

the following sentences: "My doll nancy is sleeping. She is sick. mildred is well uncle frank has gone hunting deer. we will have venison for breakfast when he comes home. I did ride in wheelbarrow and teacher did push it," and so on. Enough has been said to indicate the remarkable powers of this unfortunate child, and to give basis for the belief, that if her training is continued in a wise direction, and with a proper appreciation of the value of detailed and accurate investigation, the world will be able to read in the life of Helen Keller a most momentous psychological lesson.

EXPLORATION AND TRAVEL.

Tibet and Nepaul.

A SUPPLEMENT to the 'Indian Survey Report for 1885-86' has just been issued. It contains the description of a native surveyor, M—H, through eastern Nepaul and southern Tibet, of which the *London Times* gives the following extract:—

"The explorer crossed the Nepaul boundary near Dagmarathana, in Bhagalpur, and, after making customary presents, obtained a passport authorizing his further progress, which lay northward over the Mahabharat range, one of the spurs of the great Himalayan Mountains. At various points along the route his passport was examined, his goods searched, and a tax exacted from him, and in some cases he had, in addition, to propitiate the local authorities with presents. On July 24, 1885, the explorer passed a great temple, called Halsia Mahadeo, situated on a mountain-spur, and deputed his travelling-companion to visit and examine the temple, which is held in veneration in the neighborhood, and has been endowed with a large free grant of land. At Asaliakhark, a fort held by four hundred Nepaulese soldiers under a captain, whose duty it is to examine all passes brought by travellers from the south, and, after full inquiry, to grant fresh ones to those proceeding farther north, the explorer was subjected to much interrogation, as his pass was only available for Nepaul. As it was known that he intended penetrating northwards into Tibet, he was closely searched, interrogated, and directed to return by the way he came, the soldiers being ordered to keep him under surveillance for such time as he remained there. After being detained for six days, the explorer was able, by making suitable presents, to obtain permission to proceed, having persuaded the official that he and his party were inhabitants of Jumla, and that they were anxious to return thither by Dingri, Jonkhajong, and Kagbeni, as being the most expeditious route. Their further march lay pretty close to the Dudhkosi River, and at Jubang Tibetan inhabitants were met for the first time. Khumbujong, a little west of Mount Everest, is the residence of the governor of the Khumbu district. The official is a Tibetan, and has held the post for the last thirty years: he receives no pay from the Nepaul Government, but is allowed fifteen per cent of the net revenue of the district, and pays an annual official visit to Khatmandu. For a time the governor absolutely refused the party permission to proceed northwards by a route which he alleged had never till then been traversed by any Hindostanee or Goorkha. The explorer had therefore to make a lengthened stay at this place, during which he endeavored to ingratiate himself with the inhabitants by treating their sick. One of the commonest diseases in the locality was goitre, and, as he succeeded in curing the governor's daughter-in-law of this, he was naturally taken into favor, and secured the sympathies of her husband, Sunnam Durje. This last-named individual was about starting on a trading expedition to the north, and by the exercise of sufficient tact was prevailed upon to take the explorer's party in his train. The man eventually gained his father's tacit consent to the arrangement, and, after a six-weeks' enforced inactivity, the explorer again started on his way. On Sept. 23, near Pangji, the famous deity Takdeo ('horse-god'), a black rock, in shape like a huge horse, was passed. Out of deference to Takdeo, which is considered very sacred by the Tibetans, no ponies are allowed on the route over the pass. The Pangula Pass over the Himalayas, he says, is decidedly the highest and most formidable ever crossed by him: he estimates the height at over twenty thousand feet, but, owing to an unfortunate accident to his boiling-point thermometer, he was unable to estimate it more accurately. The ridge forms the boundary between Tibet and Nepaul. At Keprak, the first frontier village, the Tibetan official refused the

party permission to go on, saying any such concession would cost him his life; but with the influence of their friend, Sunnam Durje, and by the exercise of a little diplomacy, a guide was eventually obtained to Dingri, across the great grassy plain called the Dingri Maidan.

"The town of Dingri, which has an elevation of 13,860 feet, consists of about two hundred and fifty houses, and the inhabitants are chiefly Tibetans, though there are five houses belonging to Goorkhas, and three or four to Chinamen, who have established themselves at this place for trading purposes. The houses are all stone-built, a tenacious whitish clay being used in place of mortar, and with flat roofs. The country round is well cultivated, but barley and peas are the only produce. The inhabitants all appear well-to-do. On the hill which rises immediately from the north of the town to a height of about three hundred feet, stands the stone-built fort occupied by the Daibung and forty Chinese officers, who are in command of about five hundred Tibetan soldiers. The Daibung is relieved once in three years, and during his tenure of office is allowed to trade within the limits of his province. There are said to be only three Daibungs, in all, under the Lhasa Government: of these, one resides in Lhasa, another in the Nam-Cho district, and the third at Dingri. The authority of the last mentioned extends from Shakia to the westernmost limits of Tibet, and he exercises both military and civil jurisdiction, short of capital punishment, within his territory. The trade in which the Daibung engages, so far as tea and salt are concerned, cannot be characterized as free. Each house in his jurisdiction is compelled to take one brick yearly from the Daibung at a high rate, and he realizes a large annual revenue from it. In addition to these two articles, he deals in blankets on the same footing as private traders. No gold is to be seen at Dingri: it is much sought after, and many inquiries were made of the explorer as to whether he had any gold, pearls, or coral to dispose of.

"The soldiers occupying the Dingri fort are armed with a sword, matchlock, and bow and arrows. The sword is the usual short, straight weapon, in wooden scabbard, met with all over Tibet; the matchlocks are sent from Lhasa; and the bows are made of bamboo which is brought from Nepaul. The soldiers manufacture their own powder on the spot. Lead is imported from Nepaul and Darjeeling; but, as bullet-moulds are unknown, they pour out the molten lead into a long, hollow scoop in the ground, and then clip it into convenient-sized pieces, which are hammered to suit the bores of the guns. The soldiers receive a small yearly pay (about £2 to £2 10s.), and are allowed to engage in agriculture, trade, etc. They are drilled by their Chinese officers every week or so, sometimes on foot, at other times mounted on ponies, which they maintain for themselves, and there are periodic inspections by the Daibung. At these inspections the soldiers always appear mounted, in uniform, and have to go through target-practice. For the latter a disk of leather, one foot in diameter, painted white, is suspended to a rope stretched across two poles. Each soldier in turn then rides full gallop across the field at about fifteen feet from the target, and fires as he goes past. Should he hit the mark, the officer in attendance with the Daibung scores a point. When all the soldiers have gone past in one direction, they return, firing in the same way as they go past the target, to their original position. They next go through the same course, using their bows and arrows instead of matchlocks. The Daibung then examines the notes of each officer, and for every point scored presents him with a khatag or kerchief. The explorer was not much impressed with the marksmanship he saw.

"As Dingri is situated on the high road from Lhasa westwards, it is the constant resort of traders, for whose convenience a serai capable of accommodating two hundred men has been built. The bulk of the goods is carried on mules, chiefly because they travel so much faster than either yaks or asses.

"Throughout the country from Bhagalpur to Dingri the chief articles carried northwards are tobacco-leaf, cotton-cloth, broad-cloth, iron, brass, and copper vessels, corals, and rupees, which are used for making jewelry; and for these the men of Khumbu go annually in parties to India, some even as far as Calcutta, taking with them musk-pods, yak-tails, antelope-horns, blankets, and stuffed munal and argus pheasants. From Dingri are exported into Nepaul

Tibetan blankets, musk-pods, goats, ponies, clarified butter, and yâk-tails. The chief grain grown is maize or Indian-corn. The domestic animals comprise buffaloes, yâks, zobus (cross-breed between yâk and cow), goats, and sheep of the long-horned species, largely used in Tibet for transport purposes. The yâk and female zobu afford a plentiful supply of milk. Among the wild fauna are musk deer and Tibetan antelopes, while flocks of wild pigeons and ravens and pheasants are common.

"The Daibung was away when the explorer reached Dingri, and did not return till Oct. 21. Great trouble was experienced in getting him to accord permission for the party to proceed westwards. The Daibung declared that this route was absolutely closed to all but officials; but in consideration of the explorer's companion, who was a man of influence in these parts, and in consideration of his promise to be answerable for their good behavior, the required permission was granted, but with a proviso that from village to village a guide should escort the party and send back regular reports of the progress made.

"The general direction of the explorer's route then trended to the west, past the Palgucho Lake, about nine miles by four in extent, the waters of which are clear and sweet to the taste, though it has no outlet. The Tibetan fort of Jonkhajong, the farthest point to the north-west reached, is a substantial stronghold, about four hundred paces square, protected by a mud and stone wall. Two officials, called Jongpons (Tib. = 'governor of a district') reside here, and exercise civil and judicial authority short of capital punishment. The surrounding country appeared well cultivated, and the inhabitants were reaping their harvest at the time. The Jongpons gave permission for the party to travel to Nubri in accordance with the terms of the passport, but, as the route was reported to be closed by heavy falls of snow, it was only by more presents that a pass allowing M—H to proceed as far as Kirong was obtained. Beyond Kirong the route nears the river, and for about one hundred paces is carried over a gallery about six feet wide, run along the perpendicular face of the rock at a height of from fifteen to twenty feet above the water's edge. The gallery rests on thick iron bolts driven into the rock at intervals, over which planking is loosely laid: the outer edge is fenced by a rudely made rope passed round wooden posts fixed to the bolts. At Naiakot the route turned westwards, and, crossing the watershed of the Tirsuli River, descended into the valley of the Buri Gunduk, one of the chief rivers of Nepal, which M—H ascended as far as Nubri, along a route nearly parallel with the line of his southward journey. Thence he retraced his steps along the Buri Gunduk to Arughat, a Nepalese village, where the party were detained three days pending the result of inquiries as to whence they had come and for what purpose. The explorer professed to have gone all the way to Nubri in search of one of his dependants, who, he alleged, had run away from M—H's home in Jumla with a large sum of money some time before, but whom he had not succeeded in finding. He said that, having failed in his object, he was anxious to return home *via* Tirbeni, where he intended going through the customary religious observances. He was then allowed to proceed, but warned, that, owing to the disturbed state of the country consequent on the recent insurrection in Khatmandu, he was liable to detention in several places. His further route to Tirbenighat, on the British frontier, lay in a south-westerly direction."

ELECTRICAL SCIENCE.

Alternating Current Electro-Motors.¹

THE alternating system of electrical distribution possesses many advantages for distributing electrical energy over extended areas; it has, however, certain disadvantages, among others that of not at present allowing the use of electric motors for the distribution of power.

In any central station supplying electric lights the full capacity of the plant is utilized but a short time during the twenty-four hours, and, taking the whole day, we will find that we have sold an amount of energy equal to a half or a third — perhaps even less

¹ Abstract of a paper read before the American Institute of Electrical Engineers, by Dr. Louis Duncan, Johns Hopkins University.

— of the amount we could supply supposing we worked always at full capacity.

If we draw a curve representing the energy used at different hours of the day for lighting, it will be something like $ODEHF$ $G X$ in Fig. 1. The total amount we could have sold is $A O X B$. If we can use motors on the circuit, we can sell an additional amount of power such that the power used for lighting and by the motors never exceeds the maximum capacity of the station. For instance, if the motors work until 6 P.M., we can use for them a horse-power equal to $H I$, and the total energy we can sell for the motors is $H I K L$. The solid part of our diagram is all of the energy that a purely alternating system can expect to utilize: a continuous current system, by employing storage-batteries, could fill the whole of the area $A O X B$.

In the alternating system the current and electro-motive force may be represented by the curves I and II, Fig. 2, the maximum

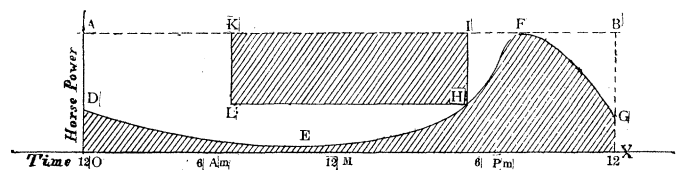


FIG. 1.

value of the current lagging behind the maximum of the electro-motive force. In the main circuit a high electro-motive force of constant maximum value is used, and this is reduced at points of consumption to the low potential necessary for safety, and for use with incandescent lamps, by 'transformers;' that is, by 'induction-coils' working backward. The value of the system lies in this: by using high potentials in the main or primary circuit, we can transmit a great deal of energy with comparatively little current, and therefore with little loss in the lines. This enables us to use small conductors, and avoid the large investment in copper necessary in distributing energy by the direct system.

If we can use motors in this system, we can almost double our receipts with comparatively little increase in our expenses. The plant remains the same; the salaries, interest on investment, and depreciation, are only slightly increased; our main additional expense is for the fuel.

The forms of motors that can be run by alternating currents are (1) an ordinary series-wound motor; (2) a motor built like an alternating current dynamo, the field-magnets being excited by the

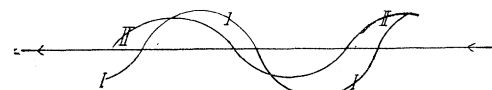


FIG. 2.

alternating current, which is first commutated so that its direction is always the same; (3) the same arrangement as the last, except that the field-magnets are excited by a continuous current from some external source; (4) the form proposed by Prof. E. Thomson, in which the armature currents are not supplied from any external source, but are induced in them by the alternations of the field-current.

Of these forms, (3) appears the most promising. Its advantages are, that when it is once started it will perfectly govern itself, revolving at such a speed that its own reversals of electro-motive force occur with the same rapidity as those of the dynamo driving it; it is cheap to construct, and durable; and it should be efficient, and give a greater output than corresponding machines of the other types. Its disadvantages are, that it must be first driven to its proper number of revolutions before the alternating currents will run it; there must be some external source of continuous current to excite the field-magnets; and if a load possessing any considerable inertia be suddenly applied, the motor will stop.

It is proposed to avoid these difficulties in the following way: