

ostertagi, new to this country, and large numbers of the rare *Sclerostoma hypostomum*.

Exigencies of space forbid the mention of other contributions.



FIG. 3.—A branch of seeded hops produced on the same line and under identical conditions as those shown in Fig. 2, except that pollen was supplied to the "burr."

The letterpress and plates are alike excellent, and, as a year's record of all that is best in scientific agriculture, the *Journal of the South-Eastern Agricultural College* should find a place on many bookshelves.

C. A. E.

THE ROYAL PRUSSIAN AÉRONAUTICAL OBSERVATORY'S AÉROLOGICAL EXPEDITION TO TROPICAL EAST AFRICA.

THE Royal Prussian Aëronautical Observatory, Lindenberg, supported by the active interest of some "friends of science," sent out in June, 1908, an aërological expedition to tropical East Africa under the direction of Prof. Berson, first observer at Lindenberg, accompanied by Dr. Elias, formerly assistant, and Mr. Mund, balloon superintendent of the observatory. At the end of December last they returned safely, and in possession of a good amount of interesting data.

In consideration of the proximity of the region explored to British possessions in East Africa, and also in recognition of the help and protection given to our work by the English authorities, I asked Prof. Berson to write a special report for *NATURE*, believing that there are British readers who take interest in our work.

I am therefore glad to offer the following account of the work by Prof. Berson.

R. ASSMANN.

Director of the Royal Prussian Aëronautical Observatory, Lindenberg.

Much good work has been done lately in the exploration of the upper atmosphere in the region of the trade winds, more particularly the Atlantic trades, where men of science of Germany, the United States, and France have been making investigations, trying above all to

elucidate the very important question of the anti-trade. But in the Indian Ocean and the adjacent regions, the realm of the most powerful and persistent monsoonic system of the globe, with the exception of a few ascents from the German ship *Planet*, carried out in the southern and eastern portions of the ocean, only the Indian meteorologists, Mr. Walker and Mr. Field, had applied the new aërological methods for the study of the monsoon phenomena, the work in the south-west monsoon proving especially difficult on account of the stormy and rainy character of the weather prevailing during its sway.

Very naturally the idea occurred to try similar explorations on the east African coast and the waters washing it, the region lying at the starting point or (in the case of the Indian "winter monsoon") at the extreme limit of these peculiar wind-systems. It might be expected that there would be less difficulty to be encountered here than in India proper, especially if the work were carried out on the water, where self-registering balloons might be found easier, by means of a small steamer chartered for the purpose, and the wind, if too weak or too strong for kite ascents, increased or lessened by the motion of the vessel.

This plan once conceived, it occurred to us that some 600 miles further inland there was situated a vast sheet of water—the Victoria Nyanza—on the surface of which all the above-named advantages might be met for balloon as well as for kite work, thus affording the possibility of efficient and fruitful aërological research in the heart of a tropical continent, even in the middle of the equatorial belt, a unique spot of similar convenience to be found on the surface of the globe.

The Royal Prussian Aëronautical Observatory, the well-known creation of Prof. Assmann, took the matter in hand, and after having overcome a rather lengthy series of difficulties—above all, naturally enough, of a financial character—chiefly by the persistence of Prof. Assmann and the generosity of a few wealthy friends of scientific work we succeeded in carrying out our plan, at least in the leading features. This had in itself a double bearing. The first item consisted in an investigation of the monsoons, more particularly of the conditions of their change in the north-hemispheric autumn, and the intervening land and sea breezes, on the coast of British and German East Africa, as well as on the neighbouring sea (as a matter of fact, the work was carried far beyond the limits of the monsoons, down to the tropic of Capricorn). The other point was the "study of the tropical, or, more exactly speaking, the equatorial continent"—in contrast to the ocean of the same latitudes—from the aërological point of view, over the Lake Victoria, implying the research of the vertical distribution of temperature, the question of the "upper inversion," the study of the winds prevailing in the different strata, and, in addition, a comparative investigation of the land and sea breezes of the lake in analogy to those on the coast of the ocean.

For scientific and practical reasons, though, the experiments had to be executed in the inverse order; we began by the ascents on the large "inland sea of Central Africa," and wound up by research on the ocean.

The writer, as leader of the expedition, accompanied by Dr. Elias, and a technical assistant, left Europe in the middle of June, and managed, after some little delay at Mombasa and Nakuru, to arrive, *via* Uganda Railway and the lake, with all our cargo of windlasses, kites, balloons, chemicals, instruments, and personal equipment, on July 24 at Shirati, in German East Africa, situated on the east coast of the Nyanza, in 1° 7' S. lat.

That all the difficulties which, of course, did not fail to arise could be overcome with so little loss of time is to a large extent due to the extreme courtesy, or in many cases even most helpful assistance, with which the expedition met everywhere in British East Africa. For this the observatory is largely indebted to Dr. Shaw, the director of the Meteorological Office, to the Colonial Office, and to all the authorities, Imperial as well as local, in British East Africa and Uganda. We beg to express our feelings of sincere gratitude to all of them, most particularly to Dr. Shaw and to the officials of the Uganda Railway, the custom and port officers in all those places, and the officers of the steamers plying on Lake Victoria.

Owing to this loyal help we succeeded in securing a

small craft, the 45-ton steamer *Husseni*—owner, Mr. Allidina Vishran, of Entebbe, Uganda—for two months, in lieu of the intended *Heinrich Otto*, of Muanza, which, though otherwise likely to answer our purposes, unfortunately had broken down just when on the way to meet us. This delay, of some four days, was the reason that, contrary to our decided intentions, we only were capable of a very insufficient collaboration during the international series of ascents of July 27 to August 1.

After having got through the starting difficulties usual with African work we managed to execute in the time from the end of July until the middle of September twenty-three ascents of self-registering balloons, of which fifteen were retrieved with their apparatus, and registered curves of pressure, temperature, &c., whereas eight instruments were lost; but even the lost balloons furnished highly valuable data for the direction and velocity of wind in the alternate vertical strata, since nearly all the balloon flights were studied by means of theodolites from a fixed point on the shore.

A large number of smaller or larger pilot balloons carrying no apparatus, and some of them ascending to enormous heights, were inserted between the ascents of the self-registering tandem systems to complete the exploration of the wind, so important in these latitudes. A dozen or more kite ascents served the purpose of furnishing details about the lower parts of the atmosphere, particularly during the sea breeze, not exceeding in elevation 3000 feet to 4000 feet above the level of the lake, where the breeze disappeared altogether, thus rendering higher kite ascents impossible.

There can be no question as yet, having only just returned home from Africa, of giving a summary of the meteorological results; this must be reserved for some months later. We can only mention here crudely a few of the most striking points.

The highest self-registering balloon recovered rose to an elevation of 65,000 feet (19,800 metres), where a temperature of -84° C., $=-119^{\circ}$ F., was encountered, a lower temperature than ever registered at equal or even greater heights over Europe! Two other ascents reached 55,000 feet to 56,000 feet, with variable, although also comparatively low temperatures.

These very low temperatures confirmed the similar results obtained by MM. Teisserenc de Bort and Rotch on the *Otaria* in the equatorial regions of the Atlantic; but over continental East Africa we found also, occasionally, the "upper inversion of temperature" not encountered in the high strata of the atmosphere above the corresponding latitudes of the ocean west of this continent—certainly a feature of great importance.

While omitting the enumeration of many other interesting results, we at present only desire to point out the surprising fact that several times there was found an uppermost current of air blowing nearly from due west, and flowing above the regular easterly current of the equatorial region. The lower strata, underlying the regular east trade, were dominated by diurnal (at the very bottom) and seasonal winds.

After the middle of September we made a cruise on the lake, crossing it for the first time from east to west (from Shirati to Bukoba). The interior of the lake proved to be devoid of islands and uniformly deep.

The end of September and beginning of October were devoted to simultaneous ascents on the coast—at Mombasa—where experiments with kites and pilot balloons were carried out, and on the borders of the Nyanza, where Dr. Elias remained for a couple of weeks and made a series of pilot-balloon ascents, no kite work being possible there, since the little steamer had to be given up.

From October 9 until December 5, when the expedition definitely started on its homeward voyage, Dr. Elias preceding the other members by three weeks, the headquarters of our work was transferred to Daressalam. In this whole space of time there was hardly a day without a kite ascent, and besides these quite a series of pilot-balloon experiments was carried out. Part of the kite work was executed on the ocean south of Zanzibar from the little Government steamer *Rovuma*, in order to reach greater elevations; several of those higher ascents—a few exceeding 10,000 feet—were made at the end of October

in the time between the two monsoons, the others in the first days of December, the north-east monsoon blowing then steadily.

We had at first the intention of making in the month of November simultaneous researches on the coast of the continent and on the Seychelles Islands, situated in mid-ocean, some 1000 miles to the eastward. This plan had to be given up for meteorological and practical reasons; we succeeded, though, in replacing it, at least to a certain extent, by two of us going on board the small German cruiser *Bussard* to the south as far as Delagoa Bay, and making a couple of *ballons-sondes* and several kite ascents from this ship, on the ocean as well as in the bay of Inhambane, 24° S. lat. Dr. Elias, who had remained at Daressalam, made in the meantime simultaneous kite and pilot-balloon ascents there and on the sea.

In this whole series of experiments on or near the ocean, forming the second part of our work, the kite and "pilot" experiments prevailed, whereas ascents of self-registering balloons, forming the chief feature of the investigations on Lake Victoria, could only be carried out in two cases in the months of October and November. The higher reached 13,300 metres, $=$ nearly 44,000 feet, the kite ascents, as mentioned, reaching some 10,000 feet, $=$ 3200 metres; but the highest pilot balloon soared up to an elevation of about 21,000 metres, $=$ nearly 70,000 feet, before it burst, yielding most interesting data about the superposition of the wind systems and the westerly air-drift in the highest strata of the atmosphere in those regions.

A. BERSON.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual meetings of the Institution of Naval Architects opened on Wednesday, March 31, and were continued on Thursday and Friday, the rooms of the Royal Society of Arts being used, as on previous occasions. Owing to a family bereavement, Lord Cawdor, the president, was unable to be present, and the chair was taken by Sir Wm. White, K.C.B. The institution, having been founded in 1860, will complete its fiftieth year in 1910, when it proposes to commemorate the occasion by an international congress to be held in London.

The programme comprised eighteen papers, together with an additional paper by Sir Philip Watts on trials of torpedo-boat destroyers in waters of various depths. Limitations of space will permit of only a few of these to be noticed here.

Lord Brassey contributed the opening paper, on types of warships omitted in recent programmes of naval construction. Every maritime Power is now building Dreadnoughts; the needs of different countries may differ, but almost identical types are being produced, unanimity having been attained by imitation of British design. Types other than the Dreadnought, however, are of great value for the line of battle. Armoured cruisers have disappeared from the latest programmes, being too vulnerable to be reckoned as fighting ships. It is a waste of public money to keep such ships as the *Powerful* and the *Terrible* in commission. The naval experience and professional skill which we have available should now be directed to the creation of a type specially designed for the inshore squadron. The Dreadnoughts are essentially ships for the open sea, beyond the range of torpedoes and free from the danger of floating mines.

In closing the discussion on this paper, Sir Wm. White pointed out that the responsible naval architect had to produce designs to fulfil conditions laid down by the Admiralty. The *Powerful* and the *Terrible* had been designed to deal with some large Russian cruisers which had been built for the purpose of harrying our commerce, and would certainly have done so satisfactorily had occasion arisen. Although ships should be put out of service when twenty years old, it did not follow that such ships then disappeared for all practical purposes. In 1884 the speaker had designed two cruisers for the Japanese, and these ships destroyed Russian cruisers in 1905, when, of course, they ought to have been non-existent. Two matters had to be specially considered in modern policy—power of concentration and power of distribution.