rapidly to a maximum (the gust), then falls off slowly to a minimum (the lull), and superposed on this general change there are many smaller irregular oscillations". Moreover, "the main gust and lull do not affect the direction greatly; in fact, the changes in direction produced by the rapid irregularities are as large if not larger than the changes produced by the main gust and lull". Of these two types of disturbance, the first-mentioned varies in magnitude according to the gradient of temperature in the vertical direction, and tends to vanish under conditions of extreme stability. This large scale type of disturbance Durst associates with convectional eddying in cells of a depth of perhaps 1500 feet, of length in the direction of the wind of the order of 3000-8000 feet, and of a width of perhaps 600-2000 feet. The small scale disturbances he considers to be of frictional origin, eddies set up by contact of the air stream with the surface of the earth; the diameters of these frictional eddies are of the order of 50-100 feet, and the axes may be oriented in all directions.

In Part V., A. F. Crossley takes up the discussion of the effect of the present theory of eddies on the variation of wind with height, and finds that simple equations of motion can be applied to the atmosphere only above a height of 1500 feet if superadiabatic conditions are present in the surface layer, and above about 50 feet when there is an inversion. A. H. R. G.

Sadi Carnot, 1796–1832

ON Aug. 24, 1832, a hundred years ago, Sadi Carnot, the author of the famous memoir "Réflexions sur la puissance motrice du feu et sur les machines propres à développer cette puissance", died in Paris at the early age of thirty-six years. For some weeks previously he had been very ill with fever, and was only just beginning to recover when he fell a victim to the cholera epidemic which claimed some 18,000 persons in Paris alone.

Little notice was taken of Carnot's death, and no one realised that he had made a contribution to science which was destined to render his name immortal. His essay had been printed in 1824 by the minor Parisian publisher Bachelier, and had it not been for the comments on the views of Carnot by his countryman, Clapeyron (1799–1864), the engineer, who in 1834 wrote a paper entitled "Sur la théorie méchanique de la chaleur" for the journal of the École Polytechnique, it might well have been lost sight of altogether. It was Clapeyron's essay which attracted the attention of Kelvin when studying in Regnault's laboratory in 1845, and it was Kelvin who first mastered the principle enunciated by Carnot; as he was also the first to realise the merits of the work of Joule.

Carnot's essay was reprinted in 1871 in the *Annales scientifiques de l'École Normale supérieure*, and in 1878 it was again reprinted by the publishers Messrs. Gauthiers-Villars, together with a letter from Carnot's brother Hippolyte (1801–88) to the Paris Academy of Sciences, dated Nov. 30, 1878, a biographical sketch and extracts from Carnot's manuscripts. The centenary of the publication of the essay was celebrated at the P.N. Russell School of Engineering, University of Sydney, on Oct. 23, 1924; and again on Jan. 20, 1926, at a special meeting of the Société des Ingénieurs Civils de France, which was attended by the President of the Republic and many officials, savants, and engineers.

Except for two incidents, the life of Carnot was uneventful. He was born in Luxemburg on June 1, 1796; but before he had reached manhood, Napoleon had been overthrown, and a career which might otherwise have been spent on the battlefield was passed in the barracks and the study. He was taught mathematics by his father, and attended the Lycée Charlemagne; in 1812 gained admission to the École Polytechnique, and in October 1814 passed into the Corps of Engineers at Metz. Earlier that year he had, with his fellow students, served in a battalion formed for the defence of Paris, but he saw nothing of active service. For five years he was employed on routine work in various towns; in 1819 he entered the staff corps in Paris, in 1827 was made a captain of engineers, and the following year retired from the army.

A born student, Carnot when in Paris followed courses at the Collège de France, the Sorbonne, and the Conservatoire des Arts et Métiers, his scientific studies being interwoven with others on music, the arts, literature, and political economy. He made himself familiar with mechanical engineering and various industries, and it was the absence of any exact theory of the steam-engines of Newcomen, Watt, Smeaton, and Trevithick which led him to the study of heat and to writing his "Réflexions". Towards the end of his life he joined the Association polytechnique started by old students of the École Polytechnique for popularising knowledge, and had he lived longer he would no doubt have taken a prominent part in its proceedings.

Carnot came of a celebrated family of Burgundy, his father being Lazare Nicolas Marguerite Carnot (1753–1823), the mathematician and engineer who earned for himself the title of "the organiser of victory". Nicolas Leonard Sadi Carnot was his second son; an older one who had also been given the name of Sadi, after a thirteenth century Persian poet, died in infancy. Hippolyte was the third son, while his son was Marie Francois Sadi Carnot, who became President of the French Republic and was assassinated at Lyons on June 24, 1894.

Of the character of Sadi Carnot, his brother gives a pleasing sketch. Energetic, courageous, with few prejudices and many amiable qualities, Carnot left behind him manuscripts which not only contain

his ideas on heat, gases, vapours, and such matters, but also his thoughts on conduct and life. Thus he writes, on various occasions:

"Régler le matin l'emploi de sa journée et réfléchir le soir à ce qu'on a fait."

"La promptitude des résolutions s'accorde le plus souvent avec leur justesse."

"Parler peu de ce qu'on sait et point du tout de ce qu'on ne sait pas."

"La vie est un passage assez court. Je suis à la moitié du chemin. J'achèverai le reste comme je pourrai."

"Les lois de la guerre, dit-on; comme si la guerre n'était pas la destruction de toutes les lois."

Carnot had had an uncle, a magistrate who, stricken with apoplexy in court, had exclaimed, "Vous allez voir comment on passe courageusement de la vie à la mort". It was in that spirit that Carnot had faced the long illness which led to his own death.

Obituary

MR. GEORGE BARROW

MR. GEORGE BARROW, who died at his home in London on July 23, at the age of seventy-eight years, was a well-known geologist, who served for thirty-nine years on the Geological Survey of Great Britain. His earliest work was carried on in the north of England, especially in north Yorkshire. Afterwards he was transferred to Scotland, where he spent many years in surveying the southern Highlands, especially Aberdeenshire, Kincardineshire, and Forfarshire. This work brought him into prominence and placed him in the first rank of British authorities on metamorphic rocks and the tectonics of ancient crystalline provinces.

In 1900, Barrow returned to England and was entrusted with the mapping of parts of Cornwall and Devon, including Bodmin Moor and the southern flanks of Dartmoor. On his promotion to District Geologist in 1909, Barrow took charge of work in the London district, and interested himself greatly in economic geological problems, such as water supply and underground railways. He retired from the Geological Survey in 1915, and thereafter devoted his energies, to a considerable extent, to the local administration of the district in which he lived.

In his official work, Barrow was responsible for contributions to a large number of maps and memoirs published by the Geological Survey. Of these we may mention Cheadle (1903), Whitby (1882), Braemar (1912), Blair Atholl (1905), Scilly Isles (1906), Tavistock (1911), Bodmin (1909), Dartmoor (1912). This list might be considerably extended, but is sufficient to indicate the variety of his work. He was an active member of the Geological Society, the Mineralogical Society, and the Geologists' Association, served on their councils, and published papers in their transactions. In 1912 he received the Bolitho Gold Medal from the Royal Geological Society of Cornwall, and in 1913 the Murchison Medal from the Geological Society of London.

Barrow was a remarkably original field geologist, with a very acute eye for surface features and their relations to geological structure and history. His work on the high-level platforms of the west of England and the Pliocene features of the country around London is a good example of this. He was exceedingly painstaking and thorough, and was one of the first in Britain to perceive the importance of microscopic investigation of the older crystalline rocks. Working under the influence and tuition of Allan Dick, he applied these methods to Scottish Highland problems and obtained results of great value. In this he was really a pioneer. He was endowed with constructive imagination and a wonderful intuition, which led him often to arrive at conclusions very rapidly and in a manner which even his colleagues had some difficulty in understanding. Yet often these hypotheses, which seemed at first mere guesses, turned out to be sound. Consequently he had a very stimulating personality, and his conversation on geological topics was very inspiring, especially to younger men who had not his wide experience in the field. A genial companion and a generous opponent, he knew how to enjoy life, and retained his wide outlook, his courage, and his enthusiasm to the end of his days.

J. S. F.

MR. R. STAPLES-BROWNE, M.B.E.

RICHARD STAPLES-BROWNE, of Butler's Court, Alvescot, Oxfordshire, who died on June 5, was born in 1881, and from Rugby School went up to Emmanuel College, Cambridge, taking his degree by the Natural Sciences Tripos of 1902. He then commenced the medical courses, but the endocrine trouble which afflicted him throughout life called for a voyage round the world before he passed his second M.B. examination in 1906. About this time he came under the influence of William Bateson and relinquished medical study for biology, always his chief interest.

Staples-Browne's experimental work on inheritance in pigeons is among the best pioneer studies engendered by the rediscovery of Mendel's papers; he showed that Darwin's inquiry into the origin of the domesticated races of pigeons was unnecessarily complicated, and that his results are capable of simple explanation on Mendelian lines. Sex-linked heredity in doves was demonstrated by Staples-Browne just after this important condition had been discovered in poultry, and he may be said to have laid the foundation of our genetical knowledge of pigeons. During the War he joined up with the Medical Corps of the New Zealand Expeditionary Force, and, with the rank of captain, he did four years' service in its clerical and statistical branches in England, for which he was awarded the M.B.E.