warping the wings, a freely connected cross-warp tending to eliminate the effect of dihedral angle. If for the time being we neglect the complication introduced by the warping mechanism, the system reduces to one of the cases considered by Messrs. Harper and Bryan, who state that, "for stability, the distance of the tail fin behind the centre of gravity must not be less than a certain inferior limit." The condition is closely connected with the covering of the tail girder, as the covering means that the equivalent fin is brought nearer to the centre of gravity of the machine.

The only representative at the exhibition of another method of obtaining lateral stability is the Handley Page monoplane. In common with other well-known machines, such as the Dunne and Etrich, the Handley Page monoplane has wings of special shape and disposition arranged so as to give righting couples to the machine when rolling or turning occurs. The experimental information available is not yet sufficiently advanced to show that this system of specially shaped wings is either better or worse than the more usual one previously referred to, which depends on wings of a simpler form.

Perhaps the best indication of the position of the subject of lateral stability is to be found in the fact that the whole of the warp and rudder is left to the personality of the pilot, and that both are powerful controls. As the periods of the oscillations are comparatively long, it is quite within the bounds of possibility that a pilot would be able to keep his balance without the aid of inherent stability devices. If, however, the treatment of longitudinal stability is any indication of the trend of construction, then in the near future we may expect considerable attention to be paid to the problems of lateral stability, and that the final solution will not be inconsistent with the principles of stability deduced from mathematical investigations of the stability of small oscillations.

THE SCIENTIFIC WORK OF THE LOCAL GOVERNMENT BOARD.[1]

IN the introduction to the report before us Dr. Newsholme surveys the public health of England and Wales during 1911, and reviews the work of the medical department of the Board for the year ending March 31, 1912. The variations in mortality from various diseases since 1901 are illustrated by charts, as in the previous report. The percentage increase of population for 1901–11 remains the same (12·4) as in the preceding decade, but this is due to a fall in the death-rate by 3·0 per cent., which just counterbalances the decline in the birth-rate. The deaths from scarlet fever continued to decline during 1911, those from diphtheria and enteric fever increased slightly, but those from diarrhœal diseases showed a considerable increase over previous years, due to the abnormally hot season; even so, however, there was less diarrhœa, still less infant mortality, in 1911 than in 1899.

The previously plague-infected district in East Anglia has been kept under observation, and during July–October, 1911, 15,332 rats were examined, and twenty-seven farms or other premises were found to harbour plague-infected rodents.

Of the auxiliary scientific investigations carried out for the board, the first is a report on arterial degeneration by Dr. Andrewes. Dr. Newsholme points out in his introductory remarks that while there has been a great reduction in the general death-rate during the past thirty or forty years, this reduction only affects ages up to forty-five years, while higher ages participate in it little or not at all. In fact, for males between fifty-five and seventy-five, the death-rate actually tends to be going up. Inasmuch as one-third of the total deaths for the age period fifty-five to sixty-five is caused by diseases of the heart and blood-vessels, a knowledge of the causation of arterial degeneration is of importance. Dr. Andrewes's report is of a preliminary nature; he considers that the use of tobacco appears at most an adjuvant cause, while the influence of alcohol cannot be satisfactorily demonstrated.

Studies on the frequency of non-lactose fermenting and non-liquefying aërobic bacilli in young children have been continued at Birmingham by Dr. Lewis, and at Liverpool by Dr. Alexander, and Dr. Graham-Smith has investigated the incidence of the same organisms in flies. Prof. Nuttall and Messrs. Strickland and Merriman record observations on the species and number of fleas on British rats.

Prof. Hewlett and Dr. Nankivell have investigated the influence of the Porter-Clark water-softening process on the bacterial content of water treated by it, and find that considerable purification is effected thereby.

Dr. Blaxall finds that 0·1 per cent. of oil of cloves is a valuable aid in the preparation of glycerinated calf lymph free from micro-organisms.

Altogether this volume contains matter of much scientific value and importance. R. T. H.

[1] Forty-first Annual Report of the Local Government Board, 1911–12. Supplement containing the Report of the Medical Officer for 1911–12.

THE MOUNTAINS AND THEIR ROOTS.[1]

(1) IT would be difficult to conceive a greater divergence in character and scope between two books, nominally dealing with cognate subjects, than between the two first-named on our list. Prof. Bonney, in his metaphorical use of the word "building," follows popular usage, for how

[1] (1) "The Building of the Alps." By Prof. T. G. Bonney, F.R.S. Pp. 384. (London: T. Fisher Unwin, 1912.) Price 12*s.* 6*d.* net.
(2) Survey of India. Professional Paper No. 12: "On the Origin of the Himalaya Mountains: a Consideration of the Geodetic Evidence." By Colonel S. G. Burrard, F.R.S. Pp. ii+26. (Calcutta, 1912.)
(3) Survey of India. Professional Paper No. 13. "Investigation of the Theory of Isostasy in India." By Major H. L. Crosthwait, R.E. Pp. iii+14. (Dehra Dun, 1912.)

many, when speaking of a building, whether it be cottage or cathedral, ever think of anything but the superstructure, the material or methods of construction, the outward form, or the internal plan? And so Prof. Bonney deals with the Alps. Commencing with the materials of which they are made, he goes on to deal with the processes by which they were raised, and the carving of their outward form by rain, rivers, and glaciers, winding up with the vegetation that clothes their surface, the animals that wander over them, and the humanity which frequents them, whether as permanent inhabitants or temporary visitors. Attractively got up and pleasantly written, it gives Prof. Bonney's views on all these subjects—views which, as he mentions in the preface, are by no means universally accepted, but which, we may add, are none the less deserving of respectful attention—and will prove of interest not merely to the geologist, but to every intelligent and observant traveller in the Alps.

(2) Col. Burrard's memoir is of an entirely different character from Prof. Bonney's book. Addressed to the adept, it makes no appeal to the tyro, and, leaving on one side all consideration of the superstructure, deals only with what may be called the foundations of the Himalayas. Geodesists have long known that the attraction exercised by mountains on the plumb-line is much less than that which should result from their visible masses, and the explanation, first suggested by the late Sir G. Airy, has of late years crystallised itself in the hypothesis of isostasy, according to which the mountains are supported by a species of flotation, the excess of material in the protuberance above sea-level being compensated by a defect of density below.

The most complete and best-known investigation of this hypothesis is that of Mr. J. F. Hayford, of the United States Coast and Geodetic Survey who has dealt with it, in the light of American geodetic observations, in an elaborate manner. The form of the hypothesis adopted by him was that the compensation extended to a uniform depth, and was effected by variation of the density of the earth's crust, so that the total downward pressure of a column of rock under the mountains should be the same as that of the lesser thickness under the ocean depths. Assuming this as the method of compensation, he found that the residual differences between the observed and the calculated deflection became least if the depth to which the compensation extended was taken at about 113·7 kilometres, and with that assumption the residuals became so small that the hypothesis might be accepted as extremely probable. This is not, however, a necessary conclusion, for an erroneous hypothesis may be in accord with a limited number of observations, but fail when these are extended; and the result of the application of Mr. Hayford's explanation to the Indian observations shows that it is inapplicable to that country.

(3) The facts on which this conclusion is based are interesting, and are given in detail by Major Crosthwait. At stations within the Himalayas the plumb-line is deflected by about 30″ to 40″ to the north, along the foot of the hills this has sunk to some 15″ or thereabouts, and at distances of more than forty miles it disappears or is replaced by a small southerly deflection. There is, consequently, a rapid variation in the amount of the observed deflection as we cross the limits of the mountain range, and this change is about double as great as it should be on Mr. Hayford's hypothesis.

The only other explanation investigated by Col. Burrard is that of foredeep, filled with sediment, and according to his calculations this hypothesis gives results which depart even further from observation than Mr. Hayford's. Col. Burrard offers an explanation of his own—that there is a rift in the subcrust along the foot of the mountains, the gradual opening of which gave rise to the compression of the Himalayas, and which became filled with the alluvium of the Gangetic plains as it was formed. Unfortunately he confesses that he is not geologist enough to elaborate this hypothesis, and it is difficult to see how it can be brought into accord with what is known of the geology of the Himalayas and of the country to the south of them, nor how it differs from Prof. Suess's foredeep.

Moreover, Col. Burrard appears to have overlooked an important paper, published by Rev. O. Fisher in *The Philosophical Magazine* of 1904, in which he investigates the effect of the Himalayas on the plumb-line in the light of an hypothesis of isostasy radically different from Mr. Hayford's. According to this the crust is of uniform density, the isostatic compensation being obtained by a variation in thickness, and on this hypothesis he finds that the attraction of the visible range, combined with the negative attraction of the downward protuberance, should give a northerly deflection of about 24″ at the foot of the hills, of 2″ at sixty miles away, and a southerly deflection of about 2″ at the farther edge of the plains. These results appear to be in very fair accord with observations in the region of the great Gangetic plain of upper India, where the conditions resemble those postulated in the calculations; beyond this region, in the Punjab and in Bengal, the variations are greater than in the central area, but there the conditions are complicated by the fact that geology suggests, and gravitation measurements indicate, the presence of denser rock at a small depth below the alluvium.

It must be acknowledged that Mr. Fisher's investigations do not give a complete explanation of all the variations observed, but this is inevitable in the case of any hypothesis which assumes—as must be done for purposes of calculation—that the crust and the underlying material have everywhere the same density. All that can be said is that it seems to be more closely in accord with the Indian observations than Mr. Hayford's, and it is to be hoped that Col. Burrard will be able

to complete his investigations by a study in detail of the relation between the effects which should be observed, according to it, and the actual results of observation.

SIR WILLIAM ARROL.

SIR WILLIAM ARROL, the famous bridge-builder, born in 1839 at Houston, Renfrewshire, died on February 20 at his residence, Seafield House, Ayr. His great mechanical abilities and his remarkable administrative powers—two qualities not often found associated—enabled him in the space of little more than forty years, for he started on his own account only in 1869, to expand a humble little boiler-repairing shop into the great Dalmarnock works employing some 5000 hands.

Sir William Arrol was fortunate in finding a suitable field of work for the mental gifts with which he was so richly endowed. From the first his attention had been directed to the many novel problems, hitherto unsolved, which must be overcome if the building of long-span steel bridges was to be rendered commercially possible. It is with the great steel cantilever bridge over the Firth of Forth that his name will be for ever linked. Designed by Sir John Fowler and Sir Benjamin Baker, the hazardous and difficult task of its erection was entrusted to the firm of W. Arrol and Co. Splendid as was the design, perfect as were the working drawings down to the minutest details, when they left the hands of the two designers, it is not too much to say that it was the mechanical genius of William Arrol which made the erection of the bridge a possibility within the limits of time and cost which had been laid down by the engineers. The lengths of the spans and the height of the piers were far beyond anything previously attempted, and as a result the difficulties which had to be overcome would have daunted most men; they only served to show more clearly the extraordinary gifts he possessed. It was in this task that his mechanical genius found its best outlet. During the whole of the seven years that the work was in progress he was constantly busy, scheming new devices such as improved hydraulic riveting appliances, oil-fired rivet-heaters, complex and ingenious machines for the troublesome task of drilling the plates which went to build up the huge steel compression members, and, most important of all, no detail, however insignificant, escaped his watchful supervision and control.

He received his knighthood on the completion of the bridge in 1890, and never was this honour bestowed on one who had more worthily earned it; he had revolutionised the art of bridge-building and made it a science. The Tay Bridge, the Tower Bridge, and many other great structures will bear testimony to the fact that Sir William Arrol was, as a mechanical engineer, fully entitled to a place in that little band of men whose achievements in the field of engineering shed lustre over the last half of the nineteenth century.

NOTES.

BAD news is to hand from the Australian Antarctic expedition, under the leadership of Dr. Mawson, for two members of it have lost their lives. These are Lieut. Ninnis, an Englishman, and Dr. Mertz, a Swiss member of the scientific staff. The manner of their death is not stated, and, indeed, the whole message, which has reached Australia from the wireless telegraphic station established by the expedition at Macquarie Island, leaves us anxious for further information. It may be recalled that the expedition, reaching the Antarctic region in February of last year, was divided into two parties, under Dr. Mawson and Mr. Wild respectively, which landed about 143° E. and 95° E., in Adélie Land and Kaiser Wilhelm Land. It is known that valuable scientific work has been done, and that a considerable extent of coast-line has been charted for the first time. The vessel of the expedition, the *Aurora*, returned to Australia after landing the parties, and made a second voyage to the south to bring them off. It was thought that Dr. Mawson was aboard her, but apparently he missed her, owing to "unfortunate circumstances," which are not specified, and will have to remain in the south for another year, with six of his staff. For the rest, after mentioning the unhappy loss above referred to, he merely adds that there has been a successful sledging season, "opening up a large area of new land, both east and west of Commonwealth Bay, and obtaining important data at a number of stations in close proximity to the magnetic pole." But in view of what has befallen, anxiety must remain for many months as to the welfare of this party.

IT is officially announced that in recognition of the Antarctic work of her husband, the King has been pleased to grant to Mrs. Kathleen Scott the same rank, style, and precedence as if Capt. Scott had been nominated a Knight Commander of the Bath, as he would have been had he survived.

AN interesting exhibition of works by the late Mr. Thomas Woolner, R.A., is open at his studios, 29 Welbeck Street, W., until March 8. The exhibits include a number of objects of interest to men of science, among them being plaster busts of Charles Darwin, Huxley, and Richard Quain, bronze medallions of Darwin and Sir Joseph Hooker, a colossal head, in plaster, of Capt. Cook, and a bronze medal representing science and research. Any works not disposed of during the exhibition will be sold in the studio by auction, on a date to be announced later.

WE learn from *The Lancet* that, on the suggestion of the High Commissioner for Cyprus, the Secretary of State for the Colonies has arranged that a visit shall be paid to the island, during March, by Sir Ronald Ross, K.C.B., F.R.S.. The object of the visit is to investigate the causes of the prevalence of malarial fever in the island, and to advise in regard to the best means of combating the disease.

THE President of the Board of Agriculture and Fisheries has appointed Mr. D. H. Lane and Mr. Stephen Reynolds to be members of the Departmental