

Shanklin and also at Ross-on-Wye, and "reddish-yellow" at Newquay.

The display was first noticed at Bristol at 9.15, and the final traces of it disappeared 5½ hours afterwards, viz. at 15h. G.M.T. The appearance was that of a band of luminosity lying just over the northern region of the sky and extending over about 70° from nearly north-west to north-east. From this intense glow streamers occasionally shot upwards, but these quickly broadened and disappeared. They showed a reddish tint, and in several cases could be traced nearly to the altitude of Polaris. The stars of Ursa Major were deeply involved in the aurora, but shone conspicuously amid the light surrounding them.

At first sight a person might have mistaken the aurora for the reflection of a widespread conflagration, but a little watching revealed the precise nature of the event. Clouds covered a large portion of the sky at times, but it seemed curiously to avoid the region affected by the phenomenon, and there were showers of rain at intervals. The brilliancy of the northern light and the darkness of the clouds in other parts offered a striking contrast. Several meteors were seen during the night radiating from a point at 355°+40°.

A letter from the Isle of Man describes a brilliant aurora visible there at 8.45 G.M.T. on the same night, and continuing with various modifications for several hours.

Dr. C. Chree has supplied the following note on the simultaneous magnetic storm as recorded at Kew Observatory, Richmond:—

"A smart magnetic storm was simultaneously experienced in connection with the aurora. As recorded at Kew Observatory, it began with a well-marked S.C. (sudden commencement) about 16h. 12m. G.M.T. on October 1, and continued until 4h. on October 2. The approximate ranges were 32' in D, 280γ in H, and 170γ in V. The extreme westerly position was reached at the end of the S.C. about 16h. 16m., the extreme easterly position about 23h. 25m. on October 1. Between 22h. 18m. and 22h. 50m. there was a swing of 29' to the east. The maximum in H appeared about 17h., the minimum shortly before midnight. After the minimum there was a rapid recovery from the depression. As usual in storms, V was enhanced in the afternoon, the maximum appearing about 19h. 10m. There was, however, a second approximately equal maximum about 22h. 15m. This was preceded and followed by somewhat rapid movements. After 23½h. there was depression in V, the minimum appearing shortly after midnight. The element remained depressed until 4h. on October 2. The curves were fairly quiet for the next twenty-four hours, but disturbance began again about 4h. on October 3, and was active when the sheets were changed about 10h. It may be noted here that the storm itself was quite secondary as compared with the big one in August last, and so, from the purely magnetic point of view, the interest is very moderate."

#### THE SUDAN IRRIGATION WORKS.

IT is an unfortunate circumstance when a controversy respecting the merits of rival schemes for Imperial development works is embittered by charges impugning the good faith of either side, and it is particularly painful when an accusation of this kind is levelled by a Government official of high standing and repute against his colleagues in the Department with which he was formerly associated. We do not propose to discuss the ethical question (it has already been the subject of inquiry by a Foreign

Office Committee), but it is unavoidable to mention it as indicating the ground upon which Sir William Willcocks has published his brochure on "The Nile Projects" and the acutely critical spirit in which it is written.

We have already outlined in NATURE for September 18 (p. 67) the schemes actually adopted by their respective Governments, and now in course of execution, for the development of irrigation in Egypt and the Sudan, comprising the formation of a dam on the Blue Nile at Makwar, near Sennar, and of a reservoir at Gebel-el-Auli, on the White Nile; and in the "Notes" columns of the issue for May 22 last (p. 233) we briefly alluded to the alternative proposal advocated by Sir W. Willcocks and designated by him "the Sudd reservoir." The following additional particulars gleaned from the pamphlet before us may be of some interest.

The Blue Nile project, for the irrigation of the Gezira plain in the Sudan, involves the storage of 463,000,000 cubic metres of water for distribution during the winter season to 300,000 feddâns (acres) about to be exploited in cotton-raising. To meet this requirement a supply of 120-150 cubic metres per second will be necessary at the canal head throughout the winter up to the end of March, although in an occasional year the supply may have to be continued to the middle of April. This would leave three months for the gathering of the crop and the preparation of the ground prior to the next sowing. It is essential to have this period as dry as possible in order to root out the old stalks, which otherwise tend to sprout, as, indeed, happens when the rains supervene. Sir W. Willcocks expresses the apprehension that irrigation supplies will have to be given much later than April 15, and that the sources for Egyptian use will be seriously depleted in consequence.

The White Nile reservoir at Gebel-el-Auli, proposed to be formed by an earthen bank across the river at a point some 50 km. above Khartoum, comes in for the criticism that it will flood a considerable tract of country, disturbing the inhabitants and necessitating their transfer elsewhere, and that the stagnant pools left when the reservoir is low will lead to an increase in mosquitoes. Both these objections were before the Foreign Office Committee, but were not held to be vital. Another point made by Sir W. Willcocks is that a work so remote from Egypt might in the hands of a hostile Power become a serious menace to that country. "An enemy getting possession of the dam and filling it brimful to the height of the earthen bank in a high flood could sweep the Nile Valley as thoroughly as Noah's deluge swept the Euphrates Valley."

Pursuing a trenchant criticism of the estimated cost of the foregoing schemes, Sir W. Willcocks compares them very unfavourably with his own project of utilising as a reservoir the vast tract of swamp known as the Sudd region, where, owing to the dense growth of papyrus and aquatic vegetation there are "a score of milliards of cubic metres of water standing well above the level of the flat plain as though they were congealed." Such a region, Sir William contends, could be laid under contribution for practically inexhaustible supplies of water more effectively and at less cost.

BRYSSON CUNNINGHAM.

#### COLLIERY BOILER-PLANTS.

A REPRINT of articles on the performance of colliery steam boiler-plants and the saving to be obtained by their reorganisation, which appeared in *Engineering* for July 25 and August 1 last, has been sent us by the author, Mr. D. Brownlie. The

discussion in the articles is based upon results of tests carried out by the author, and a valuable feature is a large table giving details of these results for 100 boiler plants, chiefly of the Lancashire type. Mr. Brownlie's figures indicate that the average net working efficiency of colliery steam-boiler plants is only about 55.5 per cent. By carrying out a re-organisation of such plants on modern scientific lines it is possible to obtain 70 per cent. efficiency, and Mr. Brownlie estimates that about 6,600,000 tons of coal per annum could be saved by the adoption of scientific methods and by more extensive use of refuse coal.

The 100 boiler plants tested have a total of 570 boilers, 500 of these being Lancashire, 2 Cornish, 37 egg-ended, and 31 modern tubular boilers. The average efficiency of the egg-ended boilers is less than 35 per cent., and there appears to be still a fair number of this type at work, in spite of it being hopelessly out of date. It is also of interest to note that the few modern tubular boilers installed are, on the average, giving no better results than the Lancashire boilers, which average 55 per cent. efficiency. This fact obviously indicates improper arrangements in the installation or bad methods of working, or both.

Another point of importance to which Mr. Brownlie directs attention arises from the Final Report of the Coal Conservation Committee, which states that "the policy of collieries has been to set free the best qualities of coal for the market, and to retain for colliery consumption the poorest quality. The returns show that the quantity of ash in some of the fuels used ranges from 50 per cent. to 80 per cent." Mr. Brownlie actually finds an average of 15.5 per cent. ash and coal of 10,500 B.Th.U. used at colliery boiler plants, and most people will support him in his statements that he has never heard of a case of 50-80 per cent. ash; that such instances must be rare; and that the statement in the report is most misleading. In actual fact, 52 per cent. of the coal employed at collieries is high-grade coal; of the remainder, 32 per cent. could be used economically in industry for steam generation, and only 16 per cent. is definitely unsaleable. The highest ash-content of this refuse coal was 35 per cent. Mr. Brownlie maintains that these results are typical of the colliery industry, and the idea that collieries burn chiefly refuse and unsaleable coal is a complete fallacy.

As a matter of fact, there are millions of tons of refuse coal lying unburnt at collieries, and a very large proportion of this refuse could be utilised for steam generation, as has been proved by Mr. Brownlie's firm on a number of colliery plants. The carrying out of this proposition would result in a very large saving in the coal consumption, even after ample deduction for the cost of extra boilers and plant necessary because of the low calorific value. A fair average price for the whole of the coal burnt on colliery boiler plants is to-day about 20s. per ton; making allowance for extra labour, plant, and depreciation, and taking 3 tons of refuse coal as equal in practice to 1 ton of saleable coal, the value of refuse coal to-day would be about 8s. per ton.

Mr. Brownlie's pamphlet is to be welcomed, partly on account of the strong case for reform presented in view of the need for national economy, and partly on account of the large number of test results which he gives in a form suitable for easy comparison. The pamphlet may be obtained from Messrs. Brownlie and Green, Ltd., 2 Austin Friars, London, E.C.2.

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## THE BRITISH ASSOCIATION AT BOURNEMOUTH.

### SECTION D.

#### ZOOLOGY.

OPENING ADDRESS BY DR. F. A. DIXEY, M.A., F.R.S.,  
PRESIDENT OF THE SECTION.

ONE of the results of the great war now happily at an end has been its effect upon science. On the one hand it has checked the progress of scientific investigation; it has done much to destroy international co-operation and sympathy; it has removed from our ranks, temporarily or permanently, many admirable workers. On the other hand it has acted as a great stimulus in many departments of scientific inquiry, and it has given the general public an interest in many scientific questions which have hitherto met with little recognition or encouragement from the people at large. It was perhaps inevitable, but at the same time, as I venture to think, rather to be deplored, that that interest has tended to concentrate itself upon applied more than upon abstract science; that it has been concerned chiefly with the employment of natural knowledge in devising and perfecting new methods of destruction. Terrible as is the power which the present-day engines of warfare have attained, it may be reasonable to hope that some compensation for the mischief and suffering which they have caused may eventually be found in peaceful directions; that the submarine, the aircraft, and even the high explosive may cease to be a terror to civilisation, and in spite of their past history may after all become agents in the advancement of the general welfare:

*Hoc paces habuere bone, ventique secundi,*

will, let us hope, be a legitimate reflection in later times. But for the true scientific worker, I think I may safely assert, the primary object of his studies is the attainment of knowledge for its own sake: applications of such knowledge may be trusted to follow; some beneficial, some perhaps the reverse. Still, whether they do or do not so follow is less a concern of the scientific man than whether his labours have resulted in a fresh advance into the realms of the unknown. I confess to some sympathy with the feeling which is said to be expressed in the regular toast of a certain scientific gathering:—"Pure mathematics, and may they never be of any use to anybody."

For genuine enthusiasm in the cause of science for its own sake, I think that we zoologists may claim a good record. We are by no means unmindful of the great benefits to humanity which have taken their rise more or less directly from zoological science. I need do no more than mention the services to medicine, great at the present and destined to be greater still in the future, that are being rendered by the protozoologist and the entomologist. We may look forward also to results of the highest practical importance from the investigations into the laws of heredity in which we are engaged with the co-operation of our allies the botanists. But what we are entitled to protest against is the temper of mind which values science only for the material benefits that may be got from it; and what above all we should like to see is a greater respect on the part of the public for science purely as science, a higher appreciation of the labours of scientific men, and a greater readiness, in matters where science touches on the common affairs of life, to be guided by the accumulated knowledge and experience of those who have made such matters the subject of constant and devoted study. If the war leads to any repair of the general deficiency in these respects, it