The Umdhlebe Tree of Zululand

THE word "umdhlebe" does not, I think, appear in Döhne's "Zulu-Kaffir Dictionary." I presume it to be a derivative from the root *hlaba*, which Döhne interprets as denoting, among other things, the giving of pain. Some native tales of the tree will be found in part iv. of Bishop Callaway's "Religious System of the Amazulu," in which it is asserted that "there are several kinds, not one kind only of umdhlebe; some are small." I should be disposed to think the kernel of fact will be found to lie in native observation of the deleterious properties and weird aspects of certain *Euphorbiaceæ*. H. M. C.

Charlton, November 4

The Weather

THE past month has probably been one of the wettest on record. I have registered here 5·14 inches of rain during the month; only on seven days out of the thirty-one has the gauge shown less than 0·1; and on three days out of the seven rain has been recorded. J. M. FOUNTAIN

Hillingdon, Uxbridge, November 2

ON THE GRADUATION OF GALVANOMETERS FOR THE MEASUREMENT OF CURRENTS AND POTENTIALS IN ABSOLUTE MEASURE

THERE are several methods by which galvanometers may be graduated so as to measure currents and potentials in absolute measure, but they all involve, directly or indirectly, a comparison of the indications of the instrument to be graduated with those of a standard instrument, of which the constants are fully known for the place at which the comparison is made. There are various forms of such standard instruments, as, for example, the tangent galvanometer which Joule made, consisting of a single coil of large radius, and a small needle hung at its centre, or the Helmholtz modification of the same instrument with two large equal coils placed side by side at a distance apart equal to the radius of either; or some form of "dynamometer," or instrument in which the needle of the galvanometer is replaced by a movable coil, in which the whole or a known portion of the current in the fixed coil flows. The measurement consists essentially in determining the couple which must be exerted by the earth's magnetic force on the needle or suspended coil, in order to equilibrate that exerted by the current. But the former depends on the value, usually denoted by H, of the horizontal component of the earth's magnetic force, and it is necessary therefore, except when some such method as that of Kohlrausch, described below, is used, to know the value of that quantity in absolute units.

The value of H may be determined in various ways, and I shall here content myself with describing one or two of the most convenient in practice. The easiest method is by finding (1) the angle through which the needle of a magnetometer is deflected by a magnet placed in a given position at a given distance, (2) the period of vibration of the magnet when suspended horizontally in the earth's field, so as to be free to turn round a vertical axis. The first operation gives an equation involving the ratio of the magnetic moment of the magnet to the horizontal component H of the terrestrial magnetic force, the second an equation involving the product of the same two quantities. I shall describe this method somewhat in detail.

A very convenient form of magnetometer is that devised by Mr. J. T. Bottomley, and made by hanging within a closed chamber, by a silk fibre from 6 to 10 cms. long, one of the little mirrors with attached magnets used in Thomson's reflecting galvanometers. The fibre is carefully attached to the back of the mirror, so that the magnets hang horizontally and the front of the mirror is vertical. The closed chamber for the fibre and mirror is very readily made by cutting a narrow groove to within a short distance of each end, along a piece of mahogany about 10 cms. long. This groove is widened at one end to a circular space a little greater in diameter than the diameter of the mirror. The piece of wood is then fixed with that end down in a horizontal base-piece of wood furnished with three levelling screws. The groove is thus placed vertical; and the fibre carrying the mirror is suspended within it by passing the free end of the fibre through a small hole at the upper end of the groove, adjusting the length so that the mirror hangs within the circular space at the bottom, and fixing the fibre at the top with wax. When this has been done, the chamber is closed by covering the face of the piece of wood with a strip of glass, which may be either kept in its place by cement, or by proper fastenings which hold it tightly against the wood. By making the distance between the back and front of the circular space small, and its diameter very little greater than that of the mirror, the instrument can be made very nearly "dead beat," that is to say, the needle when deflected through any angle comes to rest at once, almost without oscillation about its position of equilibrium. A magnetometer can be thus constructed at a trifling cost, and it is much more accurate and convenient than the magnetometers furnished with long magnets frequently used for the determination of H; and as the poles of the needle may always in practice be taken at the centre of the mirror, the calculations of results are much simplified.

The instrument is set up with its glass front in the magnetic meridian, and levelled so that the mirror hangs freely inside its chamber. The foot of one of the levelling screws should rest in a small conical hollow cut in the table or platform, of another in a V-groove the axis of which is in line with the hollow, and the third on the plane surface of the table or platform. When thus set up the instrument is perfectly steady, and if disturbed can in an instant be replaced in exactly the same position. A beam of light passing through a slit, in which a thin vertical cross-wire is fixed, from a lamp placed in front of the magnetometer is reflected, as in Thomson's reflecting galvanometer, from the mirror to a scale attached to a lamp-stand, and facing the mirror. The lamp and scale are moved nearer to or farther from the mirror, until the position at which the image of the cross-wire of the slit is most distinct is obtained. It is convenient to make the horizontal distance of the mirror from the scale for this position if possible one metre. The lamp-stand should also have three levelling screws, for which the arrangement of conical hollow V groove and plane should be adopted. The scale should be straight, and placed with its length in the magnetic north and south line, and the lamp should be so placed that the incident and reflected rays of light are in an east and west vertical plane, and that the spot of light falls near the middle of the scale. To avoid errors due to variations of length in the scale, it should be glued to the wooden backing which carries it, not simply fastened with drawing pins as is often the case.

The magnetometer having been thus set up, four or five magnets, each about 10 cms. long and ·1 cm. thick, and tempered glass-hard, are made from steel wire. This is best done as follows. From ten to twenty pieces of steel wire, each perfectly straight and having its ends carefully filed so that they are at right angles to its length, are prepared. These are tied tightly into a bundle with a binding of iron wire and heated to redness in a bright fire. The bundle is then quickly removed from the fire, and plunged with its length vertical into cold water. The wires are thus tempered glass-hard without being seriously warped. They are then magnetised to saturation in a helix by a strong current of electricity. A horizontal magnetic east and west line passing through the mirror is now laid down on a convenient platform (made of wood put together without iron and extending on both sides of the magnetometer) by drawing a line through that