Darwin's time, they actually ended in the water, now they are cut off from the channel by belts of densely wooded moraine. The former greater extension of the ice is also shown by the way in which "the graceful ice-rounded foundation rocks of this and all the other mountains around slope up to the cliff and jagged arrêtes above" (p. 199), and proofs of oscillations of level are seen in the raised beaches and iceberg-carried boulders near Otway Water (p. 219).

Aconcagua (pp. 71, 72) towers into the sky, the grandest peak of the southern Andes. It appears to be built up of approximately horizontal beds of volcanic rock of different texture, hardness and friability, which are carved into steps like those which gave their name to the "trap" rocks of Sweden. The steps are better preserved towards the right- and left-hand sides of the slope than in the middle, where the downward drift of débris and the fall of avalanches are most common. The edges of the steps are there completely worn away and buried. The flow of débris down the face is such that the fragments tend to become rounded or subangular, like pebbles in a brook by their friction against one another. When he was descending the mountain, the stones at one point (about 20,500 feet up) poured away beneath his feet and disclosed the subjacent rock, which he perceived to be ground quite smooth by the passage of the débris over it.

Sir Martin gave some time to the examination of those curious remnants of great slipped or drifted masses of snow, the *nieves penitentes*, so called because they stand like devotees enveloped in shroud-like robes doing penance. They require peculiar conditions for their full development, and therefore, although somewhat similar pillar-like remnants of melting snow may sometimes be seen even in this country, they are not common anywhere in the Old World and only over limited areas in South America. They are cut out of avalanche snow which has been subjected to pressures roughly perpendicular to the direction of its fall, and thus hardened into approximately vertical strata of different densities. The wind has nothing to do with their origin, but they are carved out by the melting action of direct solar radiation. They are roughly elliptical and somewhat bent over to the north, the major axis of the elliptic sections being oriented east and west. On searching for *penitentes* in different stages of development, he found that a thick bed of well-compacted snow, when exposed to the action of the sun, soon becomes pitted over with little saucer-like depressions, and the deeper these become, the less power has the sun's rays upon their sides and the more upon the bottoms of the depressions. The hollows enlarging ultimately run into one another, leaving rough pyramids of snow standing up between them, until at last the ground is reached; the spires are entirely separated from one another and are seen standing about on the stony floor like separate sugar cones.

There is also a mountain called Penitentes (p. 108), from the weathered-out columnar structure of the rocks which form its summit, not unlike what we sometimes see in our strongly jointed Mountain Limestone or Millstone Grit.

Many other curious questions arise out of an examination of such an area; for instance, the great unconformity (p. 105); the inosculating valleys (pp. 127, 131); the landslips and rock creep, or rivers of mud and stone, similar to those described by Heim in Switzerland; the moraines modified by blown sand (pp. 55, 56).

So little has been done towards the exploration of those strangely varied and, for most people, inaccessible regions that we gladly welcome Sir Martin Conway's diary of his adventurous journey through southern Chili and Tierra del Fuega, and of his difficult climb and almost equally dangerous descent of Aconcagua and Sarmiento. T. McK. H.

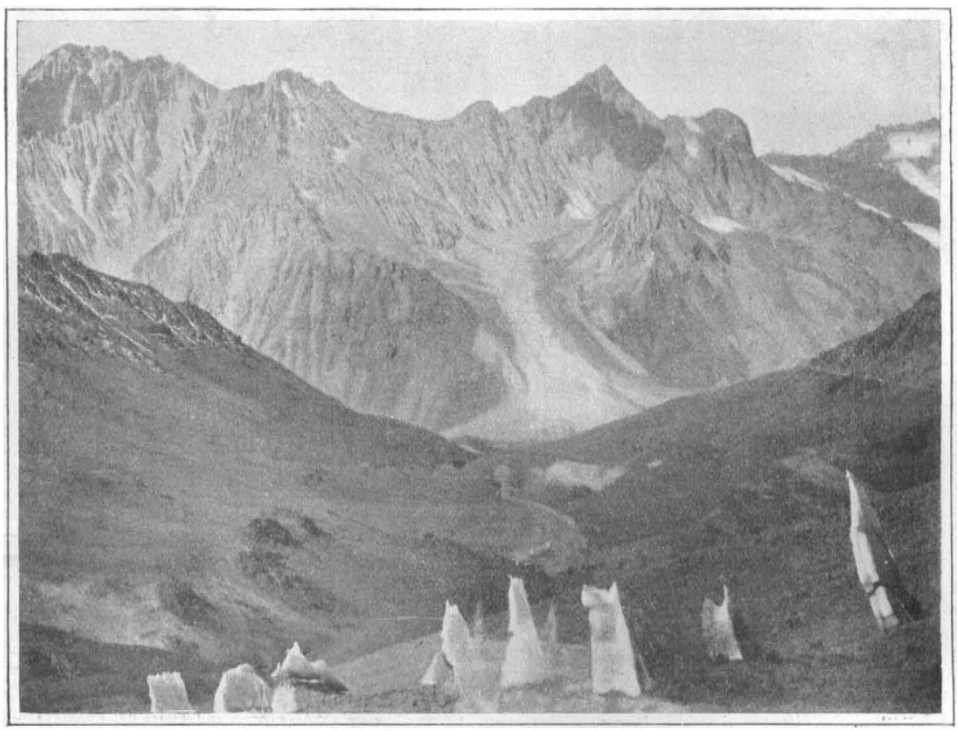

FIG. 2.—Nieves Penitentes; the last stage. (From Conway's "Aconcagua and Tierra del Fuego.")

## *SECONDARY AND TECHNICAL EDUCATION.*

NOW that the Education Act has become law, one of the first duties of the newly constituted local authorities will be to determine what are the educational needs of their districts and how far these needs are met by existing institutions; they will then be able to decide in what directions increased educational facilities are needed and how they can most efficiently provide what is wanted.

It is in the domain of secondary education that such a survey as is foreshadowed above is likely to form most

frequently the basis for a demand for a revision of the curricula of some of the schools in the district. Thus, in many of the administrative counties, we still have too many schools which devote a large amount of time to the study of classics, not because most of their pupils are best fitted for life by such study, but mainly because the school prepares each year a boy or two for Oxford or Cambridge. Wise county councils will probably decide to limit the number of classical schools within their counties, sending, by means of scholarships, the best boys capable and desirous of receiving a good classical education to one or more selected schools in the district. The remaining county grammar schools will, it may be hoped, be modernised and adapted to the needs of the bulk of the pupils attending them. In many, a strong agricultural side should be developed; in some, a good modern education should be given.

It will be asked, "What is here meant by a good modern education?" In the opinion of the writer, this should include English—taught much more thoroughly than is usually the case in grammar schools, where classics absorb the lion's share of the pupil's time—and mathematics, based on practical measurements and including a knowledge of geometry gained by methods more suitable for boys and girls than those set forth in Euclid's elements. German, taught by colloquial methods, should be a compulsory subject because the study of its grammatical peculiarities forms a mental training as useful as can be given through the medium of Latin or Greek, and because it is becoming increasingly difficult for one who does not know this language to follow the latest developments in either industry or commerce. French should also be taught where possible, but in cases where only one language can be learned, it should be German. Drawing would naturally form part of the course, and some suitable form of manual training, such as modelling or woodwork, should be introduced.

Above all, it is to be hoped that local authorities will discourage the pseudo-classical schools which have sprung up in the last two decades owing to the desire of some ancient grammar schools to meet the demand for the teaching of modern subjects while still devoting some portion of the school time to Latin. The result is—what might be expected—that neither Latin nor modern subjects are mastered; the pupil has a smattering of too many things.

Although a diminution in the amount of classical teaching is here advocated, it must not be supposed that the value of sound classical training is underestimated, where a pupil's time suffices for this as well as for the subjects he needs to enable him to earn his living, it is well that he should study Latin and, if possible, Greek. But in cases where the school life of a boy or girl is necessarily limited, it is much better that his or her mind should be trained through the medium of subjects likely to be of greater service in after life; above all, it is very doubtful whether a child obtains any substantial benefit from a classical training so imperfect that he remains unable to appreciate, or even to read easily, classical literature.

In the towns, the matter will be more complicated. Many local authorities will have to determine how best to deal with the higher grade board schools, where they exist. In each town, the problem will be different; where the towns are badly provided with secondary schools, it may be wise to convert the higher grade board schools into secondary schools, but, in such cases, they should not be allowed to strangle existing efficient secondary schools by providing education of the same kind as these schools offer, practically free of charge. If the circumstances of the town make it desirable that secondary education of a certain type should be offered free, then all the schools of this type should be placed in a position to offer the same terms to their pupils, so that such competition as exists will depend only on the relative efficiency of the teaching in the schools. On the other hand, in some towns the higher grade board schools have been competing needlessly with secondary schools in their neighbourhood. In such towns, the higher grade board schools can be converted into higher elementary schools, giving a training for the large number of boys and girls who must leave school at a comparatively early maximum age, say fourteen or fifteen. Indeed, as recent Parliamentary returns show, there are, in most higher grade schools, very few boys or girls above fifteen, except backward ones. The curricula of these schools should be materially altered; they are at present far too ambitious, having regard to the average age at which their pupils leave, and should be amended so as to include only that amount of work which can be satisfactorily covered, and the comparatively few pupils for whom the present curricula are devised should be transferred, by means of scholarships, to secondary schools.

One of the most fertile causes of the comparative inefficiency of some of the secondary schools in this country is the large number of examinations for which they find it necessary to prepare their students. Thus we have, not only the examinations of the Board of Education, but also the local examinations of the various universities, special examinations for the Army, the Navy, the Civil Service, different county and other scholarships, &c. It would be an enormous gain if, in place of all these various examinations, we had one State examination, on the results of which there would be issued a certificate, guaranteeing a good general education and recognised as qualifying for admission to the universities, the Civil Service, the Army, the Navy, &c. Unfortunately, enormous vested interests are opposed to such a plan, as the present system of indefinite multiplication of examinations finds employment for a large number of examiners and is stamped with approval by the action of the older universities, which have in recent years extended their system of local examinations so as to include quite young children; *e.g.*, the maximum age for admission to a so-called "honours" class in the preliminary local examination of the University of Cambridge is fourteen!

Assuming that a suitable basis for technical education has been made by the provision of an adequate number of secondary schools, it will then be necessary to consider what technical institutions are needed in the district. This will, of course, depend largely on the nature of the industries which exist in particular neighbourhoods. In many administrative counties, the only technical institution needed will be an agricultural college, and for some counties a share in an agricultural college would suffice. In other administrative counties, provision must be made for proper technical instruction in such subjects as coal mining, metallurgy, fisheries, &c. But, as a rule, the county will find much of what it wants in the large technical colleges already existing in the great cities within, or adjacent to, the geographical borders of the county.

In many of the smaller county boroughs, there are already technical schools providing evening classes for artisans; in the remainder, such evening classes might not infrequently be provided in connection with the modern secondary school of the place. In large cities, which are great centres of population, a first-class technical institution will be needed, providing not only evening classes but more especially instruction for adult day students on a par with that given in Germany and the United States. This can only be done effectively by concentrating in one institution for each district either all the higher technical education or, at least, the highest part of such education in a certain number of branches of technology and commerce. For it is only in institutions with numerous pupils that it is economically justifiable to provide the expensive equipment needed for such work

and the large number of highly paid specialist teachers who ought to be employed therein.

At present there is no technical institution in the United Kingdom which is staffed on a scale even approximately equal to that of such foreign institutions as the Charlottenburg Technical High School, Berlin, and the Massachusetts Institute of Technology, Boston. In these magnificent technical high schools, in place of two or three professors, *e.g.*, of engineering, we find a very large number of highly qualified men, each dealing with some special branch of engineering knowledge, and this can be economically done because of the very large number of engineering students gathered together in one institution. In this country, at present our comparatively few adult engineering day students are scattered among a relatively large number of institutions; as a result, such far-reaching subjects as electrical engineering have to be entrusted to a single professor. Indeed, there are some technical colleges in which there is only one professor of engineering, and electrical engineering is in charge of a poorly paid assistant lecturer.

To remedy this, coordination of work is necessary, not merely within the great towns, but even between neighbouring educational authorities, which are not infrequently jealous of one another and pursue their work regardless of what is going on around them. Hence we have cases of towns within easy reach of one another where technical institutions have been established, each of which tries to do the highest possible work in all the subjects which it undertakes. The result is a small number of students in each subject in each town and a staff of teachers proportionate, it is true, to the number of students, but inadequate for the purposes of advanced technical education. It would be well, therefore, if power were given to the Board of Education to select a limited number of central institutions where alone higher technical education in the day-time should be given.

Liberal financial aid will be needed to place such institutions on a satisfactory basis, and as they will be national rather than local institutions, a large part of the money for their support should be provided from the imperial exchequer; the remainder should be contributed by the various local authorities in the districts which they serve.

Another important matter which must be determined is the relation of institutions providing the highest kind of technical training to the universities or university colleges in the same district. The best solution of this problem in such a case as, *e.g.* Manchester would be for the technical institution to absorb all the higher technical work of the city and for the university college to devote itself to the faculties of theology, literature, philosophy, medicine, law, pure science, music, &c. Where local universities are established, the technical institution would become the faculty of technology and commerce; it should not be subjected to the academic control of the university, which might tend to destroy its usefulness for industrial and commercial purposes.

The great technical institutions of Germany and America exist side by side with important universities; they are, however, independent of these, and it is partly to this fact that they owe their usefulness in promoting the industrial progress of the German and American nations.

An important problem for the new local educational authorities will be the training of teachers of trade subjects. It is easy to find men with a good knowledge of their respective trades, or persons who can teach well, with a superficial knowledge of an industry, but the combination of these qualifications is comparatively rare. It is not easy to see how this can be speedily remedied, but an improvement might be produced by arranging a higher scale of remuneration for teachers of trade subjects who had passed examinations giving evidence of their power to explain in simple language matters connected with their own industry. More than this it is probably impossible to demand at present.

As regards the more highly qualified teachers needed for adult day classes in technical institutions, one of the greatest difficulties is how best to keep such men in touch with their respective industries. If the teacher's whole time is not required for the work of the institution, he can remain in contact with the industry by doing consulting work and by research. Unfortunately, in such cases there is often a tendency for him to regard his teaching work as the least important part of his occupation; in fact, one has known cases where the principal value of such a teacher to his students has been the fact that his name was well known in the industry and his recommendation consequently a valuable one, though his actual teaching work was of a merely nominal character. The cure for this would be to make the pay which the teacher receives for teaching by far the largest part of his income; such an arrangement would, however, mean a considerable increase in the salaries of teachers of technical subjects, but, in the opinion of the writer, it would be justifiable, as it would make it possible for some of the best men to continue teachers; at present, such men are attracted to the industries by the incomparably larger financial prizes which they offer.

J. WERTHEIMER.

## *PREVENTION OF RABIES.*

A LETTER headed "Mr. Hanbury admits the failure of the muzzle" has been addressed to us by a member of the executive committee of the National Canine Defence League, which letter, as might be expected, urges in so many words on behalf of the canine species the total abolition of the muzzling order at all times and under all conditions. The writer of the letter vindicates for himself, as might also be expected, a superior knowledge concerning rabies, its nature and its mode of spread; he, as a matter of course, is one "who understands dogs" and considers "that the muzzle was from the first condemned as useless cruelty." According to this authority, the Board of Agriculture, including, we presume, its veterinary department, "itself ignorant of dogs and their diseases, has persistently refused to be advised and guided by those who do possess the requisite knowledge" (*sic!*).

To be serious, it is no new thing that there never is any lack of amateurs who, notwithstanding the obvious want of special knowledge required to form an opinion, are in their own estimation quite capable of judging of the merits or demerits of a question that can be only dealt with adequately by the specialist possessed of the requisite knowledge.

Rabies is an infectious disease, directly communicated by the bite of a rabid animal, in the vast majority of cases a rabid dog. In the interest of the animals themselves—all domestic animals are susceptible to the disease—and above all in the interest of human beings, the disease should be, and as a matter of fact has been, controlled, checked and prevented from spreading by the thorough, not half-hearted, carrying out of the muzzling order: that is, the slaughter of ownerless and stray dogs—the most dangerous because the most frequent means of contagion—and by the muzzling, not merely the pretence of muzzling, of all dogs, so as to include also those that may and sometimes do harbour the contagium before the actual disease has fully declared itself in them. Such is the practice, the only rational practice, which is followed, and successfully followed, in other countries at times when rabies makes its appearance. The private opinion of Mr. Hanbury or any other politician on this subject, and the complaint that—owing, most probably, to the loose and half-hearted manner of