130 times as much as the wire alone. Mr. C. J. P. Cave calculated that in Hampshire there was a weight of 85–90 lb. of ice on a single wire between adjacent posts. Under the strain, wires and posts gave way, blocking roads and disorganizing the telephone service. Trees were split or brought down by the weight of ice on their branches, and added to the confusion, while the frozen road and rail surfaces caused an almost complete breakdown of transport. The weather continued very cold, and it was some days before conditions approached normal; there was even a second, though less severe, glazed frost on the morning of February 3.

The difference of eleven years between 1929 and 1940 at once suggests the influence of the sunspot cycle, especially when it is remembered that February 1917 also produced a severe frost, while that of 1895 came 22–23 years earlier. All these occurred about one year after a sunspot maximum. There was, however, no similar frost in 1906 or 1907 and the eleven-year recurrence is completely absent before 1895, so that the succession 1917–1929–1940 must be regarded as most probably a coincidence. D. Brunt, in his study "Periodicities in European Weather" (*Phil. Trans. Roy. Soc., Lond.*, A, 225, 247–302), finds no trace of a periodicity of eleven years in the temperatures of London, Stockholm, Paris or Vienna. The cycle of eleven years is the largest periodic element in the temperature of Edinburgh, and shows a minimum about 1938–39; but the double sunspot cycle of 22–23 years is almost equally prominent and is now near its maximum. For London this 22–23 year cycle is the largest component and is likewise near its maximum. In any event the amplitude of these periodic terms is small in comparison with the departures from normal temperature during a severe winter.

The other well-known cycle, Brückner's of thirty-five years, also fails to appear in Brunt's tables for London and Edinburgh, though he found it at Paris and Berlin. It happens that the interval between the last two great frosts, 1895 and 1929, was thirty-four years, but the Brückner cycle is of no help on this occasion, for the winter of 1904–5 was not particularly cold. Nor was 1840, in spite of the supposed grand cycle of a hundred years. Cycles are useless for forecasting severe winters.

On the other hand, although really severe winters may come at irregular intervals, they do present a considerable regularity in the course of events which constitutes them. The greatest intensity of cold rarely occurs until some time in January and quite frequently not until February, and in Great Britain it tends to come in waves of ten or fifteen days separated by brief intervals of milder weather. In a prolonged severe winter, central Europe is occupied by a persistent stream of very cold air coming from the east and north-east, with a temperature sometimes many degrees below 0° F., but over the Atlantic the normal south-westerly winds still prevail. For most of the time the cold winds succeed in crossing the North Sea or English Channel, though sometimes by devious routes, but now and again they give place to the mild south-westerlies. Even the brief passage over the North Sea warms the cold air appreciably, and temperatures in Britain do not fall so low as those on the Continent. Minimum temperatures are not yet available; but at 7h., temperatures only a degree or two above 0° F. were recorded at Copenhagen on January 17 and at Paris on January 23–25. Farther east much lower figures were recorded, down to − 26° F. at Dorpat on January 17. The whole period from about January 1 until January 25 appears to have been generally cold in Europe.

Another cold wave began about February 9, and on February 12, when Copenhagen recorded − 4° F. at 7h., the Baltic between Denmark and Sweden was firmly frozen and, according to reports in the Press, was crossed on foot for the first time in centuries.

OBITUARIES

Colonel R. E. B. Crompton, C.B., F.R.S.

WE deeply regret to record the death on February 15 at ninety-four years of age of Colonel R. E. B. Crompton. He was one of the greatest pioneers both in mechanical road traction and in electrical engineering.

Rookes Evelyn Bell Crompton was born at Sion Hill, Yorkshire, on May 31, 1845. In 1871, he married Elizabeth Gertrude, daughter of George Clarke of Tanfield House, Ripon, and had two sons and three daughters. He was educated at Harrow and served as a naval cadet in the Crimean War (medal and Sebastopol clasp); in the Rifle Brigade (1864–76); in South Africa, 1900 (despatches, Queen's medal with three clasps, C.B.). He was founder of Crompton and Co.; twice president of the Institution of Electrical Engineers; president of the Institution of Automobile Engineers; founder member of the Royal Automobile Club.

Colonel Crompton had a most varied and interesting life and career, and had numerous friends all over

the world. Luckily for us, in 1928 he wrote a volume of "Reminiscences" which he dedicated to his wife; "during almost sixty years my courageous fellow-worker and devoted companion". She died on November 27 last, to the great grief of her husband. They had nearly reached the seventieth anniversary of their wedding day.

The Hon. Sir Arthur Stanley, treasurer of St. Thomas's Hospital, London, in an introduction he wrote to Crompton's "Reminiscences", says: "to write the preface to an autobiography is never a very easy task, but when it is the self-told life story of a man of 83, every minute of which has been made to do the work of two, the task becomes well-nigh impossible". One who remembered Lord Alvanley, the celebrated wit, and could speak of the Great Exhibition in Hyde Park as if it were a thing of yesterday, who was a cadet in the Royal Navy at the age of eleven; who, at that early age, went out and received the Crimean War Medal and Sebastopol clasp before reaching the age of twelve, was undoubtedly making a remarkable beginning to a wonderful career.

Then comes a period which is similar to the ordinary life of a lively English boy. When Crompton returned to England he left the Navy, and towards the end of 1856 was sent to school at Elstree to prepare for Harrow. He left Harrow in 1860 and entered the Rifle Brigade three years later. He went to India in the following year, and after serving for a time with his regiment was seconded for special service as superintendent of the Government Steam Train Department. In 1865, when the summer was exceptionally hot, he caught a particularly noxious form of malaria, which troubled him intermittently for many years. He was sent by his doctors to the Murree Hills to convalesce, and made friends with several great sportsmen.

Shortly after this, Crompton received a staff appointment at the Umballa Durbar, and got into touch with several influential men at headquarters. He was invited by the commander-in-chief to the aides-de-camp quarters at Simla, and he was successful in interesting them in his project of substituting mechanical transport for the bullock trains which at that time were generally employed for army purposes. He was appointed an extra aide-de-camp to the commander-in-chief, and in this capacity was often asked to accompany Lord Mayo, the Viceroy, on his rides. His own road engine (the *Blue Bell*), which he had practically completed before he left for India and which travelled at an average speed of four miles per hour, had been left in the hands of R. W. Thomson of Edinburgh, to develop. Through the good services of the Director-General of the Post Office, who controlled the bullock train service in India, the first *Blue Bell* 6 h.p. road vehicle was ordered and Crompton received the official appointment as "Superintendent of the Government Steam Train", so as to take charge of the experiments. He was temporarily withdrawn from the army in order that this could be done. After many difficulties and adventures with the *Blue Bell* in India, his return to London was of an unusual kind, as the Franco-Prussian War was on and Paris was invested. Eventually the German military authorities gave them permission to proceed, provided they put on uniforms and wore their swords to show that they were officers.

At this time, mechanical road transport in England was limited to the agricultural traction engines, which were allowed, as a favour, to clank along the high roads at the speed of the man who walked in front with a red flag, and even at those low speeds their hauling capacity was very poor. Thomson, by his invention of rubber tyres of great cross-section which flattened themselves under the weight of the engine, at once doubled the hauling power and allowed his engines to be run at speeds up to ten miles an hour whenever the Red Flag Act permitted it.

From 1878 until 1882, Crompton carried on a business as an electrical manufacturer, confining himself to the manufacture of electrical arc plant. The firm sold and installed Gramme generators and Bürgin dynamo machines, for the latter of which it acquired the sole right of manufacture. These machines could supply from six to eight arc lamps in series, and so the firm could undertake the lighting of railway stations, goods yards, docks and other open places in which work has to be carried on at night; and for such purposes the firm found a ready market. An order to light St. Enoch Station, Glasgow, with arc lamps was obtained, and the interest taken in this work by Sir William Thomson (Lord Kelvin) cemented a friendship between them which was helpful to both.

Willans the engine-builder, about this time (1879–1880), was a frequent visitor at Crompton's house in Porchester Gardens. They were both interested in electrical development and were able to discuss together and help one another in their respective difficulties. They agreed that the generator sets of the future must consist of a high-speed engine coupled direct to a direct current dynamo. During 1879, Cromptons designed many portable sets of electric lighting plant. Combined with this set, the first Willans high-speed compound engine gave such remarkably economical results that it attracted great attention from the engineering world. About Christmas, 1879, Crompton lighted up his own house in Porchester Gardens. At first he used primary cells, but they were not a success, so he brought in one of his portable sets into the mews at the back of his house and gave special parties, using small arc lights fixed in his drawing-room and dining-room. This was probably the first instance of effective electric lighting in a private house, although there had previously been exhibitions of arc lighting at the Royal Institution and elsewhere.

Early in the year 1880, a messenger from Messrs. Mawson and Swan, the well-known chemists of Newcastle, to whom Crompton had supplied arc lighting plant, called on him to say that Mr. Swan urgently desired to see him. He went to Newcastle, where Swan took him to his laboratory and showed him twenty small incandescent lamps, which burned very

brightly and steadily, each having a carbon filament enclosed in a globe, exhausted to a very perfect vacuum, and claimed that he had solved the problem of electric light for internal illumination. Crompton agreed with him. Later in the same year (1881), the great German physicist Helmholtz lectured at University College, London, and for the illustration of his experimental work Crompton supplied him with one of his portable sets of generating plant. For the International Exposition of Electric Lighting held in Paris in the summer and autumn of 1881 in the Palais de l'Industrie, Cromptons sent over a fine exhibit, and were awarded the first gold medal ever given for electric lighting plant.

The great fire which in 1883 destroyed the Ring Theatre of Vienna with great loss of life so impressed on the Emperor Francis Joseph the dangers of gas that he asked the Imperial and Continental Gas Company, which then supplied gas for the lighting of Vienna, whether it could not arrange for the lighting of the Opera House and the other Imperial theatres by electricity as being a safer and better illuminant. The Gas Company, advised by Prof. Monnier of the École Centrale in Paris, suggested that Crompton should be called in for consultation, and so in June 1885 he went with Prof. Monnier to Vienna and spent some weeks in considering the Emperor's question. At this time a small central station had been started in Berlin in the Friedrichstrasse. In London, the original Edison Company had done the same at a point near the Holborn Viaduct, and the Grosvenor Gallery scheme was in its initial stage. At this time the Swan Company had succeeded in turning out satisfactorily 100-volt lamps. At Vienna the company designed from its central station in the Schenkenstrasse 440-volt generators and laid twin conductors to carry this pressure up to the Opera House. Babcock and Wilcox boilers were some of those used. Part of the Vienna plant was delivered in the spring of 1886, and when more plant was required, Crompton went to Witcowitz in Moravia to give instructions for the boiler work.

The old Emperor Francis Joseph showed great interest in the electrical work when in progress, and very frequently came to watch the workmen, generally accompanied by his son, the Crown Prince. He paid Crompton the high compliment of saying that he wished his son Rudolph to be a good deal with them as a sort of pupil.

As soon as new scenic effects were made possible by electric lighting, Crompton had to spend a good deal of his time on the stage of the Grand Opera. This threw him into the society of Richter, who had already made his name as the great conductor of opera in London and was then endeavouring to reconcile old-time opera with the Wagnerism that was then just commencing. At that time there were two directors of the Grand Opera, Richter, who stood rather for the old school, and Jahn, who was all for Wagner and the Wagner school. They used to have great arguments and ask Crompton for his opinion on musical points. Crompton disclaimed all pretence of being an authority on music, although his mother had known Mendelssohn well at the time of his apogee and was acquainted with very many of the musical world at that time.

In 1896, Dr. John Hopkinson, who had succeeded Colonel Crompton as president of the Institution of Electrical Engineers, discussed the possibility of forming a corps of electrical engineers. This was accepted by the War Office, and Hopkinson took command with the rank of major in the Royal Engineers, Crompton being the senior captain. Four or five men well known in the electrical profession, including Hopkinson's eldest son Bertie, also joined the corps as officers. After training at Alum Bay in the Isle of Wight, Dr. Hopkinson left the corps to join his family in Switzerland. But a few weeks later the sad news arrived that he and two members of his family had been killed when climbing on the Alps, and so the whole work of training and organization of the corps fell on Crompton's shoulders.

Throughout the years which followed his return from the Boer War until 1914, Crompton never ceased from his efforts to persuade the War Office to interest itself in the introduction of mechanical transport, not only for war material, but also for the haulage into position of guns of greater power than had been hitherto used.

In an epilogue to his book of reminiscences Crompton says, quoting from an address he delivered to the borough authorities of Chelmsford in 1900, at the time when that town received its first cheap electrical supply:

"England in future, instead of being spoilt by densely populated industrial centres, might be covered with cottages extending for miles over the present almost uninhabited rural districts, so that the population would be more evenly spread over the kingdom. The factory hands, instead of having to work under the shafting in factories, should be able by the electrical transmission of power to carry on industrial pursuits in their own cottage homes. That is the future which lies before electrical engineers if they have the pluck and energy to force their views upon the public to a sufficient extent. The thing has been done in Switzerland, in Sweden and elsewhere on the Continent, and if I can live to see it accomplished in our own country, I shall be proud to have contributed in some degree to the solution of all the greatest problems of distribution."

ALEXANDER RUSSELL.

Prof. Ludwig Hopf

THE death of Prof. Ludwig Hopf occurred on December 21 at Dublin, only a few months after he had been appointed lecturer in applied mathematics at Trinity College, Dublin. Dr. Hopf went as a refugee to Cambridge in April 1939, after having lost his position as professor of applied mathematics at the Technische Hochschule, Aachen, on racial grounds soon after the Nazis came into power. He had been on the staff of the Hochschule since 1914 and had become one of its most popular teachers.