ultérieusement étendre le nombre des observations pluviométriques si la necessité s'en fait sentir.

(4) Les chefs des services météorologiques et hydrographiques sont priés d'ajouter aux données météorologiques envoyées à la Commission, autant de données sur la niveau et la debit des rivières et des lacs qu'ils croirent possibles et utiles.

(5) That the secretary be asked to prepare a regional statement of rainfall for India as an example of what the Commission desires in the way of reports of regional rainfall and variation of rainfall for each meteorological organisation.

Instructions were given to Dr. W. J. S. Lockyer for his action as representative of the Commission at the Oxford meeting of the Solar Research Union.

It was resolved that while thanking the Washington Weather Bureau for its courteous offer to publish in the Washington *Monthly Weather Review* the data collected by the Commission, the Commission is not yet in a position to decide upon the most appropriate form of publication.

It was decided that a circular should be sent to the various meteorological organisations in the following terms:—The Commission desire to direct attention to the concluding paragraph of Prof. Violle's report to the International Meteorological Committee, 1903, and would be greatly obliged if the Commission could be informed of the arrangements for observing solar radiation adopted at the observatories of the various meteorological organisations and the methods employed to render the observations comparable with those of other observatories.

A first list of places at which actinometric observations are made was presented.

It was resolved that "une circulaire sera envoyé aux directeurs des services météorologiques pour leur demander de designer les stations de leur pays ou les observations actinométriques sont regulièrement faites. Dans le liste des stations il serait utile d'éviter les grandes villes ou les conditions atmospheriques sont generalment défectueuses."

That steps should be taken to obtain observations from the places mentioned.

La Commission Solaire prie M. le Président de vouloir bien obtenir les courbes de la distribution de l'energie solaire pour les observatoires qui ont déjà l'obligéance de communiquer les autres données indiqués dans les Comptes rendus des Seances de la Conférence de Cambridge, à propos de la physique solaire.

ANTHROPOLOGICAL NOTES.

L'*ANTHROPOLOGIE* usually devotes much space to archæology, and the recent number (vol. xvi., Nos. 4–5) contains three papers on that subject. Mr. H. Obermaier gives the first instalment of a most useful memoir on Quaternary human remains and the sites in Central Europe where they have occurred. Mr. A. Viré describes a prehistoric cave of the Solutré period at Lacave (Lot); the human bones were too fragmentary to have any value. Mr. E. Cartailhac and Father Breuil continue their account of the mural paintings and engravings of the Pyrenean caves; they give several illustrations; as is usually the case among primitive peoples, the representations of human beings fall greatly below the excellence of animal delineations. The authors come to the conclusion that in the cave of Marsoulas the earlier engravings with linear contours are associated with black paintings, while the later engravings, in which the contours are made with short lines to indicate hair, are associated with polychromatic paintings of animals. In a paper on the myology of a Negro, Messrs. R. Anthony and A. Hazard state that muscles are thick and short, thus indicating strength rather than agility. Hunting and agriculture among the populations of the Sudan are the subjects of a paper by Mr. J. Decorse. Mr. L. G. Seurat describes the marae, or stone altars, of the little frequented eastern islands of the Tuamotu Archipelago. Mr. C. Monteil discourses on the numbers and numeration among the Mandés, a large linguistic family of people of western French Africa. The journal contains the usual valuable *résumé* of recent anthropological literature.

Two papers in the *Journal of the Asiatic Society of Bengal* (vol. lxxiii.) should not be overlooked. Mr. J. E. Friend-Pereira has discovered totemism among the Khonds, where the wider totemic exogamy has been hidden by the narrower and probably newer rule of the "local, communal, or family type." The "septs," as the author terms the totem groups, have the ordinary totem tabus of feeding, use and marriage, and myths of origin. He believes totemism "serves to mark to a primitive people who possess no written characters to record kinship and descent as they begin to get more remote in time the distinction between separate stocks of blood. In other words, totemism is merely a guide for the observance of the rules of exogamy: it is not the cause that originated or evolved these rules." He holds that the explanation of the origin of totemism must be sought for, not in its social, but in its religious aspect. Among the Khonds "the totem ranks as the spirit of the ancestor founder of the stock, who is also the chief tutelary deity of the stock, and the totem class is considered as a manifestation of the chief tutelary deity." Major P. R. T. Gurdon has a valuable short paper on the Khasis, Syntengs, and allied tribes of Assam, among whom mother-right so predominates that males can own only self-acquired property. There are traces of totemism. Ancestors are worshipped by the erection of remarkable memorial stones, of which two illustrations are given; this form of worship largely underlies the Khasi religious system. Divination by the breaking of eggs is very common. Major Gurdon is superintendent of ethnography in Assam, and is apparently preparing a monograph on the people under his charge which, judging from these notes, should be a valuable work.

The current number of the *Journal of the Anthropological Institute* (vol. xxxv., 1905) contains papers in all branches of anthropology. Physical anthropology is represented by a paper by Messrs. F. G. Parsons and C. R. Box on the relations of the cranial sutures to age, and by a critical paper by Dr. C. S. Myers traversing the conclusion of Miss Fawcett that in certain characters a progressive evolution has taken place in regard to the "prehistoric" and modern Egyptians. South African archæology has been much to the fore of late; the notes on the Great Zimbabwe elliptical ruin by Mr. Franklin White, and a paper on the stone forts and pits on the Inyanga Estate, Rhodesia, were written before Mr. Randall-MacIver's subversive views were published. Mr. T. W. Gann discourses on the ancient monuments of Honduras and on the natives now living there. In technology there is a beautifully illustrated paper by Mr. D. Randall-MacIver on the manufacture of pottery in Upper Egypt. Mr. N. W. Thomas enumerates the varieties of the canoes and rafts in Australia and their distribution. Mr. E. B. Haddon, in a well illustrated paper on the dog-motive in Bornean art, discusses the origin and degeneration of certain designs. Religion is represented by notes by Mr. R. E. Dennett on the philosophy of Bavili of Luango, West Africa. Finally, a report on the ethnology of the Stlatlumh, one of the Salish tribes of British Columbia, by Mr. C. Hill Tout, is a good example of a paper on regional ethnography. It will be seen that the journal maintains its high standard, both for the quality of its matter and the excellence of its illustrations.

A GAS CALORIMETER.

THE paper on a new gas calorimeter which was read before the Royal Society by Mr. C. V. Boys, F.R.S., on December 7, 1905, is of interest, partly on account of the causes which led to the design, and partly on account of the features which are original.

The agitation of the gas companies in favour of reducing the candle-power of gas on the ground that gas of lower candle-power is cheaper while the diminution of the light afforded by a luminous flame is of little consequence as incandescent lighting is so largely used, while it has succeeded in many cases in getting the statutory lighting power reduced, has on the other hand raised the question whether the value of the gas for heating purposes

and for power may not be reduced also, so that while the flame-lighting power may be reduced without much detriment, the consequent fall of heating-power may be a serious loss to the public. In the London Gas Act, 1905, such risk has been met by the obligation to test the calorific value of the gas for information only, but no penalties are incurred, even though the gas should prove to be of much less heating value than it has been.

The gas referees have therefore had the question of a suitable calorimeter before them, and in the "Notification" issued on January 1 (see p. 273) the calorimeter designed by Mr. Boys, who is one of them, is prescribed for use in official testings.

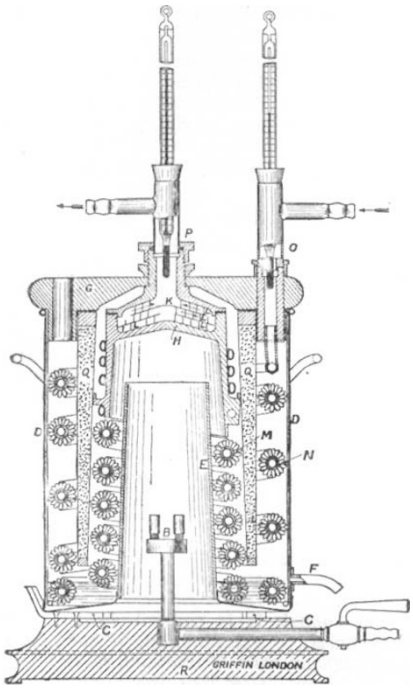

FIG. 1.

The calorimeter in question is of the Hartley type, *i.e.* a stream of water constantly passes through the instrument, and in so doing it is raised in temperature by the heat produced by the combustion of a stream of gas. The observations available enable the observer to ascertain the calorific value of the gas.

The best known instrument of this class is the Junker calorimeter, and it is in relation to this that the new features introduced by Mr. Boys are best described. From the accompanying figure it will be seen that the gas is burned at two small union jets instead of in the usual long Bunsen flame. The hot gases rising into the bell H descend outside the chimney E through the wires of the inner coil M. This and the outer coil N are made of the well known motor-car radiator tube invented by Mr. Clarkson. The circulating water enters the outer coil at the union O, and leaving the inner coil enters the space above the bell H, where it circulates between two dished plates and then leaves at the union P. The two lower turns of the Clarkson tube are immersed in a condensed water bath with an overflow F, which may be turned in any direction. This water bath serves to keep the chimney cool enough not to burn, but not cool enough to cause condensation to occur on the inner surface. One result of this construction is the slow passage of the products of combustion through the instrument and the small resistance they encounter. Hence the instrument need not be more than a foot high. The circulation of the water through the instrument strictly in series in every part prevents the formation of pockets or streaks of warmer water and consequent spasmodic changes of the outlet thermometer reading, and such small changes as might remain are almost entirely destroyed in the temperature equalising chamber above the bell H. The result is that, with a rise of temperature of 23° C., the variations do not exceed two or three hundredths of a degree, and even this appears to be largely due to friction in the meter insufficiently corrected by the governor.

Five minutes after lighting the gas the outlet thermometer is within 6 per cent. of its ultimate rise; in ten minutes it is within 2·2 per cent., and in fifteen minutes it is less than $\frac{1}{2}$ per cent. In this and other respects the gas examiner who will have to use the instrument will find that not only accuracy, but his convenience has been studied.

One feature is quite peculiar. While hitherto gas calorimeters have been soldered up so as to be of the nature of mystery boxes, this can be seen in its essential features, while it can be completely taken to pieces in a few minutes for examination of every part.

After use the coil system is lifted out of the outer vessel by the lid and is then immersed in a dilute solution of bicarbonate of soda, so as to neutralise the weak sulphuric acid condensed upon the metal and prevent it and its dissolved oxygen from prematurely destroying the metal-work of the coils. The instrument is made by Messrs. Griffin and Sons.

THE ELECTRIC PRODUCTION OF NITRATES FROM THE ATMOSPHERE.[1]

AS the demand of the white races for wheat as a foodstuff increases, the acreage devoted to wheat growing increases, but at a less rapid rate; and being limited by climatic conditions will in a few years, perhaps less than thirty, be entirely taken up. Then, as Sir William Crookes pointed out in his presidential address in 1898, there will be a wheat famine, unless the world's yield per acre (at present about 12·7 bushels per acre on the average) can be raised by use of fertilisers. Of such fertilisers the chief is nitrate of soda, exported from the nitre beds in Chili. The demand for this has risen from 1,000,000 tons in 1892 to 1,543,120 tons in 1905, and the supply will at the present rate be exhausted in less than fifty years. Then the only chance of averting starvation lies, as Crookes pointed out, through the laboratory.

In 1781, Cavendish had observed that nitrogen, which exists in illimitable quantities in the air, can be caused to enter into combination with oxygen, and later he showed that nitrous fumes could be produced by passing electric sparks through air. Although this laboratory experiment had undoubtedly pointed the way, though the chemistry of the arc flame had been investigated in 1880 by Dewar, and though Crookes and Lord Rayleigh had both employed electric discharges to cause nitrogen and oxygen to enter into combination, no commercial process had been found practical for the synthesis of nitrates from the air until recently.

After referring, in passing, to the tentative processes of Bradley and Lovejoy, of Kowalski, of Naville, and to the cyanamide and cyanide processes, attention was directed to the process of Birkeland and Eyde, of Christiania, for the fixation of atmospheric nitrogen, and their synthetic production of nitrates, by use of a special electric furnace. In this furnace an alternating electric arc was produced at between 3000 and 4000 volts, but under special conditions which resulted from the researches of Prof. Birkeland, the arc being formed between the poles of a large electromagnet, which forced it to take the form of a roaring disc of flame. Such a disc of flame was shown in the lecture theatre by a model apparatus sent from Christiania. In the furnaces, as used in Norway, the disc of flame was 4 feet or 5 feet in diameter, and was enclosed in a metal envelope lined with firebrick. Through this furnace air was blown, and emerged charged with nitric oxide fumes. These fumes were collected, allowed time further to oxidise, then absorbed in water-towers or in quicklime, nitric acid and nitrate of lime being the products. The research station near Arendal was described, also the factory at Notodden, in the Hitterdal, where electric power to the extent of 1500 kilowatts was already taken from the Tinnfoss waterfall for the production of nitrate of lime. This product in several forms, including a basic nitrate, was known as Norwegian saltpetre. Experiment had shown that it was equally good as a fertiliser with Chili saltpetre, and the lime in it was of special advantage for certain soils. The yield of product in these furnaces was most satisfactory, and the factory at Notodden—which had been in commercial operation since the spring of 1905—was about to be enlarged; the neighbouring waterfall of

[1] Abstract of a discourse delivered at the Royal Institution on Friday, February 2, by Prof. Silvanus P. Thompson, F.R.S.