the main statistics bearing on a particular point all indicate the same conclusion, it is not difficult to reason from them and to convince all who study them; but when the indications are apparently in conflict it would be folly to dogmatize. I have indicated frankly my own opinion, but I, for one, should like the subject to be more fully threshed out. It is a very obvious suggestion, moreover, that one may prove too much by such figures—that it is an outrage on common-sense to talk of there being no check to the rate of growth in the country when times are notoriously bad and everybody is talking of want of profit. What I should suggest finally, by way of a hypothesis reconciling all the facts, would be that probably there is some check to the rate of material growth in the last ten years, though not of the serious character implied by the first set of figures discussed; that this check may even be too small to be measured by general statistics though it is sufficient to account for no small amount of *malaise;* and that the *malaise* itself is largely accounted for, as I have suggested on a former occasion, by the mere fall of prices, whatever the cause, as it involves a great redistribution of wealth and income, and makes very many people feel poorer, including many who are not really poorer, but only seem so, and many who are really richer if they only allowed properly for the increased purchasing power of their wealth. All these facts are quite consistent with the fact of a very slight real diminution in the rate of our material growth generally, and with that change in the direction of the national industry, significant of a general change beginning throughout the world which would seem to have occurred.

To some extent also it ought to be allowed that the tendency in the very latest years seems unsatisfactory, and that the developments of the next few years should be carefully watched. Up to now there is nothing really alarming in the statistics when they are analyzed and compared. It may be the case, though I do not think it is the case, that causes are in operation to produce that great check and retrogression which have not as yet occurred, though many have talked as if they had occurred. The exact limits of the discussion should be carefully kept in mind.

Fortunately, however, there is no doubt what some of the conclusions on practical points should be. If it be the case that the hold of an old country like England on certain staple industries of the world is less firm than it was, and, as I believe, must be less and less firm from period to period, owing to the natural development of foreign countries and the room there is among ourselves for development in new directions, then we should make assurance doubly sure that the country is really developing in new directions. If our dependence must be on the new advantages that have been described, such as acquired manufacturing skill, concentration of population, and the like, then we must make sure of the skill and of the best conditions of existence for the concentrated population. If, in point of fact, shorter hours of labour and taking things easy have contributed to check our rate of progress slightly, there is all the more reason for improving the human agent in industry so as to make work in the shorter hours more efficient. Looking at the stir there now is about technical education and such matters, and the hereditary character of our population, I see no cause to doubt that the future will be even more prosperous than the past. The national life seems as fresh and vigorous as ever. The unrest and complaints of the last few years are not bad signs. But the new conditions must be fully recognized. The utmost energy, mobility, and resource must be applied in every direction if we are only to hold our own.

REPORTS.

Fourth Report of the Committee, consisting of Prof. Balfour Stewart (secretary), Profs. Stokes, Schuster, G. Johnstone Stoney, Sir H. E. Roscoe, M.P., Captain Abney, and Mr. G. J. Symons, appointed for the purpose of considering the best methods of recording the Direct Intensity of Solar Radiation.—In their last report the Committee gave a description of a copper inclosure which had been constructed by them. This consisted of a copper cube $3\frac{1}{2}$ inches square outside, the faces of which were $\frac{5}{8}$ of an inch thick. The cube was packed round with felt $\frac{9}{16}$ of an inch thick, and the whole was faced outside with thin polished brass plates. Thermometers were inserted into that side of the cube intended ultimately to face the sun, and into the opposite side, by means of which the temperature of these sides could be accurately determined. Finally, a thermometer was placed in the vacant space in the very centre of the inclosure. This last thermometer occupies the position that will ultimately be occupied by the internal thermometer, upon which the sun's rays are to fall through a hole; only at this stage the hole had not been constructed. It is obvious that when the instrument is finally in action, with a beam of solar rays (condensed by means of a lens so as to pass through the hole) falling upon the bulb, this thermometer will be subject to a heating effect from two separate causes. (*a*) It will, first of all, be subject to radiation and convection from the surrounding inclosure, which is gradually (let us suppose) getting hot through exposure to the sun. (*b*) It will, secondly, have a beam of solar rays of constant size and of constant intensity (except as to variations arising from atmospheric absorption, seasonal change in the sun's apparent diameter, or change in the sun's intrinsic radiation) continuously thrown upon it through the hole. In fine days when there is no abrupt variation of the sun's intensity the temperature of the internal thermometer will remain sensibly constant, or at least will only vary slowly with the sun's altitude; and this temperature will be such that the heat lost by radiation and convection from the internal hot thermometer will be equal to the heat which it gains from the sources (*a*) and (*b*), save as to a small correction, calculable from the slow variation of the temperature of the thermometer. Now, our object being to estimate accurately the intensity of source (*b*), we must be able, notwithstanding the gradual heating of the inclosure, to determine how much heat the internal thermometer gains from source (*a*). That is to say, we must be able to tell what would be the temperature of the internal thermometer if the instrument were still made to face the sun, but without any aperture. For the solid angle subtended by the hole at any point of the bulb is so small that we may regard it as a matter of indifference whether there be a hole or not, except as to the admission or exclusion of direct solar radiation. It was suggested by Prof. Stokes that a simple practical method of doing this would be to expose the instrument, without a hole, to an artificial source of heat, such as a fire or a stove, the intensity of which might likewise be made to vary. By this means the conditions of the instrument when facing the sun might be fairly represented. Experiments of this nature were made at Manchester by Mr. Shepherd, acting under the superintendence of Prof. Stewart, and these were reduced by Prof. Stokes. It was ascertained from these experiments that the internal thermometer represented with great exactness the temperature of the cube such as it was $3\frac{1}{2}$ minutes before; in other words, there was a lagging time of the internal thermometer equal to $3\frac{1}{2}$ minutes. We may thus find what would be the reading of the internal thermometer if the balance were perfect between the gain of heat by direct solar radiation and the loss of heat by communication to the environment; and as the latter is approximately proportional to the difference of temperature of the envelope and internal thermometer, and the deviation from exact proportionality admits of determination by laboratory experiments, we have the means of measuring the former. We must bear in mind that the lagging time of the final thermometer may be different from that of the thermometer with which the experiments were made. It was likewise ascertained that the difference between the temperature of the internal thermometer and that of the case need not exceed 20° Fahr., and that a comparatively small lens and hole would suffice for obtaining this result. In consequence of this preliminary information, we have made the following additions to the instrument described in our last report:—(1) We have had it swung like the ordinary actinometers with a motion in altitude and azimuth, and with two moderately delicate adjusting-screws, one for azimuth and another for altitude adjustments. (2) We have had a thermometer centrically placed in the interior. The graduation of the stem is very delicate, and extends from 20° to 120° Fahr., the reading being taken from one of the sides. The bulb is of green flint, and the stem of colourless glass. (3) We have also had a small plate of quartz cut and polished and mounted so as to cover the hole, and to be easily removed and replaced. The object of the plate is to prevent irregularities arising from irregular issue of heated air through the hole, entrance of cooler air blown in by wind, &c., and the choice of material was influenced by the wish to permit of frequent cleaning without risk of alteration by scratching. We ought to mention that as it would be difficult to procure the loan of a good heliostat, and expensive to make, we resolved that in the preliminary experiments the adjustments to keep the sun's image on the hole should be made by the observer. Hence the necessity for the adjusting-screws already described.

The Committee suggest that they should be reappointed, and that the sum of £10 be placed at their disposal to defray the expenses of further experiments connected with the instrument.

Report of the Electrical Standards Committee, consisting of Prof. G. Carey Foster, Sir W. Thomson, Prof. Aryton, Prof. J. Perry, Prof. W. G. Adams, Lord Rayleigh, Prof. O. J. Lodge, Dr. John Hopkinson, Dr. A. Muirhead, Mr. W. H. Preece, Mr. Herbert Taylor, Prof. Everett, Prof. Schuster, Dr. J. A. Fleming, Prof. G. F. Fitzgerald, Mr. R. T. Glazebrook (secretary), Prof. J. J. Thomson, Mr. W. N. Shaw, and Mr. J. T. Bottomley.—The Committee was appointed for the purpose of constructing and issuing practical standards for use in electrical measurements. The Committee report that the work of testing resistance coils has been continued at the Cavendish Laboratory, and a table of the values found for ten various coils is given. Of these two coils have been tested before, but, owing to the green coloration mentioned in the last report showing itself in the paraffin, the paraffin was removed and the coils refilled with ozokerit, which can be obtained more nearly free from traces of acid. This change in all cases produced an appreciable increase in resistance. Shortly after the Birmingham meeting of the Association the secretary received a letter from the Board of Trade, inclosing a copy of the general bases of a convention proposed by the French Government for the consideration of the Powers with the object of carrying out the resolution of the Paris Conference with regard to electrical standards. The convention stipulates that a legal character is to be given to (1) the legal ohm, (2) the ampere, (3) the volt, (4) the coulomb, (5) the micro-farad. These questions had been considered by the Committee at the Birmingham meeting, and the following series of resolutions, which the secretary was instructed to forward to the British Government, had been agreed to on the motion of Sir W. Thomson, seconded by Prof. W. G. Adams: (1) to adopt for a term of ten years the legal ohm of the Paris Congress as a legalized standard sufficiently near to the absolute ohm for commercial purposes; (2) that at the end of the ten years period the legal ohm should be defined to a closer approximation to the absolute ohm; (3) that the resolutions of the Paris Congress with respect to the ampere, the volt, the coulomb, and the farad be adopted; (4) that the resistance standards belonging to the Committee of the British Association on Electrical Standards now deposited at the Cavendish Laboratory at Cambridge be accepted as the English legal standards, conformable to the adopted definition of the Paris Congress. During the year the original standards of the Association have again been compared by the secretary. An account of this comparison, and of the very complete one made in the years 1879-81 by Dr. Fleming, the details of which have not been published previously, is given in the appendix. The general result of the comparison is to show that there is no evidence that any of the original coils have changed in value since the year 1876, when they were compared by Prof. Chrystal and Mr. Saunders. The Committee recommend the adoption of the watt as the unit of power. The watt is defined to be the work done per second by the ampere passing between two points between which the difference of electric potential is one volt. The Committee was also of opinion that it was highly desirable to proceed with the construction of an air condenser as a standard of capacity, and for this purpose they desire to be reappointed, with the addition of the name of Mr. Thos. Gray, and a grant of £100.

Report of the Committee on Ben Nevis Meteorological Observations.—The work of the Ben Nevis Observatory for the past year has been carried on by Mr. Omond and his assistants with the same intelligence, enthusiasm, and completeness as in previous years. With the two exceptions of October and November the temperature was every month below its normal. Atmospheric pressure at Fort William was very nearly the normal on the mean of the year, being only 0·012 inch under it. The maximum pressure for the year at the Observatory was 26·093 inch on November 24, and the minimum 23·45 inch on December 8. The maximum temperature for the year was 55°·8 in September, and the lowest 8°·4 in December, thus giving an absolute range of 47°·4. In addition to the regular work of the Observatory, Mr. Omond, superintendent, Mr. Rankin, first assistant, and Mr. Dickson, who has repeatedly relieved the regular observers at the Observatory, are engaged in carrying on original researches. The plotting of the observations of storms made at the sixty-four Scottish lighthouses is now far advanced. The results show a very large number of failures both of storms which have occurred of which no warning has been sent by the Meteorological Office, and of warnings issued with no accompanying or following storm. These failures are at present being investigated by the Ben Nevis observations in connexion with the observations at Fort William and other low-lying stations in Scotland. The directors of the Observatory have from the outset spoken with some earnestness on the absolute necessity of combining the double observation for all forecasting purposes—in other words, of combining the observations at the top of Ben Nevis with those made at the same instant at Fort William. The reason is obvious, it being by vertical gradients, and not by horizontal gradients, that the observations at high-level stations can be turned to their proper and fullest account in forecasting weather. Since none of the sea-level observations at Fort William are in the Meteorological Office, or indeed anywhere but in the office in Edinburgh, the opinion that the Ben Nevis observations are useless in forecasting falls to the ground. A recent discussion in Parliament, already referred to in NATURE, was then alluded to.

In the course of a discussion Prof. Cleveland Abbé said that the problems of meteorology demanded mathematical treatment more and more.

Final Report of the Committee, consisting of Mr. R. H. Scott (secretary), Mr. J. Norman Lockyer, Prof. G. G. Stokes, Prof. Balfour Stewart, and Mr. J. G. Symons, appointed in August 1881, and reappointed in 1882-83 and 1884 to co-operate with the Meteorological Society of the Mauritius in the publication of Daily Synoptic Charts of the Indian Ocean for the year 1861.—Your Committee have to report that the sum of £50 granted in 1881 has now been expended, and they inclose herewith a receipt for the amount, showing its disposition, from the Treasurer of the Mauritius Meteorological Society.

Dr. Meldrum, in a letter to the Secretary, dated June 4, 1887, says: "I am requested by the President and Council of our Meteorological Society to convey to yourself and the British Association their very best thanks, and to say that the Society will forward to the Association, through you, two copies of each of the publications that have been issued."

The following is a list of these publications:—

1. Daily Synoptic Weather Charts of the Indian Ocean for the months of January, February, and March, 1861. The charts for the remaining months of 1861, and remarks to accompany the months already published, are in preparation.

2. Tabular Statements of the number of gales experienced monthly between the parallels of 20° S. and 46° S., and the meridians of 0° and 120° E. during the last 39 years.

Dr. Meldrum further states that the following works are nearly ready for publication:—

I. Synoptic Weather Charts of the Indian Ocean for January 1860, in the course of which month a typical cyclone took place.

II. The Tracks of the Tropical Cyclones in the Indian Ocean, south of the Equator, from 1848 to 1886, as far as is known, together with the observations from which the tracks have been deduced.

III. The Mean Pressure and Temperature of the Indian Ocean for 5° square, in the months of January and July.

IV. Synoptic Charts of the Indian Ocean for each day, during the last 39 years, in which it is known that a cyclone existed.

V. The Average Limits in the Indian Ocean of the South-East Trade in each month, and of the North-West Monsoon from November to May.

Fourth Report of the Committee, consisting of Prof. Balfour Stewart (secretary), Mr. J. Knox Laughton, Mr. G. J. Symons, Mr. R. H. Scott, and Mr. G. Johnstone Stoney, appointed for the purpose of co-operating with Mr. E. J. Lowe in his project of establishing on a permanent and scientific basis a Meteorological Observatory near Chepstow.—This Committee met at 22 Albemarle Street on March 26, and passed the following resolution:—"As your Committee have heard no further results from the action referred to by Mr. Lowe in his letter quoted in their last report, and there thus appears to be an absence of local support, they see no prospect of the scheme ever being carried out. The fundamental idea presiding over the establishment of the observatory was that it should be one of permanence, and hence it is

obvious that adequate endowment is essential. To provide this, and properly equip the observatory, several thousand pounds are needed; but the Committee have no assurance that anything at all approaching the necessary amount has yet been subscribed or even promised. As they have now been in existence for between three and four years with this negative result, they are of opinion that the Committee should now be dissolved." In consequence of this resolution the Committee have not drawn the £20 voted at Birmingham, and they do not now request their reappointment.

Report of the Committee on Tidal Observations in Canada.—In the absence of Prof. Johnson, Mr. Robert E. Baynes presented this report. He said that no grant had yet been obtained from the Dominion Government, for though the Hudson Bay Expedition was ended, the Canadian Government had undertaken to pay half the expenses of the re-survey of the Gulf of St. Lawrence. This survey would probably take two years, but when it was concluded there was the greatest possible expectation that a special grant might be given to the Committee. In the meantime, Lieut. Gordon, commanding one of the Dominion cruisers, had been ordered to make certain preliminary observations.

Report of the Committee on Magnetic Observations.—The Committee had met at various intervals during the year. The subject which chiefly occupied them at present was the diurnal variation of terrestrial magnetism and the reduction of the observations. The great difficulty of the Committee was the want of proper observations in the southern hemisphere. The observations which had been made went to show that the two hemispheres were pretty well symmetrical, and at present the Committee had to take for granted that it was so. They hoped in another year to be able to give a more complete report, and some definite results.

Report of the Committee on Standards of Light.—The Committee have compared the standards hitherto proposed, but have not done much. Prof. Adams has, however, presented a report of some experiments, and the Committee think that if funds are provided they will be able to settle the question of standards.

Report of the Committee on Differential Gravity Meters.—Since last report the Committee have received from Mr. Boys an account of experiments in which he is engaged. They await the result of those experiments before proceeding with the construction of an instrument.

Report of the Committee on the Translation of Foreign Scientific Memoirs.—In reply to a communication from the Committee to the Royal Society, Prof. Reinold has informed them that the Royal Society is not at present able to undertake the publication of foreign memoirs in a systematic manner, but anything of special interest would be attended to.

NOTES.

We learn that the Government of Jamaica offers a premium of £100 for the production of the best practical elementary text-book of tropical agriculture specially applicable to Jamaica, and embodying the first principles of agriculture. It is stated that the object of the manual is to create in the mind of the young an early and intelligent interest in the soil and its products, and particular attention is to be paid to simplicity, brevity, and freedom, as far as possible, from technical terms. It is stated that the propagation and cultivation of tropical economic plants should have due prominence. Manuscripts are to be forwarded to the Government of Jamaica on or before August 1, 1888.

The Iron and Steel Institute held their autumn meeting at Manchester last week. It was an entire success both as regards the papers and discussions and the excursions to industrial works and places of interest in the neighbourhood. We shall give a report of the proceedings in our next week's issue.

One point which seems to be determined by the news which has just reached Zanzibar concerning Emin Pasha is that Albert Nyanza and Muta Nzige are two distinct lakes, a point which has hitherto been doubtful. It is stated that in the recent campaign between Mwanga, King of Uganda, and his neighbours the whole country between these two lakes has been laid waste. Doubtless we shall soon have full details as to this, as well as to the results of the recent explorations, from Emin Pasha himself.

Mr. Richard Quain, F.R.S., Surgeon Extraordinary to the Queen, died on Thursday at his residence, 32 Cavendish Square, at the age of eighty-seven. He began his career in 1828, and speedily rose to high distinction. He wrote many books on medical subjects, such as "Anatomy of the Arteries of the Human Body," and was Honorary Fellow of the Medical and Surgical Society of Edinburgh, Emeritus Professor of Clinical Surgery in University College, Consulting Surgeon at University College Hospital, and President of the Royal College of Surgeons.

The Annual Congress of the Sanitary Institute of Great Britain was opened on Tuesday at Bolton. Lord Basing delivered the Presidential Address, in which he reviewed what has been done for the protection of public health since the importance of the question was brought home to the minds of legislators. An exhibition of sanitary appliances and apparatus was opened at the same time in the Drill Hall at Bolton.

The University College of Bristol has recently been enabled by the generosity of local firms to make a notable advance in the matter of engineering education. At a meeting held in the early part of the present year the desirability of instituting engineering scholarships was considered. The practical result of this meeting was that most of the firms of the neighbourhood agreed to institute bursaries, or scholarships, at their works. The holders of these are to be nominated by the College authorities. Some will be awarded on the results of the annual examinations, while others will be reserved for deserving students who may be unable to pay the usual premiums required on entrance into works. The educational scheme adopted at Bristol does not include any attempt to impart practical workshop instruction within the College walls, but the students will spend six months (April to October) in each year acquiring practical experience in the works and drawing offices of the engineers of the west of England. This system is found to answer so well that Messrs. Stothert and Pitt, of Bath, and the Bristol Wagon Works Company propose to make it obligatory on all their pupils to attend the College courses in the winter months for the first three years of their pupilage. Several firms have also signified their willingness to take College students for short periods, so that civil engineering and electrical engineering pupils may spend one or two terms of six months in works, while at the same time mechanical engineers may have experience in two or three different establishments during their College career. In return for these concessions the Council of the College has decided to permit deserving apprentices or artisans, nominated by the local engineers, to attend the College courses at reduced rates. It is expected that about nine first-class scholarships, and a larger number of second-class ones, will be available during the coming session.

Messrs. Crosby Lockwood and Co. will publish during the forthcoming season the following scientific and technical works:—"Flour Manufacture: a Treatise on Milling Science and Practice," by Frederick Kick, translated by H. H. P. Powles, illustrated; "A Dictionary of Terms used in the Practice of Mechanical Engineering"; "Practical Surveying," by George Wm. Usill; "The Mechanical Engineer's Office Book," by Nelson Foley (second edition); "British Mining: a Treatise on the History, Discovery, Practical Development, and Future Prospects of the Metalliferous Mines in the United Kingdom,"