REPORT

OF THE

SPECIAL COMMITTEE ON EQUIPMENT FOR MOUNTAINEERS.

(Vide *Alpine Journal*, Vol. XV., page 458.)

MR. PRESIDENT AND GENTLEMEN,

As it is evident that climbers engaged in exploring unknown mountain ranges require all the equipment which is necessary in the Alps, in addition to the special outfit needed for camping out for prolonged periods, we have endeavoured in our report to set forth a fairly complete equipment, adding such details of information as we think may be useful to members.

In order to simplify reference as much as possible we have divided the report into two parts. We enumerate in the first what may be necessary when actually climbing, including such articles as a climber might require if sleeping one night in an Alpine hut, which we have assumed to be furnished with blankets, cooking apparatus, &c.; the second part is devoted to what may be useful in camp or at headquarters. In the latter an Alpine climber may possibly find some useful hints.

Every one must settle for himself, according to the length of the expedition and the number of the party, the quantities requisite of each article. When an article has been described in the actual climbing equipment, it is not necessarily mentioned again in the camp equipment, though it may be one which is very liable to breakage or rapid wear.

In 'Hints to Travellers' (6th edition), published by the Royal Geographical Society, both climbers and intending explorers will find much valuable information.

For convenience of reference this report is paged separately; an index and a list giving the addresses of all the firms mentioned in it will be found at the end.

A list is also given of various Continental firms, with the articles of equipment they are prepared to supply. For this information we are indebted to the courtesy of many of the Foreign Alpine Clubs.

We take this opportunity of thanking the large number of members who have assisted us in our work, and more especially all those (members and others) who have sent us valuable suggestions since the provisional report was issued.

C. T. Dent.
W. M. Conway.
J. H. Wicks.

EQUIPMENT FOR MOUNTAINEERS.

PART I.

Ice Axe — Rope — Rücksack — Liquor Bottle — Flask — Drinking-Cup — Spectacles — Lantern — Knife — Crampons — Sundries — Food — Wearing Apparel, including Gaiters, Gloves, &c.

Ice Axe.—Individual tastes vary to so great an extent that we consider it best to limit ourselves to the following few remarks :—

As a rule, axes made in Switzerland are better adapted for actual step-cutting than those made in England. An axe must be well balanced, and should be too short rather than too long.

Leather fastened on to the handle is a mistake. A rubber tube, such as is made for cricket-bat handles, is considered to be a good substitute; a length of about six inches will suffice.

When climbing without guides, there should be at least one heavy axe, weighing fully three pounds, in the party, as it reduces very much the labour of cutting. One light axe is recommended as useful for clearing rocks of ice, or for cutting an occasional step with one hand, whilst hanging on to difficult rocks with the other hand.

Rope.—In addition to the climbing rope, a spare rope will be found useful in descending very difficult rocks; when hitched over a rock it acts as a safeguard to the last man, and when time is of importance it enables a whole party to descend more quickly.

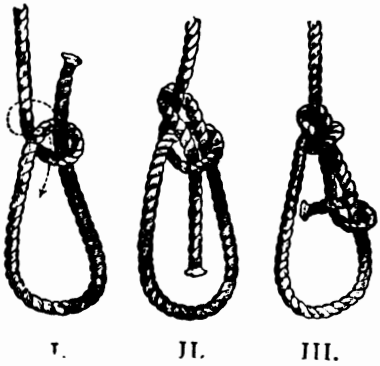
All rope should be carefully examined from time to time, to see if it shows signs of wear.

Members are strongly advised to buy their Alpine Club rope of John Buckingham, for the reasons given on p. 5.

Since the article in the 'Alpine Journal' (vol. i. p. 323) was published, it has been found that the bowline knot is much the most simple for use at the ends of the rope. As the article referred to was published in 1864, and may possibly not have been read by many of the present members,

we think it advisable to append diagrams of the knots which we consider to be the best; they are as follows:—

(1) The 'Bowline Knot,' for making a loop at the end of the rope.



I. II. III.

Fig. I. shows the method of making the knot, Fig. II. shows the knot complete, and Fig. III. shows it drawn tight with a half-hitch added to prevent its working loose.

(2) The 'Middleman Noose,' or 'Running Knot to hold,' for making a loop in the middle of the rope.

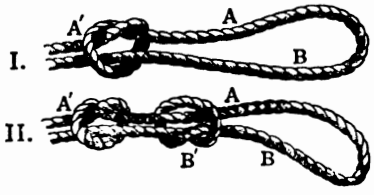


Fig. I. shows the loop made first in the middle of the rope, forming the first knot A', and the loop AB.

Fig. II. shows the similar loop and knot B', made on the free side of B (Fig. I.), giving the loop AB (Fig. II.), which is drawn tight round the waist and secured by the knot A'.

(3) The simple 'Fisherman's Bend' for joining two ropes together.

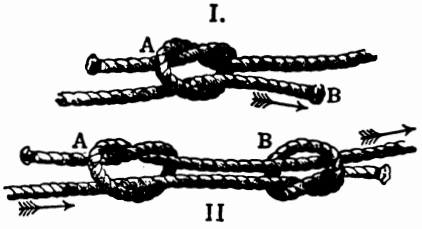


Fig. I. shows the knot made on rope A, with rope B passed through it.
Fig. II. shows the knot complete.

(4) The 'Figure of Eight' tie for joining two ropes together.

I.

II.

Fig. I. shows the first half of the knot made.
Fig. II. shows the knot completed.

The 'Middleman Loop,' or 'Running Knot to hold,' is practically the same as the simple 'Fisherman's Bend,' and some prefer to employ this loop also at the ends of the rope so as to use only one kind of knot for all purposes. The 'Fisherman's Bend,' however, has disadvantages, when employed as a loop, which do not exist in the 'Bowline.' It is perfect for uniting two ropes of the same size for temporary purposes, but in a long day's climb it has a tendency to work loose, and if it is necessary to unite two ropes for the use of one party (which should be obviated if possible), then the 'Figure of Eight' tie, though somewhat complicated, is by far the best. We have been unable to discover any simple loop suitable for the middle of the rope when the ends are not available, which is better than the one we have recommended. Naturally, all complicated knots should be avoided.

The following are the results of that portion of a larger series of experiments on the strength of ropes and knots which are likely to be of interest and importance to mountaineers. The experiments were made by Messrs. L. A. Legros and O. Eckenstein, with the testing-machine at University College, London.* This is a steelyard machine, reading (for such loads as were observed in the experiments) to within five pounds dead load.

* Messrs. Legros and Eckenstein express themselves much indebted to Professor T. H. Beare for kindly placing at their disposal this testing-machine and other apparatus.

SERIES I.

Tests of Ropes and Cords in Plain Tension.

—	No. of Tests	Mean Dead Load	Weight per 60 feet	Strength per lb. per 60 feet
		lbs.	lbs.	lbs.
Alpine Club Rope, Buckingham's	5	2,271	3·170	716
Ditto ditto	2	2,135	2·910	734
Alpine Rope, with red thread, *not* made by Buckingham	3	2,060	3·670	561
Buckingham's Flax Cord cable laid No. 1	1	685	1·241	552
Ditto No. 2	2	550	1·028	535
Ditto No. 3	2	495	0 814	608
Ditto No. 4	2	408	0·636	641
Ditto No. 5	3	262	0·420	624
Buckingham's Snood line, No. 8	3	142	0·157	905

SERIES II.

Strength of Knots in Buckingham's Alpine Club Rope compared with the Strength of the Rope.

Type of Knot	No. of Tests	Strength of the Knot in comparison with the strength of the Rope
		Per cent.
Plain knots:—		
Thumb knot	2	54·7
Twofold knot	2	60·3
Figure-of-eight knot	2	60·6
Knots for uniting two ropes:—		
Single sheet bend	2	47·1
Granny	2	47·9
Openhanded knot, against the lay	2	52·7
Reef knot	2	53·4
Openhanded knot, with the lay	2	54·5
Simple tie, or double overhand	2	55·6
Weaver's knot	2	57·7
Double sheet bend	2	58·4
Double fisherman's bend	2	59·3
Two links with sailor knots	2	59·6

STRENGTH OF KNOTS IN BUCKINGHAM'S ALPINE CLUB ROPE—*Continued.*

Type of Knot	No. of Tests	Strength of the Knot in comparison with the strength of the Rope
		Per cent.
Knots for uniting two ropes:—		
Simple fisherman's bend . . .	3	61·7
Figure-of-eight tie	2	63·1
Loop knots, tested in the position of end loops only:—		
Swiss loop, against the lay . .	1	57·4
Openhanded loop	2	64·1
Running knot to hold, or middleman loop	2	65·0
Swiss loop, with the lay . . .	1	70·7
Bowline	3	72·4
Figure-of-eight loop . . .	2	76·8
Double tied loop	2	82·9

All the knots, unless otherwise stated, were tied with the lay. With guides and amateurs alike, it is usually a matter of chance whether the knot is tied with or against the lay.

We believe the majority of Swiss guides use the Swiss loop at the end of the rope, and the openhanded loop in the middle.

The method of securing the rope in the machine was such that fracture occurred in each case in the portion of the rope clear of the means of attachment. The tests of all the loop-knots were made with a two-inch round pin passing through the loop, which was in each case two feet round. It is hardly necessary to add that in every case in the knot tests fracture occurred at the knot.

Rücksacks.—Having inspected various kinds of rücksacks, we have selected three types as likely to be useful to mountaineers. Two of them are made in Willesden canvas; the third is lined with mackintosh. The Willesden canvas is sufficiently waterproof to turn any wet likely to be met with in purely climbing expeditions; but for carrying clothes the mackintosh lining is recommended, as the canvas alone does not afford sufficient protection against heavy rain on low passes or in valleys. The selected types can be modified in detail to suit individual tastes, especially as regards both outside and inside pockets. The straps at the bottom will be found useful for carrying gaiters (especially when

wet), camera legs, &c. If desired, webbing can be used instead of shoulder-straps; but in that case leather ends should be employed to fit the existing buckles. The three types are made by Messrs. Silver & Co., and are known as Nos. 1, 2, and 3, and are of the following sizes, measured when empty:—

No. 1. Large, Willesden canvas, 28 inches long by 22 inches wide, with two inside pockets.

No. 2. Medium, Willesden canvas, 24 inches long by 22 inches wide, with two inside pockets.

No. 3. Small, lined with mackintosh, 20 inches long by 17 inches wide, with two outside pockets.

Bottle for Liquor.—We know of two kinds only which we can recommend; both should be carried yoke fashion.

Silver's vulcanite gourd, covered with felt, having a cup on the top with a strap fastened through it which can be locked with a padlock. These are strong and well made, and have the drinking-cup always handy, but they take up the same room empty as when they are full. The felt covering keeps the contents to a certain extent hot or cold, as the case may be, and if wetted will rapidly cool wine, &c.; but a wetted bottle is not pleasant to carry. The largest size, which is provided with two cups, one inside the other, holds two quarts, and weighs, when empty, 2 lbs. 5 oz.; a smaller size holds one quart, and weighs 1 lb. 5 oz.

Leather bottles (*Peau de Bouc*), made in the South of France, but round instead of leg-of-mutton or flagon shape. They should have loops all round for the strap, especially one at the bottom; the position of these loops is of importance. The bottles are provided with an ingenious arrangement for locking. They diminish in size as the contents are consumed, and consequently the liquor cannot shake about in them. They are quite flat when empty. The strap for carrying them may be wider where it crosses over the back than towards the ends. When new, care is necessary in curing the bottles; water first, constantly changed, and then a little weak spirit and water, are the best curing agents. When in use, a wash with weak spirit and water now and again tends to keep the bottles sweet. If it is desired to change the liquor which has to be carried, the inside of the bottle, being hair, is not so easy to clean thoroughly as is the case with the vulcanite gourds. Brandy or other spirit must not be carried in these leather bottles. They can be obtained through Silver & Co., but the makers often take three months to deliver. A con-

venient size is one which holds two quarts, and weighs, when empty, 1 lb. 2 oz.

Sometimes climbers prefer to carry their liquor in small indiarubber bottles holding a pint each (J. H. Pontifex). Each member of a party can carry one of these in his pocket, and thus every man becomes responsible for his own liquor. Spirits of wine must not be carried in indiarubber bottles.

Whatever bottle is used should have the stopper securely attached to it by string.

The Spirit Flask should be small and be made of metal, which is preferable to both glass and vulcanite. If the cap is attached to a small chain secured to the flask it cannot be dropped and lost.

A Drinking-Cup of rubber, leather, or canvas to carry in the pocket. A large rubber bowl which folds flat is useful for making cup in (J. H. Pontifex). It takes a considerable time to destroy the taste of the rubber. A good plan is to fill the bowl with a mixture of Sanitas and water, which should be constantly changed.

Goggles should be of smoked glass (not blue). Take care to have velvet round the edge. Many are made without this protection, and the bare metal hurts the face on a very hot day, and more still in bad weather. Velvet is preferable to elastic over the nose. A strong leather case is recommended by some instead of the usual flimsy case or tin box. If a glass is broken a piece of card, with a thin horizontal slit in it, makes a good substitute. Some prefer the glass to be clear white, claiming that they can see more distinctly, and that the wire gauze affords sufficient protection to the eye. Goggles can be bought at Silver's.

Lantern.—The Vienna and Italian Alpine Club patterns (Hill & Son) are both suitable, but in a high wind it may be found necessary to stop up some of the holes. The latter, which is more generally known as the 'Excelsior,' is the best. Take good carriage candles to fit; they burn more slowly than others. Also take a few spare sheets of mica, cut to fit the lantern.

In case of necessity, a clear glass bottle with the bottom knocked out, turned upside down and slung by a string, makes a fair lantern with a candle in the neck. It may be well to know that a bottle with an inch of water in it, planted upright in hot ashes, breaks off evenly. The cracked edge is very sharp.

A Knife, with bright metal handle and loop to attach to

a chain or string, a large blade and tin-opener (both having lock spring), corkscrew, leather punch and button-hook. The tin-opener should not have a fulcrum sticking out at right angles to the side, but the fulcrum should be a bar parallel to and above the blade, so that the blade and fulcrum resemble a partially opened pair of scissors. A pick, let into the side of the handle, and long enough to clean a pipe, is useful.

Crampons, Steigeisen, or Climbing Irons.—All those who use properly made crampons speak very highly of their advantages, but the number of English climbers who have used them, or even given them a really fair trial, is exceedingly limited. They must be specially made in each case to fit the nailed boot. They consist of a framework of the best steel, in two parts, hinged together under the instep, and carrying ten large spikes. They will be made to order by the Albion Iron and Wirework Co. It is of special importance that the two front and the two back spikes should come just under the edge of the sole. It is perhaps needless to remark that for crampons to be of any great use every member of a party must be provided with them.

Sundries.—

Watch; an alarum watch or a repeater is an advantage.

Money.

Passport.

Note-book and pencil.

Sketch-book and other sketching materials (*vide* 'A. J.,' xii., 360–380).

Maps and guide-books, if procurable. Carry maps in a transparent oiled-silk case. G. Scriba, of Metz, makes a good case of this description, which can sometimes be obtained at Stanford's.

Compass, aneroid, telescope or field-glass (*vide* Instruments, Part II.). There should be two compasses in a party; those with luminous dials are the most suitable.

Tobacco, pipe, fusees, and matches. A wooden pipe, all in one piece, is very handily carried in a waistcoat or ticket pocket if the pipe is made short enough. A short pipe is less liable than a long one to be in the way; moreover, the tube of a long pipe has been known to freeze up in very cold weather. A cover for the bowl is essential in a high wind. Loewe & Co. make a good pipe of this description.

Short bandage, lint and plaster, cold cream, lanoline, or other grease (*vide* Medicines, Part II.).

Spare laces and twine (fine and thick). A few safety pins.

Candles, a sufficient quantity.
Linen bags to keep food clean in the rücksack.
Oiled-silk bags for sugar and biscuits.
Boxwood or horn spoon.
Whistle or siren.
Sling for axe.

Food.—The provisions to be carried for a single day's climbing from a centre will naturally vary with the taste of the individual and the capacities of the locality. Bread, butter, cheese, jam (or honey), meat, sugar, lemons (or strong lemon essence, not essential oil); wine (or cold tea and the like), brandy, biscuits, chocolate, prunes, or perhaps acid drops, may be mentioned as a fairly typical list.

Butter is generally carried in a strong glass or horn tumbler, but Silver & Co. make a round vulcanite box with a screw lid, which is preferable. The other provisions are usually wrapped in paper (destined ultimately to be littered over the mountain), but it is best to do them up in small linen bags brought out from England for the purpose. Oiled-silk bags are also useful for biscuits and sugar. A small wooden box with a screw top will be found handy for carrying salt. Southwell & Co.'s jam, in 4-oz. tins, enough for one meal, can be purchased of R. Jackson & Co.

The fresh meat usually to be had in the Alps is not appetising, and does not improve by being knocked about in a guide's sack. Chickens are perhaps the best and most palatable form of fresh meat, when obtainable properly fattened, as they generally can be in the great Swiss centres; potted meat is now very frequently preferred, and individual taste will naturally decide the form to be chosen. Irish stew, mulligatawny, and ox-tail soups, curries, and other preparations, put up in Silver's self-cooking tins, will be found excellent on the mountain side, where a hot meal is especially agreeable; one tin contains enough for the substantial part of a meal for three men. It may be well sometimes to carry beef-tea lozenges (Brand & Co.) when circumstances are likely to necessitate a prolonged interval between meals. The *rations condensées accélératrices* (*formule du Dr. Heckle*), made by Gaucher, costing 3 francs a box, and more commonly known as Kola biscuits, have been found to delay the approaches of exhaustion. Kola chocolate is also recommended. Both can be obtained from Silver & Co.

Most climbers prefer to drink red wine on the mountain side. A little sugar and lemon, and lemon essence, with a

couple of glasses of suitable liqueur, may be carried without perceptible addition to the weight of the packs; and with these, in addition to the red wine, the ingenious mountaineer may prepare a 'cup' which will be found very palatable, especially when the hard work of the day has been accomplished. Some men prefer cold tea or other non-alcoholic drinks, which may be made and carried in a variety of ways, according to individual tastes or prejudices.

Cold tea is infinitely superior when made with cold water instead of hot; indeed it is difficult to credit how great the difference is. The relative quantities of tea and water are the same in either case, but in cold water it has to remain soaking for several hours. We have made careful experiments with Darjeeling tea both in hot and cold water, the latter being left to soak from one to six hours, using the same quantity of tea and water in each case. We find that from four to six hours gives the best results. With other descriptions of tea the time might vary somewhat. One ounce of tea to three pints of water is about the right proportion. It is advisable to carry a small muslin bag (which should be well soaked in boiling water before being used) to strain the tea from the leaves.

Some kind of soup will probably form part of every supper at an Alpine hut, and, if Silver's self-cooking tins are considered too heavy, Lazenby's pea, bean, julienne, and gravy soups are all good—so is Edward's desiccated soup (F. King & Co.), but it is more bulky. The same qualification applies to Nelson's soups, but they are packed in small tin boxes, useful for many purposes. All these soups require to be soaked in cold water for about fifteen minutes before being thrown into boiling water. Pea flour, which can be bought in small tins (Symington's or Brand's), is a valuable ingredient in any plain soup, and so are the French desiccated vegetables, which can be bought everywhere. Bovril is useful for strengthening other condensed soups. Dr. Koch's meat peptone is more portable than bovril, and possesses certain valuable digestive properties, but it is not so palatable, and takes longer to dissolve. It may be bought in packets of 200 grammes (price 3*s.*), calculated to make ten litres of soup (Cie. Peptones de Viande du Dr. Koch). A pint of soup can be readily made in a light tin apparatus, sold by Hill & Son, for which spirit is necessary. Inglis's Metropolitan heating bottle, price 2*s.* 6*d.* (J. H. Pontifex), is very portable and light; it is similar to Hill's apparatus, but smaller. Should it be requisite to make soup only, then

Silver's self-cooking tins are more handy, especially if only one or two meals are required.

Wearing Apparel.—With the exception of boots, every article should be made entirely of wool. The coat and knickerbockers must be of strong texture. By dipping any woollen material in a solution of alum its power of resisting wet is greatly increased. Individual tastes will differ, but the following will be found to comprise everything necessary.

Coat.—Norfolk jacket (some prefer it made without the pleats) with as many pockets as possible, all made of light strong cloth and to button up. On the outside there may be the two usual breast pockets, two small ticket pockets, and four side pockets. The last six should have flaps, and be lined with mackintosh. On the inside have two breast pockets (one being wide and deep enough to carry a map) and a large game pocket going all round the skirt and fastened by several buttons. The inlet to this pocket should be high up in the coat, to avoid snow getting in when on a sitting glissade. The sleeves should have tabs for buttoning tight round the wrist, the tabs being on the upper part of the wrist, not on the under part. There should also be three buttons at the wrists, enabling the sleeve to be opened wide and turned back in hot weather. The collar should have the usual tab to button across the neck. The band should be let into the coat, and not be loose all the way round. About 3 inches loose on each side in front and working through loops is ample, one side being furnished with two buttons, the other with two holes to allow of varying the tightness. The tab for hanging up the coat should be made of doeskin, stitched on linen; such a tab will not stretch when, in hot walks, the coat is carried slung over the shoulder on the axe; this is better than wearing the coat and carrying the waistcoat.

Waistcoat.—Lined throughout with light flannel, and provided with a flannel back. Have four or six pockets, the upper ones with flaps; also have one inner pocket for bank-notes, which should be carried in an oiled-silk case. Silver & Co. sell a very warm waistcoat made of a thin soft leather lined with wool.

Knickerbockers.—The band should be of flannel; they may be lined with flannel extending down to the knees. The pockets should be made of flannel. In addition to the usual side pockets, two small fob pockets to button may be added high up—one to carry a watch, the other to carry money; they should be quite short. 'Revolver' pockets lined with

mackintosh and made to button are very useful, especially if a revolver or much paper money has to be carried. Knickerbockers fastening below with a band, turned up inside and buttoning below the knee, are recommended instead of the usual strap and buckle kind. Messrs. Hammond & Co. and the Jaeger Company know how to make this pattern. Some people prefer to have an extra seat sewn on the outside and a double thickness of stuff at the knee. In any case it is advisable to have a small quantity of the same cloth for repairs. Those who are always comfortable without braces should have the usual brace buttons omitted.

Shirt.—Should be of thick flannel, thoroughly shrunk, with collar attached.

Hat.—Felt, with broad brim and rather high in the crown. A strip of flannel between the leather band and the felt is an advantage. Some prefer to have a woollen band only, without any leather, but this plan has its drawbacks. An eye fixed under the brim at the back is useful to fasten a string to in high wind; if a similar eye be placed under the collar at the back of the coat the string can be quite short, and so never in the way; it should, in this case, have a spring hook at each end.

Climbing Cap.—In really bad weather a climbing cap protecting the ears, &c., is requisite, and at all events a light one should be carried on all long expeditions. Three kinds are recommended:—

Light: Generally known as Balaclava caps, Templar or knitted helmets, obtainable at the Jaeger Company.

Medium: A tweed cap made rather large, with large peak and with a large flap covering the whole neck, and buttoning under the chin; the flap is made double over the ears, and when not in use folds back and buttons over the top.

Heavy: Similar to the medium, but made of fur, obtainable at Silver's.

Stockings.—Stout hand knitted (Macdougall & Co.). Some recommend wearing socks under the stockings, in which case the boots must be made sufficiently large.

Boots.—Stout boots with large but rather low heels, the soles and heels projecting beyond the upper part; the tongue let into the uppers on both sides of the opening, so as to be watertight up to the top of the boot; the tab at the back to be of leather. Wrought, and not cast-iron, nails should be used; the outer row to be angular, so as to pro-

tect the edge of the soles and heels. The heads of the outer row at least should be as close together as possible. A supply of spare laces should be remembered.

Knitted Anklets.—We recommend these as invaluable, more especially for keeping small stones and moraine *débris* out of the boots. They are also useful in forest walking and in snow. They must be put on before the boots, but can be folded back when not actually wanted. They are also made as a part of the stocking (knitted in with it), but we recommend the loose pattern. Both are obtainable of the Jaeger Company and of Macdougall & Co.

Gaiters.—Any gaiter with a leather spat is a mistake. In our opinion, box-cloth is the best material for the whole gaiter, but a box-cloth spat with tweed uppers or a complete tweed gaiter may be used. Box-cloth, however, is stronger and more waterproof. It is absolutely essential that the gaiters should be made to fit perfectly the boot that is to be worn as well as the calf of the leg. They must come well down over the instep, and have a chain under the hollow of the foot. This chain is adjusted by being passed under the heel from behind forwards, instead of (as usually) under the fore part of the foot. The gaiter itself can be fastened with horn buttons, or hooks and eyes; a small strap and buckle at the top is an advantage. These gaiters are made by the Jaeger Company.

Putties, as used in India, made of a coarse strong woollen material, have been tried in the Alps, and are well spoken of.

Gloves.—These should be closely knitted, of thick woollen thread; they should have one pod for the fingers and another for the thumb. The back of the hand and fingers may be further protected by a piece of box-cloth or flannel sewn into the back of the glove. It is often advisable to carry two pairs. Such gloves can be obtained of the Jaeger Company. Thin indiarubber gloves (J. C. Cording & Co.) of good quality may be pulled over these woollen gloves, and will be found materially to increase the warmth; but rubber gloves with fixed woollen linings are not recommended.

Handkerchief.—The larger the better.

Muffler.—To be of silk, and large enough to go twice round the neck. Some prefer Shetland wool (Standen & Co.).

Over-jersey.—Made of Shetland wool (Macdougall & Co.), very warm and light; being elastic, it will go over or under the coat. It weighs far less than a kitted waistcoat, and goes into a smaller space. Some prefer in place of this a

spare flannel shirt; if taken, it should be large enough to go over the waistcoat. Others like the usual knitted waistcoat best, but this is heavy and bulky.

Flannel Running Drawers.—Made large, they are useful to draw on over the knickerbockers when sleeping out, or at starting on a very cold morning. They can be put on or off in a moment without delaying the caravan; and, in fact, they are to the nether man what the over-jersey is to the upper man.

Slippers.—Should be of leather, and strong enough for wear in the neighbourhood of an hotel or hut. A light and warm kind of high shoe is made by the Jaeger Company; it has elastic sides and no stiffening behind the heel, and is lined with woollen material. 'Ente-Finken' are thick list gout boots made throughout of strips of list plaited together and lined with wool; they can be bought anywhere in Switzerland for about 3 francs. They are valuable in a high bivouac to a person subject to frost-bite. Some prefer shoes made of indiarubber, with cloth uppers, manufactured by the North British Rubber Company, obtainable at most boot shops.

Mask.—Those who are obliged to wear a mask will find white wool far preferable to linen (Jaeger Company).

Waterproof Coat.—Many consider this to be a necessity. It should be made of light but tough mackintosh material. Probably the best shape is a sort of cape (not too wide in the skirt), just long enough to cover the coat, the sleeves being very loose at the armhole. The edges of the skirt and sleeves should have on the inside a strip of mackintosh about 2 inches wide, which, to a certain extent, will prevent the wet working up. An arrangement for tightening the sleeves at the wrist is desirable. Ventilation holes in the coat just below the armhole are of some use.

Part II.

Heavy Camp—Sleeping Kit—Cooking Apparatus—Lanterns—Camp Sundries—Tools—Clothes—Food—Packing—Light Camp—Instruments—Photography—Medicines.

In the previous part we have given a description of an equipment for the normal climber in the Alps, who usually starts from an hotel and returns to one, after a single night's absence at most. Mountaineers, however, now roam further afield; we, therefore, propose in this section to give a brief summary of the additional articles of equipment likely to be required by a man whose base of operations is a movable camp. It will be obvious that no single catalogue of requirements will apply uniformly to mountain expeditions made in all parts of the world. Equipment must vary for different men and different countries. The following paragraphs, therefore, are necessarily put forward more as a collection of hints than as an exhaustive catalogue, universally applicable.

The Heavy Camp.—The first requisites are the tents, of which one or more will be carried, according to circumstances. We recommend a tent made essentially on Mr. Whymper's pattern. It can be seen at B. Edgington's. If it is to hold four persons it should be 7 feet square at the base. Tent and floor should be made throughout of Willesden canvas. The floor should be sewn to the foot of the two sides and back of the tent, and should be turned up at the door end to a height of about 6 inches. Pockets (one for each person, and one extra) may be sewn to the lower parts of the sides and end of the tent, or bags may be hung by strings from the ridge or from the tent-poles. If ants are aggressive, the contents of the bags may be protected from them by bird-liming the suspending strings. A loop in the centre of the roof is useful to hang the lantern on. It is well to carry an extra piece of Willesden canvas and suitable needles and twine to mend rents. Each tent-pole may be made of two pieces jointed together in the middle. All the joint ends should be brass shod, and all corresponding pieces should be interchangeable. The joints must fit easily. Thick bamboo canes make the best poles. Such jointed poles can be packed in the Willesden canvas bag that

contains the tent. Mr. Mannering ('With Axe and Rope in the New Zealand Alps,' p. 65) recommends using inverted ice-axes, lengthened by means of supplementary poles, as tent-poles. This would save but a trifle in weight, and must cause delay at starting in the early morning.

A mackintosh sheet may be taken for additional protection against damp ground or snow. It should be about 8 feet square, and should have plenty of strings sewn on round the edge, loops to match them being attached at suitable intervals round the lower part of the sides and end of the tent, so that the mackintosh sheet when fastened in place forms a sort of waterproof tray. Instead of the mackintosh sheet a poncho may be used. This is a garment formed out of a large waterproof sheet of any convenient size (say 5 feet by 8 feet), with a longitudinal slit (say 1 foot long), which can be closed by a flap, cut in the middle. The head goes through this slit, and the garment is thus worn by the traveller whether on horseback or in camp. It weighs 2½ to 3 lbs. (J. C. Cording & Co.).

A folding seat will be found a luxury in camp. A light and strong form of sketching stool, made in France, and folding quite flat, can be bought at all artists' shops.

Sleeping Kit.—There are great differences of opinion about this. For sleeping in the 7-feet tent a large downy quilt at least 7 feet long and 8 feet wide, may be used; but an extra rug or two, or a Scotch plaid, will be no disadvantage, if additional weight is not of much importance. Empty bags, made of unbleached calico (Forfar), and measuring about 6 feet by 2 feet, may be taken out from England and filled, as opportunity arises, with grass or other stuffing, to serve the purpose of mattresses; cork mattresses, not necessarily more than 4½ feet long and 1½ feet wide, are likewise recommended. The Tuckett form of sleeping-bag (Silver & Co.) has many admirers. The material employed for it should not, however, be the red flannel generally used; Jaeger's thick camel-hair fleece will be found both lighter and warmer.* It is claimed for this bag that it will serve for protection against both cold and wet, and renders the employment of a tent unnecessary. The claim is disputed by some. Others, again, object to all waterproof coverings, and use plain woollen bags made of some undyed material. Another form of bag will be referred to in connection with the light

* It is well to bear in mind that undyed stuffs are often considerably lighter than the same materials dyed.

camp. A ring-shaped air-cushion to put under the hip is warmly recommended by all travellers who have used it. The Tuckett 'Insect Puzzler' is a very valuable contrivance, fully described in 'Hints to Travellers.'

Cooking Apparatus.—No good complete one is to be bought. Strong and rather heavy canteens are sold by B. Edgington, but the packing of them is found, by unskilled persons, to be like the fitting together of a Chinese puzzle, and thus articles get left out and lost. The traveller is advised to take one or more stew-pots or camp-kettles (with lid), which may be had of various sizes, to go one inside the other; a tin frying-pan with hollow-jointed handle; a Dutch-oven (if the extra weight can be permitted) for baking bread other than that made with baking powder, useful also for cooking all kinds of fresh meat; a ladle, a gridiron, a toasting-fork, one or two large spoons, a large knife and fork, and some strong tin-openers; a good pattern, made by John Watts of Sheffield, can be bought at Farrow or Jackson's. Each member of the party should also have a soup bowl, a tin plate, a cup, a spoon, and a knife and fork; a coffee-pot may also be taken. Where wood is not to be had for fuel, oil or spirit must be used. Spirit may be burnt in an open metal tray, without any wick or lamp apparatus at all. For a spirit lamp the Russian form, generally known as the Rob Roy (Silver & Co.), is the best; the smallest size is large enough for ordinary purposes. Mr. Mannering recommends the 'Aurora' pattern, which we have not been able to inspect. It is well to carry a tin bottle or two of petroleum, which is very useful for inducing unpromising materials to catch light. At high altitudes a small pair of bellows will be found invaluable for sparing the fatigue of blowing the fire with the breath. The smallest size Defries' oil cooking stove is also warmly recommended, if certain alterations are made to render it portable and protect the flame from the wind. The apertures of the casing must be filled with wire gauze, and an extra tin plate case provided, with perforations to admit just enough air for the flame. A tin bottle containing nearly a pint of petroleum will go inside the lamp. One ounce of petroleum will boil a quart of water in 20 to 25 minutes; the apparatus and bottle of oil weigh together 7½ lbs.; to be bought of Defries & Sons, price (including alterations) 1*l.* 5*s.* The traveller is advised to take with him some cloths suitable for washing up pots and plates. He should carry a plentiful

supply of matches and wax fusees * in a waterproof tin case (an old Aspinall's enamel case is said to be good for this purpose); a flint and steel and a few yards of tinder will save the matches if smokers are of the party. A lens carried in the pocket is useful as a burning-glass and for many other purposes.

Lanterns.—It is advisable to have a stronger lantern for use in camp than the Vienna and Italian patterns. The Beresford Lantern (Silver & Co.), with Mr. Dent's improved method of fixing the candle, has been found to stand rough wear. It is sold in a tin case, which also carries extra candles. It suffers from the defect that the position of the flame cannot be regulated. Good thick carriage candles, which have been tried in, and found to fit the lantern, should be taken out from England. A petroleum lantern is preferred by some.

Camp Sundries.—Large buckets are needed for fetching water to the camp. Silver's canvas water-bag is good for this purpose, and it also serves as a rough filter. A collapsible bath may be used to store the water in, or a plain rubber sheet, stretched over a depression in the ground, will do as well. Carry a pocket filter and *boil all doubtful water* before drinking it. Brushes, combs, a small mirror, scissors, towels, soap, and other toilet implements may be mentioned in this connection. The soap actually in use may be carried in a piece of tin-foil or a celluloid soap-box (Pontifex), which is light and does not get knocked out of shape by ordinary pressure, as the metal soap-cases do. Some pots of dubbin may be taken for the boots, but sperm oil is better, unless the smell is considered too great an objection. Yellow soap will keep leather soft.

A sufficiency of note-books, writing-paper, envelopes, small adhesive labels, pencils, crow-quill and other pens, blotting-paper, tracing-paper or cloth, drawing-paper, a piece of good indiarubber, and the like, with a waterproof case convenient for holding them, will be required. Black ink is best taken in the form of Perry & Co.'s soluble ink pellets, with a little bottle for dissolving them in. Red and blue inks and pencils may be required by some. A small paint-box will often be useful, and so will a number of elastic bands of various sizes. One or two packs of playing-cards may well be included.

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* It is to be regretted that wax fusees and matches are not to be obtained with waterproofed heads. They could be easily made.

A revolver and a few cartridges may be taken to certain countries. Plenty of insect powder (Dalmatian flowers), which should be fresh, is likely to be more generally useful. This powder, dissolved in spirit, and smeared on the face and hands, will ward off flies. Spirit of lavender or strong lavender water has been known to keep insects off; it should be sprinkled inside the sleeping-bag. A compact spring balance, with a ring at one end and a hook at the other, weighing up to 100 pounds, is convenient for making up the loads. A few extra clasp knives, a field-glass or two, and a few small musical-boxes, flasks, and looking-glasses are suitable for presents.

Some pots of paint (such as Aspinall's enamel) may be taken for making surveying marks or other needful records of position, and a paint brush must not be forgotten. Large safety-pins are often useful. Smokers should not forget a supply of tobacco, short pipes (with covers), and cigarette papers.

Tools.—Every traveller must carry some tools, but he need only take such as members of the party know how to use. The following is by no means an exhaustive list:—An American axe with leather cover, a hack-saw frame with spare blades, a geological hammer, cutting pliers, a cold set, a small two-handed screwdriver, a small jemmy, files, gimlets, bradawls, shoemaker's awls, tin-openers, knives, corkscrews, large scissors, a plain steel foot-rule (divided also on the metric system), a six-foot steel tape measure, marked in the English system on one side and in the metric on the other, an auger if a raft is likely to be needed, materials for mending kettles, boots, tents, sacks, and clothes, supplies of spare buckles and buttons, twine, straps, thread, wire, copper rivets, copper nails, and boot nails. No good boot nails can be bought in England, but excellent ones can be purchased from G. Anghiliri, the official bootmaker to the Italian Alpine Club. We recommend the traveller to take with him balls of Buckingham's twine, and of his 'Nos. 1, 4, and 8 snood,' also a few pounds of his 'No. 4 cable-laid.'

An experienced traveller writes:—'I have one hollow handle containing ten tools—gimlets, saw, turnscrew, nail-wrench, &c.; another hollow handle containing six files of different shapes, and a small drill (the smallest obtainable), with six bits for brass and tin work, and six for wood. Three stout bands of indiarubber hold all these together. A small saw, such as locksmiths use, and a geological

hammer and chisel (which can be used for purposes unconnected with geology) complete an equipment that I have carried in many lands.'

Clothes.—The clothes needed by the travelling mountaineer will not differ, except in number, from those required by the climber in the Alps, but an ample supply of underclothes is necessary. Two hats should certainly be taken. The best form of head-covering seems to be a leather cap of the kind used by Dundee whalers, and which can be bought in Dundee, and doubtless elsewhere. This cap is externally of leather and internally of warm wool. It has a fur-lined curtain, which can be either tied up out of the way on top of the head, or let down over the back of the neck and the ears, and tied under the chin. It has also a fur-lined peak, which can be either turned up or down. A more elaborate cap of the kind can be bought at Silver's. It will in some countries be well to provide, in addition, one or more white linen covers, made with an ample hanging curtain to protect the back of the neck from the heat of the sun. A couple of wide flannel cholera-belts should be taken, to be worn round the loins as protection against chills, especially in hot countries. A stout leather belt to buckle round the waist is found useful by many. A knife, luggage keys, and the like, can be hooked to it, and it can likewise be made to carry one or two small leather pouches, to hold the watch, compass, aneroid, or other small articles. Such belts and leather pouches can be found at Silver's. A large warm comforter should always form part of the kit. It will be lightest if made of Shetland wool.

Food.—In nothing is the advantage of the experienced traveller over the novice more marked than in the way he feeds himself. It is easy enough to draw up a list of foods which may be taken out from England, but that does not suffice. The health and condition of mountaineers on a protracted expedition will largely depend upon the skill with which they make use of the sources of supply afforded by the place in which they happen to be. It is only when all these resources fail that the traveller has to fall back, for his entire nourishment, upon tinned provisions. Such contingencies must, of course, be carefully prepared for in advance.

We have received many hints about the making of camp-bread, but we recommend the intending traveller to take lessons in the art from some person who has had practical experience in it, and in any case not to use fine flour, but

coarse meal, which produces a more easily digestible compound. Bad camp-bread is the cause of more deranged digestions than any other incident of travel. Bread is lighter if made with milk instead of water. A few cooking lessons will not involve waste of time to any intending traveller, and he should know how to cut up an animal or prepare a fowl or fish for the pot. Walking mutton should be taken as far as possible; a goat to give milk is an admirable companion. A *small* sheep will go very well over easy snow if it is properly roped between two men. The rope from the leading man should be passed with a round turn and knot round the body of the sheep, just behind the shoulders, and another round turn and knot just in front of the hind legs, before it goes to the second man. When killed the carcass should be covered with snow, and not exposed to the rays of the sun. Meat boiled in well-salted water will keep much longer than meat cooked in any other way. If a little sugar is added it improves the flavour.

A light, many jointed fly fishing rod, with reel and line, and a few flies, hooks, and casts in a Paley's fly pouch, will often enable a party to improve their *menu*.

The following is a fairly representative list of the kind of provisions useful on a long journey (see also the article 'Food' in Part I.):—

Biscuits (Garibaldi or other) for use when bread cannot be had.

Kola biscuits (*see* Part I.).

Meat or thick soups in Silver's self-cooking tins (one tin contains a substantial meal for two men).

Symington's pea-flour; it makes soup with one minute's boiling.

Cross and Blackwell's soups.

Edward's desiccated soup.

Koch's meat peptone.

Nelson's soups.

Lazenby's soups.

Vegetables (French), dried and compressed.

Erbswurst.

Canned meats.

Meat and vegetables done up together in sausage form.

The best diet for resisting cold should contain a considerable element of fat or oil. Bacon is excellent for this purpose. Sardines in oil are also good, and so is tinned butter. A bottle of good salad oil may be taken for frying eggs, &c.

Lemons, dried apples, prunes, or other fruits are good

If fresh vegetables cannot be obtained, Edward's dried potatoes will be a valuable substitute.

Jam or marmalade, in small tins (to be bought at Jackson's).

Chocolate in cakes; Kola chocolate.

Condensed milk in tins.

Tea and coffee.

Sugar, or saccharin; salt and pepper.

A small quantity of good brandy, best carried in a lock-up enamelled iron gourd.

Flour and baking powder.

Oatmeal for porridge.

Rice, sago, tapioca, and the like.

Cornflour and condensed milk boiled together in water produce a food very easily digested by a sick person.

If Swiss guides are of the party, it will be well to provide Swiss cheese for them, and the kind of dried meat (Bockfleisch) that is to be bought in Switzerland. Dutch *Rookvlees* is an excellent kind of dried meat.

Packing.—The bulk of a climbing traveller's baggage has ultimately to be carried on the backs of men, in loads of (at the outside) from 50 to 60 lbs. The heavier the load the rougher the treatment to which the bearer will subject it. Instruments, and a few of the most delicate objects, are best kept in boxes to the last, but some form of canvas sack will be required for the bulk of the things. A supply of Willesden canvas rücksacks (Silver's), fitted with locking straps or padlocks, with a master-key and spare keys, should certainly be taken. In addition to these we recommend the bolster-shaped bags, such as were used by Mr. Topham in the Selkirks. They should be made of Willesden canvas sufficiently stout for the contents they are intended to carry. The opening into them is a longitudinal slit, which, when the bag is being carried, comes against the back of the bearer, and is thus protected from rain. The slit is closed by a flap that buckles over it. The bolster-bag when filled is carried by an arrangement of straps. Two straps are fastened tightly around the bolster at convenient distances from top and bottom. To these horizontal bands the shoulder-straps are attached by loops above and below, like two elongated handles to a bundle of rugs. The shoulder-straps (or webbings) can be lengthened or shortened by buckles in the usual way, and the distance between the two horizontal bands admits of great variety in adjustment, so that the carrying gear will fit any man. (Silver & Co.)

Rice, flour, sugar, and the like should be packed in plain Willesden canvas bags, which are afterwards to be put inside any of the other sacks or saddle-bags.

In many countries the natives have a form of basket or pack that they are accustomed to carry. It is best, as far as possible, to employ such where they are to be had.

For some portion of a journey saddle-bags will probably be found convenient. The bolster-bags can be easily adapted to any beast of burden, but where horses or mules can be much used regular saddle-bags (Silver & Co.) should be taken. For these Willesden canvas is again the best material. A good form, which has been proved in the Caucasus, is manufactured by B. Edgington. It consists of two wallets, 3 feet wide and 2 feet deep, united by a band of thin leather. In this band holes may be cut to fit the horns of the local saddle. The flaps of the wallets are secured by staples riveted to the bag and passing through slots or eyes in the flap. A rod or chain is run through each set of staples, and secured at the end by a padlock. The bags can be detached and used separately, or carried as knapsacks.

Some extra pieces of mackintosh sheeting and some spare straps can be used for making up extra loads if required.

Dark red jacconet (Wright & Co.) is a thin, waterproof material, useful for wrapping up things that it is essential to keep dry, and specially useful for wrapping up sensitive photographic plates and films.

Every package should be distinctly numbered, and an inventory of its contents should be carried by a responsible member of the party. Valuable remarks about packing will be found in 'Hints to Travellers' (6th ed.), pp. 9, 77.

The Light Camp.—Both for work in the Alps and in less accessible mountain ranges it is advisable for the climber, who expects to sleep out high up on the mountain side above the snow-line, to be provided with a light tent and sleeping kit specially constructed for that purpose. Mr. Mummery has devised and tested in actual use a form of tent which holds three men easily, and weighs only 3½ lbs. Tents of this kind can now be purchased at Edgington's. The area covered by the tent is 6 feet long by 4 feet wide. The ridge of the tent is strengthened with a stout cord, which has at each end of the ridge a loop large enough to admit the spike of an inverted axe. Two axes standing on their heads thus form the poles of the tent. The lower edges of the sloping roof, which are 32 inches from the ridge, are likewise strengthened with similar cords. These being prolonged

beyond the four corners and tied to tent-pegs or stones keep the tent open. The height of the sides will vary according to circumstances. They should be made 21 inches high, and the tent may be set with any height of side not over 18 inches. This is the best for three men, but 6 inches is quite enough for two men in a cold and windy place. The remainder of the sides, whatever it may be, as well as the ends, which are made of a corresponding length, are turned in under the floor to enable the men inside to lie on them and thus keep the walls down. The door is a vertical slit in the middle of one end of the tent, and is only just high enough to admit a man crawling. In case of tempest a wall must be built to break the force of the gale. The material employed is a light Forfar, for which, perhaps, undyed silk might be substituted. A thin mackintosh sheet

is carried for the floor, and arranged so as to button or tie to the lower parts of the tent sides. The sheet need not weigh more than 1 lb. When camping at a low altitude it is a great advantage to use this sheet as a covering for the tent during heavy rain, a floor in this case being improvised out of rücksacks, mackintosh coats, &c. For this purpose the sheet should be 6 feet square, and be provided with eyes all round to tie it down. A serviceable sheet of this size weighs nearly 2 lbs.

For use within a Mummery tent we recommend sleeping-bags made of quilts filled with the best eiderdown. 1½ lb. of eiderdown suffices for a bag of the kind, measuring 5 ft. 6 in. in length (longer would be better) and 2 ft. 6 in. in width at the opening, and closed at the foot by an oblong piece measuring 14 in. by 8 in. Heal & Son, 195 Totten-

ham Court Road, have the pattern for this bag (Pattern 280). The weight of the whole complete is 2½ lbs. A single bag, somewhat wider than the tent, might be used to hold three men, and would doubtless be lighter than three separate bags. The bags can be wrapped in the mackintosh sheet, and that again enclosed in the tent; the whole bundle (for three men) will only weigh 12 lbs.

Instruments.—As with tools so, still more, is it with instruments; the traveller need only carry those that he has learned to use. Unless already experienced in surveying, he should, therefore, before starting on his journey, take lessons from some competent surveyor (such as the instructor appointed by the Royal Geographical Society); and he should further familiarise himself in all possible ways with the actual instruments he intends to employ. If his ambition is only to make a rough sketch-map of a mountain district, all the instruments he will require are a prismatic compass and clinometer combined (the size of a large watch), a steel tape, a level, and a range-finder, such as the Labbez Telemeter, (Steward), for particulars of which *vide* 'A. J.,' xv. 356. For rapid and fairly accurate survey of a large area of country nothing surpasses a plane-table, but mountaineers will readily understand how difficult it is to carry this somewhat cumbrous piece of apparatus (although now made much lighter than formerly) to the points which are of greatest importance for instruments to reach—to wit, the actual summits of peaks. For determining altitudes the mercurial barometer stands far ahead of all other instruments, but its form and weight are great objections to its use by climbers. A mercurial barometer, on the Fortin principle, should accompany the heavy camp, and aneroids should be taken on all actual climbing expeditions, the readings on the ascent and again on the descent being always registered with equal care. Mr. Whymper's pamphlet on the Aneroid Barometer should be studied by all intending travellers. A boiling-point apparatus may be taken, but little reliance can be placed on results derived solely from it. Other thermometers will, of course, be included in any complete equipment, and need not be further particularised.

It should be remembered that the photographic camera may be employed as a valuable accessory to a survey. Information on this point may be sought from the photographic instructor appointed by the Royal Geographical Society.

For accurate work in previously unexplored districts a

good 3-in. theodolite is indispensable. It should be fitted with an eyepiece constructed to render the instrument available as a tacheometer, and suitable measuring-rods should be carried for use with it. If it should be necessary to take observations for longitude, a first-rate watch must be carried. On all these and the like questions advice should be sought from a competent authority, such as the Instructor to the Royal Geographical Society.

A compass, with a luminous dial that can be read by night, should be in the pocket of some member of a party on every expedition.* A field-glass is essential, or a good telescope, the case having a bayonet-joint. Ross & Co. make a good case of this description, which is strengthened with brass and obviates the necessity of carrying a loose cap. Good telescopes, &c., can be obtained from L. P. Casella, also from Ross & Co. A pair of proportional and a pair of pillar compasses, parallel rulers, a straight-edged scale, a good slide rule (to be bought at Stanley's), tracing cloth, or transparent celluloid tissue made especially for use with a plane-table, map paper, a tin map case japanned outside, and a 6-in. circular protractor, in case, will complete a useful equipment for all purposes.

The best existing maps of the country to be visited, Raper's 'Practice of Navigation' and the parts required of the 'Nautical Almanack' for the year, may be mentioned under this head.

For the purpose of collecting botanical specimens a supply of paper and wire-frame bindings is needed, also a certain number of envelopes suitable for holding seeds. The authorities at Kew Gardens willingly give information on this matter to intending travellers, who should not fail to apply for it. A butterfly net that folds up is a light piece of apparatus. Butterflies or moths, when caught, need not be set; it is sufficient to fold them up flat (with their wings naturally closed) in pieces of paper, and to store the little packets in a tin box. Beetles should be put into bottles filled with spirit. When any plant or insect is added to the collection, the place where it was taken should be noted down *at the time*, and the object should be numbered then and there.

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* It is not a bad plan to carry a compass fixed on the back of one's wrist by means of a leather bracelet. It can thus be constantly referred to in case of fog, and a party will be less likely to begin diverging from the intended direction of march. (Hill & Son.)

Photography.—The hand camera, with a store of films, has now become a common item in Alpine equipment, and we remind those interested in the subject of Mr. Walter Leaf's article ('A. J.,' xv. 472). A compact apparatus, which we have tried in the Alps and found excellent, is the 'Luzo' (Robinson & Sons). It weighs, loaded and in its case, 3½ lbs. The lightest of all hand cameras is the 'Eclipse' (J. F. Shew & Co.). Compared with the 'Luzo,' the 'Eclipse' has the disadvantages that it is less strong and is not carried in a form ready for instant use, but has to be opened out and adjusted before the photograph can be taken. This process will occupy about one minute on the mountain side. The 'Eclipse' is, therefore, not suited for recording actual climbing incidents. On the other hand, it is extremely portable, and it can be fitted with a rising front. Alpine photographs may be roughly divided into two classes: first, valley views, taken from some point in a valley or from a side of the bounding slopes; and secondly, views from the summits of peaks. In the first class the principal part of the view subtends a considerable angle above the horizon, in the second the horizon forms practically the upper limit of the view. If the camera is, as it should be, held level—and for this purpose a pocket level should be carried—the mountain-tops will be lost in the valley views, while in a view taken from a summit more than half will be sky and enough of the lower parts of the panorama will not be included. The rising front, provided in most fixed cameras and in the 'Eclipse,' enables this difficulty to be got over. We have had a very strong form of 'Luzo' camera specially constructed (by Robinson & Sons) for use by mountaineers. The area of the image is 4¼ inches square, and the spool of film carried suffices for seventy-six exposures. In its leather case this camera measures 7 × 5½ × 5¾ inches, and weighs (loaded) 4½ lbs. The lens is not placed opposite to the middle point of the film, but rather below, an arrangement which fulfils in great measure the purpose of the rising front, as the camera can be held either way up. A complete panorama can be included in eight exposures with this camera.

The 'Key' Camera (Platinotype Co.) is very warmly commended by the best authorities. It is well made and light, but it is adapted only for exposing quarter-plates of glass and cannot be used for spools. The plates are carried in pairs in very light metal double-backs, and six of these can be taken without much inconvenience to the bearer. If the traveller intends to take more than a dozen photo-

graphs in a day's climbing he will be better advised to employ spools than glass plates.

Hand cameras yield very fair results, and can be conveyed by the traveller himself where a more elaborate apparatus would entail inconvenience or expense. For serious photographic work, however, a regular camera with a tripod and two or three lenses is essential. The largest size that can be easily employed takes a $7\frac{1}{2} \times 5$ inch plate. The best form of camera for any operator is the one he is accustomed to use. Most cameras expose their vulnerable part, the ground-glass focussing screen, to the chances of every accidental injury; and it is far better to choose a camera which, when folded up, has the glass enclosed within the body of the apparatus. It is an enormous advantage to have the lenses fitted with revolving stops or else with the iris diaphragm; loose stops are in constant danger of being lost. The fewer loose pieces the better.

Four-fold legs are the most convenient to carry. The 'Cam Lever Grip' is better than screws for fixing the legs. These should fit into a canvas case, as wet will interfere with the sliding action. Another admirable form of light short tripod, well made and steady, is sold by Shew.

The climber in the Alps can employ at his hotel whatever developer he pleases, but the traveller dwelling in tents will find it a great advantage to use a developer that is compact and portable, even if it be not under all circumstances the most efficient. 'Eikonogen Cartridges' (Marion & Co.) are portable and convenient. One of the cartridges dissolved in a proper quantity of water suffices to develop several plates or films. The 'Graphol' developer (Shew & Co.) is also an 'Eikonogen' compound. The 'Tondeur' developer (Shew & Co.) is composed of concentrated Hydrokinone and Eosine, and is supplied in packets, each sufficing to make one quart of developer. 'Rodinal' is a new developer of an extremely portable character, and is well spoken of; being liquid, it does not have to be dissolved, a process which, in the case of the developers above mentioned, often takes a considerable time. Hypo is best carried sealed up in waterproof packets, each containing enough to make one pint of fixing solution.

We have inspected all the developing tents offered for sale in the usual London shops, and we consider Robinson & Sons' to be the best; but it should be provided with a ventilator, the struts should be made of cast steel instead of iron, and the window should be filled in with red linen fabric instead of

glass. It is not light, but it will stand much rough wear, and it can be adjusted to the tripod carried for the plane-table or theodolite. A small tent which packs up very flat and suffices for changing plates, or at a pinch for developing one or two, is made by J. Fallowfield. It is provided with a ventilator. The window is usually filled in with ruby glass. This should be replaced by red linen fabric, or in dull light by red twill, which allows of a little interchange of air. All tents are necessarily close, and a man will get warm in an Arctic climate when attempting to develop under difficulties. A simple bag of red Turkey twill answers fairly well. The bag encloses the head and arms, and is closed firmly round the waist by means of strings.

For packing glass plates, envelopes made of non-actinic paper, and each holding two plates, are good. The number of the photograph can be written on the outside. If tightly and uniformly pressed together by indiarubber bands, the plates can be re-packed in their own boxes. Tin boxes are better still. Dark red jacconet (Wright & Co.) is extremely convenient for packing the boxes; it is waterproof, and to a certain extent non-actinic. The films, if on spools, are best re-packed in silver paper, then in the jacconet, and then stored in small tin boxes. The joints of the box can be soldered, or closed by strips of adhesive plaster.

Medicines.—For ordinary Alpine travelling a very small store of medicines will suffice, and the traveller had better not take any with whose action he is not acquainted. Most of the necessary drugs can be taken in the very portable form of tabloids. Messrs. Burroughs, Wellcome & Co. make a case containing the following:—2 tubes of toilet lanoline (preventive against sunburn; better than the simple lanoline; a reserve supply should be taken), 4 small tubes containing tabloids of vegetable laxative, opium (1 gr.), quinine (2 gr.), saccharin, a small bottle of chlorodyne, and a solution of cocaine. A drop or two of this last will be found to give almost instant relief in inflammation of the eyes resulting from exposure to snow. Other tabloids, such as soda mint and ipecacuanha powder, can be added. The bottles marked 'Poison' are distinguished by a special stopper. The case fully fitted measures $6\frac{1}{2} \times 4\frac{1}{4} \times 1$ inch, and weighs $9\frac{1}{2}$ oz. This is called the 'Alpine Emergency Case.'

For more extended travel they make a case called 'The Mountaineer's Pocket Case.' This contains the following drugs made up in tabloids:—Ipecacuanha, quinine, opium,

tincture of opium (laudanum), vegetable laxative, saccharin, soda mint, chlorate of potash, chalk and opium powders; in addition, one bottle of cocaine solution, one of chlorodyne, some pills of colocynth and hyoscyamus (5 gr., coated), and two tubes of toilet lanoline. The case measures $6\frac{1}{2} \times 4\frac{1}{2} \times 1\frac{3}{4}$ inches, and weighs 19 oz. Any other drugs that are made up in tabloids can be substituted.

Another package may contain a bandage or two made of domett, oiled silk (the form known as 'Green Protective' is best), some lint or absorbent wool, safety pins, adhesive felt (Ewen). Seabury and Johnson's perforated adhesive plaster is excellent, although the tins are rather bulky. The same firm make an excellent and portable plaster wound on a bobbin. An inch width is a good size. The medicine case may conveniently contain a small pair of blunt-pointed scissors. A clinical thermometer may be added if any of the party understands its use and can interpret the information it gives.

NOTE.—Much valuable information will also be found in Mr. Whymper's 'Travels amongst the Great Andes,' especially as regards food and packing, pp. 45, 46, 61; tents, 261; barometers, 53–55.