsbach incandescent mantle. This has been greatly improved since its introduction about eight years ago, thorium being the metal now used in its construction. Still, for a perfect light both for health and comfort, the electric incandescent light stands alone; it takes nothing from the air and gives nothing to it, excepting a small quantity of heat—less than any other known illuminant; it costs less to install, and if properly done is the safest. If the cost could be brought down to that of gas, as burnt in the Welsbach burners, it would be universally used. This brings us now to the last and latest rival in artificial lighting, viz., Acetylene. It is now some seventy years past since Edmond Davey, a relation of the great Sir Humphrey, while experimenting in the process of the manufacture of sodium and potassium, noticed that a black residuum was at times formed in the retort, which, practically had the same power of decomposing water as potassium, only that the gas evolved by the decomposition was, instead of being hydrogen, a compound of that element with carbon. The proportion in which these two elements united differed from the composition of any hydrocarbon then known. The material so formed in the retort being a compound of carbon and potassium, which we know now as potassic carbide, while the new hydrocarbon then given to the world, was a compound of 24 parts by weight of carbon, with 2 of hydrogen, which we now call Acetylene. Twenty-years later the French chemist, Berthelot, made a series of researches on this gas and proved that as the electric arc passed between carbon electrodes in an atmosphere of hydrogen, direct combination took place between small particles of both elements and thus Acetylene was synthetically produced, and so it was Berthelot who gave it its name, and as such it remained until 1862, when the German chemist, Wöhler, discovered that on fusing an alloy of zinc and calcium at a high temperature with carbon, a compound of carbon and calcium was formed, now known as calcium carbide, and showed that this body in contact with water, gave rise to Acetylene gas, so it may be said that with this year 1862, through the labours of Berthelot and Wöhler, it was understood and placed in the list of rare chemicals, and as such it remained for thirty years until 1892. Then commenced the present era of activity in the history of Acteylene, which brings it forth from a condition of a rare chemical to that of a commercial article, destined to play no small part in the world of commerce. About this period Wilson of Canada, experimenting with the electric furnace, noticed the formation of calcic carbide under certain conditions, and he prepared a large quantity, by direct fusing of lime and carbon. The process being simple when the desired heat can be obtained, and the introduction of the electric furnace gives us a mean to that end, lime being a most refractory substance is mixed with coke in a suitable crucible, and a powerful arc set up therein, metallic calcium is formed which immediately unites with the surplus carbon, and produces carbide of calcium, it being very much like in appearance to greyish crystalline lime stone, 1lb. of which should produce five cubic feet of gas, giving a light for five hours equal to 240 candles. Calcium carbide on being brought in contact with water, a change of elements takes place, the carbon unites with the hydrogen of the water, and escapes as acetylene, the oxygen of the water uniting with the calcium, remains as oxide of calcium or slacked lime. The simplicity of decomposition has brought forth hundreds of inventions of machinery for generating the gas, of which very few are reliable in their action, chiefly owing to the want of technical knowledge of their designers. As to the ultimate position of acetylene in competing with coal gas as an illuminant, there can be no question that in large towns, coal gas can and will hold its own, but for places beyond the limit of supply, a large field is open to acetylene, but at present, owing to the prejudice against a new and untried article, high rates of carriage, heavy royalties, insufficient and intermittent supply, mitigate much against its adoption. Still, at the present time there are about fifty odd works running and in course of construction, with a production of about 30,000 tons per annum, yet the demand is far above the supply, and now as I write these notes, I learn that a method has been devised whereby the mixing of the gas with some inert matter, it can be sent out from the gas holder through mains and burnt in the ordinary gas fittings.

Electro Metallurgy.—The progress of electrolysis and electro metallurgy, has within the past few years been very rapid and great. Electrolysis and electrolitic methods, being now largely used in chemical analysis, in preference to older chemical practice, it being much quicker and very accurate, and now that we are able to transform the energy stored in coal, into electric energy with a minimum of loss, and also to transmit that power from sources of cheap production, such as water power, the electrolitic production of materials has extended enormously, in fact, it has entirely revolutionised the chemical industry. In metallurgy the most extensive application of electrolysis have been in connection with the refining of copper from the impure matte produced by the smelting furnace. There was in operation in 1897 five electrolitic refiners in Germany, four in France, five in England, two in Russia, and eleven in the United States. I have only been able to obtain the output of the American eleven works for 1896, but it will be sufficient to show, and also what the future will be of this comparatively new and rising industry, made possible only by the late developments of modern dynamo machinery. Thus from eleven works out of twenty-seven no less than 124,000 tons of copper, 14,000,000ozs. of silver, and 70,000ozs. of gold was produced. As the process is now employed, the anode consists of the impure copper, and the cathode of pure copper, the bath being an acid solution of sulphate of copper. Electrolysis is also employed for the separation of nickel from copper, and from gold, silver, and platinum. In these cases the anodes are the matte containing the various metals, and the cathodes are sheets of pure copper, the bath being dilute sulphuric acid, the copper going to the cathode, the nickel dissolving in the bath, while the gold, silver, and platinum, fall in the form of sludge, the nickel being subsequently separated electrolitically, using insoluble anodes of lead or carbon, and cathodes of nickel. A large amount of attention has been given to the electrolitic production of zinc. There are many difficulties, however, in connection with the practical commercial application of electricity to this metal. Its solutions are poor conductors, the metal is frequently deposited in a spongy state, and above all, the low market price of zinc renders an electrical process almost too expensive. The process of Seimens and Halske, and Hoepfner, have both met with some success, but the best results so far have been obtained by the Ashcroft method, in which a solution is obtained by treating oxide of zinc with ferric chloride, and electrolysed. This process has been used on a large scale at Broken Hill, but it is not yet altogether demonstrated that the commercial economy of any of the processes is satisfactory unless the recovery of the more valuable associated metals are included. At the present time the various processes of electro metallurgy may fairly be considered to have passed the experimental stage, and while there are doubtless many improvements to be made, there is every possibility that in the near future, the electrolitic tank will in very many instances replace altogether the more primitive furnace.

Wireless Telegraphy.—Professor Oliver Lodge has said, that at the end of the eighteenth century, the wonder was that you should be able to signal with wires; now at the end of this nineteenth century, the wonder is that you should be able to signal without wires. Telegraphing without wires has been the dream and aim of electricians for the past thirty years or more, and if anyone were to ask me who discovered wireless telegraphy, I should unhesitatingly say Professor Hughes, not that I desire in the slightest degree to detract one iota of merit from Marconi, whose research and ingenuity has made it a practical success, and who deserves all the honour and merit attached thereto; but at the same time one cannot help sympathising with Professor Hughes, after having spent years of labour and research, and actually demonstrating the fact, to be deprived of the honour appertaining thereto. In 1879 Hughes found that electric sparks from an induction coil or frictional machine, acted on the surrounding medium in form of waves, the laws of which at that time he could not understand. The following is his own description of experiments in December, 1879: "I invited several persons to see the result then obtained, and amongst others who called and saw my results were W. H. Preece, Sir W. Crookes, Sir W. R. Austin, Professor G. Adams, M. W. Grove, M. Spottswoode, Professor Huxley, Sir G. G. Stokes, and Professor Dewar. They all saw the experiments in aerial transmission by means of the extra current produced from a small coil, and received upon a semi-metallic microphone; the transmitter and receiver were in different rooms, about 60 feet apart. After trying all distances allowed in my residence, my usual method was to put the transmitter in operation and walk up and down Great Portland-street with the receiver in my hands and the telephone to the ear. The sounds seemed to slightly increase for a distance of 60 yards and gradually diminish, until at 500 yards I could hear no longer with a certainty the transmitted signals. The experiments shown were most successful, and at first they seemed astonished at the results, but towards the close of three hours' experiments Professor Stokes said that all the results could be explained by known electro-magnetic induction effects, and therefore he could not accept my views of actual aerial electric waves, unknown up to that time. I was so discouraged at being unable to convince them of the truth of these aerial electric waves, that I actually refused to write a paper on the subject, until I was better prepared to demonstrate the existence of these waves, and I continued my experiments for some years, in hopes of arriving at a perfect scientific demonstration of the existence of aerial electric waves produced by a spark, from the extra current in induction coils, or from frictional electricity." But the triumphant demonstration of these waves, was reserved to Professor Hertz, who by his masterly researches upon the subject in 1887 and 1889, completely proved not only their existence, but their identity with ordinary light, in having the power of being reflected and refracted, by means of which the length of the waves could be measured. Hertz's experiments were far more conclusive than Hughes, although he used a much less effective receiver than the microphone or coherer, and now as we all know, Marconi has lately demonstrated that by the use of the Hertzian waves, and Branley's coherer he has been able to transmit and receive aerial electric waves, to greater distances than previously ever dreamed of by the numerous discoverors and inventors, who have laboured silently in this field, and his efforts at demonstrating, merit the success he has received, and the world be right in placing his name on the highest pinnacle in relation to Aërial Telegraphy, but there is no doubt that had Professor Hughes, received the encouragement due to him from eminent scientists, the discovery of Aërial Telegraphy would have dated back 20 years ago.

Aërial navigation has been the dream of speculative minds ever since Rozier made the first ascent ever attempted, some 200 years ago. Volumes could be written of the various contrivances, mishaps and misfortunes, that have attended aerial experiments, but of late, since the introduction of aluminium owing to its lightness, a fresh impetus has been given to this subject, and there seems to be some hope that at no distant date, aerial navigation will at least meet with some measure of success, notwithstanding all the disasters and failures of the past. Confidence in a successful issue still prevails in the minds of many practical men. The importance of such an innovation must be patent to all. At the present time there is being constructed in Germany such an aërial ship, which is expected to plough its way through the regions of the air, as the Atlantic liner glides over the ocean. This vessel is being built on a floating pontoon, and has the outward appearance of an iron-clad war vessel, but as delicate in structure as a gigantic bird-cage. The framing is entirely of aluminium, together with all the fittings and utensils. The propelling machine is of the lightest description, internally she is floated by balloons, her speed is to be 22 miles per hour and a total lifting capacity of 10 tons. Her cost is something over £70,000, and we may hear very soon of the first trial of this novel and expensive venture, as much is expected from this event, since such an amount of money and skill has never before been expended on such an enterprise. All calculations have been so accurately made, every contingency so carefully considered, each possibility of failure so cautiously guarded against, that we cannot but hope that success will follow.

So while we have in Germany experiments going on in Aërial Navigation, we have at the same time, both in France and America, submarine navagation receiving a large amount of attention and experiment, especially in France quite a flotilla of these vessels of various designs have been built, from the

"Gustave Zede" to the present latest, the "Narval." This boat is propelled by oil engines for surface work, and electric accumulators for submerged propelling, which are sufficient to propel her, at surface, 250 miles at 8 knots per hour; her displacement being 160 tons. The "Argonaut" and "Holland" of the Americans are both said to have done marvellous work on their trials, but at the present their scope does not appear to be beyond a usefulness for harbour defence; however they seem to bid fair to compete with the "Nautilus" of extravagant fiction. When Jules Verne wrote his description of this boat, every one was taken with the strangeness of the idea. The author had merely collected together a number of old and new theories and clothed his conception in seemingly practical garb. Swift's account of the Island of Laputa, was based upon a curiously distorted theory of magnetism, sufficiently possible to make it interesting; and Buller Lytton's "Coming Race," in so far as Vril is concerned, turns upon a little more than the successful storage of electricity of high potential.

And now in conclusion let me add just a few words of tribute to our parent, the Royal Society of London, which has for the past 250 years, been an eye witness of the birth, rise, and progress of science; one which has at all times embraced within its membership the brightest scientific intellects of all nations, and one which recognises that "honour and fame from no condition rise." A society from which all other societies, special in their character have sprung, and it may well say unto itself, in the words of Tennyson, "For men may come, and men my go, but I go on for ever."

A vote of thanks to the retiring President for his address was moved by the Hon. A. Norton, M.L.C., seconded by the Hon. Dr. Taylor, M.L.C., and carried.

The Election of Officers for the year 1900, then took place with the following result:—*President*, John Thomson. M.B.; *Vice-President*, W. J. Byram; *Hon. Treasurer*, Hon. A. Norton, M.L.C.; *Hon. Secretary*, J. F. Bailey; *Hon. Librarian*, R. Illidge; *Members of Council*, F. M. Bailey, F.L.S., A. G. Jackson, C. J. Pound, F.R.M.S., J. Shirley, B.Sc., and J. W. Sutton; *Hon. Auditor*, A. J. Turner.

A vote of thanks was accorded to the retiring officers, after which the proceedings terminated.