

is shown that the periodicity of the oscillation is given by the equation

$$\tan(\alpha \cdot T_d) = 1/2m(\alpha_r/\alpha - \alpha/\alpha_r),$$

where  $2\pi/\alpha$  is the period of the oscillations produced,  $2\pi/\alpha_r$  is the natural period of the governor, and  $m$  is the

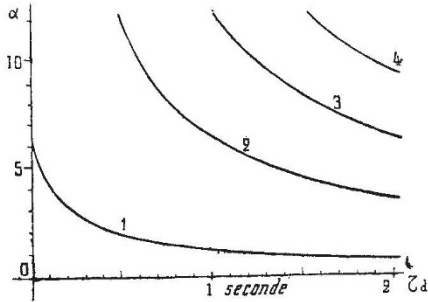


FIG. 1.

ratio of the actual damping of the governor to the smallest value of the same coefficient which makes the governor dead beat.

This equation of  $\alpha$  in terms of  $T_d$  represents a series of curves, some of which give rise to negative values. The positive values corresponding to  $m=1$  and  $\alpha_r=6.32$  are

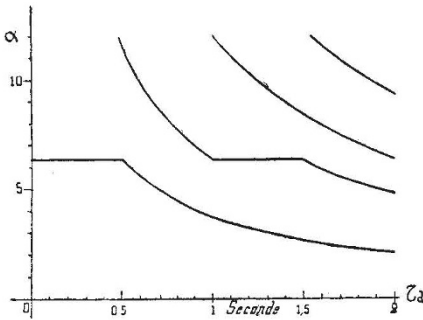


FIG. 2.

shown in Fig. 1. Of these curves, only the lowest one represents oscillations which are not evanescent.

For this case the conclusion is reached that for satisfactory running the percentage variation of speed  $K$  must not be too small, and the fly-wheel effect must be designed in proportion to the time lag of the governor.

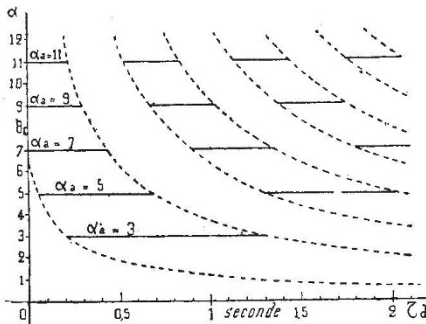


FIG. 3.

Passing to the case where two sets are working in parallel, the equation giving the frequency of the oscillations is similar to the above, provided the damping in the generators is small. In this case, however, the curves which give positive values of  $\alpha$  are quite different, being as shown in Fig. 2. The straight line portions correspond

to  $\alpha = \alpha_a$ , where  $2\pi/\alpha_a$  is the natural period of the alternator.

Now the rate of subsidence of any oscillation contains a term  $(1 - \alpha/\alpha_a)$ , and it is consequently clear that it would be unsafe to allow any value of  $T_d$  between 0 and 0.5, or between 1 and 1.5, as shown in the figure. If, however, the damping of the governor is much greater than the critical dead-beat value, satisfactory working may be possible.

A point of great interest is brought out in this connection, viz. the influence of the fly-wheel effect. The straight portions of the curves in Fig. 2 depend upon the natural period of the alternator, which in turn depends upon the fly-wheel. The heavier the fly-wheel the less the value of  $\alpha_a$ , and consequently the longer the straight portion of the curve as shown in Fig. 3. In other words, the greater the fly-wheel effect the greater will be the range of  $T_d$  for which satisfactory working is difficult. From this it would appear that it is quite possible to provide too heavy a fly-wheel.

The article concludes with a brief reference to the various methods of compounding alternators.

GEOLOGICAL NOTES.

IN the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* (1905, p. 412) Prof. Dr. A. Phillipson, of Bern, outlines his recent journey of 10,000 kilometres through the west of Asia Minor, including Brussa, near the Sea of Marmora, and Makri, on its Mediterranean inlet in the south. The preliminary results indicate the existence of a "Lydian mass" of granite, gneiss, and crystalline schists, which forms on the whole a hummocky country, flattening itself out where the lower course of the Mæander cuts into it. The inhabitants are mostly clustered along the included basins of Neogene deposits. A zone of metamorphic limestones and less altered phyllites lies outside this mass, following the strike of the bow-shaped crystalline core; and the discovery of a new species of *Fusulina* (p. 417) places part of this outer zone as Permo-Carboniferous. To the south and south-east, the Cainozoic earth-movements have brought up folded limestones of the Cretaceous and Eocene type of Greece and Rhodes. The complete results of the journey will not be worked out for several years.

Dr. G. Steinmann continues, in the *Berichte der naturforschenden Gesellschaft zu Freiburg-im-Breisgau* for September, 1905, his "Geologische Beobachtungen in den Alpen." The question of Klippen-structure and overfolding in the classical Alps of Glarus leads on to a comparison with the eastern Alps. The author gives a valuable exposition of Schardt's views, which were published in 1893, and which led to the conception of the breaking up of an overthrust limestone mass into blocks or "Klippen," which lie discordantly among later sediments. Without going so far as Termier (p. 32), Dr. Steinmann sees in this striking theory of overfolding the true explanation of the phenomena of the Bündnerschiefer and the limestone zone, and he appeals to workers in the eastern Alps to consider Schardt's views at least in the light of a scientific possibility. The last part of the present paper includes a bold but reasonable speculation as to the connection between deep-sea radiolarian deposits and diabasic igneous rocks. It is suggested, for the Alpine, Scotch, and other instances, that these basic igneous masses accumulated under the ocean-floors, just as more highly silicated rocks are believed to gather under continents. Consequently, a deep-sea epoch, followed by one of compression and overthrusting, would lead to a squeezing out of "ophiolitic" igneous rocks somewhere along the zone of the radiolarian cherts.

The activity of geological research in the African colonies is evidenced by a recent part of the *Transactions of the Geological Society of South Africa*, published in Johannesburg in September, 1905. Mr. A. L. Hall describes (p. 47) the mode of occurrence of the tin-ore in the picturesque Bushveld area forty miles north-east of Pretoria. The ore was first noticed in the local granite as recently as 1904, and the field was described by H. Merensky in that year. Its exploitation at once followed, and Mr.



Hall has been able to examine the rocks traversed by the new shafts and drives. The field was extended, while his paper was in preparation, by a further discovery on the farm Vlaklaagte. In this case there is evidence of the deposition of the cassiterite in good crystals, of the size of coarse shot, throughout a granitoid rock, which is of later age than the surrounding red granite. Minerals containing fluorine, topaz being among them, are already known in the Bushveld igneous series, and hence there is reason to believe that the tin-ore may have been developed on Enkeldorn and Vlaklaagte in the manner recognised in the "classical stanniferous localities."

Mr. H. Kynaston appropriately describes (*ibid.*, p. 61) rocks allied to greisen, from a point much further north, in the Olifants River Valley. He also adds to our knowledge of the norites and schists associated with the Bushveld granite, perhaps as marginal phenomena. Dr. Molengraaff, whom we regard almost as a veteran in these years of rapid exploration, and as the founder of much of our knowledge of the Transvaal, further supports his view (*ibid.*, p. 63) that the Pretoria series may be correlated with the jasper beds of Griqualand West. He now describes Mr. Leslie's discovery of crocidolite in the ferruginous quartzites of the Pretoria series in the Lydenburg district. These beds overlie the well known dolomite, which thus may be paralleled with the Campbell Rand dolomite of the south. Dr. Molengraaff's account of contact-altered rocks in the Pretoria series should fit in with Mr. Kynaston's observations further north; and the conferences of the Geological Society of South Africa will doubtless show how much of the extensive alteration is due to the granite and felsite series, and how much to the sheets of norite. The present tendency, however, seems to be towards the linking of these two types of intrusive rock in a continuous series.

Mr. Thord-Gray (*ibid.*, p. 66) describes in some detail the occurrences of gold in the Pretoria series round Pilgrim's Rest (Lydenburg gold-field), and concludes in favour of the view that a mineral infiltration, carrying both gold and copper, took place along certain zones of the conformably bedded series. The horizontal "reefs" may thus be described as altered quartzites.

The correlation of the members of the Transvaal system is again taken up by Prof. Schwarz, who attacks the problem in the north of Cape Colony, in Prieska. He has, quite independently, reached the same conclusions as Dr. Molengraaff, and, with certain cautious reservations, passes his comprehensive eye over similar beds in India and North America also. The extraordinary uniformity of deposits in South Africa across enormous areas certainly gives one a new faith in lithological stratigraphy; and it is on this ground that Prof. Schwarz wishes to bring together the two series of ferruginous jaspers in the southern part of the Transvaal, calling in a thrust-plane to his assistance. The general feeling will be, both in our islands and in the Transvaal, that detailed mapping will ultimately bring a just correlation in its train. But detailed geological mapping requires good topographic maps, and the limited resources of the colony seem just now, from a legislator's point of view, to have many prior claims upon them.

Mr. F. P. Mennell shares with the equally energetic Mr. A. J. C. Molyneux the task of elucidating the geological problems of Rhodesia, a region about as large as France, Germany, Austria-Hungary, and Italy put together. The gold problem is naturally the first thing to be investigated, and Mr. Mennell (*ibid.*, p. 82) seeks to correlate the Rhodesian "banket," which he shows to be a true conglomerate, with the gold-bearing series of the Rand at Johannesburg. "So far," however, "it is only at the Eldorado Mine, in the Lomagundi district, that gold has been proved to exist in payable quantities" in the banket of Rhodesia. As Prof. J. W. Gregory recently informed us, other deposits or vein-stuffs may have become known as banket, and it is certainly wise to restrict this term, of Transvaal origin, to the quartzose conglomerates, wherever they occur. In Rhodesia, Mr. Mennell has to deal with a metamorphosed series of sediments, including these conglomerates, and penetrated by ancient and now schistose basic rocks. The widely occurring granite is later than the basic intrusions, and has produced considerable contact-alteration in the entire series. The gold, in

accordance with the view now prevalent for the Rand deposits also, is regarded as a subsequent infiltration.

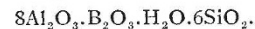
Part ii. of vol. xxxii. of the *Records of the Geological Survey of India* contains Mr. Hayden's "Preliminary Note on the Geology of Tibet," already noticed in this Journal (*NATURE*, vol. lxxii., p. 285), and Dr. T. H. Holland's paper on the occurrence of bauxite in India. The latter author directs further attention to the aluminous nature of the Indian laterites, and throws the whole field of these rocks open to the prospector. He points out (General Report of the Survey, *ibid.*, p. 142) that the red bauxites of Les Baux were first worked as iron-ores; and in his paper on bauxite the analyses of Indian samples are all from rocks previously known as laterites. A very interesting point is the high percentage of titanium dioxide revealed, and Dr. Holland supports Dr. R. S. Bayer in believing that some unfamiliar and possibly new substance becomes precipitated with the titanium in these cases. Dr. Holland regards bauxite as an intimate admixture of gibbsite,  $Al_2O_3 \cdot 3H_2O$ , and diasporite,  $Al_2O_3 \cdot H_2O$ .

Another Indian paper is by Mr. E. W. Wetherell, on the dyke rocks of Mysore (*Mysore Geological Department Memoirs*, vol. ii.), in which a large number of specimens are conscientiously described. The descriptions suffer, however, from the fact that the species of triclinic felspar are not determined. Nor are the misprints so few as the "corrigenda" might lead one to suppose. The drawings for the plates show exceptional care and delicacy.

Mr. G. H. Girty, of the U.S. Geological Survey (*Proc. Washington Acad. of Sciences*, vol. vii., June 20, 1905, p. 1), has instituted a comparison between the Carboniferous faunas of western America and those of Russia and other areas. The ultimate result tends to the increase of the Upper Carboniferous series in America at the expense of beds now classified as Permian. The polyzoan Archimedes, moreover, is shown to possess a far wider range than would be gathered from a consideration of the typical American deposits.

Messrs. Stanton and Hatcher, assisted by Mr. Knowlton, discuss the geology and palæontology of the Judith River beds, in northern and central Montana and the adjacent parts of Canada (Bulletin 257, U.S. Geol. Survey, 1905). The outcome of stratigraphical study, and the examination of the vertebrate and plant remains, show that these beds are no longer to be regarded as on the Laramie horizon, but are Senonian at the highest, and reach down to the Cenomanian.

The same survey (Bulletin 262) issues contributions to mineralogy, by several authors. The researches on which these careful papers are based arose in connection with the general work of the survey, and the results are here conveniently brought together. Messrs. Hillebrand and Ransome discuss the nature of carnotite (p. 18), which, "instead of being the pure uranyl-potassium vanadate, is to a large extent made up of barium and calcium compounds." From this "mixture of minerals" the true carnotite remains to be extracted and defined. Messrs. Lindgren and Hillebrand (p. 48) incidentally direct attention to the optical properties of chrysocolla, which, though noticed by Jannetaz, have been very generally overlooked. Mr. Schaller (p. 115) gives us a critical analysis of dumortierite, deducing thence the formula



The boron oxide was first indicated by R. B. Riggs in 1887. These are only a few of the matters that will attract mineralogists to these 147 pages.

The surface-features of the glaciated areas of North America have provided a wide field for description and for controversy. Mr. R. S. Tarr has sent us four papers, in which various problems are set forth. That on moraines of the Seneca and Cayuga lake valleys (*Bull. Geol. Soc. America*, vol. xvi., p. 215) is mainly descriptive. The drainage-features of central New York (*ibid.*, p. 229) involve questions of stream-capture, the lowering of water-partings, and the formation of new slopes by detrital deposits, such as delight the glacial expert. A geographical account of the gorges and waterfalls of central New York (*Bull. American Geographical Soc.*, April, 1905) is largely concerned with the relations of pre-Glacial and post-Glacial



valleys. Of still more general interest is the paper on some instances of moderate glacial erosion (*Journal of Geology*, vol. xiii., 1905, p. 160), with its examples of granite boulders lying in a sand derived from their own decay, and left undisturbed by the passage of an ice-sheet over them. The remarkable variations in the intensity of glacial erosion recorded by Dr. Ampferer from the valley of the Inn (*NATURE*, vol. lxxi., p. 236) might be cited in support of the author's observations.

The sixth volume of *Spelunca* is to be devoted to a review and bibliography, by M. E. A. Martel, of all papers on caves published so far in the twentieth century. The first part, issued in June, 1905, covers the papers dealing with France, and the enthusiastic author has spared no pains in making a series of complete and valuable abstracts. The result is a readable work, full of attraction for the geographer as well as the geologist, in which M. Martel devotes most of his own energies to the tracing out of the courses of underground streams.

In the *Geological Magazine* for 1905, Dr. Francis Baron Nopcsa has begun a study of the remains of British dinosaurs, preserved in the collections of the British Museum at South Kensington. He shows that some crocodylian remains are mingled in the rock with those of *Polacanthus*. The remarkable bony dermal armour and the general skeleton of this dinosaur are figured, and the inflexible union of the lumbar vertebrae is pointed out as a unique feature in this group. The author is, indeed, led to style *Polacanthus* a sort of glyptodon among dinosaurs.

G. A. J. C.

#### THE FORTHCOMING INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

THE sixth International Congress of Applied Chemistry, already mentioned in *NATURE* (this vol., pp. 322 and 421), will be opened at Rome on April 26 by H.M. the King of Italy. The work of the congress is divided into eleven sections, and in each section an extensive programme has already been organised. Many of the most eminent chemists of Europe and America have promised to attend and deliver papers. Sir Wm. Ramsay will give an address on the purification of sewage, Prof. Moissan will lecture on the distillation of metals, and Dr. A. Frank, of Berlin, on the direct utilisation of atmospheric nitrogen in the manufacture of manures and chemical products. Among the numerous papers which have been received by the committee of the congress, the following may be noticed as possessing general scientific interest:—

Section ii.—The extraction of thorium and cerium from the monazite sands, and their utilisation in Welsbach mantles, by Prof. F. Garelli and G. A. Barbieri.

Section iii. (metallurgy).—The actual state and the future of thermoelectric metallurgy, especially with regard to steel, by Major E. Stassano; report on the state of metallurgy in France, by the Comité des Forges de France.

Section vii. (agricultural chemistry).—Chemical changes during the assimilation of nitrogen by bacteria, by Dr. J. Stoklasa; the significance of the bacterial examination of soils, by Prof. Remy.

Section viii. (hygiene and medical chemistry).—The value of inulin as food in glycosuria, by Prof. C. Ulpiani; our present knowledge of the fats from the standpoint of physiological chemistry, by Dr. A. Jolles; inosuria, by Dr. Meillère.

Section x. (electrochemistry and physical chemistry).—This section is represented by more papers than any of the other sections. The following may be mentioned:—Certain cases of hydrolysis, by Prof. Veley; the van 't Hoff-Raoult formula, by Prof. W. D. Bancroft; isomorphism and solid solutions, by Prof. Bruni; electrochemistry of non-aqueous solutions, by Prof. Carrara; relations between proteids and electrolytes, by Prof. Galeotti; action of catalysts in the Deacon process for manufacturing chlorine, by Prof. G. M. Levi; silicide of carbon and the calcium carbide industry in France, by Prof. Moissan; catalysis by common metals, by Prof. Sabatier; chemistry of colloids, by Prof. Beckhold; amphoteric elements, by Prof. Le Blanc; toxins and anti-toxins, by Prof. Ehrlich; solid polyiodides of the alkali metals, by Prof. Abegg;

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dissociation of fused salts, fused silicates, and glasses, by Prof. Doelter.

The Italian State railways have granted to the members of the congress and their ladies a reduction of about 60 per cent. on the price of an ordinary railway ticket from the frontier to Rome. On their arrival in Rome members of the congress will receive from the committee a book of coupons, which will enable them to obtain at any station tickets at fares reduced by 40 per cent. to 60 per cent., according to the length of the journey. These tickets are available from April 26 until June 11, so that members of the congress may have the opportunity of visiting the International Exhibition at Milan. The subscription fee for membership of the congress is 20 lire for gentlemen and 15 lire for ladies. A special ladies' committee has been formed to receive foreign ladies with the purpose of making their stay in Rome as pleasant as possible.

All inquiries should be addressed to the bureau of the congress, 89 Via Panisperna, Rome

#### PHYSICAL CONDITION OF CHILDREN IN ELEMENTARY SCHOOLS.<sup>1</sup>

THE physical condition of those who are about to enter on active service in the affairs of life, and whose energy is the chief of the national assets, is certainly a matter of great national importance. Every effort is justified in producing as effective a working community as is possible, and Dr. Kerr's report affords welcome evidence of the increasing concern with which those who direct education are regarding the physical conditions of child-life.

During the period dealt with in this report a limited investigation was made of the conditions of some 3500 of the girls and boys attending the Council's schools, and very striking were the results obtained. It was found that some 42 per cent. of these possessed insufficient clothing to retain animal heat, and therefore stood in urgent need of help in this direction; it is not surprising to find that these children were below the average weight of the school for their age; 45 per cent. of those examined had dirty clothes and bodies, and about one-quarter of these were in a verminous condition; here again these children fell distinctly short of the average age weight. The above results tend to show, perhaps, no more than the fact of poverty, although the excessive shortage of weight in the worst clad class of scholars suggests that insufficiency of clothing is a definite factor in producing malnutrition, the insufficient food energy being first taxed to keep up the animal heat.

The greatest effect upon the life capital of the population is produced by the infantile mortality, which in some years actually kills off during the first year one in five of all children born; the question naturally arises, what is its effect upon the survivors? Does the adverse environment which slaughters one in five have a maiming effect upon those left? Dr. Kerr's investigations indicate that the children born in a year when infantile mortality is low show an increased physique, and those born in the years of high infantile mortality show a decreased physique. It appears, therefore, that in the years of high infantile mortality the conditions to which one in five or six of the children born are sacrificed have a maiming effect upon the other four or five.

The examination of the teeth of some 1500 school children demonstrated that, in the case of the boys, some 90 per cent. had caries, and 70 per cent. to a serious extent. Only the boys who had insufficient grinding surface were below the average in physique. It appears, therefore, that caries must be severe to produce an effect on nutrition.

As the result of an examination of the condition of the eyes, it was found that a constant number of about 10 per cent. of scholars have bad vision and it is estimated that deafness alone is probably sufficient to interfere

<sup>1</sup> "Report of the Education Committee of the London County Council submitting the Report of the Medical Officer (Education) for the Year ended March 31, 1905." No. 922. (London: P. S. King and Son, 1905.) Price 1s., post free, 1s. 2d.