Galton's second book

THE

ART OF TRAVEL;

OR

SHIFTS AND CONTRIVANCES AVAILABLE IN WILD COUNTRIES.

BY

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PREFACE.

THIS volume is intended as a Manual to all who may have to "rough it," whether they be travellers, missionaries, emigrants, or soldiers.

I planned the work when exploring South Africa in 1850–51; and, since my return to England, my own stock of experiences has been steadily increased by those of other travellers, which I have made a point of re-testing, in every needful case, except where the contrary is implied.

In it are included the experiences, not alone of one kind of country, but those of the Bush, the Desert, the Prairie, the Ice, the Water-side, and the Jungle; and the whole is arranged in a systematic manner, as a book of ready reference.

A First Edition was published in 1854; and a Second one, enlarged, revised, and more fully illustrated, in 1856. I have now to offer to the public a Third Edition, which is far fuller of information than the preceding one, and in the composition of which I have been more or less indebted to hints from nearly every modern English traveller of eminence. Indeed, I have to thank very numerous correspondents, of various positions in society, for valuable suggestions.

To conclude, I sincerely trust that I may continue to be favoured by my readers with such remarks, sketches and corrections, as would appear to them likely to add to the value of the work. I hope I have given sufficient assurance, both that the experiences of others are highly valued, and also that I am most anxious to test them thoroughly and to turn them to account.

Communications may be addressed to me—"Care of Mr. MURRAY, 50, Albemarle Street, London."

FRANCIS GALTON.

October, 1859.

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ART OF TRAVEL.

WATER.

§ 1. Where to look for Water.—§ 2. Occasional supplies from Rain, Dew, &c.—§ 3. Precautions against Thirst.—§ 4. To purify Water that is muddy, putrid, or salt.—§ 5. To dig Wells, and to water Cattle from them.—§ 6. Water Vessels.

In the majority of countries, it is the chief care of an explorer to discover water for himself and his caravan. I will, therefore, begin this book by describing the indications which ought to guide him in his search for it.

Sect. 1.—Where to look for Water.—For many days after there has been rain, water is sure to be found among mountains, however desert may be their appearance; for not only does more wet fall upon them, but the fact of their being mountains ensures a more perfect drainage; and long after the ravines and stream-beds are quite dry, puddles and cupsful of water will be found here and there along their courses, in holes and chinks and under great stones, which together form a sufficiency, and a sponge tied to the end of a stick will do good service in lapping these up.

But for the most part, a traveller in an arid land that is visited by occasional showers, finds his supplies in ponds made by the drainage of a large extent of country, or else in pools left here and there along the bed of a partly dried-up watercourse, or, lastly, in fountains. And when the dry season of the year has advanced, and the water has disappeared from the surface, there remains no alternative, but to dig wells where the pools formerly lay, or in other places where there are signs to show that well-water may be obtained. Spots must be sought for where the earth is still moist; or, failing that, where birds and wild animals have lately been scratching, or where gnats hover in swarms. It is usual, when no damp earth can be seen, but where the place appears likely to yield well-water, to thrust an iron ramrod down into the soil; and, if it bring up any grains that are moist, to dig.

The places in a sandy river-bed, where well-water may be obtained, are not necessarily those where it has been found in a preceding year. The conditions necessary for its existence do not alone depend on the rocky bottom of the sandy bed, but, more especially, on the stratified accumulations left after each flooding. For instance, a vast bed of sand, wholly enclosed between two layers of clay, would be eminently capable of remaining moist, and therefore of supplying well-water during a long dry season. A very trivial matter might affect the deposition of clay strata in successive years.

In searching the beds of partly dried-up watercourses, the fact must never be forgotten, that it is especially in little tributaries, at the point where they fall into the main one, that most water is to be found; and the most insignificant of these should never be overlooked.

I do not know why this should be the case, but presume that the bar, which always accumulates in front of tributaries, and is formed of numerous layers of alluvial deposit, parallel to the bed of the great stream, is very likely to have one, at least, of its layers of an impervious character. If so, the bar would shut in the wet sand of the tributary, like a wall, and prevent it from draining itself dry.

It often happens, when digging wells in sandy watercourses, that a little water is reached and then a clayey stratum. If the digging is continued in hopes of a larger supply, the stratum is pierced, more sand is reached, and the water that had been seen drains rapidly and wholly away, to the utter discomfiture of the traveller.

Where a river-bed has been long followed by a traveller, and a constant supply of pool or well-water found along it, say at every 2 or 3 hours' journey,—then, should this river-bed appear to lose itself in an arid plain, there is no cause of being disheartened; for, on travelling further on, it will be sure to be found again, as those plains are always green and grassy where such watercourses entirely disappear.

Fresh water is frequently to be found under the very sands of the sea-shore, whither it has oozed down, underground, from the upper country, and where it overlays the denser salt-water. In very many places along the skirt of the great African desert it is to be found by digging two or three feet.

Scanty wells in hot climates should be bushed over, when not in actual use, to check their evaporation.

Fountains are as godsends: they occur unexpectedly, but are observed to be far more numerous and more abundant in districts composed of limestone rocks than in any others, owing to their frequent fissures; and where these rocks crop out in the midst of sand deserts, a careful search should be made for signs of water. In granite, and other primary rocks, many, but small, springs are usually seen.

The theory of ordinary fountains is simple enough, and affords help in discovering them. In a few words, it is as follows:—All their water has originally been supplied by rain, dew, or fog-damp, falling on the face of the land and sinking into it. But the subsoil and the rocks lying below are very far from being of an uniform density. They are full of layers of every imaginable degree of sponginess. Thus, strata of clay wholly impenetrable to water, may, and often do, divide beds of gravel that imbibe it freely. There are also cracks that offer open channels, and dislocations that may close them; and there are rents, filled with various materials, that entirely bar the course of water. Hence, when water has sunk into the earth, it does not by any means wet it in an equable degree. It is an easier matter for the water to ooze for many miles along a layer of gravel, than to penetrate six inches into the clay that bounds it. Therefore, whenever a porous earth or a fissured rock crops out to the light of day, there is, in ignorance of all other facts, some reasonable chance of a spring being discovered in the lowest part of its outcrop. A favourable condition for the existence of a large and permanent fountain is where a porous stratum spreads over a broad area at a high level, and is prolonged, by a gradually narrowing course, to an outlet at a lower one. The broad upper part of the stratum will catch plenty of water during the wet season, that will become stored in its depths as in a reservoir, and will ooze out in a regular stream at its lower outlet. A fissured rock makes a still easier channel.

As examples of ordinary cases of fountains, we will take those represented by the following figures.

Fig. 1 is a mountain. Fig. 2 is a kind of diagram of what is intended to be expressed with regard to fig. 1: there is a ravine, R, in front; a line of fault, L, M, N, on its left side, filled with water-tight rock; and a valley, V, on its right. The upper part of the mountain is supposed to be much more porous than the lower part of it, and the plane which divides the porous from the non-porous rock, cuts the surface of the mountain along the line A, B, C, D, E, F, whose highest point is F, and whose lowest point is A. The effect of long-continued rain would be, to wet the entire upper half of the mountain; and in a simple arrangement like that of fig. 2, the water would ooze out along the whole of the line A, M, B, C, D, E, F; but it would stream out copiously at M, which is the lowest part of the larger of the two separate compartments of porous material.

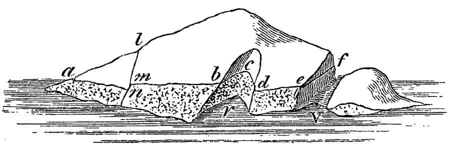


Fig. 1.

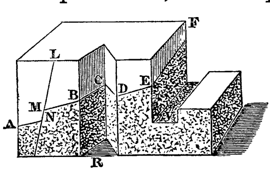


Fig. 2.

In the mountain, fig. 1, this could hardly be the case. The actual rind of the earth, with its vegetation and a weather-impacted surface, is not nearly so porous as its subsoil, and it forms a comparatively impermeable envelope lying over the mountain, not likely to be broken through, except at a few places.

But in the ravine, such as *r*, which is denuded of its rind, and in all steep cliffs, such as at v, we do in fact find a line of minute fountains, or, at least, of vegetation that indicates water, along the base of the porous rocks. The appearance is well known and often described of a ravine utterly bare of verdure above, but clothed with vegetation below a sharply defined line, whence the moisture proceeds that irrigates all beneath it. Near *m* or near *a* we should be almost certain of finding a spring breaking forth, but a person riding along v, would only remark some signs of former moisture along *e, f;* such as a few bunches of vegetation upon the arid cliff, or an efflorescence of salts. As soon as these catch his attention, he should observe the inclination of the strata, which would clearly direct him towards *m*, or *a*, where they promised to be the lowest, and the probability of finding water would be the greatest. In a very arid country, the anatomy of the land is so manifest, from the absence of mould, that geological indications are peculiarly easy to be followed.

To know when Water is near at hand.—Vegetation is a deceitful guide, unless it be luxuriant, or when such trees are seen as are observed usually to grow near water in the particular country visited, as the blackthorn-tree in South Africa. Birds—as water-fowl, parrots, and the diamond bird; or animals—as baboons, afford surer signs; but the converging flight of birds, or the converging fresh tracks of animals, is the most satisfactory of all. It is about nightfall that desert birds usually drink, and hence it often happens, that the exhausted traveller, abandoning all hope as the shades of evening close in, has his attention arrested by flights of birds, that give him new life and tell him where to go. In tropical countries that have rainy and dry seasons, it must be recollected that old paths of men or wild animals only mislead; they go to dry ponds that were full at the time they were trodden, but have since been abandoned on becoming exhausted.

From the number of birds, tracks, and other signs, travellers are often pretty sure that they are near water, but cannot find the spring itself. In this case the party should at once be spread out as skirmishers, and the dogs cheered on.

There is great instinct shown in discovering water: dogs find it out well; and the fact of a dog looking refreshed, and it may be wet, has often and often drawn attention to a water-pond that would otherwise have been overlooked and passed by. Cattle are very uncertain in their instincts. Sometimes oxen go for miles and miles across a country unknown to them, straight to a pond of water; at other times they are most obtuse. Dr. Leichhardt, the Australian traveller, was quite astonished at their stupidity in this respect.

Sect. 2.—Occasional Supplies from Rain, Dew, etc.—A shower will yield a good supply—the clothes may be stripped off and spread out, and the rain-water sucked from them; or a cloth or blanket may be made fast by its four corners, in expectation of a coming storm, and a stone or a quantity of bullets thrown in the middle of it, which will cause the water that it receives to drain to one point and trickle through it, down into a cup or bucket set below. An umbrella reversed will catch water; but the first drippings from clothes that have been long unwashed, as from a macintosh cloak, are intolerably nauseous and very unwholesome.

It must be remembered, that thirst is greatly satisfied by the skin being wetted, and, therefore, it is well for a man suffering under thirst to strip to the rain. Lives of sailors have more than once been saved when turned adrift in a boat, by bathing frequently and keeping their clothes damp with salt-water. However, after some days, the nauseous taste of the salt-water is very perceptible in the saliva, and at last becomes unbearable; such, at least, was the experience of the surgeon of the wrecked "Pandora."

Dew-water is abundant near the sea-shore, and may be collected in the same way as rain-water. The storehouse at Angra Pequena, in 1850, was entirely supplied by the dew-water deposited on its roof. The Australians who live near the sea go about the bushes with a great piece of bark and a wisp of grass, and brush the dew-drops from the leaves down into it, collecting in this way large quantities. Captain

Eyre used a sponge, and appears to have saved his life by its use.

There are other sources of fluid which may be mentioned, for they are resorted to in emergencies—as the contents of the paunch of an animal that has been shot; its taste is like sweet-wort. Mr. Darwin writes of people who, catching turtles, drank the water that was found in their pericardia, and which was quite pure and sweet. Many roots exist, from which both natives and animals obtain a sufficiency of sap and pulp to take the place of water. The traveller should acquaint himself with those peculiar to the country that he visits, such as the roots which the eland eats, the bitter water-melon, &c.

Sect. 3.—Precautions against Thirst.—Enjoin on yourself and others to "drink well before starting in the morning, and to drink nothing all day till the halt; to keep the mouth shut; to chew a straw or leaf; or, Arab-like, to keep the mouth covered with a cloth; for all these are helps to prevent suffering from extreme thirst. Tying a handkerchief, well wetted in salt water, round the neck, allays thirst for a considerable time." (Sir James E. Alexander.) I have already mentioned that people may live long without drinking, if they have means of keeping their skin constantly wet with salt or otherwise undrinkable water. In Australia, Africa, and North America, it is a frequent custom to carry a small quantity of fat, or butter, and to eat a spoonful at a time, to allay severe thirst. The Editor of 'Alpine Peaks and Glaciers' recommends a pebble (quartz) held in the mouth. When the thirst is simply such as may follow an exhausting day's work, and not such as follows a scorching sun in an arid air, which has literally evaporated the fluids of the body to a dangerous extent, it is very conceivable that anything put into the mouth, and kept there, should provoke the saliva to flow and moisten the tongue and palate, and again, if the object in question be non-absorbent, as a quartz pebble, so much the better.

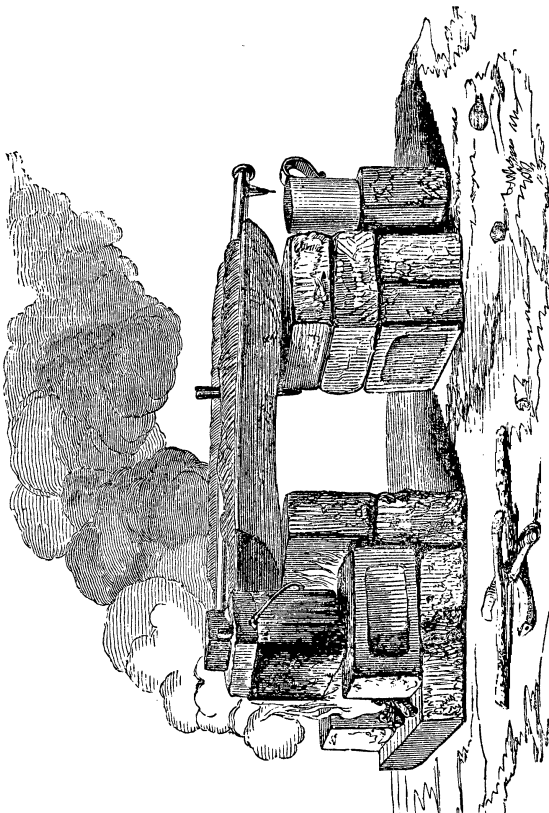
Sect. 4.—To purify Water that is muddy, putrid, or salt.—With muddy water, the remedy is to filter, and to use alum, if you have it. With putrid, to boil, to mix with charcoal, or expose to the sun and air; or, what is best, to use all three methods at the same time. With salt-water, nothing avails but distillation.

Muddy Water.—When, at the watering-place, there is little else but a gritty or a filthy mess, take a good handful of grass or rushes, and tie it roughly together in the form of a cone, 6 or 8 inches long; then dipping the broad end into the puddle, and turning it up, a streamlet of partly-filtered water will trickle down through the small end. This excellent plan is used by the Northern Bushmen—at their wells quantities of these bundles are found lying about. (Andersson.) Otherwise drink through your handkerchief—either put it over the mouth of your mug, or else throw it on the gritty mess as it lies in the puddle, and suck through. For a copious supply, the most perfect plan, if you have means, is to bore a cask full of auger-holes, and put another small one, that has had the bottom knocked out, inside it; then fill up the space between the two with grass, moss, &c. Now sinking the whole in the midst of the pond, the water will filter through the auger-holes and moss, and rise up clear of, at least, weeds and sand, in the inner cask, whence it can be ladled. With a single cask, the lower parts of the sides may be bored, and alternate layers of sand and grass thrown in, till they reach up above the holes; through these layers the water will strain. Or any coarse bag that is kept open with hoops, made on the spot, may be moored in the muddy pool, by having a heavy stone put inside it, and will act on the same principle, but less efficiently than the casks. Sand, charcoal, sponge, and wool, are the substances most commonly used in filters: peat charcoal is excellent. Turbid water is also, in some way as yet insufficiently explained, made clear by putting a piece of alum into it; it appears to unite with the mud, and to form a clayey deposit; and, independently of this, to have effect upon organic matters. No taste of alum remains in the water unless it has been used in great excess. Three thimblefuls of alum will clarify a bucketful of turbid water. It is generally used in India. In arctic regions, place a quantity of snow on the water until it is considerably higher than the level of the fluid, then suck the water through. (Dr. Rae.)

Putrid Water should always be boiled together with charcoal or charred sticks before drinking it, as low fevers and dysenteries too often are the consequences of its being used indiscreetly, but charcoal largely disinfects it; bitter herbs, if steeped in it, or even rubbed well about the cup, are said to render it less unwholesome. The Indians plunge hot iron into putrid and muddy water.

Distilling requires a good supply of fuel, which is too often deficient where there is no fresh water. The simplest still is to light a fire among stones near a hollow in a rock that is filled, or can be filled, with the salt-water; then taking a hot stone, to drop it in: the water will hiss and give out clouds of vapour, much of which may be collected in a cloth and wrung from it, or sucked out of it. In the same way a pot on the fire may have a cloth stretched over it to catch the steam. There is an account of the crew of the "Levant" packet, which was wrecked near the Cosmoledo Islands, who supplied themselves with fresh water by means of distillation alone, and whose still was contrived with an iron pot and a gun-barrel, found on the spot where they were wrecked. They procured, on an average, 60 bottles, or 10 gallons, of distilled water in each 24 hours. "The iron pot was converted into a boiler to contain salt water; a lid was fitted to it out of the root of a tree, leaving a hole of sufficient size to receive the muzzle of the gun-barrel, which was to act as a steam-pipe; the barrel was run through the stump of a tree, hollowed out in the middle, and kept full of cold water for the purpose of condensation; and the water so distilled escaped at the nipple of the gun-barrel, and was conducted into a bottle placed to receive it." Some thought or cleverness is required to build a good furnace, or fireplace, on which to place the pot. It is necessary that the fire should act to the best advantage, and burn fiercely, or the pot will never boil fast enough to distil a sufficiency.

The sketch is taken from a model which I made with a soldier's mess-tin. It is badly drawn. The knob at the end of the barrel represents the breech; and the projection, through which the water is dropping, the nipple. I may remark that there is nothing in the arrangement which would hurt the most highly-finished gun-barrel, and that the trough which holds the con-

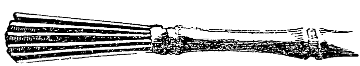


densing water may be made with canvas, or even dispensed with altogether. In default of other tubes, a reed, or one of the long bones of an animal, or of a wading bird, will be found better than nothing. A drop a second is fully equivalent to an imperial pint in three hours, or an imperial gallon in an entire day and night.

Sect. 5.—To dig Wells, and to water Cattle from them.—In default of spades, water is to be dug for with a sharp-pointed stick: take this in both hands, and, holding it upright like a dagger, stick and dig it about in the ground, as in the first sketch; then clear out the loose earth with the left hand, as in the second. Continue thus working with the stick and hand alternately, and a hole as deep as the arm is easily burrowed out. In making a larger well, the earth must be loosened in precisely the same way, and handed up to the surface, and carried off by means of a bucket or bag, in default of a shovel and wheelbarrow.

After digging deeply, the sand will often be found just moist, no water actually lying in the well; but do not, therefore, be disheartened; wait awhile, and the water will collect. After it has once begun to ooze through the sides of the well, it will continue to do so much more freely. Therefore, on arriving at night, with thirsty cattle, at a well of doubtful character, it should be deepened at once by torch-light, and then enough water will have time to collect for the cattle, which can be watered in the early morning, and be sent to feed before the sun is hot.

I am indebted to a correspondent for an account of a method employed in the plains of the Sikhim Himalaya for digging deep holes. The natives take a bamboo, say three inches in diameter; they cut it just above one of the knots, and then split the wood up to the next joint in about a dozen places. (See illustration.) The grass is then torn away, and this instrument is worked vertically up and down with both hands. The sandy soil soon gets up into the hollow of the bamboo and spreads out the blades, as is intended to be shown in the sketch. The bamboo is then withdrawn, this plug of earth is shaken out, and it is reintroduced and worked up and down as before. Holes 10 feet deep and 6 inches wide can be made, as I am informed, in this way.

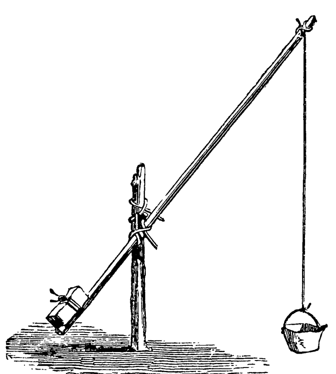


In sandy soils, the sides of the well are so often falling in, that it is advisable often to sink a cask in the soil. The following extract from Bishop Heber, though hardly within the scope of my subject, is very suggestive.

Wells (Bhurtpoor, India).—" The wells of this country, some of which are very deep, are made in a singular manner. They build a tower of masonry of the diameter required, and 20 or 30 feet high from the surface of the ground. This they allow to stand a year or more, till its masonry is rendered firm and compact by time; then they gradually undermine it, and promote its sinking into the sandy soil, which it does without difficulty, and altogether. When level with the surface, they raise its walls higher; and so go on, throwing out the sand and raising the wall, till they have reached the water. If they adopted our method, the soil is so light that it would fall on them before they could possibly raise the wall from the bottom; nor, without the wall, could they sink to any considerable depth."

To water Cattle from Wells.—Let one man stand in the water, or just above it; another 5 feet higher; and again another, if the depth of the well requires it. Then let the lowermost man dip a bucket in the water, and pass it from hand to hand upwards. In this way, watering cattle proceeds very quickly. The top man pours the water into a trough, out of which the cattle drink. This trough may be simply a ditch scratched in the ground, and with a piece of canvas thrown over it, should the soil be sand, to keep the water from being lost before the cattle have time to drink it. Thus Colonel Eyre speaks of watering his horse out of his black servant's duck frock.

The drove of cattle should be brought up to 60 yards from the watering-place; then three or four should be driven out—they will run at once to the water. After they have drunk, drive them to one side, and let another three or four take their place, and so on; keeping the two droves quite distinct—those that have drunk, and those that are waiting to drink. They will drink at the rate of one per minute; sheep and goats drink very much faster. Never let the cattle go in a rush to the well, else they will stamp it in, get no water, and do much damage. Light gutta-percha buckets are very useful in temperate climates, and so are baskets with oilcloth inside them.



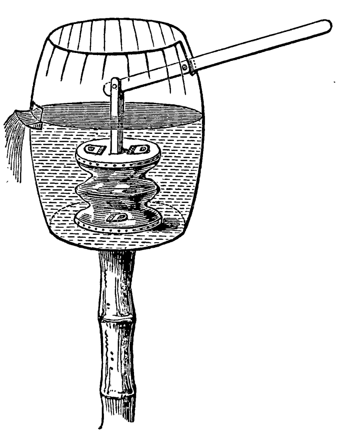
A pole and bucket is a very convenient way of raising water from 4 to 12 feet. The bucket may be made of anything — canvas, basket-work, leather, or wood; leakage is of little consequence, even though it is very considerable.

This contrivance is used over almost the whole globe—less in England than elsewhere; it is very common where long poles can easily be obtained, as in fir forests.

The Tartars sometimes draw water from their wells, of 150 feet deep and upwards, by a rider harnessing the bucket-rope to his horse, and galloping him off to a mark that tells the proper distance, and so draws up the bucket. Their ropes are of twisted hair, and run over a smoothed stone or log of wood.

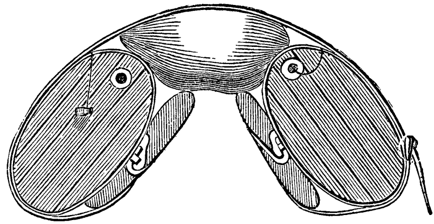
An excellent pump is used by the Arabs in Algeria; a piece of leather (or waxed canvas) is stretched round hoops, and at top and bottom round circles of wood also. In these circles are holes covered with valves of leather, opening upwards. The lower circle is nailed to the bottom of a tub, and the hole in it corresponds with the feed-pipe; the upper circle is attached to the pump-handle.

When this leather pump-barrel is collapsed, the water flows out through the upper valve into the barrel around it; when expanded, water is sucked up through the tube, and an equal quantity displaced in the barrel, which pours out into the trough. A bag would do as well as a tub to hold the water which surrounds the pump-barrel; but, without either one or the other, the pump-barrel must be air-proof as well as water-proof.



The action of this pump is marvellously perfect. It attracted much attention in the French Exhibition of 1855.

Sect. 6.—Water Vessels. To carry a Supply of Water on Pack-Horses.—Small barrels, flattened equally on both sides, so that their tops and bottoms are of an oval and not a circular shape, are most convenient for carrying water on pack-saddles across a broken country. They are very strong indeed, and require no particular attention, while bags suffer from thorns, and natives secretly prick them during the march, that they may suck a



draught of water. These kegs should not exceed 22 inches in length, 10 in extreme breadth, and 7 in extreme width; a cask of which measurements would hold about 40 lbs. weight of water, and its own weight might be 15 lbs. As the water is expended, it will be easy to replace the diminished weight by putting on a bag from one of the other packs. Before starting away into the bush, these kegs should be satisfactorily fitted and adjusted to the pack-saddle that is intended to carry them, in such a way that they may be packed on to it with the least possible trouble. A couple of leather or iron loops fixed to each keg, and made to catch on to hooks which are let flush into the sides of the pack-saddles, will effect this.

The sketch represents a section of the pack-saddle at the place where one of the hooks is situated on either side, but the front of the kegs themselves, and not their section, is given. Above and between the kegs lies a bag, and a strap passing from the near side of the saddle goes over the whole burden, and is buckled to a similar short strap on the other side. It is of importance that the bung-hole should be placed even nearer to the rim than where it is drawn, for it is necessary that it should be convenient to pour out of and to pour into, and that it should be placed on the highest part of the keg, both when on the beast's back and also when it stands on the ground, lest water should leak and be lost. According to the above plan, when water is ladled into it, the rim keeps it from spilling; and in pouring out water, the rim acts as a spout.

In making the bung-hole itself, a metal plate, with a screw-hole in it, is firmly fixed in the face of the cask; into this a wooden stopper, bound with iron, is made to screw (natives would probably steal a metal one). The stopper has a small head and a deeply-cut neck, by which it is tied to the cask, and its body has a large hole bored in it, which admits of a stick being put through, to prize it round, if ever it becomes jammed. A spigot, to screw into the bung-hole on arriving at camp, might be really useful; but if used, a gimlet-hole must be bored in the cask to act as an air-vent. A large tundish is very convenient, and a spare plug might be taken; but a traveller, with a little painstaking, could always cut one with his own knife sufficient to screw in firmly, and to retain the water, if it had a bit of rag wrapped round it. A roll of rag alone will suffice.

A flexible tube of some kind, whether of India-rubber, gutta-percha, or, still better, macintosh, strained over rings, would be very valuable as a syphon; both for filling large kegs out of buckets and for emptying them again. Vulcanised India-rubber becomes rotten after short use, and gutta-percha will stand no extremes of temperature.

To carry a supply of water in Waggons.—The most efficient way of carrying a large supply of water upon wheels has yet to be determined.

Captain Sturt, when he explored in Australia, took a tank in his cart, which burst, and, besides that, he carried casks of water. By these he was enabled to face a desert country with a success which no traveller before had ever attained to. For instance, when returning homewards, the water was found to be drying up from the country on all sides of him. He was at a pool, and the next stage was 118 miles, or 4 days' journey, at the end of which it was doubtful if there remained any water. It was necessary to send to reconnoitre, and to furnish the messenger with means of returning should the pool be found dry. He killed a bullock, skinned it, and, filling the skin with water (which held 150 gallons), sent it by an ox-dray 30 miles, with orders to bury it and to return. Shortly after he dis-patched a light one-horse cart, carrying 36 gallons of water; the horse and man were to drink at the hide, and go on. Thus they had 36 gallons to supply them for a journey of 176 miles, or 6 days, at 30 miles a day, at the close of which they would return to the ox-hide—sleeping, in fact, 5 nights on 36 gallons of water. This a hardy, well-driven horse could do, even in the hottest climate.

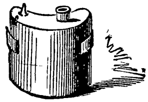
The jolting and straining of a waggon is, at times, terrible, and it stands to reason that a large solid tank must require to be made of excessive substance and weight to resist it. I am, therefore, inclined to recommend square bags of strong macintosh (or even canvas, p. 20), fitting into square compartments, in large panniers, arranged just like those in a bottle-basket. I have made some experiments upon them. The basket-work would give protection against blows and the jolting together of packages, and it would yield without harm to a strain, and the bags would yield also. Moreover, water churns about less in half-empty bags than in half-empty barrels. No particular strength of materials would be required in making these bags; their mouths should be funnel-shaped, and corked at the point of the funnel. They should be wide open above, for the convenience of pouring in water, and also because a string, tied round the neck to secure it, if the cork were lost or fitted badly, would never slip off. The bags should have loops along their sides, through which a strap passing underneath might be run, to give a good hold for lifting them up.

The question remains, of what size would it be the most convenient to make them? They could easily be filled as they lay in their compartments, and would only require to be lifted out in order to empty them; there would, therefore, be no objection to their holding a considerable weight of water. An India-rubber tube as a syphon, and with a common spigot at the end of it, would be here particularly useful.

All things considered, I should recommend their being fitted to compartments, measuring 18 inches deep and 10 inches square; they would then each hold about 60 lbs. of water. A pannier not much exceeding 30 inches long, by 20 broad, and

18 deep, would hold six of these bags, or 360 lbs. weight of water in all; and two such panniers would be ample for exploring purposes. I find that the weight of the panniers and bags together is at the rate of 6 lbs. for each compartment: in fact, the weight of these water-vessels is not more than 10 per cent. of that of the water which they carry. It might be very proper to vary the contents of some few of the compartments, by way of experiment; putting, for instance, two or even three small bags into one, and tin cases into a few others, instead of the large bags. These panniers, with the bags inflated and connected together by a stage, would form an excellent and powerful raft. If secured within a waggon about to cross a deep river, they would be ample enough, in all ordinary cases, to cause it to float and not to sink to the bottom. I trust some explorer will try this plan. I may add that these water-bags cost about 1*l.* each, when made of macintosh.

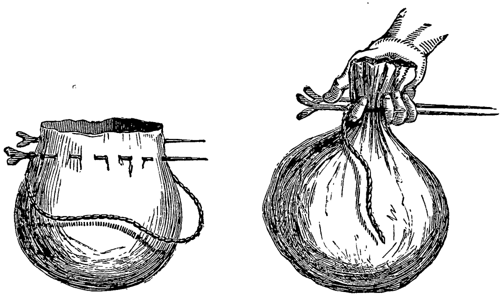
Small Water-vessels.—No expedition should start without being very adequately supplied with these, for no ingenuity in the bush can make anything so efficient as casks, tin vessels, or macintosh bags. People drink excessively in hot, dry climates, as the evaporation from the skin is enormous, and must be counterbalanced; the daily ration of a European in these is at least two quarts. To make an exploring expedition efficient, there should be means of carrying at least one gallon of water for each white man, and in unknown countries this quantity should invariably be carried on from every watering-place, so long as means can possibly be obtained of carrying it; and should be served out thus:—two quarts the first day, in addition to whatever private store the men may choose to carry for themselves; a quart and a half during the second day; and half a quart on the morning of the third, which will carry them through that day without distress. Besides water-vessels sufficient for carrying all this, there ought to be means of leaving water buried in the ground as a store for the return of a reconnoitring expedition; and each man should be furnished with a tin canteen holding a quart, of this shape, which, whether empty or full, he should have the charge of. It has a vent-hole, and a larger hole to be stopped with a cork. The Arabs use a porous leather flask called a Zemsemiyah, which is hung on the shady side of the camel, and by evaporation keeps the water it contains deliciously cool. It is rather wasteful. Canvas bags do as well. (See p. 96, Kettles.)



Native Vessels.—Vessels for carrying water are made as follows :—

From the raw or dry skins of animals, which should be greased down the back.

The paunch, the heart-bag (pericardium), the intestines, and the bladder. When used they should have a wooden skewer run in and out along one side of their open mouths, by which



they can be carried, and a lashing passed round under the skewer to make all tight. The Bushmen do this. The water oozes a little through the sides, and by its evaporation the contents are kept very cool. Another plan is, after having tied a length of intestine at both ends, to roll it up in a handkerchief and wear it as a belt round the waist. The fault of these membranous bags, besides their frailty, is, that they become putrid after a little use.

The bark of a tree, either taken off in an entire cylinder, and having a bottom fitted on, or else a knot or excrescence being cut off the outside of a tree, and its woody interior scooped out ;

or birch bark sewed or pegged at corners, and with the seams coated with gum or resin of the pine-tree.

Soft wood hollowed out into buckets.

Calabashes and other large fruits, cocoa-nuts, &c.

Ostrich eggs.

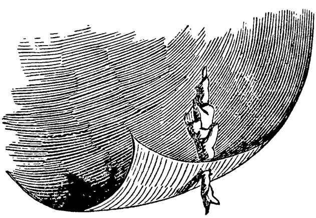
Canvas bags, smeared with grease on the outside, become perfectly waterproof after a short soaking.

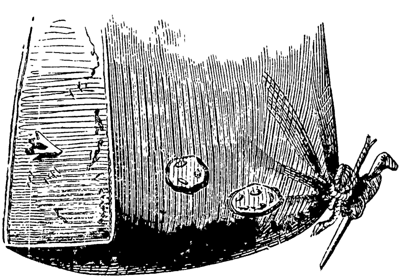
Baskets with oiled cloth inside make efficient water-vessels, and are in use in France as firemen's buckets.

Pots, on the Snake river, are made by winding long tough roots, as is done in making a beehive.

When carrying water in buckets, put a wreath of grass, or something floating on the top of the water, to prevent it splashing; and also make a hoop, inside which the porter walks, while his laden hands rest on its rim, whose office it is to keep them wide from his body, and prevent the buckets from knocking against his legs.

If a water-vessel becomes leaky, it should be caulked up by stuffing a rag, a wedge of wood, a tuft of grass, or anything into it, as shown in the upper figure and also in the left of the lower one, and then greasing or waxing it over. A larger rent must be seized upon, the lips of the wound pinched up, a thorn or other spike run through the lips, and lastly a piece of twine lashed firmly round, underneath the thorn, whose office it is to keep the string from slipping off. (See





the right-hand corner of the lower figure.) When there is an opportunity, the bag must be patched.

The Bushmen of South Africa make great use of ostrich-shells as water-vessels. They have stations at many places in the desert, where they bury these shells filled with water, corked with grass, and occasionally waxed over. They thus go without hesitation over wide tracts, for their instinct of locality is so strong that they never fear to forget the spot in which they have dug their hiding-place.

It is a good rule for an explorer of an arid country, when he happens to come to water, after not less than three hours' travelling, to stop and encamp by it; it is far better for him to avail himself of his good fortune and be content with his day's work, than to risk the uncertainty of another supply.

FIRE.

§ 1. Gunpowder, Lucifers, Fire-sticks.—§ 2. To obtain a Spark.—§ 3. To kindle a Spark into a Flame.—§ 4. Fuel.—§ 5. Camp Fires.

ALTHOUGH, in the teeth of every precaution, fires constantly break out, yet when we want a spark, and do not happen to have our ingenious fire-making contrivances at hand, it is scarcely possible to get one. And further, though sparks, of their own accord and in the most unlikely places, too often burst out into conflagrations, yet it is a matter of no small skill and difficulty to coax a spark into a blaze.

Sect. 1.—Gunpowder, &c.—Given—a knife, a flinty stone, a pistol-charge of powder, and fuel: to light a fire.

1st. Sort the fuel into logs, sticks, twigs, and *fibre*. (Under the head fibre are included all substances such as dry grass, moss, bark rubbed between the fingers, unravelled rope or rag, dry cattle-dung, paper cut into very fine strips, peaty matters, or dry leaves rubbed small. There must be enough "fibre" to fill both hands full when uncompressed; if no fibre or small fuel can be found, the large fuel must be cut small and be diligently scraped until the "twigs" and "fibre" are replaced by chips and scrapings.)

2nd. Make a loose *nest* of the fibre, just like a sparrow's nest in shape and size, and let the finer part of the fibres be inwards.

3rd. Pour two-thirds of the pistol-charge of powder into the palm of the hand, wet it from the mouth, and work the wet powder into a little tuft of the fibre, that should have been laid aside for the purpose, converting it into tinder.

4th. Lay this fibrous tinder on any flat, dry surface, as a stone, a board, &c., and scatter what remains of the powder on and around it.

5th. Strike sparks with the knife and stone over the gunpowder, till it catches, and flares up and lights the tinder. (The hand need not suffer, but it is well to practise at first in gloves.)

6th. Drop the lighted tinder in the nest.

7th. Holding the "nest" quite loosely in the half-closed hand, whirl the outstretched arm in great vertical circles round the shoulder-joint, as indicated by the dotted line in the diagram. In 30 seconds, or about 40 revolutions, it will begin to glow and shortly after burst out in a grand flame.

8th. Drop it, and pile small twigs round it, and nurse the young fire carefully.

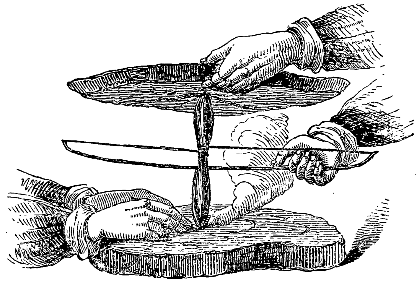
Every traveller should carry about him a light handy steel, a flint or an agate, amadou, and a little bundle of splinters of wood, thinner and shorter than lucifer-matches, with fine points, which he has had dipped in melted sulphur, and also a small spare lump of sulphur in reserve. Cigar fusees are not worth taking in travel, as wet entirely spoils them. The cook should have a regular tinder-box, such as he happens to have been used to, and an abundance of lucifer-matches. There are usually three separate agents in making a fire, each of which may be varied in many ways and requires separate description.

1. The Spark. 2. The Tinder; that is, some easily ignited and smouldering substance, which secures the continuance of the spark. 3. Judicious application of fuel and air to make a blaze. There are methods in which two or more of these agents are in action at the same time. We will describe these the first.

Lucifers.—An inexperienced hand will waste an entire boxful before he succeeds in lighting a fire with one of them in the open air, on a windy day. The convenience of lucifers is great, but they have two undeniable faults: they require a perfectly still air while the burning sulphur is struggling to ignite the stick; and, again, when the match is thrust among the wood, it has to act upon sticks that have not been previously warmed, and, consequently, though one or two of them may catch, the fire is liable to fail. In all methods where the traveller begins with tinder, and blows its spark into a flame, the adjacent wood has become thoroughly heated, and the flame once started is almost certain to maintain itself. Consequently, in lighting a fire with lucifers, be careful to shield it from wind by throwing a cloak, or saddle-cloth, or something over the head, whilst you operate; and secondly, to have abundance of twigs of the smaller sizes, that there may be no uncertainty of the lucifer-match being able to light them, and set the fire a-going. In a steady downfall of rain, you may light a match for a pipe under your horse's belly. Wax lucifers are undoubtedly better than wooden ones, for in damp weather wooden ones will hardly burn, but wax is waterproof, and independent of wet or dry. When there is nothing dry at hand to rub the lucifer-match against, in order to light it, scratch at the composition on its head with the edge of a knife or with the finger-nail. It is a sure way of lighting it, and with care there is no need of burning the fingers.

Guns.—With a flint-and-steel gun, the touch-hole may be stuffed up, and a piece of tinder put among the priming powder: a light can be obtained in that way without letting it off. With a cap gun, a light may be got by putting powder and tinder round the cap outside the nipple, which will, though not with certainty, catch fire on exploding the cap. But the common way with a gun is to put a quarter of a charge of powder in, and above it, quite loosely, a quantity of rag or tinder. On firing the gun straight up in the air, the rag will be shot out lighted; you must then run after it as it falls, and pick it quickly up. With percussion-caps, gunpowder, and tinder, a light may sometimes be got on an emergency by scratching and boring with a knife, awl, or nail, at the fulminating composition in the cap till it explodes; but a cap is a somewhat dangerous thing to meddle with, as it often flies with violence, and wounds. Crushing gunpowder with sand, or among hard stones, *may* make it explode.

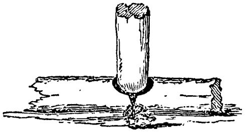
Fire-sticks.—The sticks that savages use require a long apprenticeship to work with, and it is not every kind of sticks that will do. But if a serious emergency should occur, it is by no means hopeless to obtain fire after the method shown in the woodcut. A party of men have advantages, because, as the work is very fatiguing, the whole party can try in turns, and, as there is considerable knack required to succeed, it is much more probable that one man out



of many should succeed, than that a single beginner should do so. One person works the "drill-stick" with a rude bow, and with his other hand holds the upper piece of stone, or even of wood, both to steady it and to give the requisite pressure,—gentle at first, and increasing judiciously up to the critical moment when the fire is on the point of bursting out. Another man holds the lower piece of wood, the "fire-block," to steady it, and has a piece of tinder ready to catch fire. The "fire-block" is more important than the drill-stick; any tough hard and dry stick will do for the latter, but the fire-block must be of wood with little grain, of a middle degree of softness, and sufficiently inflammable. If very hard, the action of the drill-stick will merely dent and polish it; if very soft, it will be worn away before the friction has time to heat it sufficiently. It is not at all difficult to produce smoke with a broken fishing-rod, or ramrod, as a drill-stick, and a common wooden pill-box, or tooth-powder box, as a fire-block. Walnut, also, does as a fire-block, and the stock of a gun is of walnut. Deal and mahogany are both worthless for fire-sticks.

It is well to notch the fire-block, so that the wood-dust, as it is ground away, should all run into one place: it will then glow with a smouldering heat, ready to burst out into an available flame with a little fanning, as soon as heat sufficient to ignite tinder has been attained to. Tinder is a great convenience in ensuring that the fire, once obtained, shall not be lost again, but it is not positively necessary. Savages carry the drill-stick in a quiver with their arrows, and the fire-block—a stick three inches long and one in diameter—as a pendant to their necklace. Most savages work by squatting down, and holding the fire-block to the ground by resting their toes upon it, and twirling the drill-stick between the palms of their hands. They require no assistance and no drill-bow, and dispense with tinder; but they practise the art all their lives.

The Australian blacks use the flower-stem of the grass-tree, which is of a tough pithy nature, and about one inch in diameter. The operation is assisted by the use of a little charcoal-powder, which, in Australia, is found on the bark of almost every tree, from the constant passage of grass-fires over the ground. The process is as follows:—One piece of the stick is notched in the middle, and the notch slightly hollowed out; another is roundly pointed at one end. The black fellow, being seated on the ground, holds one end of the notched stick down with each foot, and placing the point of the other stick into the notch, rubs it rapidly round between the palms of his hands. In doing this, of course his hands gradually slip down, and he has to shift them rapidly up, which loses time: but two people, seated opposite, can alternately take up the rubbing, and very soon produce fire. A little powdered charcoal, having been dropped into the notch during the operation, assists it. In a very few minutes, red-hot powdery ashes commence to work up out of the notch, which, falling on a *little* heap of tow, or dry tow-like bark, or lint, or cotton stuff, is quickly blown into a flame.



The method of obtaining fire by rubbing sticks together was at one time nearly universal. It seems remarkable that the time of discovery of the art of fire-making is not recorded in the Bible. We may easily imagine that our first parents obtained their fires from natural sources; of which, some parts of the Caucasus, at least, abound in examples. But when Cain was sent an outcast, how did *he* obtain fire? It is remarkable that his descendants are precisely those who invented metallurgy, and arts requiring fire. We might almost theorize to the effect that he or they discovered the art of fire-making, and pushed the discovery into its application. In Greek history, Prometheus is accredited with the invention of fire-sticks. Both Seneca and Pliny write about them. Pliny says (Nat. Hist. xvi. 76, 77), "There is heat in the mulberry, in the bay-laurel, in ivy, and in all plants whence fire-sticks are made. The experience of soldiers reconnoitring for encamping-grounds, and that of shepherds, made this discovery; for a stone is not always at hand whence a spark might be struck. One piece of wood, therefore, is rubbed by another, and it catches fire through the friction, while a dry tindery substance—fungus and leaves are the most easily attainable—is used to perpetuate the fire. Nothing is better than ivy used as the stick to be rubbed, and bay-laurel as the stick to rub with. Wild vine—not the 'labrusca'—is also found good."

Spontaneous combustion.—It is conceivable that the property which masses of greasy rags, and such like matter, possess of igniting when left to themselves, might, under some circumstances, be the only means available to procure fire. Any oil mixed with a hatful of shavings, tow, cotton, wool, or rags, heaped together, will become very hot in one, two, or more days, and ultimately burst into flame. The rapidity of the process is increased by warmth.

Sect. 2.—To obtain a Spark.—The Romans certainly used two flints, and not a flint and steel; but I must confess myself wholly unable to light tinder from stones alone, and am equally at a loss to understand the "dry leaves" they used for tinder.

It must be a flint and *steel;* a flint and iron will not give an available spark. As to flints, they may be replaced by any siliceous stone,—as agate, rock-crystal, or quartz. Agate is preferred to flint, as giving a hotter spark: it is sold by tobacconists. A partly siliceous stone—such as granite—will answer in default of one that is wholly siliceous. I have been surprised at finding that crockery and porcelain of all kinds will make a spark, and sometimes a very good one. There are cases where a broken teacup might be the salvation of many lives in a shipwrecked party. On coral-reefs, and other coasts destitute of flinty stones, search should be made for drift-wood and drifted sea-weed. In the roots of these the pebbles of other shores are not unfrequently entangled, and flint may be found among them. The joints of bamboos occasionally contain enough silex to give a spark.

Steels.—The possession of a really good steel is a matter of great comfort in rough travel. Any blacksmith will make one out of an old file, if he has nothing more appropriate at hand. An equivalent for a steel can be made, even by an ordinary traveller, out of common iron, by means of casehardening. The link of a chain, or the iron heel of a boot, or a broken horse-shoe, is of a convenient shape for the purpose. (See p. 178.)

Pyrites are, and have been, widely used for striking sparks. Two pieces struck together, or one piece struck with a steel, give a good spark; but it is a very friable mineral, and therefore not nearly so convenient as flint.

Tinder.—There are two divisions of tinder: those that are of a sufficiently strong texture to admit of being grasped in the hand, and those that are so friable as to require a box to hold them. Of the first division are the following,—they will afterwards be explained in detail:—amadou; a roll of rag; a cotton lamp-wick; a roll of touch-paper; a mass of hair of certain plants; and a long string of pith, sewed up in a sheath. Of the second division are:—tinder of burnt rags; tinder of any kind, with grains of gunpowder strewed over it; and touchwood. Amadou, punk, or German tinder, is made from a kind of fungus or mushroom that grows on the trunks of old oaks, ashes, beeches, &c.; and many other kinds of fungus, and, I believe, all kinds of puff-balls, will also do. "It should be gathered in August or September, and is prepared by removing the outer bark with a knife, and separating carefully the spongy yellowish mass that lies within it. This is cut into thin slices, and beaten with a mallet to soften it, till it can easily be pulled asunder between the fingers. It is then boiled in a strong solution of saltpetre." Charred rags make the best of all tinder. The rags are lighted, and when in a blaze, and before they are burnt to white ashes, the flame is stifled out. It is usual to make this kind of tinder in the box intended to hold it; but it can be made, perfectly, on the ground in the open air, by taking a handful of dust or sand, and then—having lighted the rag—by dropping pinches of the sand upon the flaming parts as soon as it is desired to quench them. The sand is afterwards brushed away, and the tinder gently extricated.

Touch-wood is an inferior sort of tinder, but is always to be met with in woody countries. Dry and powdered cattle-dung,—especially horse-dung—will take a spark, but with trouble. Once alight, it can be kept so with little difficulty. There are many other substances used in different countries, about which a traveller should inform himself.

Tinder-boxes and cases.—There are three ways of striking a flint, which are best explained by sketches, as below.

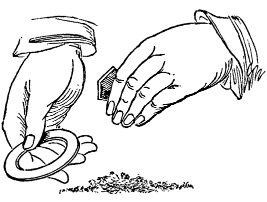


Fig. 2.

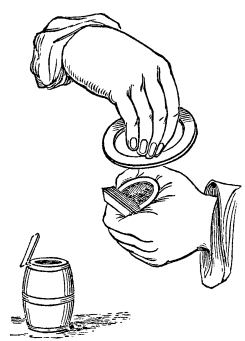
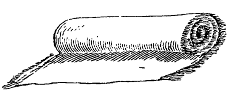


Fig. 3.

Fig. 1, below, shows how tinder that is tough enough to be grasped is held against the flint. The more friable kinds of tinder, as touchwood, can be enveloped in a roll of rag and struck in this manner. Fig. 2 shows how tinder may be laid on the ground and be struck upon. The household tinder-boxes of thirty years back, before lucifers were invented, were used on this method. Fig. 3 shows how a small tinder-box may be struck into. It is the more common method adopted by travellers: for instance, it is universal in South Africa and North America. A hollow cylinder of wood or metal, about three inches long, and corked up at one end, is all that is essential. If barrel-shaped, the flint lies against it at a more handy angle, as shown in the bottom drawing of fig. 3. In long-continued soaking weather, the best way to keep tinder dry is in a small pocket hung under the armpit.

Cotton rag will light from a spark of a flint, in a very dry climate, if well struck. It must be rolled up moderately tight, so as to have the end of the roll fluffy; the rag having been *torn*, not cut.



A rag rolled in this way is not bad tinder, if the sparks are strong, and one commences to blow it the instant one of the fibres is seen to be alight. If its fluffy end be rubbed into a little dry gunpowder, its property as tinder is greatly improved.

A piece of cotton-wick drawn through a tin tube, which shields the previously charred part from being rubbed off, is excellent in dry climates, where cotton is very easily made to take fire. Many kinds of pith are remarkable as tinders; that whence the well-known pith hats are made is used as tinder in India. Pieces of pith are often sewn round with thin cotton or silk, so as to form a long cord, like the above-mentioned lamp-wick, and they are carried in tubes for the same reason.

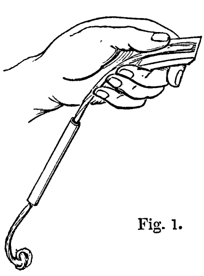


Fig. 1.

The silky down of a particular willow (*S. laniata*) was used by the Esquimaux, with whom Dr. Kane had intercourse; and the botanist, Dr. Lindley, once informed me that he had happened to receive a piece of peculiarly excellent tinder, that was simply the hair of a tree-fern. Gomuti tinder is the hair of a palm.

Saltpetre.—In all cases the presence of saltpetre makes tinder burn more hotly and more fiercely, and saltpetre exists in such great quantities in the ashes of many plants (as tobacco, dill, maize, sunflower), that these can be used, just as they are, in place of it. Thus, if the ashes of a cigar be well rubbed into a bit of paper, they convert it into touch-paper. Gunpowder, also, of which three-quarters is saltpetre, if rubbed into paper, has the same effect; and injured gunpowder will do as well for this purpose as any other. If it be an object to prepare a store of touchpaper, a strong solution of saltpetre in water should be obtained, and the paper, or rags, or fungus, dipped into it, and hung to dry. This solution may be made by pouring a little water on a charge of gunpowder, or on the ashes above-mentioned, which will dissolve the saltpetre out of them. Boiling water makes a solution forty-fold stronger than ice-cold water, and about eight times stronger than water at 60° Fahr. Unsized paper, like that out of a blotting-book, is the best suited for making into touchpaper; paper is rendered unsized by being well soaked and washed in water. (See p. 238.)

Burning-glasses.—The object-glass, and indeed almost any other glass of a telescope, *is* a burning-glass, and has only to be unscrewed to be fit for use. The larger the glass, the greater the heating power. Convex spectacle and eye glasses are too small to be used with effect, except when the sun is very hot. The inside of the polished metal cover of a hunting-watch will sometimes converge a sufficiency of rays; so will an old-fashioned watch-glass, filled with water, and having the sun's rays glittered down upon it vertically by help of a mirror. Dr. Kane made burning-glasses of ice.

Blackened tinder ignites in the sun far sooner than light-coloured tinder.

Sect. 3.—To kindle a Spark into a Flame by blowing, is quite an art. Few Europeans have learnt it, but every savage is proficient in it. No novice should attempt this method of making a fire, when his tinder is nearly expended, and he is in difficulties. He should, by far, rather adopt the plan already explained (p. 23) of whirling the spark, enclosed in a sort of bird's-nest of inflammable substances, at arm's length. With ordinary care, he is almost sure to be successful. When the wind blows freshly and steadily, it suffices to hold the "nest" up against the wind. When the flame is once started, it should be fed with little bits of sticks or bark, split with a knife, or rubbed between the fingers into fibres, until it has gained enough strength to grapple with thicker ones. There is a proverb, "Small sticks kindle a flame, but large ones put it out." It is the duty of a cook, when the time of encamping draws near, to get down from his horse, and to pick up, as he walks along, a sufficiency of little bits of wood to start a fire, which he should begin to make as soon as ever the caravan stops. The fire ought to be burning, and the kettle standing by its side, by the time that the animals are caught and are ready to be off-packed.

The best substances for making a nest are such as dry moss, lichen, *fine* grass, scraped wood, shavings rubbed fine between the fingers, tow, or cord untwisted and picked into oakum, paper doubled up many-fold and shaved with a sharp knife into very fine cuttings, wild cotton, bark rubbed small between the fingers, &c. &c.

There should be an abundance of small sticks, and if these are not to be found, the traveller should split up large ones with his knife. It is far the wiser economy of time to prepare plenty of these, than to have to recommence fire-making after an unsuccessful attempt for want of them. I have made many experiments myself, and seen many novices attempt fire-making; and conclude that, for efficiency, there should be small bundles of sticks of each of the following sizes:—1st, size of lucifer match; 2nd, of lead pencil; 3rd, smaller than little finger; 4th, size of fore-finger; 5, stout stakes.

Sulphur matches are so very useful to convert a spark into a flame, and they are so easily made, in any quantity, out of split wood, straws, &c., if the traveller will only take the trouble of carrying a small lump of sulphur in his baggage, that they always ought to be at hand. The sulphur is melted on a heated stone, or in an old spoon, bit of crockery, bit of tin with a dent made in it, or even a piece of paper, and the points of the pieces of wood dipped in the molten mass. A small chip of sulphur pushed into the cleft end of a splinter of wood makes a fair substitute for a match. For *lucifer matches*, see p. 23.

In soaking wet weather, the little chips of dry wood—that are so essential to start a fire—are best cut with an axe out of the middle of a log; and the fire may be started, as Capt. Murray recommends, in the frying-pan itself, for want of a dry piece of ground. In moderately wet weather, they should be looked for under large stones and other shelter. But observe what the natives do, in the country in which you are travelling.

Sect. 4.—Fuel.—There is something of a knack in finding firewood. It should be looked for under bushes; the stump of a tree that is rotted nearly to the ground has often a magnificent root, fit to blaze throughout the night. In want of firewood, the dry manure of cattle, and other animals, as found on the ground, is very generally used throughout the world, and there is nothing whatever that is objectionable in employing it. The Canadians call it by the apt name of "Bois de Vache." In North and in South Africa it is frequently used; throughout a large part of Armenia and of Thibet they rely entirely upon it. There is a great convenience in manure-fuel; because, as it is only in camps that fuel is wanted, so it is precisely at old encamping-places that manure is abundantly found.

Bones.—Another very remarkable substitute for firewood is bones, a fact to which Mr. Darwin was, I believe, the first to draw public attention. The bones of an animal, when freshly killed, make good fuel; and even those of cooked meat, and such as have been exposed to the air for some days, will greatly increase the heat of a scanty fire. Their smell is not disagreeable, it is simply that of roast or burnt meat. In the Falkland Islands, where firewood is scarce, it is not unusual to cook part of the meat of a slaughtered bull with its own bones. When the fire is once started with a few sticks, it burns hotly. The flame, of course, depends on the fat within the bones, and, therefore, the fatter the animal the better fuel should we expect them to be. During the Russian campaign in 1829, the troops suffered so severely from cold, at Adrianople, that the cemeteries were ransacked for bones for fuel. (Molkte, *in the Appendix.*)

Sea-weed makes a hot, though not a cheerful fire. It is largely used. The vraic or sea-weed gatherers of the Channel Islands are represented in many picturesque sketches. The weed is carted home, spread out, and dried.

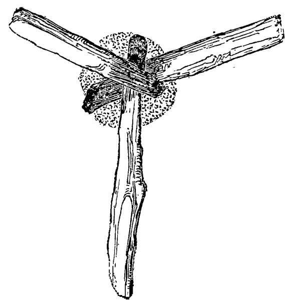
Travellers must bear in mind that peat will burn, especially as the countries in which it is found are commonly destitute of firewood, and besides that, marshy, cold, and aguish. Charcoal is frequently carried by travellers in sacks; they use a prepared charcoal in the East, which is made in the form of very large buttons, that are carried strung together on a string. An Indian correspondent informs me that "this prepared charcoal is made by mixing powdered charcoal with molasses, in the proportion of ten to one, or thereabouts, rolling the mass into cakes about the size of a fives-ball, and drying them in the sun; one of them is called a '*gul*,' and is used for igniting a *hookha*. A number of them are burnt inside the smoothing-iron used by washermen, in order to heat it. (See p. 189.)

"There can be no doubt that the juice or sap of many plants would answer the purpose of molasses in the preparation.

"Fuel so prepared, and compressed into cubes, would afford a compact and portable fuel.

"When properly ignited, a *gul* will burn to the last morsel, with a bright heat."

Sect. 5.—Camp Fires.—The principle of making large logs to burn brightly is to allow air to reach them on all sides, and yet to place them so closely together that each supports the combustion of the rest. A common plan is to make the fire with three logs, whose ends cross each other, as in the diagram. The dots represent the extent of the fire. As the ends burn away, the logs are pushed closer together.



In the pine-forests of the North, at winter time, it is usual to fell a large tree, and, cutting a piece six or eight feet long off the large end, to lay the thick short piece upon the long one, which is left lying on the ground; having previously cut flat with the axe the sides that come in contact, and notched them so as to make the upper log lie steady. The chips are then heaped in between the logs and are set fire to; the flame runs in between them, and the heat of each log helps the other to burn. It is the work of nearly an hour to prepare such a fire; but when made, it lasts throughout the night. In all cases, one or two great logs are far better than many small ones, as these burn fast away and require constant looking after. Many serious accidents occur from a large log burning away and topling over with a crash, sending a volley of blazing cinders among the sleeping party. Savages are always getting burnt, and we should take warning from their carelessness: sometimes they find a single scathed tree without branches, and which they have no means of felling; this they set fire to as it stands, and when all have fallen off to sleep, the tree tumbles down upon them. Indeed, savages are seldom free from scars of severe burns; they are so cold during the night that they cannot endure to be an inch further from the fire than necessary, and consequently, as they turn about in their sleep, often roll into it.

Should your stock of fuel consist of large logs and but little brushwood, keep what you have of the latter to make a blaze when you get up to catch and pack the cattle in the dark and early morning. As you travel on, if it be bitter cold, carry a firebrand in your hand, near your mouth, as a respirator—it is very comforting; then, when the fire of it burns dull, thrust the brand for a few moments in any tuft of dry grass you may happen to pass by, which will blaze up and give a new life to the brand.

If in a country where only a number of small sticks and no large logs can be collected as firewood, the best plan is to encamp after the manner of the Ovampos. These, as they travel, collect sticks, each man his own faggot, and when they stop, each takes eight or nine stones as large as bricks, or larger, and sets them in a circle; and within these he lights up his little fire. Now the party make their fireplaces close together, in two or more parallel lines, and sleep in between them; the stones prevent the embers from flying about and doing mischief, and also, after the fires have quite burnt out, they still continue to radiate heat.

On very deep snow, a hearth has to be made of a number of green logs, upon which the fire may be made.

If charcoal be carried, a small chafing-dish, or other substitute for a fireplace, ought also to be taken, together with a set of tin cooking-utensils.

In boating excursions, dab a lump of clay on the bottom of the boat, beneath the fireplace—it will secure the timbers from fire. "Our primitive kitchen was a square wooden box, lined with clay and filled with sand, upon which three or four large stones were placed to form a hearth." (Burton's 'Medinah.') See chapter on COOKING, p. 84, for other kinds of fire arrangements.

BIVOUAC.

§ 1. Where to seek for Shelter.—§ 2. Bivouac without Tents.—§ 3. Mattresses, Blankets, and their Substitutes.—§ 4. Tents.—§ 5. Tent Furniture.—§ 6. Huts.

THE most bulky, and often the heaviest, parts of a traveller's equipment are his clothes, sleeping-mat, and blankets: neither is it at all desirable that these should be stinted in quantity; for the hardship that most tries a man's constitution, and that lays the seeds of rheumatism, dysentery, and fever, is that of enduring the bitter cold of a stormy night, which may happen to follow a trying day of extreme heat and exhaustion, or of drenching wet. After many months' travel and camping, the constitution becomes far less susceptible of injury from cold and damp, but in no case is it ever steeled to their influence. Indeed, the oldest travellers will ever be found to be those who go the most systematically and carefully to work in making their sleeping-places dry and warm. Unless a traveller makes himself at home and comfortable in the bush, he will never be quite contented with his lot; but will fall into the bad habit of looking forwards to the end of his journey, when he shall return home to civilisation, instead of complacently interesting himself in its progress. This is a frame of mind in which few great journeys have been successfully accomplished; and an explorer who cannot divest himself of it, may be sure he has mistaken his vocation. (See pp. 47–50.)

Sect. 1.—Where to seek for Shelter.—Study the *form* of a hare! In the flattest and most unpromising of fields, the creature will have availed herself of some little hollow to the lee of an insignificant tuft of grass; and there she will have nestled and fidgeted about, till she has made a smooth, round, grassy bed, compact and fitted to her shape, where she may curl herself snugly up, and cower down below the level of the cutting night wind. Follow her example. A man, as he lies down upon his mother earth, is but a small low object, and a screen of eighteen inches high will guard him securely from the strength of a storm. The great mistake of a novice lies in selecting a tree for his camping-place, which spreads out nobly above, but

affords nothing but a bare stem below. It may be, that as he walks about in search of a bush, the quantity of foliage at the level of his eye, with its broad shadow, chiefly attracts him, and as he *stands* to the leeward of it, it seems snug, and, therefore, without further reflection, he orders his bed to be spread at its foot. But as soon as he lies down on the ground, the tree proves worthless as a screen—it is a roof and not a wall; what is really wanted in blowy weather is a dense low screen, perfectly wind-tight, as high up as the knee above the ground. Thus, if a traveller has to encamp on a bare turf plain, he need only turn up a broad sod, seven feet long by two feet wide, and, if he succeeds in propping it up on its edge, it will form a sufficient shield against the wind.

In heavy gales, the neighbourhood of a single tree is a positive nuisance. It creates a violent eddy that may be observed to leave clear evidence of its existence. Thus, in corn-fields, it is a common result of a storm to batter the corn quite flat in circles round each tree that stands in the field, while elsewhere no injury has taken place. This very morning that I am writing these remarks, November 15, 1858, I was forcibly struck by the appearance of Kensington Gardens, after last night's gale, which had covered the ground with an extraordinary amount of dead leaves. They lay in a remarkably uniform layer, of from three to five inches in depth, except that round each individual tree the ground was absolutely bare of leaves for a distance of about a yard. The effect was, as though circular discs had been swept with scrupulous care, leaving the edges of the layer of leaves that surrounded them perfectly sharp and vertical. It would have been a dangerous mistake to have slept that night at the foot of any one of those trees.

We must bear in mind that a gale never blows in a level current, but in all kinds of curls and eddies, as the driving of a dust-storm, or the vagaries of bits of straw caught up by the wind, unmistakably show us. Little hillocks, or undulations, combined with the general lay of the ground, cause these eddies, and entirely divert the impact of the wind from some particular spots. These spots should be looked for; they are discovered by watching the grass, or even the sand, that lies on the ground. If the surface be still in one place, while all around is agitated by the wind, we shall not go far wrong in selecting that place for our bed, however unprotected it may seem in other respects. Indeed, it is constantly remarked that quite a slight mound or ridge will sometimes shelter the ground for many feet behind it; and an old campaigner will accept such shelter gladly, notwithstanding the apparent insignificance of its cause.

But the shelter of a *wall* is only sufficient against wind or driving rain; we require a *roof* to shield us against vertical rain and against dew, or, what is much the same thing, against the cold of a clear blue sky on a still night. The temperature of the heavens is known pretty accurately, by more than one method of calculation: it is $-239°$ Fahr.; the greatest cold felt in the Arctic regions being about $-40°$ Fahr. If the night be cloudy, each cloud is a roof to keep off the cold; if it be clear, we are exposed to the full chill of the blue sky, with only such alleviation as the warming and the non-conducting powers of the atmosphere may afford. The effect is greater than people generally would credit. The uppermost layer of the earth, or whatever may be lying exposed upon it, is called upon to part with a great quantity of heat. If it so happen that the uppermost layer is of a non-conducting nature, the heat abstracted from it will be poorly resupplied by communication from the lower ones. Again, if the night be a very calm one, there will be no supply of warmth from fresh currents of air falling down upon it. Hence, in the double event of a clear blue sky and a perfectly still night, we are liable to have great cold at the very surface of the ground, and in the thin layer of air that immediately rests upon it; while, at each successive inch in height, the air becomes more nearly of its proper temperature. A vast number of experiments have been made by Mr. Glaisher on this subject ('Phil. Trans.,' 1847), the upshot of which is that a thermometer laid on *grass*, under a blue sky on a calm night, marks on an average 8° Fahr. colder than one 4 feet above it; 1 inch above grass, 5½°; 1 foot, 1°; 4 feet, ½°; on gravel and sand the differences are only about one-third as much. These were the results of experiments made in England, where the air is always moist, and the formation of dew, while it testifies to the cold of the night, assists largely to moderate it. In arid climates, the chill would be far greater; so also would be the case at high altitudes. One of Mr. Glaisher's experiments showed a difference of no less than 28° between the cold on the ground and that at 8 feet high. This great difference might often be rivalled in an elevated desert, as in those of South America. Hence the value of the protection of a roof and of a raised sleeping-place to a man sleeping under a blue sky, in still weather, admits of easy recognition. Avoid sleeping in slight hollows in clear still weather. The cold stratum of air we have just been speaking about, pours down into them, like water, from the surrounding plain, and stagnates there. Spring frosts are always more severely felt in hollows. But in a broad level plain, especially if the night be clear and calm, look out for some slight rise for an encampment. The chilled stratum of air drains from off it, and is replaced by warmer air. Horses and cattle, as the night sets in, always draw up to these higher grounds, which rise like islands through the sea of mist that covers the plain.

A clump of trees yields wonderful shelter. The Swedes have a proverb that "the forest is the poor man's jacket." In the cruel climate of Thibet, Dr. Hooker tells us that it is the habit to encamp close up to some large rock, because a rock absorbs heat all day and parts with it but slowly during the night-time. It is, therefore, a great reservoir of warmth when the sun is down, and its neighbourhood is always coveted; and from the same cause, but acting in the opposite direction, its shadow is peculiarly cool and grateful during the heat of the day. The near neighbourhood of water is objectionable, for, besides being exposed to malaria and musquitoes, the night-air is sure to be felt more cold and penetrating by its side than at one or two hundred yards' distance from it. A stony shingle makes a fine dry encamping-place, and has an advantage in making it impossible for marauders to creep up unheard.

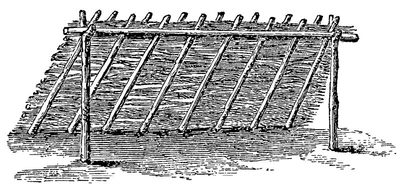
Burying oneself in sand, snow, &c.—A European can live through a bitter night, on a perfectly dry sandy plain, without any clothes besides what he has on, if he buries his body pretty deeply in the sand, keeping only his head above ground. It is a usual habit of the naked natives in Australia to do so, and not an unfrequent one of the Hottentots of South Africa. Mr. Moffat records with grateful surprise how he passed a night, of which he had gloomy forebodings, in real comfort, even luxury, by adopting this method. In snow, it appears that people may do even more: they may bury themselves entirely, and want neither air nor warmth. I have never tried it; but the instances are numerous of people falling into snow-drifts, and not being extricated for many days, and when at length they were taken out, they never seem to have complained of cold, or any other sufferings than those of hunger and of anxiety. A few chill hours may be got over by nestling in among the ashes of a burnt-out camp fire. In Napoleon's retreat after his campaign against Russia, many a soldier saved or prolonged his life by creeping within the warm and reeking carcase of a newly-dead horse.

Sect. 2.—Bivouac, without Tents.—A bivouac is an encampment made in a temporary way, partly from materials found on the spot, and partly from what the traveller may happen to have by him. A traveller may carry his tent, which he can pitch in half an hour, or he may spend days in building a hut from the materials at hand; but a bivouac partakes in some degree of the nature of both a tent and a hut: it is also essentially a temporary makeshift. Bivouacking is miserable work in a wet or unhealthy climate; but, in a dry and healthy one, there is no question of its superiority over tenting. A man breathes fresher air, and is far more imbued with the feeling of a wild life, when he sleeps habitually in the open, instead of within the stuffy enclosure of a tent. It is an endless pleasure to lie half awake with the stars above you, and the picturesque groupings of the encampment about you, and to hear on all sides the stirrings of animal life. And, later in the night, when the fire is low, and men and cattle are asleep, and there is no sound but the wind and an occasional plaintive cry from night-roving animals, the traveller finds himself in that close communion with nature, which is the true charm of wild travel: all this is lost by sleeping in a tent. Tent life is semi-civilization, and perpetuates its habits. Thus, a man who has lived much in bivouacs, if there be a night alarm, runs naturally into the dark for safety, just as a wild animal would; but a man of tents is frightened when away from the lights, or from his tent.

In a dangerous country there can be no comparison between the hazard of a tent and that of a bivouac. In the former, a man's sleep is heavy; he cannot hear nearly so well; he can see nothing; his cattle may all decamp; and marauders know exactly where he is lying, and may make their plans accordingly. The first Napoleon had a great opinion of the advantages of bivouacking over those of tenting. He said it was the healthier of the two.

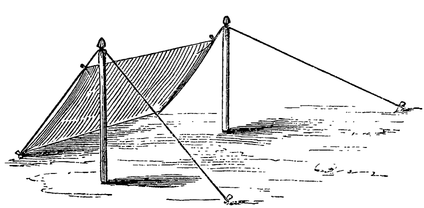
We have already remarked that a main object before sleeping out at night is to secure a long wind-tight wall. Two or three small bushes standing near together may be easily pleached into one; or boughs may be torn off elsewhere, and interwoven between the bushes. A few leafy boughs cut and stuck into the ground, with their tops leaning over the bed, and, when in that position, secured by other boughs, and wattled-in horizontally, give great protection. Long grass, &c., should be plucked and strewn against them, to make them as wind-tight as possible. A pile of saddle-bags and other travelling gear may be made into a good screen against the wind, and travellers usually arrange them with that intention. We have already spoken (p. 38) of a broad sod of turf propped up on edge.

In fir-woods there is great facility in making warm encampments, even in the most bitter weather. A young tree, when felled, yields poles to support branches for shields against weather, and flooring above the snow or damp. A common arrangement is as follows:—A cross-bar is supported by two uprights; against this cross-bar a number of poles are made to lean; on the back of the poles abundance of fir



branches are laid horizontally; and, lastly, on the back of the fir branches are another set of leaning poles, in order to make all secure by their weight.

A cloth of any kind is made to give shelter by an arrangement of this kind. The corners of the cloth should be secured by a simple hitch in the rope and not by a knot. The former is sufficient for all purposes of security, but the latter will jam, and you may have to injure both



cloth and string to get it loose again. It is convenient to pin a skewer in the middle of the sides of the cloth, round the ropes.

Any strip of wood makes a skewer. Earth should be banked up against the bottom edge of the cloth, to keep out wind, and to prevent flapping.

The sticks may, on an emergency, be replaced by faggots of brushwood or by guns, or by ropes carried down from the overhanging branches of a tree. Cloths, and stones heaped into walls, make good combinations. Bags filled with sand and built into a wall have sometimes been of use in a bare plain. For a sail supported by oars, see p. 140.

The French "tente d'abri" has not, so far as I know, been adopted by travellers. It seems hardly suitable except for soldiers. Each man carries a square of canvas (fig. 1), with buttons and button-holes all round it, by which it can be doubly attached to other similar squares of canvas, and thus, from several separate pieces, one large cloth can be made. The square carried by the French soldier measures 5 feet 4½ inches in the side, reckoning along the buttons; of these there are nine along each edge, including the corner ones. Each soldier has also to carry a tent-staff, or else a proportion of the pegs and cord. When six men club together, they proceed as follows:—Three tent-sticks are fixed into the ground, whose tops are notched; a light cord is then passed round their tops, and fastened into the ground with a peg at

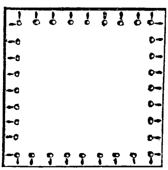


Fig. 1.

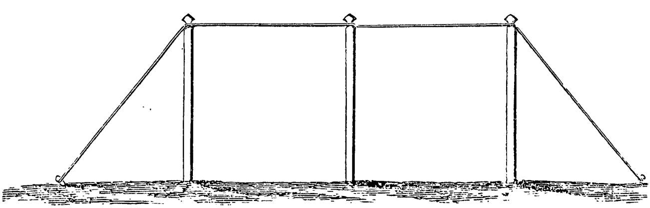


Fig. 2.

each end (fig. 2). Two sheets, A and B, are buttoned together and thrown over the cord, and then two other sheets, C and D; and C is buttoned to A, and D to B (fig. 3). Lastly, another sheet is thrown over each of the slanting cords, the one buttoned to A and B, and the other to C and D; and thus a sort of dog-kennel is formed, in which six men —the bearers of the six pieces of canvas—sleep. The sides of the tent are of course pegged to the ground. There are many modifications in the way of pitching these tents. For want of sticks, faggots and muskets can be used, as mentioned above.

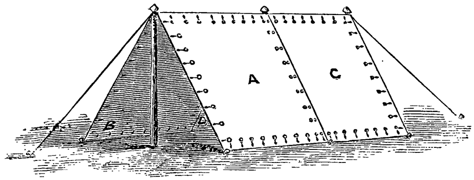
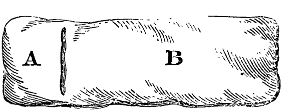


Fig. 3.

A man may be as comfortable in a burrow as in a lair. We shall speak of underground houses under *Hutting;* but for the present will only mention that, in arid countries, there are numerous dry wells, such as natives dig, half filled up with sand, and four or six feet deep. These are generally found near existing watering-places, when they have been superseded by other ones, better placed and deeper. Now, there are few warmer sleeping-places than one of these dry wells; a small fire is easily kept burning at the bottom, and the top may be partially roofed over.

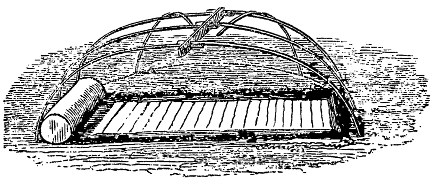
Sleeping-bags.—The peasants in the northern parts of Germany use a strong linen sack, made to draw at one end. This they stuff with straw, hay, dry leaves, &c.; and, putting their feet into it, pull its mouth up to their armpits. They use them when driving their waggons in winter, and when lodging at their wretched road-side inns (see a letter in the 'Times,' February 12, 1855). Arctic travellers use coarse drugget bags, covered with brown holland to keep them more wind-tight, and having a long flap at the upper end to fold down over the face.



"I found great comfort in a waterproof bag, into which I could creep in rain when I had no tent, and in which I slept when the weather was fine. A flap, A, at the open end of the bag, covered my head in rain, and a trench dug round it placed me on a dry island." (Col. Sir J. Alexander.)

The width of the bag should not be less than $2\frac{1}{2}$ feet, and 3 feet is better; nor the entire length than $7\frac{1}{2}$ feet, of which $1\frac{1}{2}$ go to form A, and the remaining 6 feet to form B. For the sake of experiment, I have slept in one of these in England. Once I did so during heavy rain, in the Westmoreland mountains. My bag was made of very thin calico, waterproofed with wax and oil, and had a second one of drugget, of precisely the same shape, enclosed within it; but the drugget bag was loose and could be taken out at will, and dried or aired. A change of dry clothes was packed in A, and I carried the whole on my back as a roll. By cutting abundance of wet fern, and strewing it above and below the bed, I secured sufficient warmth, while the waterproof kept out the damp; and though I undressed under a drenching rain, yet, with the help of an umbrella, both I and my companion contrived to replace our soaked clothes with dry ones taken from under the flap, A, of our respective bags, and to wriggle through their openings in perfect dryness. I strongly suspect that a combination of a sleeping-bag with a very small tent, just large enough to enclose A and part of B, so as to permit a man to eat or to write when lying in bed, without being wet, would be the smallest and lightest arrangement, compatible with efficiency, in a stormy climate, or for pedestrian mountain exploration.

A traveller who has only a blanket, a plaid, or broad piece of material of any kind, wherewith he wishes to improvise a tent, may make a framework of long wands, planting their ends in the ground, bending their tops together, and lashing or wattling them securely; over this the blanket is thrown. The gipsies in England use an excellent contrivance to the same effect: they dispense with the trouble of lashing and wattling the ends of the wands, by carry-



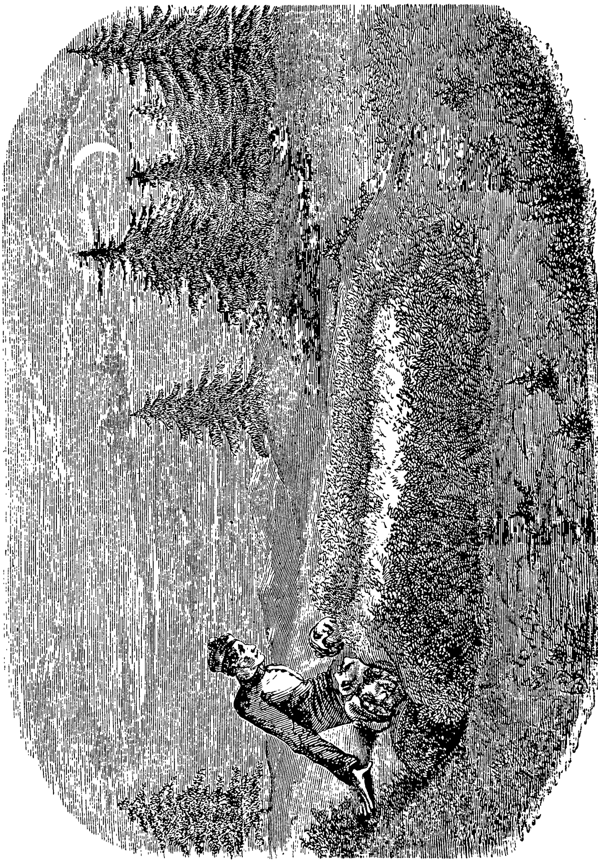
ing a light bar of wood, $2\frac{1}{2}$ feet long, bound with string here and there to keep it from splitting; through this, six holes, each big enough to admit the tip of the little finger, are bored or burnt; they also carry eight hazel rods with them, each six feet long, and arrange their framework as in the drawing. It will be observed that the two rods which are planted behind, give additional roominess and stability to the affair. The occupants sleep, as indicated in the sketch by the rug and pillow, and *blankets* pinned together with wooden pegs are thrown over the whole.

Colonel Frémont, the American traveller, bivouacked as follows:—his "rifles were tied together near the muzzles, the butts resting on the ground, and a knife laid on the rope, to cut away in case of an alarm; over this, which made a kind of frame, was thrown a large india-rubber cloth, with which he used to cover his packs; this made a tent sufficiently large to receive about half of his bed, and was a place of shelter for his instruments."

Mr. St. John tells us of an excellent way in which Highland poachers, when in a party, usually pass frosty nights on the moor-side. They cut quantities of heather, and strew part of it as a bed on the ground; then all the party lie down, side by side, excepting one man, whose place among the rest is kept vacant for him. His business is to spread plaids upon them as they lie, and to heap up the rest of the cut heather upon the plaids. This being accomplished, the man wriggles and works himself into the gap that has been left for him in the midst of his comrades. (See p. 48.)

If a night of unusual cold be expected, the best use to make of spare wearing-apparel is to put it on over that which is already on the person. With two or three shirts, stockings, and trowsers, though severally of thin materials, a man may get through a night of very trying weather.

However wet the weather may be during the day, the traveller should never relax his endeavours to keep a dry and warm change of clothes for his bivouac at night. Hardships in rude weather matter little to a healthy man, when he is awake and moving, and while the sun is above the horizon; but let him never forget the deplorable results that may follow a single night's exposure to cold, malaria, and damp. (See p. 37, 50.)



Bivouac and Travels in the Arctic regions.—Lieutenant Cresswell, who, having been detached from Captain McClure's ship in 1853, was the first officer who ever accomplished the famous North-West passage, gave the following graphic account of the routine of his journeying, in a speech at Lynn: "You must be aware that in Arctic travelling you must depend entirely on your own resources. You have not a single thing else to depend on except snow-water: no produce of the country, nor firewood, or coals, or anything of the sort; and whatever you have to take, to sustain you for the journey, you must carry or drag. It is found by experience more easy to drag it on sledges than to carry it. The plan we adopt is this:—we have a sledge generally manned by about six or ten men, which we load with provisions, with tents, and all requisites for travelling, simple cooking utensils, spirits of wine for cooking, &c., and start off. The quantity people can generally drag over the ice is 40 days' provisions; that gives about 200 lbs. weight to each. After starting from the ship, and having travelled a certain number of hours—generally 10 or 11—we encamp for the night, or rather for the day, because it is considered better to travel at night and sleep at day, on account of the glare of the sun on the snow. We used to travel journeys of about 10 hours, and then encamp, light our spirits-of-wine, put our kettle on it to thaw our snow-water, and after we had had our supper—just a piece of pemmican and a glass of water—we were glad to smoke our pipes and turn into bed. The first thing we did, after pitching the tent, was to lay a sort of macintosh covering over the snow; on this a piece of buffalo robe was stretched. Each man and officer had a blanket sewn up in the form of a bag; and into these we used to jump, much in the same way as you may see a boy do in a sack. We lay down head and feet; the next person to me having his head to my feet, and his feet to my head, so that we lay like herrings in a barrel. After this, we covered ourselves with skins, spreading them over the whole of us; and the closer we got, the better, as there was more warmth. We lay till the morning, and then the process was the same again."

Mr. Gordon Cumming.—The following extract is from Mr. Gordon Cumming's book on Africa: it describes the preparations of a practised traveller, for a short excursion from his waggons away into the bush. "I had at length got into the way of making myself tolerably comfortable in the field, and from this date I seldom went in quest of elephants without the following *impedimenta, i. e.* a large blanket, which I folded and secured before my saddle as a dragoon does his cloak, and two leather sacks, containing a flannel shirt, warm trowsers, and a woollen night-cap, spare ammunition, washing-rod, coffee, bread, sugar, pepper and salt, dried meat, a wooden bowl, and a tea-spoon. These sacks were carried on the shoulders of the natives, for which service I remunerated them with beads. They also carried my coffee-kettle, two calabashes of water, two American axes, and two sickles, which I used every evening to cut grass for my bed, and likewise for my horses to eat throughout the night; and my after-rider carried extra ammunition and a spare rifle."

Dr. Kane says, "We afterwards learnt to modify and reduce our travelling gear, and found that in direct proportion to its simplicity and to our apparent privation of articles of supposed necessity, were our actual comfort and practical efficiency. Step by step, as long as our Arctic service continued, we went on reducing our sledging outfit, until we at last came to the Esquimaux ultimatum of simplicity—raw meat and a fur bag."

I have been informed of a sportsman in Ceylon, who took with him into the woods a cot with mosquito-curtains as a protection, not only against insects, but against malaria, and had a blanket rolled at his feet: at 3 in the morning, when the chill arose in the woods, he pulled his blanket over him.

To conclude, let the traveller, when out in trying weather, work hard at making his sleeping-place perfectly dry and comfortable; he should not cease until he is convinced that it will withstand the chill of the early morning, when the heat of the last sun is exhausted and that of the new sun has not begun to be felt. It is wretched beyond expression for a man to lie shivering beneath a scanty covering, and to feel the night air become hourly more raw, while the life-blood has less power to withstand it; and to think self-reproachfully how different would have been his situation if he had simply had forethought and energy enough to cut and draw twice the quantity of firewood, and to spend an extra half-hour in labouring to make a snugger berth. The omission once made becomes irreparable, for, in the cold of a pitiless night, he has hardly sufficient stamina to rise and face the weather, and the darkness makes him unable to cope with his difficulties. (See p. 37, 48.)

Sect. 3.—Mattresses and their Substitutes.—It is a common idea among young travellers, that all the bed-clothing which they need concern themselves about is a sufficiency to cover them, forgetting that a man has an under as well as an upper side to keep warm, and must, therefore, have clothing between him and the earth as well as between him and the air. Indeed, on trying the experiment, and rolling oneself up in a single blanket, the undermost side in a cold night is by far the colder of the two; and if the ground be at all wet, its dampness penetrates through very thick substances. The object of a mattress is not alone to give softness to the bed, but to give warmth, just as much as it is that of the upper blankets to do so; and if a person lies in a hammock, with nothing but the hammock itself below, and with warm clothes above, he will be just as much chilled as if the arrangement had been reversed, and he had lain upon warm things, with only the hammock spread out as a sheet to cover him.

If a traveller, as is very commonly the case, should have no mattress, he should strew his sleeping-place with dry grass, plucked up from the ground, and other warm things, imitating the structure of a bird's-nest as far as he has skill and materials to do so. Leaves, fern, feathers, heather, rushes, flags of reeds and of maize, wood-shavings, bundles of faggots, and such like things as chance may afford, should be looked for and appropriated; a pile of stones, or even two trunks of trees rolled close together, may make a dry bedstead. Over these, let him lay whatever empty bags, skins, saddle-cloths, spare clothes, &c., he may have, which from their shape or smallness cannot be turned to account as coverings in other ways, and the lower part of his bed is complete.

The annexed sketch represents a man sleeping in a natural attitude. It will be observed that he fits into a concavity of

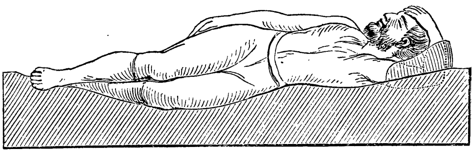


Fig. 1.

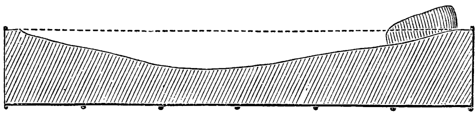


Fig. 2.

about 6 inches in greatest depth. (The slab on which he is drawn is 6 feet long and 1 foot deep.)

Travellers should always endeavour to scrape a hollow in the ground, of the shape that is shown most clearly in fig. 2, before spreading their sleeping rugs. It is bad lying on a perfectly level surface, but the acme of discomfort is to find one's bed laid upon a convex one. Persons who have omitted to make a shapely lair for themselves, should at least scrape away a little hollow in the ground, just where the hip-bone would, otherwise, press.

"Making a mattress is indeed a very simple affair. A bag of canvas, or other cloth, being made of the size wanted, it is stuffed full of hair, wool, dry leaves, or cotton, and a strong stitch is put through it every few inches. The use of this is to prevent the material used from being displaced, and thus forming lumps in different parts of the bag. Straw, well knitted together, forms a good mattress, sometimes called a paillasse." See *Mats*, p. 67.

Eight pounds weight of shavings make an excellent bed, and they can be cut with a common spokeshave in 3½ hours out of a log of deal. It is practicable to make an efficient spokeshave by tying a large clasp-knife on to a common stick which has been cut into shape. Old cord, picked into oakum, will also make a bed.

A strip of Macintosh.—If a traveller can do so, he should make a point of having, in addition to his upper bed-clothing, a strip of macintosh sheeting 7 feet by 4, certainly not less than 6 feet by 3, to lay first on the ground, and a light mattress stuffed with good horsehair to go over it. Every white servant in the expedition ought to be furnished with, at least, a strip of macintosh sheeting, or, failing that, with a strip of painted canvas. This is, however, much inferior to macintosh, as it will not fold up without cracking—it also tears easily, and is heavy. Macintosh, of the sort that suits all climates, is invaluable stuff to an explorer, whether in the form of sheeting, coats, water-bags, swimming-belts, or inflatable boats; but a little box full of the composition for mending it, and a spare bit of macintosh, should be taken. (For *Tarpauling*, see p. 67.)

Coverlets.—For an upper cover, it is of great importance that its texture should be such as to prevent the wind ever blowing through. If it does so, no thickness is of any avail in keeping out the cold; hence the advantage of skin carosses, buffalo robes, leather sheets, and macintosh rugs. All cloths lose much of their closeness of texture in a hot, dry climate; the fibres shrink extremely, and the wind blows through the tissue as through net-work. It is in order to make their coverings wind-proof, that shepherd-lads on the hills in Scotland, when the nights are cold, dip their plaids in water before sitting or lying down in them. The wet swells up the fibres of the plaid, and makes the texture of it perfectly dense and close. It is also of importance that the outer covering should have a certain weight, so as not to be too easily displaced, either by the person fidgeting in his sleep or by the blowing of the wind. In dry weather there is nothing like furs; but in a rainy country I should prefer a thick blanket bag, a large spare blanket, and a macintosh sheet and counterpane. People may object that the bag and macintosh would be close and stuffy, but be assured that the difficulty when sleeping on mother earth, on a bitter night, is to keep the fresh air out, not to let it in; on fine nights I should sleep on the bag and under the spare blanket.

Brown paper is an excellent non-conductor of heat, and English cottagers often enclose sheets of it within their quilted counterpanes. If thoroughly soaked and then dried, it will not crackle.

If a man be destitute of proper wraps, he cannot do better than put on all the spare clothes he possesses. The additional warmth of a single extra shirt is remarkable. The bivouac of the Ovampos has already been mentioned (p. 36). In the warmth of their numerous small fires, they sleep absolutely naked without suffering.

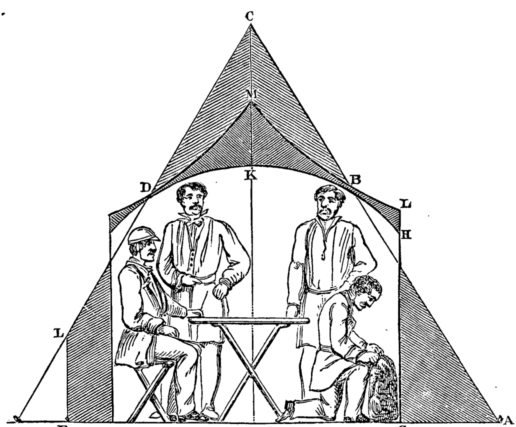
Pillows.—A mound of sand or earth, scraped together, wears flat down after a few minutes. A bag filled with earth, or it may be grass, keeps its shape. Many people use their saddles as pillows; they roll up the flaps and stirrups, and place the saddle on the ground with a stone underneath, at its hindmost end, to keep it level and steady, and then lay their heads on the seat. I prefer using anything else, as, for instance, the stone without the saddle; but I generally secure some bag or other for the purpose: however, without some sort of pillow, it is difficult to sleep. A bag shaped like a pillow-case and stuffed with spare clothes is very convenient. Some people advocate air-cushions.

Mr. Mansfield Parkyns' excellent plan, of sleeping on the side, with the stock of the gun between the head and the arm, and the barrel between the legs, will be again mentioned at length, p. 229.

Sect. 4.—Tents.—Although tents are not worth the trouble of pitching on dry nights in a healthy climate, they are invaluable protectors against rain, dew, and malaria. To a party encamped for a few days, they are of great use as store-houses for loose luggage, which otherwise becomes scattered about, at the risk of being lost or pilfered. The art of tent-making has greatly advanced since the days of the old-fashioned bell-tent; which is so peculiarly objectionable, as to make it a matter of surprise that it was ever invented and used. It is difficult to pitch, requires many tent-pegs, has ropes radiating all round it, over which men and horses stumble, is incommodious, and ugly.

In choosing a tent, select one in preference that will stand in some sort of shape with only four pegs, or with six at the very utmost; it should peg close down to the ground, without the intervention of any ropes; it is of no objection that it should require more than one pole; and as to its weight, it must be borne in mind that the weight of a tent is far greater in actual travel than it is found to be in a maker's dry show-room. It is of great convenience that a tent should admit of being pitched in more than one form. For instance, that one side should open and form an awning in hot weather, and that flys or awnings should be easily attached to it, to increase its available size during daytime. All tents should have a strong cover, for pack-ropes are sure to fray whatever they press against, and it is better that the cover should suffer than the tent itself.

The annexed diagram may assist in showing the points on which the *roominess* of a tent mainly depends. A man wants



room to sit at a table, and to get at his luggage in order either to pack it or to unpack it. He also wants a reasonable amount of standing room. A fair-sized tent ought to include the figures drawn in the diagram; and I have indicated, by lines and shaded spaces, the section of various descriptions of tents that would be just sufficient to embrace them.

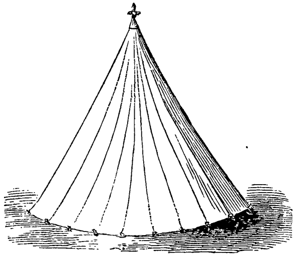


Fig. 1.

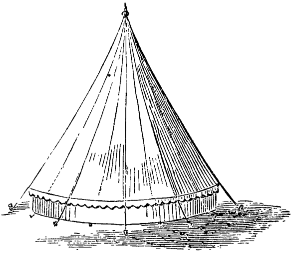


Fig. 2.

Ordinary conical (fig. 1), a front view of fig. 6, and pyramidal tents (fig. 7), are represented by the line A B C. Those that have a "fall" (fig. 2) by the lines C D L F. Gipsy-tents (fig. 4), umbrella-tents (fig. 5), and Kirghis-jourts (fig. 9), by the lines G H B K. Marquees (fig. 3), and a side view of fig. 6, by G L B M. Notwithstanding the great height and width of conical tents, compared to the others, we see by the diagram that they afford scanty space at the level of the head of a seated person. There is a recent contrivance by Major Rhodes, to be seen at Silver and Co.'s, which would fall under the same class as figs. 4, 9, and 5. It is a modification of the principle of the gipsy-tent. Of ordinary, well-known tents, I believe none will satisfy the varied wants of a traveller

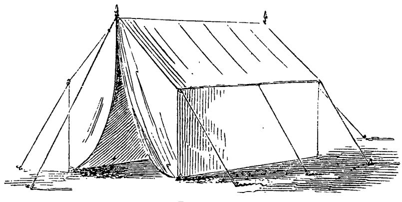


Fig. 3.

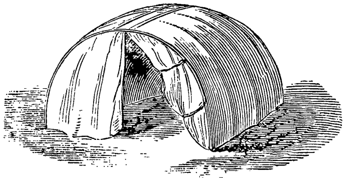


Fig. 4.

so well as Edgington's three-poled tents (fig. 6). After these, I should choose a small marquee (fig. 3); but it is less secure in wind, and the pitch of its roof is bad for rain, and the straggling tent-ropes are objectionable.

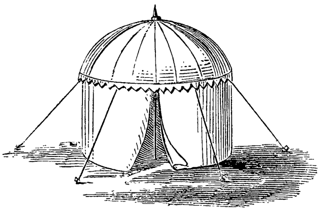


Fig. 5.

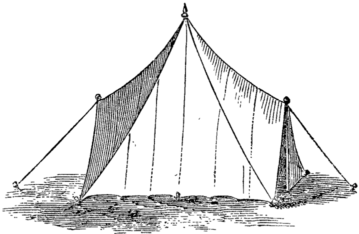


Fig. 6.

A pyramidal tent, one of seven or nine feet in the side, is remarkable for its sturdiness: it will stand any weather, will hold two people and a fair quantity of luggage besides, and weighs from 25 to 40 lbs. It is not a good tent for hot weather, it is far too stuffy; though taking an additional joint to the tent-pole, and using tent-ropes (as may also be done with any other kind of tent), it may be made more airy by being raised up, and by having walls added to it, of bushes, sods of turf, or spare cloths, as in the left-hand figure (fig. 8.)

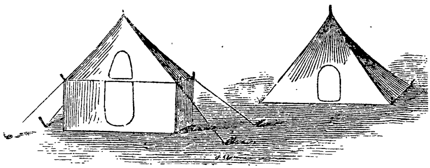


Fig. 8. Fig. 7.

The Kirghis-jourt is a capacious, solid, warm, and fireproof structure, that admits of being pitched or taken to pieces in an hour, and withstands the cold and violent winds of the steppes of Central Asia, in a way that no tent or combination of tents could pretend to effect. A jourt of from 20 to 25, or even 30 feet in diameter, forms two camel-loads, or about half a ton in weight. One camel carries the felt; the other, the wood-work. Fig. 9 shows the jourt, half-covered; and fig. 10 gives an enlarged view of part of its side. There are four separate parts in its structure:—1. The *doorway*, a solid piece of ornamented carpentering, that takes to pieces instantly. 2. The *sides*, which consist of lengths of wood-work, that shut up on the principle of easy-back scissors: they tie together and make a circle, beginning and ending with the doorway; a tape is wound round them, as shown in the sketch, about one-third from their tops. 3. The *roof-ribs*: each of these is tied, at its bottom, to the sides of the jourt (A, fig. 10), and at its top fits into a socket in 4, the

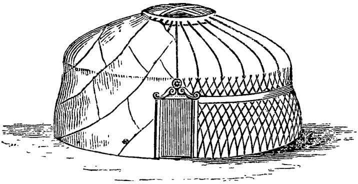


Fig. 9.

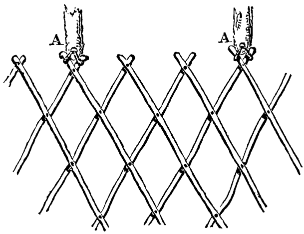
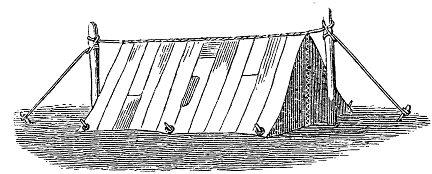


Fig. 10.

roof-ring, which is a hoop of wood strengthened by transverse bars. Over this skeleton, broad sheets of felt are thrown: they lie steadily through their own weight, for they are quite an inch in thickness; except in very stormy weather, when, if I recollect aright, they are weighted with stones or stitched together. There is no metal in the structure: the laths of willow-wood that form the sides are united, where they cross, by pieces of sinew knotted at either end; these act as pivots when the sides are shut up. I am indebted to Mr. Atkinson for my information on these interesting structures. Further particulars about them, the native way of making the felt, and numerous pictures in which jourts form a striking feature, will be found in his beautifully illustrated work on Siberia.

For tents of the smallest size and least pretensions, nothing can be better than one of this shape: the ends are slit down their middles, and are laced or buttoned together; so that, by unfastening these, the tent spreads out to a flat sheet, well adapted for an awning, or else it can be simply unrolled and used with the bedding. It is necessary that a tent should be roomy enough to admit of a man undressing himself, when wet through, without treading upon his bed and drenching it with mud and water; and therefore a tent of the above description is found to be unserviceable, if less than about 7 feet long, or ending in a triangle of less than 5½ feet in the side.



Peat, the saddler in Bond Street, makes these; they cost 2*l.* 10*s.*, and weigh 9 lbs. when dry. They are liable to bag in the side when the wind is high: a cross-pole or two sticks, following the seams of the canvas in the above sketch, would make them tauter.

The *Tente d'Abri* of the French soldier has been already mentioned, p. 44.

Further on, in page 140, the way is shown by which sailors make a tent out of their lug-sail, throwing it over a frame-work of oars. For other kinds of tents see pp. 63, 64.

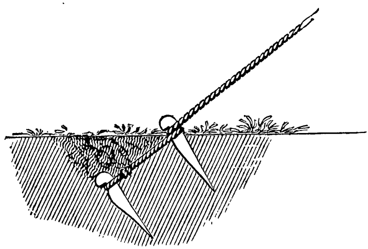
Where a tent is pitched for an encampment of some duration, it is well to lay aside the jointed tent-pole, and to cut a stout young tree to replace it: this will be found far more trustworthy in stormy weather. If the shape of the tent admits of it, it is better still to do away with the centre pole altogether; and, in place of it, to erect a substantial framework of poles, which are to be planted just within the rim of the tent, and converge to a point, under its peak. A tent-pole can be lengthened, temporarily, by lashing a log to it with the help of a toggle and strap (see p. 171); and a broken tent-pole can be mended, permanently, by placing a splint of wood on either side of the fracture, and whipping the whole together with soft cord, or with the untwisted strand of a piece of rope.

Materials for Tents.—Light canvas is usually employed, and is, to all intents and purposes, waterproof. Silk, of equal strength with the canvas, is very far lighter: its only fault is its expense. Calico, or cotton canvas, is very generally used for the smaller kind of tents. Leather is warm, but very heavy indeed; and would only be used in exceedingly inclement climates, or where canvas could not be met with. Light matting is not to be despised: it is warm and pretty durable, and makes excellent awning, or coverings to a framework. A worn-out tent may be strengthened by sewing bands of canvas, which cross each other, and make a kind of net-work: old sails are strengthened in this way. The tent-pegs should be of galvanized iron; they are well worth the weight of carriage, for not only do wooden ones often fail on an emergency, but cooks habitually purloin them when firewood is scarce.

Pitching a Tent is quite an art,—so as to let in or exclude the air, to take advantage of sun and shade, &c. &c. There is a great deal of character shown in an encampment: every available cloth or sheet may be pressed into service, to make awnings and screens, as we see among the gipsies.

A tent should never be pitched in a slovenly way: it is so far more roomy, secure, and pretty, when tightly stretched out, that no pains should be spared in drilling the men to do it well. I like to use a piece of string, marked with knots, by which I can measure the exact places in which the tent-pegs should be struck; the eye is a very deceitful guide in estimating squareness. It is wonderful how men will bungle over a tent when they are not properly drilled to pitch it. (See p. 286, *Squaring*.)

Tent-pegs, to drive securely.—When the soil is loose, scrape away the surface sand, before driving them in. Loose mould is made more tenacious by pouring water upon it. Where one peg is insufficient, it may be backed by another. The outermost peg must be altogether buried in the earth.



"*Dáterám*" is, as Dr. Barth informs me, the Bornu name for a most excellent contrivance, by means of which tent-ropes may be secured, or horses picketed in sand of the driest description, as in a drifted sand dune, whence a tent-peg can be drawn out with an almost imperceptible strain. I am not aware that this method is in use anywhere except in particular portions of the Sahara. Its efficiency is truly wonderful: I have made many experiments upon it. The plan is simply to tie to the end of the tent-rope a small object of any description, as a short-stick, by its middle,—a stone, a bundle of twigs, a bag of sand, &c.; and to bury it from 1 to 2 feet in the loose sand. It will be found, if it has been buried 1 foot deep, that a strain equal to about 50lbs. weight is necessary to draw it up; if $1\frac{1}{2}$ feet deep, that a very considerable strain is necessary; and that, if 2 feet deep, it is quite impossible for a man to pull it up. In the following theoretical case, the resistance would be as the cube of the depth; but in sand or shingle, the law of increase is less rapid. It varies under different circumstances; but it is no exaggeration to estimate its increase as seldom less than as the square of the depth. The theoretical case of which I spoke is this:—Let X be part of a layer of shingle of large extent: the

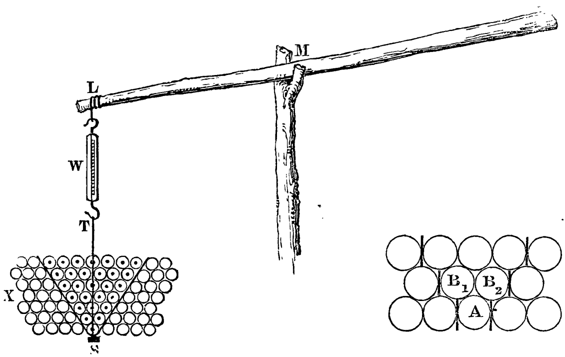


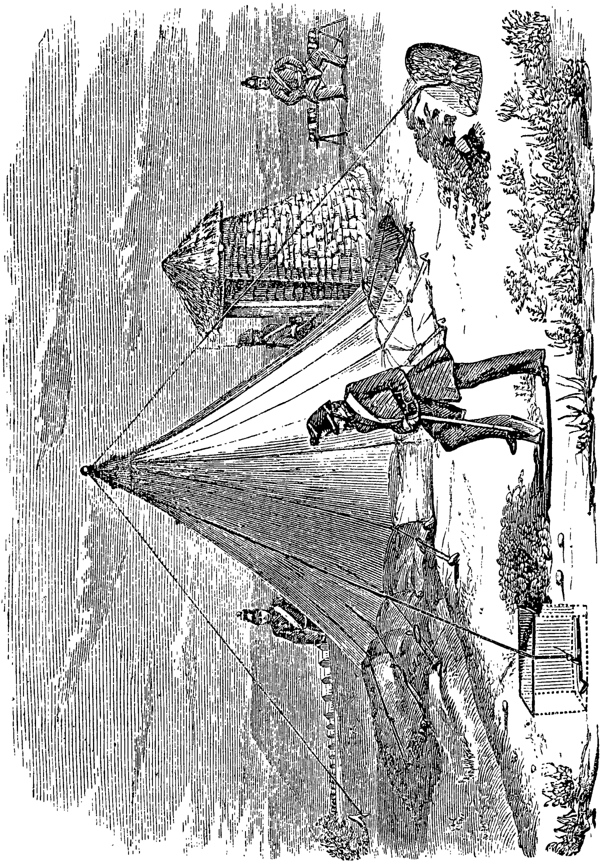
Fig. 1. Fig. 2.

shingle is supposed to consist of smooth hard spherical balls, all of the same size. Let S be a dáterám buried in X; and T, the string to which it is tied.

Now, on considering fig. 2, where the balls are drawn on a larger scale, it is clear that the ball A cannot move in any degree to the right or the left without disturbing the entire layer of balls on the same plane as itself: its only possible movement is vertically upwards. In this case, it simply disturbs B_1 and B_2. These, for the same reason as A, can only move vertically upwards, and, in doing so, they must disturb the three balls above them, and so on. Consequently, the uplifting of a single ball, above s, in the depths of x, necessitates the uplifting of a cone of balls whose apex is at s, such as is seen in section, in fig. 1. But the weight of the cone is as the cube of its height, and, therefore, the resistance to the uplifting of the dáterám is as the cube of the depth at which it has been buried. In practice, the grains of sand are capable of a small but variable amount of lateral displacement, which gives relief to the movement of sand caused by the dáterám, for we may observe the surface of the ground to work very irregularly, although extensively, when the dáterám begins to stir. On the other hand, the friction of the grains of sand must tend to increase the difficulty of movement. The arrangement shown in the diagram of a spring weighing-machine tied to the end of a lever, is that which I have used in testing the strain the dáterám bears, without stirring, under different circumstances. The size of the dáterám is not of much importance, it would be of still less importance in the theoretical case. Anything that is more than 4 inches long seems to answer. The plan succeeds in a shingly beach as well as in sand.

Bushing a Tent means the burying of bushes in the soil so far as to leave only their cut ends above the ground, to which a corresponding number of the ropes of the tent are tied. Heavy saddle-bags are often of use to fasten the tent to; and, in rocky ground, heavy piles of stones may be made to answer the same purpose. The tent-ropes may be knotted to a cloth, on which stones are afterwards piled.

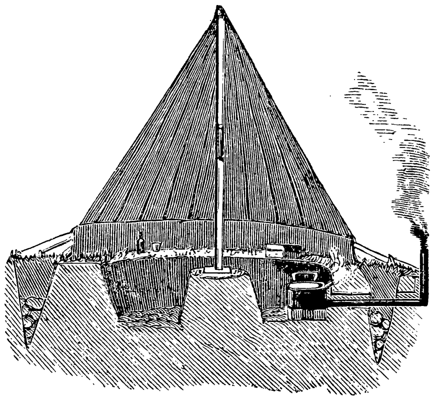
Natives are apt to creep up, and, putting their hands under the tent, to steal things: a hedge of thorn-bushes is some protection against them. In some countries a net, with three or four bells attached to it, is thrown over the packages inside a tent. Strings tied horizontally, a foot above the ground, from package to package, are found effective in tripping intruders.



Preparations for a Storm.—Before a storm, dig a ditch as deep as you can, round the outside of the tent, to turn aside the rain-water, and to drain the ground on which the tent is standing—

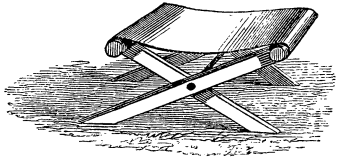
even a furrow scratched with a tent-peg is better than nothing at all. Fasten guy-ropes to the spike of the tent-pole; and be careful that the tent is not too much on the strain, else the further shrinking of the materials, under the influence of the rain, will certainly tear up the pegs. Earth, banked up round the bottom of the tent, will prevent gusts of wind from finding their way beneath.

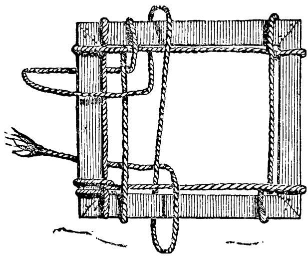
The accompanying sketch shows a tent pitched for a lengthened habitation. It has a deep drain, a seat and table dug out, and a fireplace. See also p. 59.



Sect. 5.—Tent Furniture.—A portable bedstead, with musquito-curtains, is a very great luxury, raising the sleeper above the damp soil, and the attacks of most creatures that creep on it; in tours where a few luxuries can be carried, it is a very proper article of baggage. It is essential where white ants are numerous. Hammocks and cots have but few advocates, as it is rare to find places adapted for swinging them; they are quite out of place in a small tent.

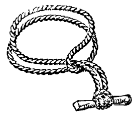
Chairs and Tables.—It is advisable to take very *low* strong and *roomy* camp-stools, with tables to correspond in height, as a chamber is much less choked up when the seats are low, or when people sit, as in the East, on the ground. The seats should not be more than 1 foot high, though as wide and deep as an ordinary footstool. Habit very soon reconciles travellers to this; but without a seat at all, a man can never write, draw, nor calculate as well as if he has one. The stool represented in the figure is a good one: it has a full-sized seat made of leather or canvas, or else of strips of dressed hide. The common rush-bottomed chair can be easily made, if proper materials are accessible. The diagram explains clearly the method of their construction. The table may consist of a couple of boards, not less than 2 feet long, by 9 inches broad, hinged lengthwise together, for the convenience of carriage, and resting on a stand, which should be made on the same principle as the framework of the above chair. It would be well to have the table made of common mahogany, for deal warps and cracks excessively. There is no difficulty in carrying furniture like the above on a pack-horse.





For want of a chair, it is convenient to dig a hole or a trench in the ground, and to sit on one side of it, with the feet resting on its bottom; the opposite side of the trench serves as a table, for putting things on, within easy reach.

To tie clothes, or anything, up to a smooth tent-pole, see *Clovehitch*, p. 170. A strap with hooks in it, to buckle round the pole, is very convenient. The method shown in the sketch suffices, if the pole is notched, or jointed, or in any way slightly uneven. Bags, &c., are hung upon the bit of wood that is secured to the loose end.



The luxuries and elegances practicable in tent life are only limited by the means of transport. The articles that make the most show are handsome rugs, and skins, and pillows; canteens of dinner and coffee services, &c.; and candles, with screens of glass, or other arrangements to prevent them from flickering. The art of luxurious tenting is better understood in Persia than in any other country, even than in India.

Losing things.—Small things are constantly mislaid and trampled in the sand: to search for them, the ground should be disturbed as little as possible—it is a usual plan to score its surface in parallel lines with a thin wand. It would be well worth while to make and use a small light rake for this purpose.

Sect. 6.—Huts.—In making a depôt, it is usual to build a house; often the men have to pass weeks in inactivity, and they may as well spend them in making their quarters comfortable, as in idleness. Whatever huts the natives live in are sure, if made with extra care, to be sufficient for travellers.

Walls.—The materials whence the walls of huts may be constructed, are very numerous, and there is hardly any place which does not furnish one or other of them. Those principally in use are as follow. The explanation of such of them as require it, is subjoined.

Skins, p. 180; canvas, felt, tarpauling, p. 67; bark, p. 67.

Reed mats, p. 67; reed walls, p. 68; straw walls, p. 68; wattle-and-dab, p. 69.

Palisades, p. 69; log huts, p. 70; fascines or faggots; boards, &c., fastened by Malay-hitch, p. 70.

Brick, sunburnt or baked, turf, stones, gabions, bags or mats filled with sand or shingle, p. 44.

Snow huts, p. 71; underground huts, p. 72; tents over holes in earth, p. 72.

Roofs.—Many of the above list would be perfectly suitable for roofs: in addition may be mentioned,—

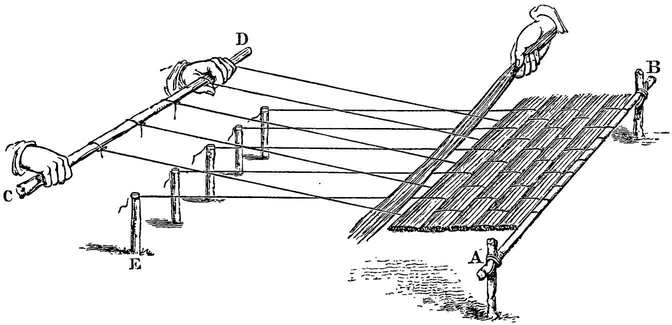
Slating with flat stones, thatch, p. 72; seaweed, wood shingles, p. 72.

Floors.—Cowdung and ashes make a hard, dry, and clean floor such as is used for a threshing-floor. Ox-blood and fine clay, kneaded together, are excellent; both these compositions are used in all hot, dry countries.

Tarpaulings, made in the sailors' way, are much superior to others in softness and durability. As soon as the canvas is sewn together, it is thoroughly wetted with sea-water; and, while still wet, is done over on one side with tar and grease boiled together—about two parts tar and one of grease. Being hung up till dry, it is turned; and the other side, being a second time well wetted, is at once painted over with the tar and grease just as the first side had been before. The sailors say that "the tar dries in as the water dries out."

Bark.—It is an art to strip it quickly—the Australians understand it well. Two rings are cut round the tree; the one as high as can be reached, the other low down. A vertical slit is then made, and the whole piece forced off with axes, &c. In spring the bark comes off readiest from the sunny side of the tree. A large sheet of bark is exceedingly heavy. It is flattened, as it lies on the ground, by weighting it with large stones, and allowing it to dry, partially at least, in that position. See p. 176.

Reed Mats can be woven with ease if there be abundance of string, or some equivalent for it (p. 172), in the following manner:—

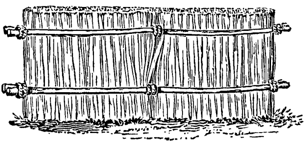


A, B, are two pegs driven into the ground and standing about a foot out of it. A stake, A B, is lashed across them; a row of pegs, E, are driven into the ground, parallel to A B, and about 6 inches apart. Two sets of strings are then tied to A B; one set are fastened by their loose ends into clefts, in the pegs E, and the other set are fastened to the stick, C D. If there be ten strings in all, then, 1, 3, 5, 7, 9, are tied to C D, and 2, 4, 6, 8, 10, to A B. By alternately raising and depressing C D, and by pushing in a handful of rushes between the two sets of strings after each of its movements, and, finally, by patting them home with a flat stick, this rough sort of weaving is carried on very successfully.

Mats are also plaited in breadths, and the breadths are stitched together, side by side. Or a thicker kind of mat may be made by taking a wisp, and working it in the way straw bee-hives are made. Stout reeds may be hitched to one another, Malay fashion (p. 70), or strung together with string. Straw is worked more easily after being damped and beaten with a mallet.

The reed huts of the Affej Arabs, and other inhabitants of the Chaldean marshes, are shaped like waggon-roofs, and are constructed of semicircular ribs of reeds, planted in the ground one behind the other, at equal distances apart; each rib being a faggot of reeds of two feet in diameter. For strength, they are bound round every yard with twisted bands of reeds. When this framework has been erected, it is covered with two or three sheets of fine reed matting, which forms a dwelling impervious to rain. Some of the chiefs' huts are as much as 40 feet long, and 12 high; the other huts are considerably smaller.

Many of these reed dwellings are contained in compounds enclosed by lofty reed fences; the reeds being planted upright, and simply strung together by a thread run through them as they stand side by side.



Straw Walls of the following kind are very effective, and they have the advantage of requiring a minimum of string (or substitute for string) in their manufacture. The straw, or herbage of almost any description, is simply nipped between two pair of long sticks, which are respectively tied together at the two ends, and at a sufficient number of intermediate places. The whole is neatly squared and trimmed. A few of these would give good help in finishing the roof or walls of a house. They can be made moveable, so as to suit the wind, shade, and aspect. Even the hut door can be made on this principle.

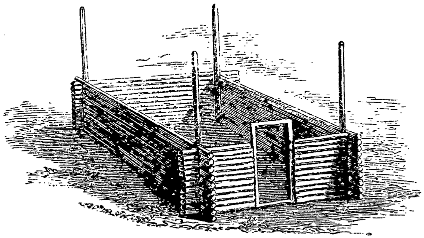
Wattle-and-dab, to be executed neatly, requires well-shaped and flexible sticks; but a hut of the ordinary description is constructed much like the sketch, p. 82. It is made by sticking a number of bare sticks, four feet long or more, into the ground—they should not be more than one foot apart—and bending their tops together, lashing them fast with string or strips of bark, and wattling them judiciously here and there, by means of other boughs, laid horizontally. Then, by heaping leaves—and especially broad pieces of bark if you can get them—over all, and banking up the earth on either side pretty high, an excellent kennel is made.

If daubed over with mud, clay, or cattle-dung, it becomes more air-proof. To proceed a step further :—as many poles may be planted in the ground as you have employed sticks in making the roof; and then, lifting the roof bodily up in the air, it may be lashed on to the top of the poles, each stick to its corresponding pole. This sort of structure is very common among savages.

For methods of digging holes in which to plant the hut-poles, see p. 11.

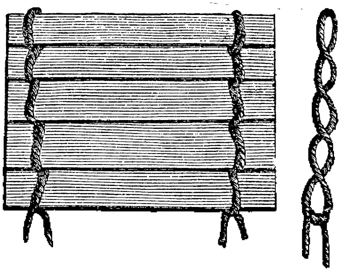
Palisades are erected of vast lengths, by savages wholly destitute of tools, both for the purposes of fortification and also for completing lines of pitfalls across wide valleys. The pitfalls occupy gaps left in the palisading. The savages burn down the trees in the following manner :—a party of men go to the forest, and light small fires round the roots of the trees they want. The fires are prevented from flaming upwards by the judicious application of leaves, &c. When the fire has eaten a little way into the tree, the man who watches it scrapes the fire aside and knocks away the charred wood, exposing a fresh surface for the fire to act upon, and then replaces the burning embers. A single man may easily attend to a dozen trees, and, indeed, to many more, if the night be still. Some hours elapse before the trees actually fall. Their tops and branches are burnt off, as they lie on the ground. The trees being procured for the palisading, they are carried to the required place, and holes are dug for their reception, as explained in p. 11.

Log-huts.—In building log-huts, four poles are planted in the ground to correspond to the four corners; against these, logs are piled one above another, as in the drawing; they are so deeply notched where they cross one another, that the adjacent sides are firmly dovetailed together. When the walls are entirely completed, the door and windows are chopped out, and the spaces between the logs must be well caulked with moss, &c., or the log-cabin will be little better than a log-cage. It of course requires a great many trees to make a log-hut; for, supposing the walls to be 8 feet high, and the trees to average 8 inches in diameter, it would require 12 trees to build up one side, or 48 to make all four walls.



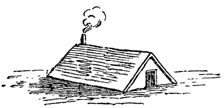
Malay hitch.—I know no better name for the following wonderfully simple way of attaching together wisps of straw, rods, laths, reeds, planks, poles, or anything of the kind, into a secure and flexible mat; the sails used in the far East are made in this way, and the moveable decks are made of bamboos joined together with a similar but rather more complicated stitch.

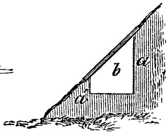
Soldiers might be trained to a great deal of hutting practice in a very inexpensive way, if they were drilled at putting together huts whose roofs and walls were made of planks lashed together by this simple hitch, and whose supports were short scaffolding-poles planted in deep holes dug, as explained p. 11, without spades or anything but the hand and a small stick. The poles, planks, and cords, might be used over and over again for an indefinite time. Further, bedsteads could be made in a similar way by short cross-planks lashed together, and resting on a framework of horizontal poles lashed to uprights planted in the ground. The soldier's bedding would not be injured by being used on these bedsteads, in the way it would be if laid on the bare ground. Many kinds of designs and experiments in hutting could be practised without expense in this simple way.



Snow-houses.—Few travellers have habitually made snow-houses, except Sir J. Franklin's party and that of Dr. Rae. Great praises are bestowed on the comfort of them by all travellers, but skill and practice are required in building them. The mode of erection of these dome-shaped buildings is as follows.—It is to be understood that the hard, compact, underlying snow is necessary for the bottom of the hut; and that the looser textured, upper layer of snow, is used to build the house. First, select and mark out the circular plot on which the hut is to be raised. Then, cut out, with knives, deep slices of snow, six inches wide, three feet long, and of a depth equal to that of the layer of loose snow, say one or two feet. These slices are curved, so as to form a circular ring when placed on their edges, and of a size to make the first row of snow-bricks for the house. Other slices are cut for the succeeding rows; and, when the roof has to be made, the snow-bricks are cut with the necessary double curvature. A conical plug fills up the centre. Loose snow is then heaped over the house, to fill up crevices. Lastly, a doorway is cut out with knives; also a window, which is glazed with a sheet of the purest ice at hand. For the inside accommodation, there is a pillar or two, to support lamps.

Underground Huts are used in all quarters of the globe. The experience of our troops encamped before Sebastopol tells strongly in their favour, as habitations during an inclement season. The timely adoption of them was the salvation of the British army. They are, essentially, nothing else than holes in the ground, roofed over. The shape and size of the hole corresponds to that of the roof it may be possible to procure for it; its depth is no greater than requisite. If the roof have a pitch of 2 feet in the middle, the depth of the hole need not exceed





4½ feet. In the Crimea the holes were rectangular, and roofed like huts.

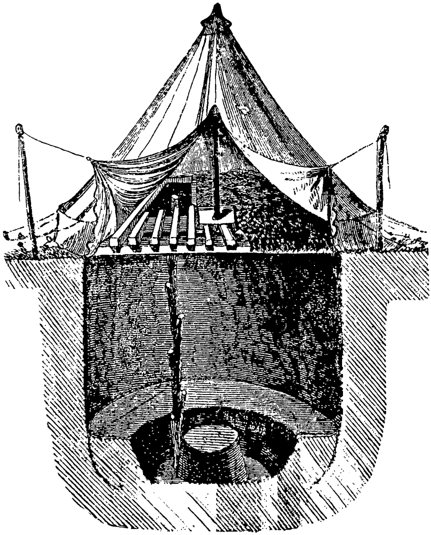
Where there is a steep hill side, *a a*, an underground hut, *b*, is easily contrived; because branches laid over its top have sufficient pitch to throw off the rain, without having recourse to any uprights, &c. Of course the earth is removed from *á*, at the doorway. See also p. 45.

Tents pitched over excavations.—A hole may be dug deeply beneath the tent floor, partly as a store-room, and partly as a living-room when the weather is very inclement. This, also, was done before Sebastopol, in the manner shown in the engraving (p. 73).

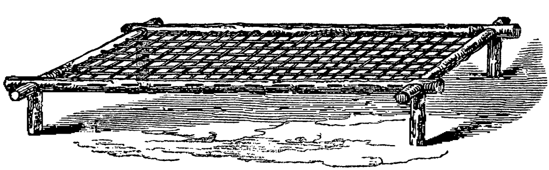
Thatching.—After the framework of the roof has been made, the thatcher begins at the bottom, and ties a row of bundles of straw, side by side, on to the framework. Then he begins a second row, allowing the ends of the bundles composing it to overlap the heads of those in the first row.

Wood shingles are tile-shaped slices of wood, easily cut from fir-trees, and used for roofing on the same principle as tiles or slates.

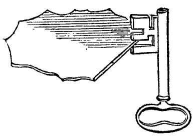
Addenda.—Fix hooked sticks, and cow or goat horns, round the walls, as pegs to hang things on; and, if you want a luxurious bed, make a cartel, which is on the principle of a tennis-player's

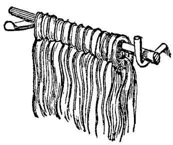


racket; being a framework of wood, with strips of raw hide lashed across it from end to end, and from side to side. If you collect bed feathers, recollect that if cleanly plucked they require no dressing of any kind, save drying and beating.



Concrete for floors is made of 80 parts large pebbles, 40 river sand, 10 lime; lime is made by burning limestone, chalk, shells, or coral, in a simple furnace, and whitewash is lime and water. Bark makes a good roof. The substitutes for glass are—waxed or oiled paper or cloth, bladder, fish-membranes, talc, and horn, (pp. 190, 184). Glass cannot be cut with any certainty without a diamond; but it may be shaped and reduced to any size by gradually chipping, or rather biting, away at its edges with a key, if the slit between its wards be just large enough to admit the pane of glass easily.





A window, or rather a hole in the wall, may be rudely shuttered by a stick run through loops made out of wisps of grass. In hot weather the windows of the hut may be loosely filled with grass, which, when well watered, makes the hut much cooler. A mosquito-curtain may be taken and suspended over the bed, or place where you sit. It is very pleasant, in hot, mosquito-plagued countries, to take the glass sash entirely out of the window frame, and replace it with one of gauze. Broad network, if of fluffy thread, keeps wasps out. The darker a house is kept, the less willing are flies, &c., to flock in. If sheep and other cattle be hurdled-in near the house, the nuisance of flies, &c., becomes almost intolerable. A hand-bell or a whistle saves shouting, when calling servants.

CLOTHES, ETC.

§ 1. Articles of Dress.—§ 2. Toilet in Travel.—§ 3. Knapsacks, Knives.—
§ 4. Dry Clothes.

Sect. 1.—Articles of Dress.—The importance of flannel next the skin can hardly be overrated: it is now a matter of statistics; for, during the progress of expeditions, notes have been made of the number of names of those in them who had provided themselves with flannel, and of those who had not. The list of sick and dead always included names from the latter list in a very great proportion. Next in excellence to flannel, comes cotton; according to the common voice of all who know the tropics, linen is very improper; for when the wearer is wet with rain or perspiration, it strikes cold upon the skin; coarse calico shirts for fine, hot, dry weather, and flannel for damp, windy, or cold, are, I should suggest, the proper dress.

A poncho is very useful, for it is a sheet as well as a cloak, being simply a blanket with a slit in the middle to admit the wearer's head. A sheet of strong calico, saturated with oil, makes a waterproof poncho. Cloth is made partly waterproof by rubbing soap-suds into it (on the wrong side), and working them well in; and when dry, doing the same with a solution of alum; the soap is by this means decomposed, and the oily part of it distributed among the fibres of the cloth. (See *Tarpauling*, p. 67.)

Coat, Waistcoat, and Trousers.—In nine cases out of ten, tweed shooting costume is the best; but should be of thick, not thin, material, for all except damp and tropical countries. If you are likely to have much riding, take extra leather or moleskin trousers, or tweed covered down the inside of the legs with leather, such as cavalry soldiers generally wear. Leather is better than moleskin against thorns, but worse against wet: it will far outlast moleskin. There should be no hem to the bottom of the legs of trousers, as the wet is materially retained by one. Waistcoats would be, generally, laid aside unused, were it not for the convenience of their pockets. A leather coat is good in cases where leather trousers are advisable. A blouse, cut short so as to clear the saddle, is neat, cool, and easy, as a riding or walking costume. A thick dressing-gown is of very great comfort; persons who travel, even with the smallest quantity of luggage, would do well to take one. It is a relief to put it on in the evening, and is a warm extra dress for sleeping in;—whether in hot or cold weather, it is eminently useful, comforting, and durable. The same may be said of slippers.

Socks.—The hotter you expect the ground to be on which you have to walk, the thicker should your socks be. Have plenty of woollen socks.

Braces.—Do not despise them, unless you have had abundant experience of belts, for belts do not suit every shape. Sailors are always hitching up their trousers. If you use braces, take at least two pair, for when they are drenched with perspiration, they dry slowly. There is no need to use a heavy belt—a tape run through a hem along the upper edge of the trousers acts every whit as well.

Shoes.—Nothing is equal to European shoes; if they wear out, and none of the party are successful in making others from dressed hide, recollect sandals. If travelling in a hot, dry country, grease plentifully both your shoes and all other leather. "La graisse est la conservation du cuir," as I recollect a Chamouni guide enunciating with profound emphasis. (See p. 180.)

There are such varieties in dress, that it would be endless to prolong these remarks; I therefore continue the subject with a list of clothes, suggested by an eminent Australian traveller, for the equipment of a party who might travel there. To which I would suggest, in addition—one pair of warm mittens; one pair slippers; one short blouse, blue or grey; one macintosh sheet. It must be recollected that the climate of Australia oscillates between the widest extremes of heat and cold, dry and wet.

Outfit.

2 woollen under-shirts.
2 blue over ,,
1 red ,, shirt.
2 pairs tweed trousers.
1 pair moleskin ,,
1 pair duck ,,
2 pairs braces.
1 Scotch cap, for sleeping.
2 black neck-ties.
6 pairs woollen socks.
6 ,, cotton ,,
6 large cotton handkerchiefs.
1 cabbage-tree hat.
1 wide-awake felt hat, with glazed cover.
2 pairs warm gloves.
3 pairs strong ankle-boots, well nailed.
1 long pea-jacket of thick cloth.
1 very light waterproof coat.
1 broad, polished leather belt.
2 towels.
1 clasp-knife, with hole through haft to tie on to waistband.
1 comb.
3 small, but good, blankets.

A light muslin turban twisted into a rope and rolled round the hat is a common plan to keep off the sun: it can also be used as a rope on an emergency.

Mr. Gordon Cumming describes his bush-costume as follows:—"My own personal appointments consisted of a wide-awake hat, secured under my chin by 'rheimpys' or strips of dressed skin, a coarse linen shirt, sometimes a kilt, and sometimes a pair of buckskin knee-breeches, and a pair of 'veldtschoens,' or home-made shoes. I entirely discarded coat, waistcoat, and neckcloth; and I always hunted with my arms bare; my heels were armed with a pair of powerful persuaders, and from my left wrist depended, by a double rheimpy, an equally persuasive sea-cow jambok. Around my waist I wore two leathern belts or girdles. The smaller did the duty of suspender, and from it on my left side depended a plaited rheimpy, eight inches in length, forming a loop, in which dangled my powerful loading-rod, formed of a solid piece of horn of the rhinoceros. The larger girdle was my shooting-belt; this was a broad leather belt, on which were fastened four separate compartments, made of otter-skin, with flaps to button over, of the same material. The first of these held my percussion-caps; the second a large powder-flask; the third and fourth, which had divisions in them, contained balls and patches, two sharp clasp-knives, a compass, flint and steel. In this belt I also carried a loading-mallet, formed from the horn of the rhinoceros; this and the powder-flask were each secured to the belt by long rheimpys, to prevent my losing them. Last, but not least, in my right hand I usually carried my double-barrelled two-grooved rifle, which was my favourite weapon. This, however, I subsequently made up my mind was not the tool for a mounted man, especially when quick loading is required."

Sir James Alexander, in the hot and damp forests of America, used the following wardrobe:—Red flannel shirt, moleskin trousers, brown leather boots, and a soft grey hat. A loose jacket and dry worsted socks and moccassins formed a safe change for the night.

Substitute for Socks.—For want of socks, pieces of linen may be used; and, when these are properly put on, they are said to be even better than socks. They should be a foot square, be made of soft worn linen, be washed once a-day, and be smeared with tallow. They can be put on so dexterously as to stand several hours' marching without making a single wrinkle. To put them on, the naked foot is placed on one of the diagonals; the triangles on the right and on the left are then folded over, then the triangle which lies in front of the toes. Now the art consists in so drawing up these ends, that the foot can be placed in the shoe or boot without any wrinkles appearing in the bandage. One wrinkle is sure to make a blister, and therefore persons who have to use them should practise frequently how to put them on. Socks similar to these, but made of thick blanket, and called "Blanket Wrappers," are in use at Hudson's Bay instead of shoes.

To keep the hands warm in severe weather, a small fur muff may be slung from the neck, in which the hands can rest till wanted.

Shirt-sleeves.—When you have occasion to tuck up your shirt-sleeves, recollect that the way of doing so is, not to begin by turning the cuffs inside out, but outside in—the sleeves must be rolled up inwards, towards the arm, and not the reverse way. In the one case, the sleeves will remain tucked up for hours without being touched; in the other, they become loose every five minutes.

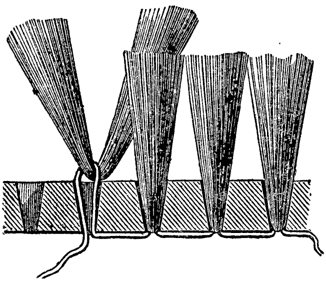
Sect. 2.—Toilet in Travel.—There is no denying the fact, though it be not agreeable to confess it, that dirt and grease are great protectors of the skin against inclement weather, and that therefore the leader of a party should not be too exacting about the appearance of his less warmly-clad followers. Daily washing, if not followed by oiling, must be compensated for by wearing clothes. Take the instance of a dog. He will sleep out under any bush, and thrive there, so long as he is not washed, groomed, and kept clean; but if he be, he must have a kennel to lie in. The same is the case with a horse; he catches cold if he is groomed at the same time that he is turned out at nights. A savage will never wash unless he can grease himself afterwards—grease takes the place of clothing to him. I mentioned previously a Swedish proverb: it would be very true if varied thus, "Grease and dirt are the savage's wearing apparel!" There must be a balance between the activity of the skin and the calls upon it; and where the exposure is greater, there must the pores be more defended. This is a strangely artificial state that we live in, in Europe; where our whole body is swathed up in many folds of dress, excepting the hands and face—the first of which are frequently gloved. We can afford to wash, but naked men cannot.

The most convenient time for a traveller to make his toilet, in rough travel, is after the early morning's ride, a bath being now and then taken in the afternoon. It is trying work to wash in ice-cold water, in the dark, early, and blowing morning; besides which, when the sun rises up, its scorching heat tells severely on a washed face. Where water has to be economised, the best way of making a little go very far is the Mahomedan fashion, in which an attendant pours a slender stream from a jug, which the washer receives in his hands and distributes over his person. (See *Soap and its substitutes.*)

During the harassing duties of active warfare, officers, who aim at appearing decorously dressed, in whatever emergency their presence may be required, make their toilets over-night, before going to sleep.

Bath-glove.—Fold a piece of very coarse towel in two parts; lay your hand upon it, and mark its outline rudely; then, guided by the outline, cut out the two pieces below; sew these together along their edges, and the glove is made.

This is an admirable invention for travellers: it was brought to my notice by Sir James Alexander, and, since first hearing of it, I have regularly used it. It is most easily made, inexpensive, and portable, and is as good a detergent as horsehair gloves or flesh-brushes.



Brushes.—It is well to know how to make a brush, whether for clothes, boots, or hair, and the accompanying section of one will explain itself.

Bristles are usually employed, but fibres, of various kinds, will do.

Sect. 3.—Knapsacks, Knives.—It is recommended that knapsacks, if not exceeding 6 pounds in weight, should be attached to a belt, and made to lie against the small of the back. When the bearer sits down to rest himself, the weight of his burden is at once relieved, and it is much speedier work to unbuckle the belt than to struggle out from the thongs of a knapsack. In hot countries the confinement from these straps is unbearable. A fishing-basket replaces a knapsack excellently: it is perhaps the better of the two. Sixteen or twenty pounds' weight, at the outside, is as much as a man not trained to the business should carry. English knapsacks have a bad reputation: they are said to be neither light nor waterproof.

Knives.—A great hunting-knife is a useless incumbrance: no old sportsman and traveller cares to encumber himself with one; but a butcher's knife, in a sheath, is an excellent thing, both from its efficient shape, the soft quality of the steel, its lightness, and the strong way in which the blade is set in the haft. If a traveller wants a pocket-knife full of all kinds of tools, he had better order a very light one of $2\frac{3}{4}$ inches long, in a tortoise-shell handle. It should have a turnscrew at one end and a light "picker" to shut over its back: this will act as a strike-light, and a file also, if its under surface be properly roughened. Underneath the picker, a small triangular thing to bore holes in leather; and a gimlet. In front of the knife, a long, narrow pen-blade of *soft* steel; a cobbler's awl, slightly bent; and a packing-needle with a large eye, to push thongs and twine through holes in leather. It may be thought advisable to increase the size of the knife, and to add a button-hook, a cork-screw, and a large blade; but a light knife is a constant companion, while a heavy one is laid by, and never at hand when wanted.

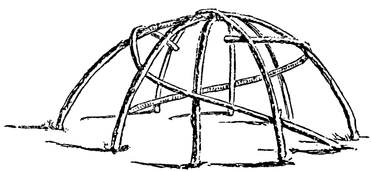
Substitutes for Knives are fragments of flint or obsidian, lashed to a handle and used as a man might use a chisel, holding it dagger-fashion, and drawing it over the skin or the flesh that he wants to cut. Shells are also used; and thin strips of bamboo, whose sharp edges cut meat easily. Any bit of good iron may be heated as hot as possible, hammered flat, lashed into a handle, and sharpened on a stone. There is a vast difference between the merits of iron and steel; but most ancient civilized nations had nothing better than iron.

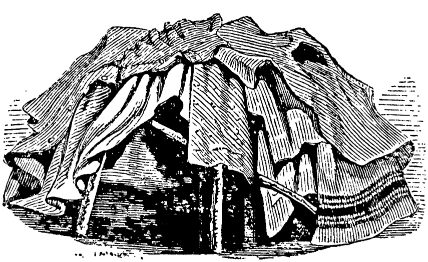
Sheath-knives are excellently carried, by half-naked men, just above the elbow: they are attached to a leather loop, through which the forearm is passed.

Sect. 4.—Dry Clothes.—"I may as well tell, also, how we managed to keep our clothes dry when travelling in the rain: this was rather an important consideration, seeing that each man's wardrobe consisted of what he carried on his back. Our method was at once effective and simple: if halting, we took off our clothes and sat on them; if riding, they were placed under the leathern shabraque of the mule's saddle, or under any article of similar material, bed or bag, that lay on the camel's pack. A good shower-bath did none of us any harm; and as soon as the rain was over, and the moisture on our skins had evaporated, we had our garments as warm, dry, and comfortable, as if they had been before a fire. In populous districts, we kept on our drawers, or supplied their place with a piece of rag, or a skin; and then, when the rain was over, we wrapped ourselves up in our 'quarry,' and taking off the wetted articles, hung them over the animals' cruppers to dry." (M. Parkyns.) And again, in another author—"The only means we had of preserving our sole suit of clothes dry from the drenching showers of rain, was by taking them off and stuffing them into the hollow of a tree, which, in the darkness of the night, we could do with propriety."

Mr. Palliser's Chagre boatmen took each a small piece of cloth, under which they laid their clothes every time that they stripped, in expectation of a coming storm.

Captain Bligh, who was turned adrift in an open boat after the mutiny of the "Bounty," writes thus about his experience:— "With respect to the preservation of our health, during a course of 16 days of heavy and almost continual rain, I would recommend to every one in a similar situation the method we practised, which is to dip their clothes in the salt-water and wring them





out as often as they become filled with rain: it was the only resource we had, and I believe was of the greatest service to us, for it felt more like a change of dry clothes than could well be imagined. We had occasion to do this so often, that at length our clothes were wrung to pieces; for except the few days we passed on the coast of New Holland, we were continually wet, either with rain or sea."

To dry clothes at a smouldering fire, it is very convenient to make a dome-shaped framework of twigs, by bending each twig or wand into a half-circle, and planting both ends of it in the ground, one on each side of the fire. Then laying the wet clothes on this framework, they receive the full benefit of the heat, and the steam passes readily upward.

Washing Clothes. (See *Soap*, p. 187.)

FOOD AND COOKING.

§ 1. Bad and poisonous Diet.—§ 2. Food from various Sources.—§ 3. Preserving Meat, Fish, Butter, Milk, &c.—§ 4. Bush Cookery.—§ 5. Plates and Cooking-utensils.—§ 6. Rations.

Sect. 1.—Bad and poisonous Diet.—In reading the accounts of travellers who have suffered severely for want of food, a striking fact is common to all,—*i. e.* that carrion and garbage of every kind can be eaten, under those circumstances, without the stomach rejecting it. And life can certainly be supported on a diet which would give severe illness to a man not driven to it by the pangs of hunger. There is, however, a great difference in the power that different people have of eating rank food without being made ill by it. It appears that no flesh, excepting that of some fish, is poisonous to man; but with vegetables it is very different. No certain rule can be given to distinguish wholesome plants from poisonous ones; but it has been observed that much the same things suit the digestion of a bird that suit that of a man, and therefore, that a traveller, who otherwise would make trials at hap-hazard, ought to examine the contents of those birds' crops that he may catch or shoot, to give a clue to his experiments. The rule has notable exceptions, but, in the absence of any other guide, it is a very useful one.

The only general rules that botany can give are still less to be depended on: they are, that a great many wholesome plants are found among the *Cruciferæ*, or those whose petals are arranged like a Maltese cross, and that many poisonous ones are found amongst the *Umbelliferæ*.

When rank birds are shot, they should be skinned, not plucked, for much of the rankness lies in their skin. The breast and wings are the least objectionable parts in them, and, if there be abundance of food, these should alone be cooked.

The converging flight of crows, and gorged vultures sitting on trees, show where dead game is lying; but it is often very difficult to find the carcase, for animals usually crawl under some bush or other hiding-place, to die. Jackal-tracks, &c., are often the only guide. It may be advisable, after an unsuccessful search, to remove to some distance off, and watch patiently through the day until the birds return to their food, and mark them down.

In hiding game from birds of prey, bush it over, and they will seldom find it out; birds cannot smell well, but they have keen eyes. The meat should be hung from an overhanging bough; then, if the birds find it out, there will be no place for them to stand on and tear it. Leaving a handkerchief or a shirt fluttering from a tree will scare animals of prey for a short time.

There are a large number of night-feeding animals, upon whose flesh a traveller might easily support himself, but of whose existence he would have few indications by daylight observation only. To take the case of Australia, the following remarks of Professor Owen are very suggestive:—"All the marsupial animals—and it is one of their curious peculiarities—are nocturnal. Even the kangaroo, which is the least so, is scarcely ever seen feeding out on the plains in broad daylight: it prefers the early morning dawn, or the short twilight; and, above all, the bright moonlight nights. With regard to most of the other Australian forms of marsupial animals, they are most strictly nocturnal: so that, if a traveller were not aware of that peculiarity, he might fancy himself traversing a country destitute of the mammalian grade of animal life. If, however, after a weary day's journey, he could be awakened, and were to look out about the moonlight glade or scrub, or if he were to set traps by night, he would probably be surprised to find how great a number of interesting forms of mammalian animals were to be met with in places where there was not the slightest appearance of them in the daytime."

If any meat that you may get, or if the water of any pool at which you encamp, is under suspicion of being poisoned, let one of your dogs eat or drink before you do, and wait an hour to watch the effects of it upon him.

One man in every party should have learnt from a professed butcher how to cut up a carcase to the best advantage.

Sect. 2.—Food from various Sources.—There are two nutritious plants—nettle and fern—that are found wild in very many countries; and therefore the following extract from Messrs. Huc and Gabet's 'Travels in Thibet' may be of service:—"When the young stems of ferns are gathered, quite tender, before they are covered with down, and while the first leaves are bent and rolled up in themselves, you have only to boil them in pure water to realise a dish of delicious asparagus. We would also recommend the nettle, which, in our opinion, might be made an advantageous substitute for spinach; indeed, more than once we proved this by our own experience. The nettle should be gathered quite young, when the leaves are perfectly tender. The plant should be pulled up whole, with a portion of the root. In order to preserve your hands from the sharp biting liquid which issues from the points, you should wrap them in linen of close texture. When once the nettle is boiled, it is perfectly innocuous, and this vegetable, so rough in its exterior, becomes a very delicate dish. We were able to enjoy this delightful variety of esculents for more than a month. Then the little tubercles of the fern became hollow and horny, and the stems themselves grew as hard as wood, while the nettle, armed with a long white beard, presented only a menacing and awful aspect." The roots of many kinds of ferns, perhaps of all of them, are edible. Our poor in England will eat neither fern nor nettle: they say the first is innutritious, and the second acrid. I like them both.

Bones contain a great deal of nourishment, which is got at by boiling them, pounding their ends between two stones, and sucking them. There is a revolting account in French history, of a besieged garrison of Sancerre, in the time of Charles IX., and again subsequently at Paris, and it may be elsewhere, digging up the graveyards for bones as sustenance.

Honey, to find, when there are Bees about.—Catch a bee, tie a feather or a straw to his leg, which can easily be done (natives thrust it up into his body), throw him into the air, and follow him as he flies slowly to his hive; or catch two bees, and turning them loose at places some distance apart, search where their flights converge to. But if bees are very scarce, choose an open place, and lay a plate of syrup to bait for the bees, and watch for them; after one has fed and flown away again, remove the plate 200 yards in the direction he flew to, and proceed in the same sort of way until the nest is found. The instinct of the honey-bird is well known, which induces him to lead men to hives, that he may share in the plunder. The stories that are told of the apparent malice of the bird, in sometimes tricking a man, and leading him to sleeping wild animals instead of the bees' nest, are well authenticated.

All old hides or skins of any kind, that are not tanned, are fit and good for food; they improve all soup, by being mixed with it, or they may be toasted and hammered. Long boiling would make glue or gelatine of them. Many a hungry person has cooked and eaten his sandals or skin clothing.

Most kinds of creeping things are eatable, and used by the Chinese. Locusts and grasshoppers are not at all bad. To prepare them, pull off the legs and wings, and roast them with a little grease in an iron dish, like coffee. Rank sea-birds, if caught, put in a coop, and fed with corn, were found by Captain Bligh to become fat and well-tasted.

Sect. 3.—Preserving Meat, Fish, Butter, Milk, etc.—When meat has to be carried in store, or left *en câche*, it should be made into pemmican—that is to say, into dried and pounded meat, which is better than that which is jerked, or simply dried. Mr. Ballantyne, who was in the service of the Hudson's Bay Company, gives the following account of the preparation of both of these:—"Having shot a buffalo, the hunters cut lumps of his flesh, and slitting it up into flakes or layers, hang it up in the sun, or before a slow fire, to dry; *and the fat can be dried as well as the lean.* In this state, it is often made into packs, and sent about the country, to be consumed as dried meat;* but when pemmican is wanted, it has to go through another process. When dry, the meat is pounded between two stones till it is broken into small pieces: these are put into a bag made of the animal's hide, with the hair on the outside, and well mixed with melted grease; the top of the bag is then sewn up, and the pemmican allowed to cool. In this state it may be eaten uncooked; but the men who subsist on it when travelling, mix it with a little flour and water, and then boil it—in which state it is known throughout the country by the elegant name of *robbiboo.* Pemmican is good wholesome food; will keep fresh for a great length of time; and, were it not for its unprepossessing appearance, and a good many buffalo hairs mixed with it, through the carelessness of the hunters, would be very palatable. After a time, however, one becomes accustomed to these little peculiarities." The best pemmican is a mixture of about five-ninths of pounded dry meat to four-ninths of melted or boiled grease, and put into a skin bag or tin can whilst warm and soft. The grease ought not to be very warm when poured on the dry meat. Wild berries are sometimes added. The skin bags for the pemmican should be shaped like pillow (not bolster) cases, for the convenience of packing on horseback. The pemmican is chopped out with an axe when required. "Four expert men slice up a full-grown buffalo in four hours and a half." (Leichhardt.) The American buccaneers acquired their name from *boucan*—which means jerked meat, in an Indian dialect; for they dried the flesh of the wild cattle that they hunted down and killed, to provision their ships.

Fish-roe is another kind of portable food, and the chemists say that its composition is nearly identical with that of ordinary eggs. (Pereira.) Caviare is made out of fish-roe, but the *recherché* sort only from that of the sturgeon. Long narrow bags of strong linen, and a strong brine, are prepared. The bags are half-filled with the roe, and then quite filled with the

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* It is often best relished raw; for, when grilled without fat, it burns and becomes ashy.

brine, which is allowed to ooze through slowly. This being done, the men wring the bags strongly with their hands, and the roe is allowed to dry. Roe-broth is a good dish. Fish may be pounded entire, just as they come from the river, dried in the sun in large lumps, and kept: the negroes about the Niger do this. Eggs, also, may be dried at a gentle heat, pounded and preserved. This is a convenient plan of making a store out of sea-birds' eggs, or even of those of ostriches.

Salting Animals.—It is well to recollect that, for want of a salting-tub, animals can be salted in their own hide. A hollow is scraped in the ground, the hide laid over it and pegged down, and the meat, salt, and water put into it. I know of an instance where this was done on a very large scale.

"*Butter is preserved* by boiling it in a large vessel till the scum rises. A person stands watching, to skim this off as fast as it appears on the surface, until the butter remains quite clear like oil, when it is cooled and left for use. It always retains its liquid state. (?) This mode of clarifying butter is adopted throughout Sennaar, Kordofan, &c., and even in Egypt, and is very useful, as the butter thus preserved may be kept for any length of time, and its flavour is but slightly inferior to fresh butter." (Parkyns' 'Abyssinia.') It is churned, in many countries, by twirling a forked stick, held between the two hands, in a vessel full of cream, or even by shaking it in a bottle. It is said that the temperature of the milk should be between 50° and 60° Fahr., and that this is all-important.

To keep Milk, bottle it, cork it very tight, and put it in a pot of water, over a slow fire, till the water boils. Milk with one's tea is a great luxury, and worth taking some pains about. A traveller is generally glutted with milk when near native encampments, and at other times has none at all. Dried *grated* milk used to be procurable. It was very good; but I cannot hear of it now in the shops.

Dried bread-crumb, mixed with fresh cream, is said to make a cake that will keep for some days. I have not succeeded to my satisfaction.

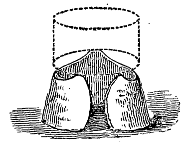
Seaweed—such as laver, Irish moss, &c. &c.—is eatable.

Sect. 4.—Bush Cookery.—The most portable and useful condiments for a traveller to take with him are—salt, red pepper, Harvey sauce, lime-juice, dried onions, and curry-powder. They should be bought at a first-rate shop; for red pepper, curry-powder, &c., are often atrociously adulterated. The craving felt for salt is somewhat satisfied by saltpetre and other mineral salts: thus we often hear of people reduced to the mixing of gunpowder with their food. An impure salt is made widely in North Africa from wood-ashes. They are put into a pot, hot water is poured over them and allowed to stand and dissolve out the salts they contain; the ley is then decanted off into another pot, where it is evaporated. The plants in use are those of which the ashes have a saline and not an alkaline taste, or a soapy feel, when wetted. As a general rule, trees that make good soap, yield little saltpetre or salt. Salt caravans are the chief sustainers of lines of commerce in North Africa. In those countries where salt is never used, as I myself have witnessed in South Africa, and among the Mandan North-American Indian tribes (Catlin, vol. i. p. 124), the soil and springs are "brack." Four Russian sailors who were wrecked on Spitzbergen, and whose well-known adventures are to be found in Pinkerton's 'Voyages and Travels,' had nothing whatever for six years to subsist on—save only the animals they killed, a little moss, and melted snow-water. One of them died; the others enjoyed robust health.

Bacon must be carried, in hot climates, in bran, and be uncooked, or the fat will melt away. Meat-biscuit, which is used in American ships, is stated to be a thick soup, evaporated down to a syrup, kneaded with flour, and made into biscuits: these are pricked with holes, dried and baked. They can be eaten just as they are, or made into a porridge, with from 20 to 30 times their weight of water. (See p. 100.)

Cooking-fires.—In cooking for a large party with a small supply of fuel, either dig a narrow trench, above which all the pots and kettles may stand in a row, and in which the fire is made,—the mouth being open to the wind, and a small chimney built at the other end,—or else dig a round hole, one foot deep, in the ground, and place the pots in a ring on its edge, half resting on the earth and half overlapping the hole. A space will remain in the middle of them, and through this the fire must be fed.

In India, the natives are very expert in constructing a fire-place of clay, or mud, called a "chulka," by excavating a shallow saucer-like hole in the ground, a foot or eighteen inches in diameter, and kneading the soil so excavated, into a circular wall, with a doorway in the windward side, and having the upper surface curved, so as to leave three pointed turrets, upon which the cooking-vessel rests, as in the sketch. Thus the wind enters at the doorway, and the flames issue through the curved depressions at the top, and lick round the cooking-vessel placed above. A capital oven is improvised by means of two earthen or metal cooking-pots, of which one is placed on the fire, and in it the article to be baked; the other pot is put at top by way of cover, and in it a shovelful of burning charcoal.



The cooking of the Esquimaux is done by stone lamps, with wicks made of moss, which are so well arranged that the flame gives no smoke. Their lamps vary in size from one foot and a half long to six inches. Each of the bits of moss gives a small, but very bright flame. (Dr. Rae.)

A few bush dishes should be mentioned:—

Baking Meat.—For doing two or three slices, lay one large flat stone upon another, and put a few pebbles between them, so as to keep them two or three inches apart; then make a fire about them, and when they are thoroughly heated sweep away, and put the slices between them to fry; but where game has to be cooked for a large party, and there are not vessels sufficient to boil it in, it is convenient to sew up as much of the animal as is wanted in its own skin, and to bake it. An entire sheep can be baked. The way is, to dig a hole in the ground, wall it with stones, and make a stone roof to it, all excepting one or two apertures. Then, having made a roaring fire in and around the oven, till the stones are quite hot, sweep out the ashes, strew with grass, leaves, or bark of any kind that is not bitter, and put the meat in, and over it more grass, &c.; now shut up the aperture, and continue the fire above the oven for some hours. For steaming vegetables, the same process is used, except that boiling water is from time to time poured, through holes on the roof, down on the vegetables. A small piece of meat, enough for four or five people, can be baked with much less preparation, simply by scraping a hole pretty deep under the bivouac fire, putting the meat in, rolled up in a piece of skin to which it remains attached, and covering it with earth and fire. In all cases it is a slow process, requiring many hours; but the meat, when done, is very soft and juicy, and the skin gelatinous and excellent. Where old white-ant hills are met with, the natives commonly dig holes in their sides, and use them as ovens.

I have heard of a very neat oven, shaped like a beehive, and built with clay and grass. A fire was lit inside, and the builder, as the walls dried sufficiently, added circles of clay until a complete dome was made, without mould or support of any kind inside.

"Meat, previously wrapped up in paper or cloth, may be baked in a clay case, in any sort of pit or oven, well covered over, and with good economy." ('Handbook of Field Service.')

It is advised that, when game is wanted to be eaten in a hurry, it should be plucked, wrapped up in a cloth and buried in the ground for a few hours before dressing it.

Kabobs, &c.—For a hurried dinner, broil the rib-bones, or skewer your iron ramrod through a dozen small lumps of meat, and roast them. In all cases, if your meat is of a tough sort, hammer it from time to time, when half done, to break up its fibre, and then continue the cooking.

Salt Meat, to prepare hurriedly.—Warm it slightly on both sides—this makes the salt draw to the outside—then rinse it well in a pannikin of water. This process is found to extract a great deal of salt, and to leave the meat in a fit state for cooking.

Haggis.—The dish called *beatee* is handy to make. "It is a kind of haggis made with blood, a good quantity of fat shred small, some of the tenderest of the flesh, together with the heart and lungs, cut or torn into small shivers; all of which is put into the stomach, and roasted by being suspended before the fire with a string. Care must be taken that it does not get too much heat at first, or it will burst. It is a most delicious morsel, even without pepper, salt, or any seasoning." (Hearne.)

Lunch.—When travelling in the morning and afternoon, tea makes an excellent mid-day meal, with enough bread, or whatever you have, to stay the appetite till the evening supper: it dispels fatigue better than anything else, and it is less heating than coffee. A wooden bowl is the best thing to drink it out of, if you have means of frequently washing it; tin mugs burn the lips too much. A large wooden, horn, or bone spoon, is also very convenient. (See *Horn*, p. 184.)

Tea.—Where there are no cups nor teapot, put the leaves in the pot or kettle, and drink through a reed with a wisp of grass in it, as they do in Paraguay. If there are cups and no teapot, the leaves may be put into the pot, previously enclosed in a loose gauze or muslin bag to prevent their floating about. A contrivance made of metal gauze, and shaped like an egg, is sold in the shops for this purpose. This plan, which is commonly used in England for making tea on a large scale, is well worth being borne in mind by a traveller in civilised countries, who carries an Etna with him. A purse made of steel rings would pack flat, but the advantage of the muslin is that you throw away bag and all, and have no trouble in cleaning.

A correspondent says:—" I believe that the Australian plan of making tea is better than any other for travellers and explorers, as it secures well-made tea, quickly, and without having to carry kettles on horseback. Each person has a common tin quart pot and a pint pot; the tea and sugar are carried in small bags. The quart pot requires very little fire to boil it. When the water in it boils, it is taken from the fire, the tea dropped in, and the pint pot placed on the top as a cover.

In a short time it is drawn, and the sugar being dropped into the pint, the tea is poured from one to the other till mixed. The pint is kept clean always for drinking out of, and the blacker the quart pot is, the sooner it will boil water. Both are slung to the saddle in travelling."

To prepare tea for a very early breakfast, make it over night, and pour it away from the tea-leaves into another vessel. It will keep perfectly well, for it is by long standing with the tea-leaves that it becomes bitter. In the morning simply warm it up. Tea is drunk at a temperature of 140° Fahr., or 90° above an average night temperature of 50°. It is more than twice as easy to raise tea up to 140° than it is to raise water to 212°, letting alone the trouble of tea-making.

Dr. Rae speaks very highly of *extract of tea*. Any scientific chemist could make it. By pouring a small quantity of it into warm water the tea was made, and, though inferior in taste to properly made tea, it had an equally good effect on the digestion.

I have made a number of experiments on the art of making good tea. We constantly hear that some people are good and others bad tea-makers; that it takes a long time to understand the behaviour of a new teapot, and so forth; and, lastly, that good tea cannot be made except with boiling water. Now, this latter assertion is assuredly untrue, because, if tea be actually boiled in water, an emetic and partly poisonous drink is the certain result. I accordingly had a tin lid made to my teapot, a short tube passed through the lid, and in the tube was a cork, through which a thermometer was fitted, that enabled me to learn the temperature of the water in the teapot at each moment. Thus provided, I continued to make my tea as usual, and to note down what I observed. In the first place, after warming the teapot in the ordinary way, the fresh boiling water that was poured into it sank invariably to under 200° Fahr. It was usually 180°, so great was the amount of heat abstracted by the teapot. I also found that my teapot—it was a crockery one—allowed the water within it to cool down at the rate of about 2° per minute. When the pot was filled afresh, of course the temperature of its contents rose afresh, and by the addition of water two or three times repeated, I obtained a perfect mastery over the temperature of the pot within reasonable limits. Now, after numerous days in which I made tea according to my usual method, but measuring strictly the quantity of leaves, and recording the times and the temperature, and noting the character of tea produced; then, taking as my type of excellence, tea that was full bodied, full tasted, and in no way bitter or flat, I found that this was only produced when the water in the teapot was between 180° and 190° Fahr., and had stood eight minutes on the leaves. I had only to add water *once* to the tea to ensure this temperature. Bitterness was the certain result of greater heat or longer standing, and flatness was the result of colder water. If the tea did not stand for so long a time as eight minutes, it was not ripe; it was not full bodied enough. The palate is far less fastidious about the second cup. Other people may like tea of a different character from that which I do myself; but, be that as it may, all people can, I maintain, ensure uniformity of good tea, such as they best like, by attending to the principle of making it,—that is to say, to time, and quantities, and temperature. There is no mystery in the teapot.

Sect. 5.—Plates and Cooking-utensils.—I have travelled much with plates, knives, forks, &c., for three persons, carried in a sabretasch which hung from the cook's saddle, and I found it very convenient. It was simply a square piece of leather, with a large pocket for the plates, and other smaller ones for the rest of the things; it had a flap to tie over it, which was kept down with a button. Each of the men on a riding expedition should carry his own tin mug, either tied to his waist or to his saddle.

Butchers' knives.—Take plenty of them, and a steel and whetstone.

Spoons of wood or horn can be made en route. See *Horn*, p. 184.

Cooking Apparatus, of any degree of complexity, and of very portable shapes, can be bought at all military outfitters'; but for the bush, and travelling roughly, nothing is better than a light roomy iron pot and a large strong tin kettle. It is very disagreeable to make tea in the same pot that meat is boiled in; besides, if you have only one vessel, it takes a longer time to prepare meals. If possible, take a second small tin kettle, both as a reserve against accidents and for the convenience of the thing. An iron pot, whose lid is the size of the crown of a hat, cooks amply enough for three persons at a time, and can, without much inconvenience, be made to do double duty; and therefore the above articles would do for six men. An iron pot should have very short legs, or some blow will break one of them off and leave a hole. (A hole in the side of a pot can be so botched up as not to leave it altogether useless, p. 97.) Iron kettles far outwear tin ones, but the comparative difficulty of making them boil, and their great weight, are very objectionable. A good tin kettle, carefully cherished (and it is the interest of the whole party to watch over its safety), lasts many months in the bush. Copper is dangerous; but the receipt is given further on for tinning copper vessels when they require it. Have the handle of the kettle notched or bored, so as to give a holding by which the lid may be tied close down; then, if you stuff a wisp of grass into the spout, the kettle will carry water for a journey.

Boiling.—It is possible to boil water over a slow fire in many kinds of vessels that would be destroyed by a greater degree of heat. In bark, wooden, skin, and even paper vessels, it is quite possible to boil water. The ruder tribes of the Indian Archipelago use a bamboo to boil their rice: "The green cane resisting the fire sufficiently long for the cooking of one mess of rice." (Crawfurd.) If, however, you have no vessel that you choose to expose to the risk of burning, you must heat stones and drop them into the water it contains; but sandstones, especially, are apt to shiver and make grit. The Dacota Indians, and very probably other tribes also, used to boil animals in their own hide. The description runs thus:—"They stuck four stakes in the ground, and tied the four corners of the hide up to them, leaving a hollow in the middle; three or four gallons of water, and the meat cut up very fine, were then put in; three or four hot stones, each the size of a 6lb. cannon-shot, cooked the whole into a good soup." To a fastidious palate, the soot, dirt, and ashes that are usually mixed up with it are objectionable; but these may be avoided by a careful cook, who dusts and wipes the stones before dropping them in. The specific heat of stone is much less than that of water, so that the heating power of a measure of stone is only about one-half of that of an equal measure of equally hot water. A pot, or kettle, with a large hole in its bottom filled up with a piece of wood, has been made to boil water, by burying it a little way in the earth, and making the fire round it.

Graters are wanted to grate jerked meat. A piece of tin, punched through with holes, then bent a little, and so nailed on to a piece of wood, makes a good one.

Sieves.—Stretch parchment (*which see*) on a wooden hoop, exactly as on a drum-head; let it dry, and burn it with a hot iron, or else punch it full of small holes.

Sect. 6.—Rations.—The most portable kinds of solid food are pemmican, jerked meat, wheat flour, oatmeal, barley, peas, cheese, meat, biscuit, sugar, preserved potatoes, and Chollet's compressed vegetables. Salt meat is sadly uncertain. It has been truly remarked with reference to Australian exploring expeditions, that if a party could make up their minds to eat horseflesh, salt provisions might be altogether dispensed with. A few extra horses could be taken; and one shot occasionally, and its flesh dried and slightly salted, sufficiently to preserve it from becoming tainted before the men could consume it.

The theory of nutritive diets is no longer a matter of mystery. Thanks to the labours of many eminent chemists, as Baron Liebig, Dr. Christison, and others, it has at length become possible to tell whether a proposed dietary will or will not suffice, and, if insufficient, what are its faults. There is a remarkable paper by Dr. Christison inserted in the Blue-book Report of the Commission of Inquiry on Crimean matters, in which this subject is examined, in reference to the then faulty dietary of our soldiers.

It appears from this and other publications, for a knowledge of which I am much indebted to Dr. Christison:—first, that a man of sedentary life can exist in health on seventeen ounces per day of *real nutriment*, and that a man in rough work requires

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fully twenty-eight ounces per day, and, if in severe work, he might have thirty ounces, or even more; secondly, that this nutriment must contain *three* parts, by weight, of one class of nutritive principles (C), and *one* part of another class (N); thirdly, that all the articles of common food admit of being placed, as below, in a table, by which we see at a glance how much real nutriment of class C, and how much of class N, is found in 100 parts, gross weight, of any of them. Thus, by the simplest computation, the effective value of any given dietary admits of being ascertained.

Class C are the carboniferous principles that maintain respiration; Class N the nitrogenous principles that repair waste of tissue. N will partly replace C, but at a great waste: C will not replace N.

A large number of diets have been examined with surprisingly uniform results: such as those of various armies and navies, of prisons and infirmaries, and of the ordinary diets of different classes of people. These all refer to temperate climates; and it would be a matter of great interest if travellers in distant lands would accurately observe and note down the weight of their own rations and those of the natives they are thrown amongst. It is a great desideratum to know the lightest portable food suitable to different countries. Any such reports, if extending over a period of not less than a month, would be very acceptable to myself. It would be necessary that *every* article consumed should be noted down; and that the state of health, at the beginning and at the end of the period, should be compared.

Articles of Diet.	C. (Carboniferous.)	N. (Nitrogenous.)	Total real nutriment per cent. of gross weight.
Wheat Flour	71·25	16·25	87·5
Bread	51·5	10·5	62·0
Oatmeal	65·75	16·25	82 0
Pearl Barley	67·0	15·0	82·0
Peas	55·5	24·5	80·0
Potatoes (preserved potatoes are thoroughly dry)	24·5	2·5	27·0

ARTICLES OF DIET.	C. (Carboniferous.)	N. (Nitrogenous.)	Total real nutriment per cent. of gross weight.
Carrots	8·5	1·5	10·0
Turnips	5·7	0·3	6·0
Cabbage	6·7	0·3	7·0
Lean of Beef and Mutton ..	..	27·0	27·0
Fat of meat	100·0	..	100·0
Average Beef and Mutton ..	15·0	20·25	35·25
Bacon	62·5	8·36	70·86
Skimmed-milk Cheese	0·4	64·6	65·0
White Fish	..	21·0	21·0
New Milk	8·0	4·5	12·5
Skimmed Milk	5·5	4·5	10·0
Butter-milk	1·0	6·0	7·0
Beef Tea strong	..	1·44	1·44
Beef Tea and Meat decoction of Broth	..	0·72	0·72
Sugar	100·0	..	100·0
Butter	100·0	..	100·0

I append three tables, as examples :—

I. British Navy Allowances. Admiralty Order, 1824.

	Gross weight in ounces.		Real Nutriment.		
			C.	N.	Total.
Bread	20·0	..	10·3	2·1	12·4
or Biscuit	..	16·0	11·4	2·6	14·0
Oatmeal	1·5	1·5	1·96	0·48	2·44
Cocoa	1·0	..	0·5	..	0·5
or Cheese	..	2·0	..	1·33	1·33
Sugar	1·5	..	1·5	..	1·5
or Butter	..	1·5	1·5	..	1·5
Meat	16·0	..	2·4	3·24	5·64
or Salt Meat	..	12·0	2·4	3·24	5·64
Vegetables	8·0	..	0·9	0·15	1·05
or Flour	..	12·0	8·95	1·95	10·9
Tea	0·25	..	..	..	..
or Coffee	..	1·0	..	..	..
Total	..	..	41·81	15·09	57·0
Daily average	..	..	20·9	7·54	28·5

N.B.—Besides this, is beer (in harbour only) sixteen ounces, or spirits four ounces.

II.—Dr. Rae's.—This shows the daily food actually consumed by probably the most energetic travelling and exploring party on record. It was in his spring journey to the Arctic shores of America. He issued, in addition, four ounces of grease or alcohol a day, to cook with. It required nearly as much fuel to melt the snow as it did to boil it afterwards. This allowance was found quite sufficient, but nothing to spare. I have unfortunately mislaid Dr. Rae's letter, in which he was so good as to send me the composition of the particular pemmican that he used: I quote from recollection only.

	Gross weight in ounces.	Real Nutriment.		
		C.	N.	Total.
Pemmican ($\frac{1}{3}$ dry meat, $\frac{2}{3}$ fat)	20·0	13·3	6·6	20·0
Biscuit	4·0	2·9	0·6	3·5
Edwards' preserved potatoes ..	1·6	1·4	0·1	1·5
Flour	5·3	3·8	0·8	4·6
Tea	0·6	?	?	?
Sugar	2·3	2·3	..	2·3
	33·8	23·7	8·1	31·9

III.—Mr. Austin's expedition to explore the interior of W. Australia, 1855. Besides this, he shot game occasionally. (Its faults are obvious.)

	Gross weight in ounces.	Real Nutriment.		
		C.	N.	Total.
Flour	18·0	12·8	2·9	15·7
Boned salt pork (say a little more lean than fat)	8·0	1·9	2·1	4·0 ?
Sugar	3·0	3·0	..	3·0
Tea	0·75	..	..	..
	29·75	17·7	5·0	22·7

Meat-biscuit is a very portable form of food. I do not know its dietetic value, but absurd statements are published with reference to it. The proportion of N. (p. 98) would be greater in it than in ordinary bread or biscuit. For making it, see p. 90. It is to be bought at Gamble's, 137, Leadenhall-street.

Pemmican.—The rude way of preparing this on the road has already been explained (p. 87). It was issued out to our Arctic expedition variously prepared, some with currants and sugar; but I do not know where it can now be bought. It is distasteful to persons who are not on hard work; and, even then, most Englishmen require condiments of some kind with it.

Chollet's preserved Vegetables are admirable, on the score of taste. A single ration weighs less than an ounce, and a cubic yard contains 16,000 of these rations. They are now to be bought at all provision-merchants'—as at Fortnum and Mason's, &c.

Dr. Kane insists on the value of raw meat as an antiscorbutic. Its use is universal among the Esquimaux.

Flour travels conveniently in strong canvas bags, each holding 50lbs., and long enough to be lashed on to a pack-saddle. (See also an exact account of Mr. Gregory's pack-saddle arrangements, p. 212.)

I quote the following excellent suggestions from an author whose name I have mislaid:—"All stores should be packed and securely lashed. Those in use should go in one cart. This should stand at the storekeeper's tent; who should issue weekly the provisions, and have every facility for weighing, and keep and furnish a weekly account, specifying what stores remain in hand."

MATTERS OF DISCIPLINE.

§ 1. Desiderata.—§ 2. Organising a Party.—§ 3. In case of Death.—§ 4. Bush Laws.—§ 5. Carrying the Wounded.—§ 6. Securing Prisoners.—§ 7. Hostile Neighbourhood.

Sect. 1.—Desiderata.—An exploring expedition is daily exposed to a succession of accidents, any one of which would be fatal to its further progress. The cattle may at any time stray, die, or be stolen; one or more of the men may become seriously ill, and cannot be abandoned; water may not be reached, and the party be worn out, and the cattle perish; or a hostile attack may happen. Hence the success of the expedition depends on a chain of minor successes, each link of which must be perfect; for where one fails, there must be an end of further advance. It is therefore well, especially at the outset of a long journey, not to go hurriedly to work and push forward too thoughtlessly; but at leisure. Let the men and cattle be acclimatised, make the bush your home, and avoid unnecessary hardships. Interest yourself, as was remarked before, chiefly in the progress of your journey, and do not look forward to its end with eagerness. It is better to think of a return to civilisation, not as an end to hardship and a haven from ill, but as a thing rather to be regretted, and as a close to an adventurous and pleasant life. In this way, risking less, you will insensibly creep on, making connections, and learning the capabilities of the country as you advance; which will be found invaluable in the case of a hurried or a disastrous return. And thus, when some months have passed by, you will look back with surprise on the great distance travelled over; for, if you average only three miles a-day, at the end of the year you will have advanced 1000, which is a very considerable exploration. The fable of the Tortoise and the Hare seems expressly intended for travellers over wide and unknown tracts. It is a very high merit to have accomplished a long exploration without loss of life, of health, of papers, or even of comfort.

Tedious journeys are apt to make companions irritable one to another; but under hard circumstances a traveller does his duty well who doubles his kindliness of manner to those about him, and takes harsh words gently, and not with a retort. He should make it a point of duty to do so. It is at those times very superfluous to stand too much on punctilious terms, about keeping up one's dignity, and so forth; since the difficulty does not lie in taking up quarrels, but in avoiding them. Great allowance should be made to the reluctant co-operation of servants; they have infinitely less interest in the success of the expedition than their leaders, for they derive but little credit from it. They argue thus:—"Why should we strain our constitutions and peril our lives in these additional enterprises, about which we are indifferent?" It will, perhaps, surprise a leader who, having ascertained to what frugal habits a bush servant is inured, learns on trial how desperately he clings to those few luxuries which he has always had. Thus, speaking generally, a Cape servant is happy on meat, coffee, and biscuit; but, if the coffee or biscuit has to be stopped for a few days, he is ready for mutiny.

A solitary traveller should never be a sleepy man: he should be quick-eared. It is remarkable how often these two qualities of wakefulness and watchfulness stand every party in stead. It is not powerful men who necessarily make the most eminent travellers: it is by the interest taken in the work, that they succeed; just as a huntsman might say "it was the nose that gave speed to the hound."

Sect. 2.—Organising a Party.—The general duties that a servant should be bound to, independently of those for which he is specially engaged, are—under penalty of his pay being stopped, and, it may be, of dismissal—to maintain discipline, take share of camp-duties and night-watch, and do all in his power to promote the success of the expedition. His wages should not be payable to him in full till the return of the party to the town that it started from, or to some other civilised place. It is best that all clothing, bedding, &c., that the men may require should be issued out and given to them as a present, and none of their own old clothes allowed to be taken. They are more careful of what is their own; and, by supplying the things yourself, you can be sure that they are good in quality, uniform in appearance, and equal in weight, while this last is ascertainable.

The following Form of Agreement is abridged from one that was used in Mr. Austin's expedition. It seems short, explicit, and reasonable.

"We, the undersigned, forming an expedition about to explore the interior of ——, under Mr. A., consent to place ourselves (horses and equipments) entirely and unreservedly under his orders for the above purpose, from the date hereof until our return to ——, or, on failure in this respect, to abide all consequences that may result. We fully recognise Mr. B. as the second, and Mr. C. as the third in command; and the right of succession to the command and entire charge of the party, in the order thus stated.

"We severally undertake to use our best endeavours to promote the harmony of the party, and the success of the expedition.

"In witness whereof we sign our names.

(Here follow the signatures.)

"Read over and signed by the respective parties, in my presence."

(Here follows the signature of some person of importance in the place where the expedition is organised.)

By the words, "abide all consequences," the leader would be justified in leaving a man to shift for himself, and refusing his pay, if the case were a serious one.

The Size of the Party depends on many considerations. It should admit of being divided into two parts; each strong enough to take care of itself, and in each of which is some one person, at least, able to write a letter,—which bush servants, excellent in every other particular, are too often unable to do. In travel through a disorganised country, where bands of marauders are about, a large party is necessary; in other cases, a small one is just as good. As a general rule, small parties succeed much better than large ones: they excite less fear, do not eat up the country, and are less delayed by illness. The last fatal expedition of Mungo Park is full of warning to travellers who propose exploring with a large body of Europeans. (See p. 263.)

On engaging natives, the people that they have lived with and become attached to, should impress on them that, unless they bring you back in safety, they must never show their faces again, or expect a balance of their pay; which will only be delivered to them on your return.

Good Interpreters are very important: men who have been used by their chiefs, missionaries, &c., as interpreters, are much to be preferred; for so great is the poverty of thought and language among common people, that you will seldom find a man taken at hazard, able to render your words with any correctness. Recollect to take with you vocabularies of all the tribes whom you are at all likely to visit.

Feasts.—Interrupt the monotony of travel by marked days, extra tobacco, sugar, &c. Avoid constant good feeding, but rather have frequent slight fasts to ensure occasional good feasts; and let those occasions when marked stages of your journey have been reached be great gala days. Tobacco is a convenient reward for extra services.

Discountenance cliques being formed among the men; and promote merriment, singing, fiddling, and so forth, with all your power. Autolycus says, in 'A Winter's Tale,'—

> "Jog on, jog on, the foot-path way,
> And merrily hent the stile-a:
> A merry heart goes all the day,
> Your sad tires in a mile-a."

Natives' Wives.—If some of the natives take their wives, it gives great life to the party. They are of very great service, and cause no delay; for the body of a caravan must always travel at a foot's pace, and a woman will endure a long journey nearly as well as a man, and certainly better than a horse or a bullock. They are invaluable in packing up, and retailing information and hearsay gossip, which will give clues to much of importance, that, unassisted, you might miss. Mr. Hearne, the American traveller of the last century, in his charming book, writes as follows, and I can fully corroborate the faithfulness of the way in which he gives us a native's view of the matter. After the account of his first attempt, which was unsuccessful, he goes on to say,—"The very plan which, by the desire of the Governor, we pursued, of not taking any women with us on the journey, was, as the chief said, the principal thing that occasioned all our wants: 'for,' said he, 'when all the men are heavy laden, they can neither hunt nor travel to any considerable distance; and if they meet with any success in hunting, who is to carry the produce of the labour?' 'Women,' said he, 'were made for labour: one of them can carry or haul as much as two men can do. They also pitch our tents, make and mend our clothing, keep us warm at night; and in fact there is no such thing as travelling any considerable distance, or for any length of time, in this country without their assistance.' 'Women,' said he again, 'though they do everything, are maintained at a trifling expense; for as they always stand cook, the very licking of their fingers, in scarce times, is sufficient for their subsistence.'"

Sect. 3.—In case of Death.—If a man of the party dies, write down a detailed account of the matter, and have it attested by the others, especially if accident be the cause of his death. If he be lost, before you turn away and abandon him to his fate, call the party formally together, and ask them if they are satisfied that you have done all that was possible to save him, and record their answers. After death, it is well to follow the custom at sea,—*i.e.* to sell by auction all the dead man's effects among his comrades, deducting the money given for them from the pay of the buyers, to be handed over to his relatives on the return of the expedition. The things will probably be sold at a much higher price than they would elsewhere fetch, and the carriage of useless lumber is saved. Any trinkets he may have had, should of course be sealed up and put aside, and not included in the sale. They should be collected in presence of the whole party, a list made of them, and the articles at once packed up. In committing the body to the earth, choose a well-marked situation, dig a deep grave, and bush it with thorns, and weight it well over with heavy stones, as a defence against animals of prey.

Sect. 4.—Bush Laws.—It is impossible but that a traveller must take the law into his own hands. Some countries are governed with a strong arm by a savage despot: then to him or his chiefs appeals would of course be made; but, for the most part, the system of life among savages is—

"The simple rule, the good old plan,—
That they should take, who have the power;
And they should keep, who can."

Where there is no civil law, or any kind of substitute for it, each man is, as it were, a nation in himself. The traveller must settle in his own mind what his scale of punishments should be; and it will be found a much more convenient principle for him to go on, that a culprit should be punished, chiefly in proportion to the quantity of harm that he has done, rather than according to the presumed wickedness of the offence. Thus, if two men were caught, one of whom had stolen an ox, and the other a sheep, it would be preferable to flog the first much more heavily than the second: it is a way of punishing, more intelligible to savages than ours. The principle of double or treble restitution, to which they are well used, is of the same nature. If all theft be punished, your administration will be a reign of terror; for every savage, even your best friends, will pilfer little things from you whenever they have a good opportunity. Different tribes have very different customs on the subject of corporal punishment: there are some who fancy it a disgrace and a serious insult. A young traveller must be very discriminating in the licence he allows to his stick, or he may fall into sad trouble. The gentler of the two sexes is a "*teterrima causa belli.*"

Bearing towards Natives.—A frank, joking, but determined manner, joined with an air of showing more confidence in the savages than you really feel, is the best. It is observed, that a sea-captain generally succeeds in making a very good impression on natives: they thoroughly appreciate good practical common sense, and truth and uprightness; and they are not half such fools as strangers usually account them. If a savage does mischief, look on him as you would on a kicking mule, or a wild animal, whose nature is to be unruly and vicious, and keep your temper quite unruffled. Evade the mischief, if you can: if you cannot, endure it; but do not trouble yourself overmuch about your dignity, or about retaliating on the man, except it be on the grounds of expediency. There are even times when any assumption of dignity becomes ludicrous, and the traveller must, as Mungo Park had once to do, "lay it down as a rule to make himself as useless and as insignificant as possible, as the only means of recovering his liberty."

Wherever you go, you will find kindheartedness amongst women. Mungo Park is fond of recording his experiences of this; but I must add, that he seems to have been an especial favourite with the sex.

On arriving at an encampment, the natives commonly run away in fright. If you are hungry, or in any need of what they have, go boldly into their huts, take just what you want, and leave fully adequate payment. It is absurd to be over scrupulous in these cases. Be very severe if any of your own party steal trifles from natives: order double or treble restitution, if the man does not know better; and, if he does, a flogging besides, and not in place of it.

Drawing Lots.—It is often necessary to distribute things by lot. Do it by what children call "soldiering:" one stands with his back to the rest; another, pointing to the portions in succession, calls out "Who is to have this?" To which the first one replies by naming somebody, who at once takes possession.

Sect. 5.—Carrying the Wounded.—If a man be wounded or sick, and has to be carried along upon the shoulders of others, make a stretcher for him in the Indian fashion; that is to say, cut two stout poles, each 8 feet long, to make its two sides, and three other cross-bars of $2\frac{1}{2}$ feet each, to be lashed to them. Then, supporting this ladder-shaped framework *over* the sick man as he lies in his blanket, knot the blanket up well to it; and so carry him off, palanquin-fashion. One cross-bar will be just behind his head, another in front of his feet; the middle one will cross his stomach, and keep him from falling out; and there will remain two short handles for the carriers to lay hold of. The

American Indians carry their wounded companions by this contrivance after a fight, and in a hurried retreat, for wonderful distances. A kind of waggon-roof top can easily be made to it with bent boughs and one spare blanket.

Sect. 6.—Securing Prisoners.—To tie a man's hand behind his back, take a handkerchief: it is the best thing; failing that, a thin cord. It is necessary that its length should not be less than 2 feet, but 2 feet 6 inches is the right length; for a *double* tie, it should be 3 feet 6 inches. Compel him to lay his hands as in the sketch, and, wrapping the cord

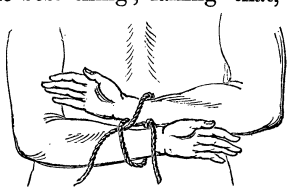


Fig. 1.

once (or twice if it be long enough) round the arms, pretty tightly, pass the longest end in between the arms as shown in fig. 1, and then tie quite tightly. To secure a prisoner with the least amount of string, place his hands back to back behind him, then tie the thumbs together, and also the little fingers. Two bits of thin string, each a foot long, will thoroughly do this. But, if you have not any string at hand, cut a thong from his leathern apron, or tear a strip from your own linen. When several men have to be made fast, the usual way is to tie them, one behind another, to a long pole or rope. If a man has to be kept prisoner all night, it is not sufficient to tie his hands, as he will be sure to watch his time and run away. It is therefore necessary to tie them round a standing tree, or a heavy log of wood. A convenient plan is to fell a large forked bough, and to make the man's arms fast round one of the branches. It is thus impossible for him to slip away, as the fork on one side, and the bushy top of the branch on the other, prevent his doing so; and, notwithstanding his cramped position, it is quite possible for him to get sleep.

A strait-waistcoat is the least inconvenient way to the prisoner of being secured, as his position is a free one, and the joints are not cut by cords. A makeshift for one is soon stitched together, by sewing a piece of canvas into the shape of a sleeve, and then sewing one end of this to the end of one cuff of an old jacket, and the other end to the other cuff; so that, instead of the jacket having two sleeves, it has but one long one. The jacket is then put on in the usual way, and buttoned fast in front: it is almost impossible for any struggling to break it loose. In a proper strait-waistcoat the opening is behind, and the sleeves in front; it laces up behind.

To take a strong man prisoner single-handed, threaten him with your gun, and compel him to throw all his arms away; then, marching him before you some little distance, make him lie flat on his face and put his hands behind him. Of course he will be in a dreadful fright, and require reassuring. Next take your knife, put it between your teeth, and, standing over him, take the caps off your gun, and lay it down by your side. Then handcuff him, in whatever way you best can. The reason of setting to work in this way is, that a quick supple savage, while you are fumbling with your strings and bothered with a loaded gun, might easily spring round, seize hold of it, and quite turn the tables against you. But if the gun had no caps on, it would be of little use in his hands, except as a club; and also, if you had a knife between your teeth, it would be impossible for him to struggle loose, without exposing himself to a thrust from it.

Tricks.—Speaking of these matters, a *ruse* should be borne in mind, that has been practised in most countries, from England to Peru. A traveller is threatened by a robber with a gun, and ordered to throw himself on the ground, or he will be fired at. The traveller taking a pistol from his belt, shouts out, "If this were loaded you should not treat me thus!" and throws himself on the ground as the robber bids him. There he lies till the robber, in his triumph, comes up for his booty; when the intended victim takes a quick aim and shoots him dead—the pistol being really loaded all the time. I have also heard of an incident in the days of Shooter's Hill, in England, where a ruffian waylaid and sprung upon a traveller, and, holding a pistol to his breast, summoned him for the contents of his pocket. The traveller dived his hand into one of them, and, silently cocking a small pistol that lay in it, shot the robber dead, firing out through the side of the pocket.

In marching off a culprit, make him walk between two of your men, while a third, carrying a gun, walks behind him. If riding alone, tie the prisoner's hands together, and, taking your off-stirrup leather (for want of another cord), pass it round his left arm, and round your horse's girth, and buckle it. The off-stirrup leather is the least inconvenient one to part with, on account of mounting. In cases where a prisoner has to be secured and galloped off, there are but two ways: either putting him in the saddle and strapping his ankles together under the horse's belly—in which case, if he be mad with rage, and attempt to throw himself off, the saddle must turn with him; or else securing him Mazeppa-fashion—when four loops are passed, one round each leg of the horse, and to each of these one limb of the prisoner, as he lies with his back against that of the horse, is tied; a surcingle is also passed round both horse and man. It is, of course, a barbarous method, but circumstances might arise when it would be of use.

Sect. 7.—Hostile Neighbourhood.—A small party has often occasion to steal through a belt of hostile country without observation. At such times, it is a rule never to encamp until long after sun-down, in order to throw out people who may be on your track. If, when you intend to encamp, you are pursuing a beaten path, turn sharp out of it, in a place where the ground is hard, and travel away for a quarter of an hour, at least; then look out for a hollow place, in the midst of an open flat. Never allow hammering of any kind, nor loud talking; but there is no objection to a fire, if reasonable precautions be taken, as it cannot be seen far through bushes. Keep a strict watch all night: the watchers should be 100 yards out from camp, and relieve one another every two hours. Enough animals for riding, one for each man, should always be tied up.

Cattle keep guard very well: a stranger can hardly approach a herd of oxen without their finding it out, for several of them are sure to be always awake and watchful. The habits of bush life make a traveller, though otherwise sound asleep, start up directly at a very slight rustle of alarm among his cattle.

Scared birds often give useful warning; and a skulking negro may sometimes be smelt out like a fox.

A person riding a journey for his life sleeps most safely with his horse's head tied short up to his wrist. The horse, if he hears anything, tosses his head and jerks the rider's arm. The horse is a careful animal, and there appears to be little danger of his treading on his sleeping master. (See p. 113.) The Indians of South America habitually adopt this plan when circumstances require extreme caution. If a troop of horsemen pass near your hiding-place, it may be necessary to clutch your steed's muzzle with both hands to prevent his neighing.

When a party, partly of horsemen and partly of footmen, are running as hard as they can, the footmen lay hold of the stirrup-leathers of the riders.

Keeping watch.—When you think you hear anything astir, lie down and lay your ear on the ground. To see to the best advantage, take the same position; you thus bring low objects high against the sky, and make them stand in bold relief against it: besides this, in a wooded country it is often easy to see far between the bare stems of the trees, while their spreading tops quite shut out all objects a few yards off. Thus, an animal sees a man's legs long before he sees his face. An opera-glass is an excellent night-glass, and at least doubles the distance of distinct vision in the dark. I should be glad to hear that a fair trial had been also given by a traveller to an ear-trumpet.

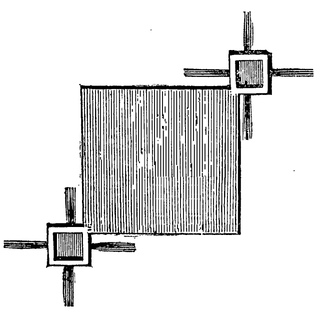
The Dahomans, the famous military nation of N.W. Africa, have an odd method of dividing their watches by night, but "which is generally managed very correctly. At each gate of a stockaded town, is posted a sentry, who is provided with a pile of stones, the exact number of which has been previously ascertained. The night is divided into four watches; during each watch the sentry removes the pile of stones, one by one, at a measured pace, from one gate to another, calling out at each tenth removal: when all are removed, the watch is relieved."—(*Forbes.*)

Setting a common gun as an alarm-gun.—The gun may be loaded with bullet, or simply with powder, or only with a cap: even the click of the hammer may suffice to awaken attention. For the *way* of setting it, *see* p. 243.

DEFENCE.

§ 1. Camp Fortification.—§ 2. Weapons.

Sect. 1.—Camp Fortification.—Explorers have frequent occasion to form a depôt: either to leave a few men in charge of the heavy luggage, while the rest of the party ride on a distant reconnoitring expedition; or else, where the whole party may encamp for weeks, until the state of the season, or other cause, may permit further travel. In either case, if in a country where hostile attempts are to be apprehended, a little forethought will vastly increase the security of the depôt. For instance, it should be at least 200 yards from any cover, or commanding heights; if the ground itself have any features of strength about it, as being near the side of a stream, or being on a hill, so much the better; the neighbourhood of shingle prevents any person from stealing across unheard; and, finally, the great principle of fortification suited to a small party is to form the camp into a square, and to have two projecting enclosures at opposite corners, where all the guns of the party may place themselves to fire on their assailants. It will be seen by the sketch, how completely even one man, with a gun in each enclosure, can sweep the edge as well as the whole environs of the camp. A square is better than a round shape for the enclosures, as it allows more men to use their guns at the same time on the same point; but it is so convenient to make the walls of the enclosure serve as sidings for your tent, that it



would be best to let the size and shape of the tent determine those of the enclosure. A square of nine or ten feet in the inside is amply sufficient for three guns or archers. The parapets can easiest be built of large stones. I do not speak of earthwork, for a travelling party has rarely spades; but if digging be possible, then, of course, the parapet should be raised from the earth thrown up by digging a trench outside it; and the common calculation is, that, with good tools, a labourer can dig one cubic yard of earth an hour, and continue working eight hours in the day. It should be raised to a height of, at least, four feet above the ground, as that is the most convenient height to fire from, standing; and as being high enough to shield a person kneeling down to load. Upon this parapet large stones are to be laid, having loopholes between them, and on these stones the tent is to be pitched; its pole being lengthened by lashing a piece of wood to it, or by cutting a fresh pole altogether. It will make a high roof to the enclosure, and complete a very comfortable abode. We have thus a square enclosed camp for the cattle, the waggons, and the natives; and, at opposite corners of it, two fortified houses: one of which would naturally be inhabited by the leaders of the party, and the other, either by the storekeeper, or by the white servants generally.

Have a standing rule that many natives should never be allowed to go inside your camp at the same time: it is everywhere a common practice among them to collect quietly in a friendly way, and at a given signal to rise *en masse* and overpower their hosts. Even when they profess to have left their arms behind, do not be too confident: they are often close at hand. Captain Sturt says, that he has known Australian savages to trail their spears between their toes as they walked to him through the grass professedly unarmed.

Sect. 2.—Weapons.—Unless your ammunition is so kept as to be accessible in the confusion of an attack, all your fortifying would be of little service. If the guns are all, or nearly all, of the same bore, it is simple enough to have small bags filled with cartridges, and also pill-boxes with a dozen caps in each.

Otherwise you must make the best of it. Buck-shot and slugs would be better than bullets for the purposes of which we are speaking. Bows and arrows might render good service. The Chinese, in their junks, when they expect a piratical attack, bring up baskets filled with stones from the ballast of the ship, and put them on deck ready at hand. They throw them with great force and precision. The idea is not a bad one. Boiling water and hot sand, if circumstances happened to permit their use, are worth bearing in mind, as they would tell well on naked assailants. In close quarters, thrust, do not strike; and recollect always that it is not the slightest use to hit a negro on the head with a stick, as it is a fact that his skull endures a blow better than any other part of his person. In picking out the chiefs, do not select the men that are the most showily ornamented, for they are not the chiefs; but the biggest and the busiest.

Rockets.—Of all European inventions, nothing so impresses and terrifies savages as fireworks, especially rockets. I cannot account for the remarkable effect they produce, but in every land the case appears to be the same. A rocket, judiciously sent up, is very likely to frighten off an intended attack and save bloodshed. If a traveller is supplied with any, he should never make playthings of them, but keep them for great emergencies.

HIDING PLACES OR CÂCHES.

§ 1. To make a Câche.—§ 2. Notices to another Party.—§ 3. Secreting Jewels.

Sect. 1.—To make a Cache.—It is easy enough to choose a spot, which you yourself shall again recognise, for digging a hole, where stores of all kinds may be buried, against your return: neither is it difficult to choose one, so that you may indicate its position to others, or else leave it to a party who are travelling in concert to find it out for themselves. But excessive caution in *depositing* the stores is, in every case, required, as hungry and thieving natives keep watch on all the movements of a party; they follow their tracks, and hunt over their old camping-places, in search of anything there may be to pick up. And hyenas, wolves, wild dogs, and all kinds of prowling animals, guided by their sharp scent, will soon scratch up any provisions that are buried carelessly, or in such a way as to taint the earth.

Leaving aside the question of landmarks, the proper place to choose for a *câche* is a sandy or gravelly soil, on account of its dryness and the facility of digging it. Old burrows, or the gigantic, but abandoned, hills of white ants, may be thought of, if the stores are enclosed in tin cases; also clefts in rocks: some things can conveniently be buried under water. The place must be chosen under such circumstances, that all signs of the ground having been disturbed can be effaced. A good plan is to set up your tent, and dig a deep hole inside it, wrapping up what you have to bury in an oilcloth, in an earthen jar, or wooden vessel, according to what you are able to get (but not in skins, for they give out smell). Continue to inhabit the tent for at least a day, well stamping and smoothing down the soil at leisure. After this, strike the tent, shift the tethering-place or kraal of your cattle to where it stood, and they will speedily efface any marks that may be left. Travellers often light their fires over the holes where their stores are buried, but natives are so accustomed to suspect fireplaces, that these do not prove safe depôts. During summer travel, in countries pestered with gnats, a smoke fire for the horses (for keeping off flies) near the place, causing the horses to trample all about, is an excellent blind.

It is easy to make a small *câche* by bending down a young tree, tying your bundle to the top, and letting it spring up again. A spruce-tree gives excellent shelter to anything placed in its branches.

Some dried plants of M. Bourgeau, the botanist, attached to Captain Palliser's expedition to the Rocky Mountains, remained underground for ten months without injury.

Some persons make two *câches*: the one with a few things buried in it, and concealed with little care; the other containing those that are really valuable, and very artfully made. Thieves are sure to discover the first, and are likely enough to omit a further search.

If a *câche* be made in dry weather, and the ground be simply levelled over it, the first heavy rain will cause the earth to sink, and will proclaim the hidden store to an observant eye. Soldiers, in sacking a town, find out hastily-buried treasures by throwing a pailful of water over any suspected spot: if the ground sinks, it has surely been recently disturbed. The natives in Ceylon jerk their game, put the dry meat in the hollow of a tree, fill up the reservoir with honey, and plaster it up with clay.

Large things, as a waggon or boat, must either be pushed into thick bushes or reeds, and left to chance; or they may be buried in sand—that is to say, in a sand drift, or in a sandy deposit by a river side. A small reedy island is a convenient place for *câches*.

To find your store again, you should have ascertained the distance, and bearing by compass, of the hole from some marked place, as a tree—about which you are sure not to be mistaken; or from the centre of the place where your fire was made—which is a mark that years will not entirely efface. If there be anything in the ground itself to indicate the position of the hole, you have made a clumsy *câche*.

It is not a bad plan, after the things are buried, and before the tent is removed, to scratch a furrow a couple of inches deep, and three or four feet long, and pick up any bits of stick, reeds, &c., that may be found at hand lying upon the ground, and place them end to end in it. These will be easy enough to find again, by making a cross furrow, and, when found, will lead you straight above the depôt. They would never excite suspicion, even if a native got hold of them; for they would appear to have been dropped, or blown on the ground by chance, not seen, and trampled in.

Mr. Atkinson mentions an ingenious way by which the boundaries of valuable mining property are marked in the Ural, a modification of which might serve for indicating *câches*. A trench is dug, and filled with charcoal beat small, and then covered over. The charcoal lasts for ever, and cannot be tampered with without being instantly observed.

Some explorers number their camps, and mark the trees with the numbers.

Sect. 2.—Notices to another Party.—One of the securest plans is to work a hole in a rock and to put a bottle into it containing the letter; then some leaves, sand, &c., may be pushed in to protect it; and, finally, a small quantity of melted lead, or even of wax, poured in, to seal it from the wet. If a letter has to be left at a known tree, for a person who, on his passing by, it may be months after, expects to find it there, a very safe way of doing so is as follows:—Clamber up the tree, when it is dark, to the first large bough, and, sitting astride it, cut with a chisel a deep hole right into the substance of the wood, or you may make one by firing a bullet down into it. If possible, the bark should not be cut quite away, but only displaced, and afterwards put back. In this hole the letter, rolled up or folded quite small, is to be pushed, and the bark nailed down over it. No savage would ever dream of looking there for it, for the tree shows no tracks, and it is impossible to see any mark from below. The letter might even be nailed flat under a piece of bark. A cut with a hatchet should be made on the tree, a yard or so below the bough, to indicate it. By using thin paper and writing small, an abundance of information may be secured from the weather and from observation, inside the quill of a good-sized feather; the open end of it being judiciously squeezed flat between two stones, heated sufficiently to soften, but not to burn the quill, and then, for greater security, twisted tight.

It is convenient to punch letters on a thin lead plate made by melting a bullet or two, and pouring the melted lead on a hot flat stone.

Marks (see also p. 147, "*Roads, to mark and follow.*")—If you want a tree to be well scored or slashed, so as to draw attention to it without fail, fire bullets into it as a mark, and let the natives cut them out for the sake of the lead, in their own way: they will do just what you want, and never suspect your real intention. When you have made a *câche*, if it be for another party who knows nothing about it, take the bearing of it from some large tree or other landmark, on which you must gash, paint, or chisel characters something of this sort:—

LETTER BURIED
50 YARDS N.N.E.

which explains itself. Savages will, however, take such pains to efface any mark that they may find left by white men, entertaining thoughts like those of Morgiana in the Arabian Nights' Tale of the Forty Thieves, that it would be the height of imprudence to trust to a single mark. It would, therefore, be very desirable for a relief party to take a branding-iron to hold letters of about a quarter of an inch in height, and to brand or stamp the tree in many places. A couple of hours spent in doing this, would leave, perhaps, two dozen marks—which would be quite beyond the power of a few savages to cut out with their axes.

A very excellent tree-line is made by cutting deep notches in a line of trees, starting from some conspicuous object, and so that the notches face the explorer: the trees must be so selected that three, or at least two of them, are in sight at once.

An arrow-head may be chiselled out in the face of a rock and filled up with melted lead. With a small cold chisel, 3 inches long and $\frac{1}{4}$ inch wide, a great deal of stone carving may readily be effected.

I have observed a very simple and conspicuous mark used in forest-roads, as represented in the sketch (fig. 1). The stone is 8 inches above ground, $3\frac{1}{2}$ wide, 8 inches long: the mark is black and deeply cut. Also, a cross of wood, constructed as in fig. 2.

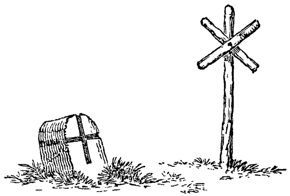


Fig. 1. Fig. 2.

The Arctic system of depositing letters 10 feet *due* north (and not *magnetic* north) from the cairn or mark, is a good rule; and, failing other previous arrangements or better reasons, should be generally employed. A universal system is of so great a convenience, that I trust travellers will consent to adopt this rule. Let me at least suggest, that persons who find a tree marked so as to attract notice, and who are searching blindly in all directions for further clue, should *invariably* dig out and examine that particular spot. The notice that should be deposited there, may simply indicate some more distant point as the actual *câche*.

These notices might be pushed into a hole bored into the head of a tent-peg, which could be driven deeply in the ground quite out of sight, and without disturbing the earth. Or it may suffice to pick up a common stone, and scratch or paint what you had to say on it, and leave it on the ground, with its written face downwards, at the place in question. A good mark to show that Europeans have visited a spot is a saw-mark (no savages use saws): it catches the eye directly. As very many good bushrangers cannot read, rude picture-writing is often used by them, especially in America. The figure of a man with a spear or bow—drawn, I mean, as a child would draw—stands for a savage; one with a hat or gun, for a European; horses, oxen, sheep; lines for numbers; arrow-head for direction, and so forth. Even without other more conventional symbols, a vast deal may be expressed in this way.

Whitewash mixed with salt, or grease, or glue-size, will stand the weather for a year or more, when painted on a tree or rock; and, of course, the rougher the surface the longer will some sign of it remain.

Black for inscriptions cut in a rock, is made by charcoal, or, better, by lampblack, mixed in the same way with some kind of size, or with tar. Dr. Kane, having no other material at hand, once burnt a large K, with gunpowder, on the side of a rock. It afterwards proved to be a remarkably durable and efficient mark.

Sect. 3.—Secreting Jewels.—Before going among a rich but semicivilised people, travellers sometimes buy a few small jewels, and shut them up into a little silver tube with rounded edges; then making a gash in their skin, they bury it there, allowing the flesh to grow over it. They feel no inconvenience from its presence—any more than a once wounded man does from a bullet lodged in his person, or from a plate of silver set beneath his scalp. The best place for burying it is on the left arm, at the spot chosen for vaccination. By this means, should a traveller be robbed of everything, he could still fall back on his jewels. I fear, however, that if his precious depôt were suspected, any robbers into whose hands he might fall would fairly mince him to pieces in search of further treasures. The jewels may be buried without the tube. Some travelling Arabs wear a chain of gold sewn up in dirty leather under their belt, and cut off and sell a link from time to time. (Burton.)

BOATS, RAFTS, FORDS, BRIDGES, ETC.

§ 1. Swimming Rivers.—§ 2. Rafts and Rude Boats.—§ 3. Carrying Boats overland.—§ 4. Hints for Boating Excursions.—§ 5. Fords, Bridges, &c.

Sect. 1.—Swimming Rivers.—If a traveller can swim pretty well, it is a good plan to make a float, and to throw himself flat down in the water with his breast upon it, while his clothes and valuables are tied in a huge turban on his head. In this way broad streams can easily be crossed, and great distances of river descended. He may adjust paddles on to his hand. His float may be a faggot of rushes, a log of wood, or any one of his empty water-vessels; for whatever will keep water in, will also, of course, keep it out: while, as to bags, the air that may ooze out through their sides may be blown afresh into them while afloat. Empty bottles may be well corked and made fast under the armpits or stuffed under the shirt or jersey, with a belt tied round the waist below them.

It is an easy matter to make a moderately effective life-belt simply out of holland, ticking, canvas, or other similar materials; and the crews of a vessel aground some way from the main-land, and who must prepare to swim for their lives, might avail themselves of this plan:—Cut out two complete rings of 16 inches outer diameter and 8 inches inner diameter; sew these together along both edges, with as fine a needle as possible and double threads, and the chief part of the belt is made. What remains, is to sew strong shoulder-straps to it, so that by no possibility it can slip down over the hips; and, lastly, to sew a long narrow tube to it, out of a strip, a foot long and two inches wide, from the same material as the belt. For the mouth of this, a bit of wood, an inch long, with a hole bored down its middle, should be inserted as a mouthpiece. Through this tube the belt can be inflated by the swimmer while in the water, from time to time, as often as may become necessary; and, by simply twisting it and tucking its end in the belt, its vent can always be closed. After canvas, &c., is *thoroughly* drenched, it will hold the air very fairly. The seams are the weak parts. For swimming in calm water, a collar is as good as a belt.

The swimmer's valuables may be put inside the empty vessel that acts as his float. A goatskin is often filled half full of things, and then blown out and its mouth secured. A very good life-belt is made to admit of this arrangement. It has a large opening at one end, which is closed by a brass door that shuts like the top of an inkstand, and is then quite air-tight. A small parcel, if tightly wrapped up in many folds, will keep dry for a long time though immersed in water, and the outside of it may be greased, oiled, or waxed, as an additional security.

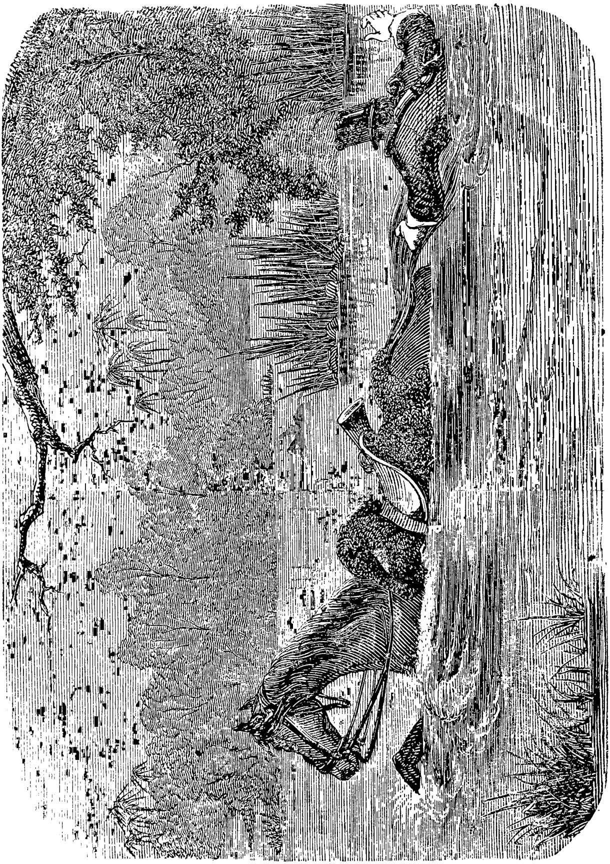
A good way of teaching a person to swim, is a modification of that adopted at Eton. The teacher sits in a punt or on a rock, with a stout stick of 6 or 10 feet in length, at the end of which is a cord of 4 feet or so, with loops. The learner puts himself into the loops; and the teacher plays him, as a fisherman would play a fish, in water that is well out of his depth: he gives him just enough support to keep him from drowning. After six or a dozen lessons, many boys require no support at all, but swim about with the rope dangling slack about them. When a boy does this, he can be left to shift for himself. The art of swimming *far* is acquired, like the art of running far, by a determination to go on, without resting a moment, until utterly unable to make a stroke further, and then to stop altogether. Each succeeding day, the distance traversed is marvellously increased, until the natural limit of the man's powers is attained. By putting about twice as much oil or bear's grease into the palm of the hand as a person uses for his hair, and rubbing it all over the person, the chilliness consequent on having stayed too long in the water is much modified.

In landing through a heavy surf, wait for a large wave, and come in on the crest of it. Make every possible exertion to scramble up to some firm holding-place, whence its indraught, when it returns, can be resisted. If drawn back you will be heavily battered, perhaps maimed, and certainly far more exhausted than before, and not a whit nearer to safety. Avoid receiving a breaker in the attitude of scrambling away from it on hands and knees. From such a position the wave projects a man headforemost with fearful force, and rolls him over and over in its surge. He ought to turn on his back the instant before the breaker is upon him; and then all will go well, and he will be helped on, and not half-killed by it. Men on shore can give help to a man who is being washed to and fro in the surf, by holding together, *very* firmly, hand in hand, and forming a line down to the sea: the foremost man clutches the swimmer as soon as he is washed up to him, and before the retiring wave begins to suck him back, and holds him until the danger of it is past. The force of the indraught is enormous, and none but strong men can withstand it.

If a person cannot swim a stroke, he should be buoyed up with floats under his arms, and lashed quite securely, and to his own satisfaction; then he can be towed across the river with a string. If he lose courage halfway, it cannot be helped: it will do him no harm, and his swimming friend is in no danger of being grappled with and drowned. For very short distances, a usual way is for the man who cannot swim to hold his friend by the hips. A few yards of intestine blown up, and tied in five or six places, so as to make so many watertight compartments, is a capital swimming-belt, if wound in a figure of 8 round a man's neck and under his armpits. A very little is enough to buoy a man's head up.

People swim much more slowly than is commonly supposed. In races between first-rate swimmers, for distances of 300 yards and upwards, the average pace of two miles an hour is barely, if at all, exceeded.

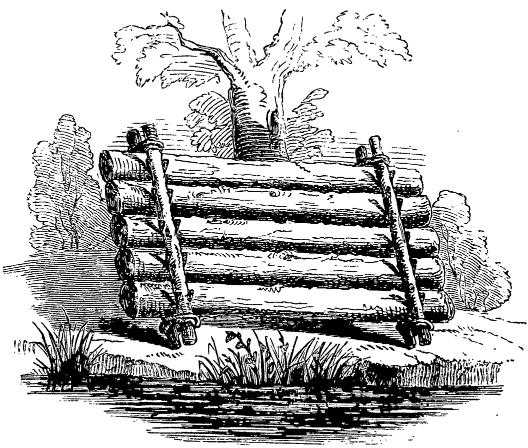
Swimming Horses.—In crossing a deep river, with a horse or other large animal, drive him in, or even walk him alongside a steep bank, and push him suddenly in; having fairly started him, jump in yourself, and, seizing him by the tail, let him tow you across. If he turns his head to try and change his course, splash water in his face with your right or left hand, as the case may be, holding on with one hand and splashing with the other; and you will in this way direct him just as you like. This is by far the best way of swimming a horse: all others are objection-



able, and dangerous with horses new to the work,—such as to swim alongside the horse, with one hand on his shoulder; or, worst of all, to retain your seat on his back. If this last method be persisted in, at least let the rider take his feet out of the stirrups before entering the water.

To float a Waggon across a river, see that it is well ballasted, or it will assuredly capsize. The heavy contents must be stowed at the bottom, the planking must be lashed down to the axletrees, or it will float away from them; great bundles of reeds and the empty water-vessels should be lashed inside, but high above all, and then the waggon will cross without danger. When fairly started, the oxen will swim it across, pulling in their yokes.

Sect. 2.—Rafts and rude Boats.—Rafts are made by felling logs; letting them drift alongside one another, if they are large;



securing them together by pairs of cross-bars, one of each pair lying above the raft and the other below; then, by a little judicious notching where the logs cross, and a few pegs and lashings, the whole may be made quite firm. Briers, woodbines, &c., will do for the lashings. Outriggers vastly increase the stability of a raft.

The rafts of European rivers are usually built on shore, and launched into the water: three slides are laid sloping down from the bank to the river; on these the four poles, which are to make the rim of the raft, are fastened together (fig. 1). Other poles are put in between, until the whole is complete.

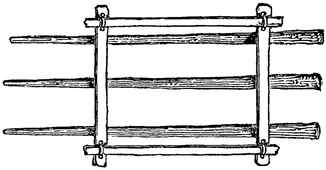


Fig. 1.

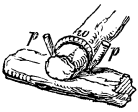


Fig. 2.

The raft-fastening, in common use, is shown in fig. 2: a piece of a stout wand is bent over the cross piece, and wedged into holes in the frame-work.

The floating power of a raft depends on the buoyancy of the wood it is made of. I have extracted, and given below, a list of the specific gravities of a few well-known woods; and annexed to them a column of what may be called their "specific floating powers"—that is to say, the difference between their specific gravities and that of water, which is 1. Hence, to find the actual floating power of a raft, multiply its weight into the specific floating power of the wood it is made of, and the thing is done. Thus, a raft of 12 logs of larch, averaging 30 lbs. each, weighs 360 lbs.; this multiplied by ·47, is equal to 169 lbs. very nearly, which is the weight the raft will support without sinking. Poplar is the lightest on the list.

	Specific Gravities.	Specific Floating Powers.
Alder	·80	·20
Ash	·85	·15
Beech	·85	·15
Elm	·59 to ·80	·41 to ·20
Fir	·47 to ·60	·53 to ·40
Larch	·53	·47
Oak	·75	·25
„ heart of	1·17	sinks
Pine	·40 to ·63	·60 to ·37
Poplar	·38	·61
Willow	·59	·41

Where there are no means at hand to fell trees, they should be burnt down; two men may attend to the burning of twenty trees at one and the same time. When felled, their tops and branches are, also, to be trimmed by fire. (See p. 69.)

Mr. Andersson, in exploring the Tioughe River, in South Africa, met with two very simple forms of rafts: the one was simply a vast quantity of reeds cut down, heaped into a stack of from 30 to 50 feet in diameter, and pushed out into the water and allowed to float down stream. Each day, as the reeds became water-logged, more were cut and thrown on the stack. On an affair of this description, Mr. Andersson, with seven attendants, and two canoes hauled up upon it, descended the river for five days. Its great bulk made it sure of passing over shallow places; and when it struck against "snags," the force of the water soon slewed it round and started it afresh. The second reed raft was a small and neat one, and used for ferries. A mattress of reeds was made, about 5 feet long, 3 broad, and some 8 inches thick; it was tied together with strips of the reeds themselves; to each of its four corners was fixed a post, made of an upright faggot of reeds, about 18 inches high, and other faggots connected their tops horizontally in the place of rails: this was all; it held one or two men, and nothing but reeds or rushes were used in its construction.

The Lake Titicaca, which lies far above the limit of trees, is navigated by boats made of rushes, and carrying sails woven of rushes also.

A canoe may be made of reeds, rushes, or the light inner bark of trees. Either of these materials is bound into three long faggots, pointed at one end: these are placed side by side and lashed together, and the result is a serviceable vessel, of the

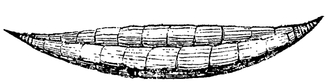


Fig. 1.

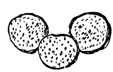
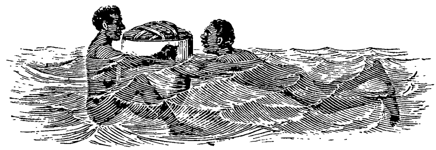


Fig. 2.

appearance fig. 1, and section as fig. 2. Little boats are sometimes made of twigs, and plastered both inside and outside with clay, but they are very leaky.

The people of Yariba have a singular mode of crossing rivers and streams, when the violence and rapidity of their currents prevent them from plying in canoes with safety. (See fig.)



The passenger grasps the float, on the top of which his luggage is lashed; and a perfect equilibrium is preserved, by the ferryman placing himself opposite the passenger, and laying hold of both his arms. They being thus face to face, the owner of the float propels it by striking with his legs. The natives use as their float two of their largest calabashes, cutting off their small ends, and joining the openings face to face, so as to form a large, hollow, watertight vessel.

Mákara.—Over a large part of Bornu, especially on its Komádugu—the so-called River Yeou of Central Africa—no boat is used, except the following ingenious contrivance. It is called a "mákara," or boat *par éminence.*

Two large open gourds are nicely balanced, and fixed, bottom downwards, on a bar or yoke of light wood, 4 feet long, 4½ inches wide, and about three quarters, or one inch, thick. The fisherman, or traveller, packs his gear into the gourds; launches the *mákara* into the river, and seats himself astride the bars. He then paddles off,

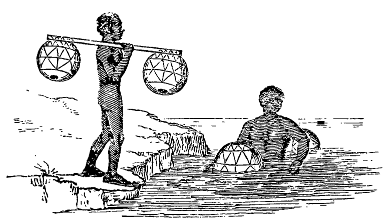


Fig. 2. Fig. 1.

with help of his hands (fig. 1). When he leaves the river, he carries the mákara on his back (fig. 2). Dr. Barth writes to me, "A person accustomed to such sort of voyage, sits very comfortably; a stranger holds on to one of the calabashes. There is no fear of capsizing, as the calabashes go under water, according to the weight put upon them, from ten to sixteen inches. The yoke is firmly fastened to the two calabashes, for it is never taken off. I am scarcely able, at present, to say how it is fastened. As far as I remember, it is fixed by a very firm lashing, which forms a sort of network over the calabash, and at the same time serves to strengthen the latter and guard it against an accident." It is obvious that the gourds might be replaced by inflated bags or baskets, covered with leather, or by copper or tin vessels, or by any other equivalent. (See p. 18.) I quite agree with Dr. Barth, that a mákara would be particularly suitable for a traveller. In Bornu, they make large rafts, by putting a frame over several of these mákara, placed side by side.

Hides simply inflated.—" A single ox-hide may be made into a float capable of sustaining about 300 lbs.; the skin is to be cut to the largest possible circle, then gathered together round a short tube, to the inner end of which a valve, like that of a common pair of bellows, has been applied: it is inflated with bellows, and, as the air escapes by degrees, it may be refilled every ten or twelve hours." ('Handbook for Field Service.')

We read of the skins of animals, stuffed with hay to keep them distended, having been used by Alexander the Great, and by others.

Goatskin rafts are extensively used on the Tigris and elsewhere. These are inflated through one of the legs: they are generally lashed to a framework of wood, branches, and reeds, in such a way that the leg is accessible to a person sitting on the raft; when the air has in part escaped, he can creep round to the skins one after the other, untying and re-inflating them in succession.

An inflatable india-rubber boat is an invention which has proved invaluable to travellers; they have been used in all quarters of the globe, and are found to stand every climate. A full-sized one weighs only 40 lbs. They have done especial service in Arctic exploration; and the waters of the Great Salt Lake, in the Mormon country, were first explored and navigated with one by Colonel Frémont; they were also employed by Dr. Livingstone in rivers of South Africa. They stand a wonderful deal of wear and tear; still, as boats, they are inferior to native canoes, as they are very slow in the water. It is, indeed, impossible to paddle them against a moderate head-wind. For the general purposes of travellers, I should be inclined to recommend as small a macintosh-boat as can be constructed; just sufficient for one, or at most for two, persons; such as the cloaks that are made inflatable, and convertible into boats. I do so, because it is rare to find a large piece of water without natives' canoes. What a traveller chiefly wants is to be able to cross over to a village and call for help, or else a means of carrying his valuables across a river, while the heavy things are risked at a ford; or for shooting, fishing, or surveying. Now a very small inflatable pontoon would do as well for all these purposes as a large one, and would be far more portable. Such a one would weigh 10 lbs. It is perfectly easy to get into a macintosh boat, after having been capsized out of it into deep water.

The lightest and most portable *boat*, properly so called, would be made of metal tube framework, and an india-rubber covering.

Captain Fitzroy gives an account of a party of his sailors, whose boat had been stolen while they were encamped, putting out to sea in a large basket, woven with such boughs as were at hand, and covered with their canvas tent—the inside of which they had puddled with clay, to keep the water from oozing through too fast. They were 18 hours afloat in this crazy craft. I mention this instance, to show how almost anything will make a boat. Canvas saturated with grease or oil is waterproof, and painted canvas is excellent for a boat, but it soon becomes rotten.

A hide boat is a good contrivance; and if the hide be smoked (see p. 182) after it is set, it is said to be vastly improved. In its simplest form, Peruvian travellers describe it as a dish or tray consisting of a dry hide pinched up at the four corners, and each corner secured with a thorn. The next plan in simplicity is that of making eyelet-holes round its rim, passing a thong through, and drawing it pretty close, while it is kept in shape by sticks put inside and athwart its bottom.

If a traveller has command of one hide only, he should make a coracle; if of two, a punt. This last is a really useful boat; one in which very great distances of river may be descended with safety, and much luggage taken. Hide boats are very light, since the weight of a bullock's skin only averages 45 lbs.; but, unless well greased, they soon rot. When taken out of the water, they should be laid bottom upwards to dry. To make a proper and substantial coracle, a dozen or more osier or other wands must be cut; these are to be bent, and have both ends stuck in the ground, in such a way as to form the framework of the required boat, bottom upwards, whose shape is much like half a walnut-shell, but more flattened. Where these wands cross, they should be lashed; and where there appears to be an unfilled part, a stick should be wattled-in. All this being completed, a raw hide is to be thrown over it, sewn in place, and left to dry. Finally, the projecting ends of the osiers have to be cut off. Should this boat, by any chance, prove a failure, the hide is not wasted, but can be removed, soaked till soft, and used again.

A skin punt requires two bullocks' or other hides, and also about ten small willow-trees, or other tough flexible wood, 14 feet long. Captain Palliser says that two days is sufficient for two people to complete an entire punt of this description. He has been so good as to furnish me with the following minute description of the way of making this very useful boat.

1. The keel, stem, and stern might be in one; but, because the stem and stern ought to be strong, this whole line is made of two small trees lashed together with the thick ends outwards, as in fig. 1.

Fig. 1.

A B is a lithe clean little willow-tree, and *a b* another similar one. They are lashed together at their taper ends.

2. Cut notches half-way through K *k*, at about 20 to 25 inches from each end; then turn up the notched portions, and you have stem, keel, and stern, all in one piece, as in fig. 2.


Fig. 2.

3. Stake out the ground, according to the size your boat will cover, in the following way:—Get eight strong pointed stakes of wood, and drive them into the ground; to these you will lash four cross (willow-tree) sticks, notched in two places, so that each of these four willows shall form two knees, as well as run across the bottom of the boat.

4. Bend two more main willows for gunwales for the boat, and two more for bottom rails. Each separate stick, as will be perceived by fig. 3, is lashed in five different places, and the keel in eight places.

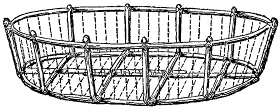


Fig. 3.

The main frame-work being now completed, loosen it from the stakes driven into the ground.

5. Fasten a large number of little slender willow twigs between each of the main cross-knees, as shown by the thin lines in fig. 3. It is then fit for covering. Lift it up like a basket, and turn it topsy-turvy.

6. Kill *two* bulls, skin them, and, in skinning, be careful to make your cuts in the skin down the rump to the hock of the animal, and down the brisket in front of the fore-leg to the knee, so as to have your skins as square as possible. (fig. 4.)

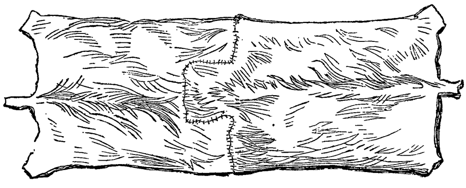


Fig. 4.

Cut off the heads, and sew the skins together at the nape of the necks; and, while reeking, cover the wicker-work, turning them over it, the hairy side inwards, and fasten it all round by means of skin-cords. Cut holes with a knife round the edges, to pass the cords through, as you lash up to the top-rails of the boat.

7. Leave it 24 hours in the sun, cover the seam where the

skins are sewn together, with melted fat, and the boat is fit for use.

Instead of using leather, the punt may be planked over, if the traveller has patience and means to cut plank, and has nails. Anything does for caulking the seams: the inner bark of trees, steeped and pounded, is the readiest material. In default of nails, the planks *can* have holes bored in them and be sewn together with strips of hide, woodbine, or string made from the inner bark or fibrous roots of trees.

"From a pine, or other tree, take off with care the longest possible entire portion of the bark; while fresh and flexible, spread it flat as a long rectangular sheet; then turn it carefully up at the sides, the smooth side outwards; *sew* the ends together, and caulk them well. A few cross-sticks for thwarts complete this contrivance, which is made by an American Indian in a few hours, and in which the rapid waters of the Mackenzie are navigated for hundreds of miles. Ways of strengthening the structure will readily suggest themselves. The native material for sewing is the fibrous root of the pine." ('Handbook for Field Service;' Lieut.-Col. Lefroy.)

Birch bark, as is well known, is used for building canoes in North America, and that also of many other trees would do for covering the framework of a boat, in default of leather. But it is useless to give a detailed account of birch canoes, as great skill and neat execution are required both in making and in using them.

A wooden canoe is best made by hollowing out a long tree by axe and by fire, and fastening an outrigger to one side of it, to give steadiness in the water. For burning down trees, see *Palisades*, p. 69.

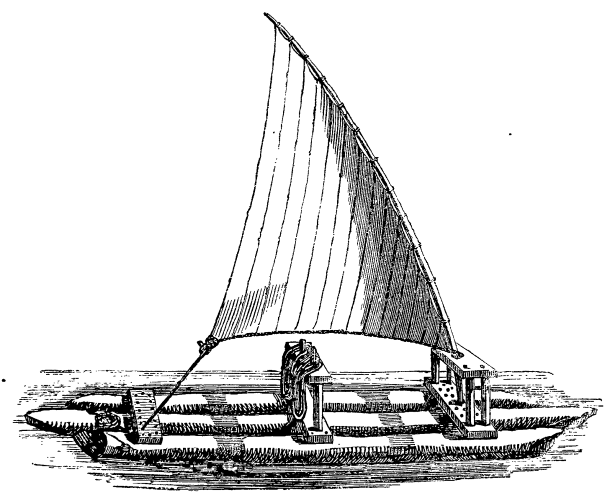
It is easy, but tedious, to burn out hollows in wood; the fire is confined by wet earth from extending too far to the side, and the charred matter is from time to time cleared away, and fresh fire raked back on the exposed surface.

Mr. Gilby informs me that he has travelled with a pair of light sculls and outrigger irons; he could adapt them to many kinds of rude boats, and found them very useful in Egypt.

Keels are always troublesome to make: lee-boards are the best things for a rude boat or punt, if you want her to carry sail; and a rude oar makes the best rudder.

Sect. 3.—Carrying Boats overland.—English-made boats have been carried by explorers for great distances on wheels: they seldom seem to have done much useful service. They would travel easiest if slung and made fast in a strong wooden crate or framework, which is fixed on to the body of the carriage. A white covering is necessary for a wooden boat, on account of the sun: it should be frequently looked at. Mr. Richardson and his party took a boat, divided in four quarters, on camel-back across the Sahara, all the way from the Mediterranean to Lake Tchad. I have already mentioned a portable framework of metal tubes, to be covered with india-rubber sheeting on arrival: it has been suggested to me by a very competent authority.

Copper boats have been much recommended, because an accidental dent, however severe it may be, can be beaten out



without injury to the metal. One of Mr. Lynch's boats was of copper, when he descended the Jordan.

If you have an ordinary boat, and wish to make it of greater burthen, saw it in half and lengthen it. Comparatively coarse carpentering is good enough to do this efficiently.

A simpler sailing boat could hardly be contrived than that shown in the sketch, and used by the Brazilian fishermen. The anchor is made of two pieces of wood lashed together, and weighted with a stone (fig. 1).

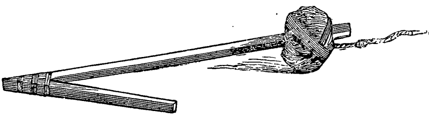


Fig. 1.

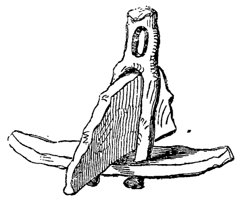


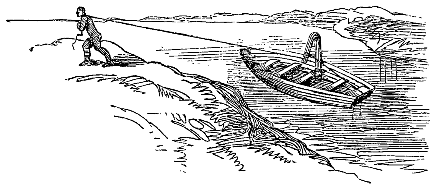
Fig. 2.

Fig. 2 is an anchor used in the Baltic; made of wood, and holding a large flat stone.

Where there is difficulty in "stepping" a mast, use a bar across the thwarts, and two poles, one lashed at either end of it, and coming together to a point above. This triangle takes the place of the masts, and is secured by shrouds fore and aft. This is a very convenient rig for a boat with an outrigger. The Sooloo pirates use it.

Sect. 4.—Hints for Boating Excursions.—To haul up a boat on a barren shore with but a few hands, lay out the anchor ahead of her to make fast your purchase to; or back the body of a waggon underneath the boat as she floats, and so draw her out upon wheels. A make-shift framework, on small, solid wheels, has been used and recommended.

A good way of fastening a tow-rope to a boat is shown in the diagram. A curved pole is lashed alongside one of the knees of the boat; and the tow-rope, passing with a turn or two round its end, is carried on to the stern of the boat. By taking a few turns, more or less, with the hind part of the rope round the stick, the line of action of the tow-rope on the boat's axis



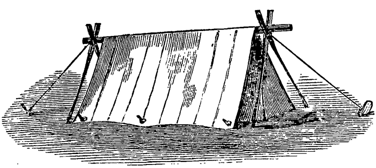
is properly adjusted. When all is right, the boat ought to steer herself.

If caught by a gale, recollect that a boat will lie-to and live through almost any weather if you can make a bundle of a few spare spars, oars, &c., and secure them to the boat's head, so as to float in front of and across the bow. They will act very sensibly as a breakwater, and the boat's head will always be kept to wind. By making a canvas half-deck to an open boat, you much increase its safety in broken water; and, if it be made to lace down the centre, it can be rolled up on the gunwale, and be out of the way in fine weather.

In floating down a stream when the wind blows right against you (and, on rivers, the wind nearly always blows right up or right down), a plan generally employed is to cut large branches, and to make them fast to the front of the boat, to weight them that they may sink low in the water, and to throw them overboard. The force of the stream on these will more than counterbalance that of the wind upon the boat. For want of branches, a kind of water-sail is sometimes made of canvas. In dark nights, when on a river running through pine forests, the mid stream can be kept, by occasionally striking the water sharply with the blade of the oar, and listening to the echoes. They should reach the ear simultaneously, or nearly so, from either bank. On the same principle, vessels have been steered out of danger when caught by a dense fog close to a rocky coast.

Awning.—The best is a waggon-roof awning, made simply of a couple of parallel poles, into which the ends of the bent ribs of the roof are set, without any other cross-pieces. This roof should be of two feet larger span than the width of the boat, and should rest upon prolongations of the thwarts, or else upon crooked knees of wood. One arm of each of these knees is upright, and is made fast to the inside of the boat, while the other is horizontal and projects outside it. It is on these horizontal and projecting arms that the roof rests, and to which it is lashed. Such an awning is airy, roomy, and does not interfere with rowing if the rowlocks are fixed to the poles. It also makes an excellent cabin for sleeping in at night.

A boat's sail is turned into a tent by erecting a gable-shaped framework: the mast or other spar being the ridge-pole, and a pair of crossed oars lashed together supporting it at either end; and the whole is made stable by a couple of ropes and pegs. Then the sail is thrown across the ridge-pole (not over the crossed tops of the oars, for they would fret it), and is pegged out below. The natural fall of the canvas closes up the two ends, as with curtains.



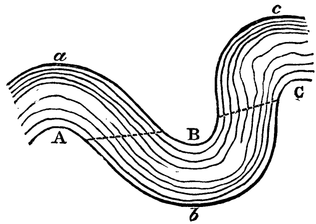
Tree-snakes.—There are rivers with overhanging branches, where travellers should beware of keeping too near in-shore, lest the rigging of the boat should brush down tree-snakes into it.

Buoys.—An excellent buoy is simply a small pole, anchored by a rope at one end. It is very easily seen, and exposes so little surface to the wind and water that it is not easily washed away. A pole the thickness of a walking-stick is much used in Sweden. Such a buoy costs only a rope, a stick, and a stone; a tuft of the small branches may be left on the top.

Sect. 5.—Fords and Bridges.—In fording a swift stream, carry heavy stones in your hand, for you require weight to resist its carrying you away: indeed, the deeper you wade the more weight you require; though you have so much the less at command, on account of the water buoying you up.

Fords must not be deeper than 3 feet for men, or 4 feet for horses. When there is a boat, they can be found by tying a sounding-pole to its stern, rowing down the middle of the stream, and searching those places where the pole touches the bottom.

Otherwise, fords should be tried for where the river is broad rather than where it is narrow, and especially at those places where there are bends in its course. In these, the line of shallow water does not run straight across, but follows the direction of a line connecting a promontory on one side to the nearest promontory on the other, as in the drawing; that is to say, from A to B, or from B to C, and *not* right across from B to *b*, from A to *a*, or from C to *c*. Along hollow curves, as at *a*, *b*, *c*, the stream runs deep, and usually beneath overhanging banks; whilst in front of promontories, as at A, B, and C, the water is invariably shoal, unless it be a jutting rock that makes the promontory. Therefore, by entering the stream at one promontory, with the intention of leaving it at another, you ensure that, at all events, the beginning and end of your course shall be in shallow water, which you cannot do by attempting any other line of passage.



Flying Bridges are well known: a long cord or chain of poles is made fast at one end to a rock in the middle of a river, and at the other end to the ferry boat, which, by being slewed so as to receive the force of the current obliquely, traverses the river from side to side, backwards and forwards.

Passing from hand to hand.—When many things have to be conveyed across a piece of abominably bad road—as over sand-dunes, heavy shingle, mud of two feet deep, a morass, a jagged mountain tract, or over stepping-stones in the bed of a rushing torrent—it is a great waste of labour to make laden men travel to and fro with them. It is a severe exertion to walk at all under these circumstances, letting alone the labour of also carrying a burden. The men should be placed in a line, each six or seven feet from his neighbour, and pass the things from hand to hand, as they stand still.

Swamps.—To take a waggon across a deep miry and reedy swamp, outspan and let the cattle feed. Then cut faggots of reeds, and strew them thickly over the line of intended passage. When plenty are laid down, drive the cattle backwards and forwards over, and they will trample them in. Repeat the process two or three times, till the causeway is firm enough to bear the weight of the waggon. Or, in default of reeds, cut long poles and several short cross-bars, say of two feet long; join these as best you can, so as to make a couple of ladder-shaped frames. Place these across the mud, one under the intended track of each wheel. Faggots strewn between each round of the ladder will make the causeway more sound. A succession of logs, put crosswise with faggots between them, will also do, but not so well.

Bridges.—If you are at the side of a narrow but deep and rapid river, on the banks of which trees grow long enough to reach across, one or more should be felled, confining the trunk to its own bank, and letting the current force the head round to the opposite side; but if "the river be too wide to be spanned by one tree—and if two or three men can in any manner be got across—let a large tree be felled into the water on each side, and placed close to the banks opposite to each other, with their heads lying up-streamwards. Fasten a rope to the head of each tree, confine the trunks, shove the heads off to receive the force of the current, and ease off the ropes, so that the branches may meet in the middle of the river, at an angle pointing upwards. The branches of the trees will be jammed together by the force of the current, and so be sufficiently united as to form a tolerable communication, especially when a few of the upper branches have been cleared away. If insufficient, towards the middle of the river, to bear the weight of men crossing, a few stakes, with forks left near their heads, may be thrust down through the branches of the trees to support them." (Sir H. Douglas.)

Weak ice.—Water that is slightly frozen is made to bear a heavy waggon, by cutting reeds, strewing them thickly on the ice, and pouring water upon them; when the whole is frozen into a firm mass, the process must be repeated.

Plank roads.—"Miry, boggy lines of road, along which people had been seen for months crawling like flies across a plate of treacle, are suddenly, and I may almost say magically, converted into a road as hard and good as Regent Street by the following simple process, which is usually adopted as soon as the feeble funds of the young colony can purchase the blessing.

"A small gang of men with spades and rammers quickly level one end of the earth road.

"As fast as they proceed, four or five rows of strong beams or sleepers, which have been brought in the light waggons of the country, are laid down longitudinally, four or five feet asunder; and no sooner are they in position than, from other waggons, stout planks, touching each other, are transversely laid upon them. From a third series of waggons, a thin layer of sand or grit is thrown upon the planks, which instantly assume the appearance of a more level McAdam road than in practice can ever be obtained.

"Upon this new-born road the waggons carrying the sleepers, planks, and sand, convey, with perfect ease, these three descriptions of materials for its continuance. The work advances literally about as fast as an old gouty gentleman can walk; and, as soon as it is completed, there can scarcely exist a more striking contrast than between the two tenses of what it was and what it is.

"This 'plank road,' as it is termed in America, usually lasts from eight to twelve years, and, as it is found quite unnecessary to spike the planks to the sleepers, the arrangement admits of easy repair, which, however, is but seldom required." (Sir Francis Head, in *Times*, Jan. 2, 1855.)

LINE OF ROAD ACROSS COUNTRY.

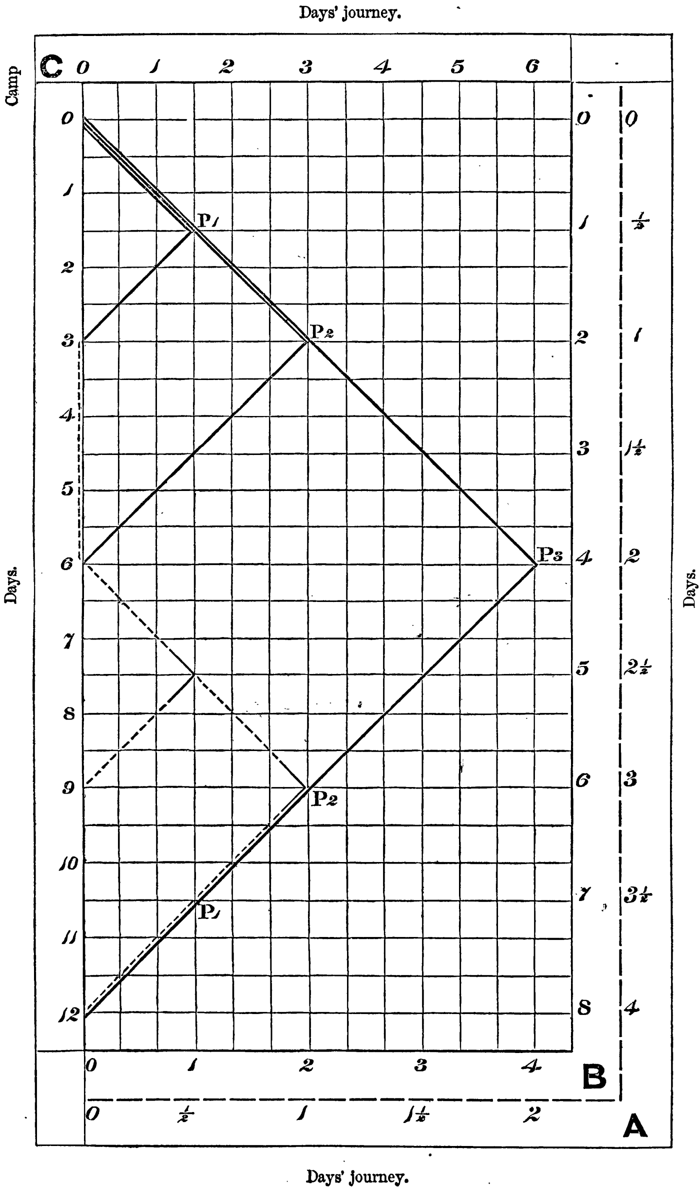
§ 1. Reconnoitring barren Countries.—§ 2. Roads, to mark and follow. —§ 3. Signals.—§ 4. Lost Path.—§ 5. Climbing.—§ 6. Points of the Compass.

Sect. 1.—Reconnoitring barren Countries.—In sending a person to reconnoitre far away from camp, the distance to which he can attain depends directly on the number of days' provision he can carry with him. Half of his load supports him on his way out, the other half on his way home. But, if he be accompanied by a porter, equally laden with provisions, he can reserve his own store, and may supply both himself and the porter from the porter's pack. When about half the porter's pack is consumed, the other half may be divided into two portions. The one, given over to the porter, who makes his way back to camp, and eats it as he goes; the other, buried or câched (see p. 118), to form a depôt, for the traveller to fall back upon when he returns. The traveller can now start from the newly made depôt, with his load untouched; just as he would have started from his camp, if he had had no porter to help him. It is evident that this process may be repeated many times; that a large party of porters might start, and, by successive subdivisions, enable the traveller to reach a position many days' journey ahead of the camp, with as much provisions as he could carry; and, besides that, with food in câche to supply him from place to place all the way home. An inspection of the Table will give a better general idea of what I mean, than a longer verbal description. The dotted lines show how the porters who have first returned, might be despatched afresh as relief parties. However, when one attempts to organize a particular case, it is found to be a particularly puzzling problem: I therefore give a table of the three most important cases. In these, the regular supply of two meals per diem, and a morning and an afternoon journey, are supposed. I wrote a paper on this subject, which is published in the 'Geographical Society's Proceedings,' vol. ii., to which I refer those who care to inquire further into the matter. Cases where each man or horse carries a number of rations intermediate to those specified in the Table, are, perhaps, too complicated for use without much previous practice. It would be easy for a leader to satisfy himself, and to drill his men to any one of the tabulated cases, by planting a row of sticks, 50 yards apart, to represent the successive halting-places of his intended journey, and to make his men go through a sham rehearsal of what they would severally have to do. Then each man's duties could be written down in a schedule, and all possibility of mistake be avoided.

The Table represents the proceedings of four men (or horses and men), who leave camp. Two turn back at P_1, one more turns back at P_2, and the remaining man pushes on to P_3. Food has been câched for him both at P_2 and P_1; but, to make matters doubly sure, a relief party, as shown by the dotted line, can be sent to meet him at P_2.

In case A,	each man		carries	$1\frac{1}{2}$	days' rations.		
„ B,	„	(or horse)	„	$3\frac{1}{2}$	„	for himself	(and drivers).
„ C,	„	„	„	$5\frac{1}{2}$	„	„	„

We will take the case C, as an example. The figures that refer to it are in the lines adjacent to the letter C in the Table. They are those in the uppermost line, and also those in the line up the left-hand side of the diagram, and they stand for days' journey and for days respectively. P_1 is reached after $1\frac{1}{2}$ days' travel, P_2 after 3 days, P_3 after 6 days, from camp. The entire party might consist of 5 men, 2 carts (one a very light one), and 4 horses, together with one saddle and bridle. The heavier cart, and 2 men and 2 horses, would turn back at P_1. One of the two horses of the second cart would be saddled and ridden back by a third man from P_2; and, finally, the remaining cart, single horse, and 2 men, would turn back, after 6 days, from P_3.—The relief party would originally consist of the first cart and 3 horses. On arriving at P_1, a horse and man would be sent


Days' journey.
C
0 1 2 3 4 5 6
Camp
0 1 2 3 4 5 6 7 8 9 10 11 12
Days.
P1
P2
P3
P2
P1
0 1 2 3 4 5 6 7 8
0 ½ 1 1½ 2 2½ 3 3½ 4
Days.
0 1 2 3 4
B
0 ½ 1 1½ 2
A
Days' journey.

back. At P_3, it would have more than enough spare rations to admit of its waiting two whole days for the exploring cart, if it were necessary to do so.

It will be seen from the Table, that 4 days' journey is the limit to which B can explore, and that 2 days is the limit for A. But where abundance of provision is secured at P_2, by means of a relief party, the explorers might well stretch a point, and travel on half-rations to a greater distance than the limits here assigned.

Sect. 2.—Roads, to mark and follow.—(See, also, pp. 120, 121.) What is termed in bush-language a "blaze," is nothing more than notches or slices cut off the bark of trees, to mark the line of road. These blazes are of much use as finger-posts on a dark night. They are best made by two persons; one chipping the trees on his right, and the other those on his left. If the axes are quite sharp, they only need to be dropped against the tree in order to make the chip. Doing so, hardly retards a person in his walking.

Boat or canoe routes through lakes well studded with islands can be well marked by trimming conspicuous trees until only a tuft of branches is left at the top. This is called, in the parlance of the "Far West," a "lopstick."

When gipsies travel, the party that goes in advance leaves marks at cross-roads, &c., in order to guide those who follow. These marks are called "patterans," and there are three sorts in common use. One is to pluck three large handfuls of grass and to throw them on the ground, at a short distance from one another, in the direction taken; another is, to draw a cross on the ground, with one arm much longer than the rest, as a pointer—and there are great advantages in a cross, for it catches many different lights. (In marking a road, do not be content with writing in the dust—an hour's breeze or a shower will efface it; but take a tent-peg, or sharpened stick, and fairly break into the surface, and your mark will be surprisingly durable.) The third of the gipsy patterans is of especial use in the dark: a cleft stick is planted by the road-side, close to the hedge, and, in the cleft, is an arm like a signpost. The gipsies feel for this at cross-roads, searching for it on the left-hand side. (Borrow's Zincali.) A twig, stripped bare, with the exception of two or three leaves at its end, is sometimes laid on the road, with its stripped end pointing forwards.

Other marks, in use in various parts of the world, are—knotting twigs; breaking boughs, and letting them dangle down; a bit of white paper in a cleft stick; spilling water, or liquid of any kind, on the pathway.

Piles of stone are used by the Arabs in their deserts, and in most mountain-tracts.

"An immense length of the road, both in the government of the Don Cossacks and in that of Tambov, is marked out on a gigantic scale by heaps of stones, varying from four to six feet high. These are visible from a great distance; and it is very striking to see the double row of them indicating the line of route over the Great Steppe—undulations which often present no other trace of the hand of man." (Spottiswoode.)

A litter may be made of paper torn into small shreds;—of a stick cut into chips; or of feathers of a bird.

A string, with papers knotted to it, like the tail of a boy's kite. Tie a stone to the end of this, and throw it high among the branches of a tree.

The earth of an old and well-trodden road has a perceptible smell, from the dung, &c., of animals passing over it, especially near to encampments. It is usual at night, when a guide doubts whether or no he is in the track, to take up handfuls of dirt and smell it. It is notorious that cattle can smell out a road.

Where the track is well marked, showers of sparks, ably struck with a flint-and-steel, are sufficient to show it, without taking the pains of making a flame.

If you arrive at the steep edge of a ridge, and have to take your caravan down into the plain, and there appears a likelihood of difficulty in finding a road, descend first yourself as well as you can, and seek about for a good road as you climb back again. It is far more easy to succeed in doing this as you ascend than as you descend: for the reason that, when at the bottom of a hill, its bold bluffs and precipices face you, and you can at once see and avoid them; but when at the top of the hill, these are precisely the parts that you overlook and do *not* see.

Before leaving a well-known track, and striking out at night into the broad open plain, notice well which way the wind blows as regards the course you are about to pursue.

Opera-glasses are invaluable as night-glasses. The eyesight of a man, by their aid, is brought into some degree of comparison with that of night-roving animals.

Mirage.—When it is excessive, it is most bewildering: a man will often mistake a tuft of grass, or a tree, or other most dissimilar object, for his companion, or his horse, or game. "Refraction will baffle a novice, on the ice; but we have learned to baffle refraction. By sighting the suspected object with your rifle at rest, you soon detect motion." (Dr. Kane.)

It is difficult to estimate, by recollection only, the true distances between different points in a road that has been once travelled over. There are many causes of error which may or may not be present, as the accidental tedium of one part, or the pleasure of another; but there is one cause which is never absent in a tiring day's journey, and which usually overpowers the others, and always tends to make the first half of the way appear the longer. It is that, when a man starts, his faculties of observation are far more fresh and active than later in the day; when, from the effect of weariness, even peculiar objects will fail to arrest his attention. Now, as a man's recollection of an interval of time is, as we all know, mainly derived from the number of impressions that his memory has received while it was passing, it follows that, so far as this cause alone is concerned, the earlier part of his day's journey will always seem to have been disproportionately long, and the latter disproportionately short. It is usually very remarkable, after taking a long half-day's walk, and then resting some hours, and subsequently returning, how very long a time the earlier part of the return journey seems to occupy, and how rapidly different marked points seem to succeed one another as one arrives towards home. In this case, the same cause acts in opposite directions in the two journeys.

Sect. 3.—Signals.—To attract the notice of a division of your party, five or even ten miles off, glitter a bit of looking-glass in the sun towards where you expect them to be. It is quite astonishing at how great a distance its flashes will catch the sharp eyes of a bushman who has learnt to know what it is. It is now a common signal in the North American prairies. The sparks from a well-struck flint and steel can be seen at an equal distance. (Sullivan.)

If, instead of flashing with the mirror, the glare be steadily directed to where the party are, it will be seen at a far greater distance, and appear as a brilliant star; but it requires some practice to do this well. The rays from the mirror, whatever its size may be, form a cone whose vertical angle is no greater than that subtended by the diameter of the sun, and it is therefore necessary that the signaller should be satisfied that he throws his flash within that degree of accuracy. Moreover, a rapidly passing flash has far less brilliancy than one that dwells steadily for a fraction of a second.

Since writing the last edition of this book, I have taken great pains to contrive a method by which a signaller should be able to ascertain the direction of his flash: I have done so in the belief that a signalling power of extraordinary intensity could thus be made use of; and, I am glad to say, have succeeded in my attempt. I have at last obtained a pretty pocket instrument, the design of which I placed in the hands of Messrs. Troughton and Simms; and upon the earlier models of which I read a paper before the British Association in 1858. I called it a "hand-heliostat." The instrument is shown in fig. 1, and the principle illustrated in fig. 2. The scale is about $\frac{2}{3}$.

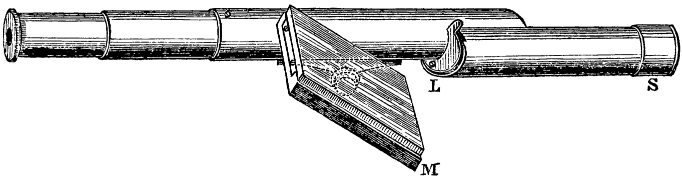


Fig. 1.

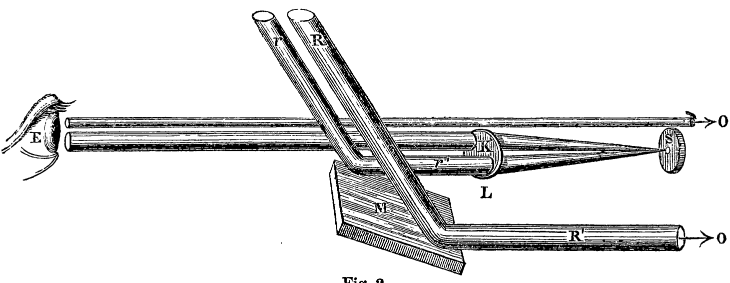


Fig. 2.

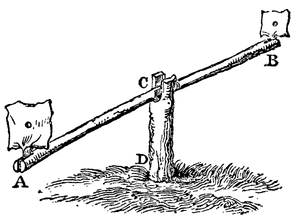
E is the eye of the signaller; M the mirror; and L S a tube, containing at one end, L, a lens, and at the other, S, a screen of white porcelain or *unpolished* ivory, placed at the exact solar focus of L; a shade, K, with two holes in it, is placed before L. Let R, *r*, be portions of a large pencil of parallel rays, proceeding from any *one point* in the sun's surface and reflected from the mirror, as R', *r'* (fig. 2). A part, *r'*, of these rays impinge upon the lens, L, through the right-hand hole of the shade, and the rest, R', go free toward some distant point, O.

Those that impinge on the lens will be brought to a focus on S, where a bright speck of light might be seen. This speck radiates light in all directions; some of the rays, proceeding from it, impinge on the lens at the left-hand hole of the shade, as shown in fig. 2, and are reduced by its agency to *parallelism* with r' and R', that is, with the rays that originally left the mirror: consequently E, looking partly at the edge of the lens, and partly into space, sees a bright speck of light in the former, coincident with the point O in the latter.

What is true for one point in the sun's disc, is true for every point in it. Accordingly, the signaller sees an image of the sun, and not a mere speck of light, in the lens; and the part of the landscape which that image appears to overlay is precisely that part of it over which his flash extends; or, in other words, is that from any point of which a distant spectator may see some part or other of the sun's disc reflected in the mirror attached to the instrument of the signaller. There is no difficulty in signalling when the sun is far behind the back, if the eye-tubes are made to pull out to a total length of five inches, otherwise the shadow of the head interferes. For want of space, the drawing represents the tubes as only partly drawn out. The instrument is perfectly easy to manage, and letters can be signalled by a combination of flashes, which I need not here describe. Its power is perfectly marvellous. On a day so hazy that colours, on the largest scale—such as green fields and white houses—are barely distinguishable at seven miles' distance, a looking-glass no larger than the finger-nail, transmits signals clearly visible to the naked eye.

The result of several experiments in England showed that the smallest mirror visible (under atmospheric conditions such that the signaller's station was discernible, but dim) subtended an angle of one-tenth of a second. It is very important that the mirror should be of truly parallel glass, such as instrument-makers procure. There is loss of power in more than one way from a slight irregularity. A plane mirror only three inches across, reflects as much of the sun as a globe of 120 feet diameter, and looks like a dazzling star at 10 miles' distance.

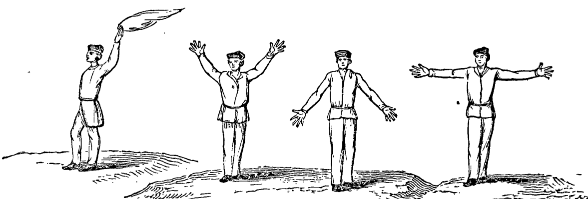
There are makeshift ways of directing the flash of the mirror; as, by observing its play on an object some paces off, nearly in a line with the station it is wished to communicate with. In doing this, be careful to bring the eye to the very edge of the mirror; there should be as little "dispart" as possible, as artillerymen would say. The aim must be a very true one, or the flash will never be seen. An object, in reality of a white colour but apparently dark, owing to its being shaded, shows the play of a mirror's flash better than any other. The play of a flash, sent through an open window, on the walls of a room, can be seen at upwards of 100 yards. It is a good object by which to adjust the above-mentioned instrument. Two bits of paper and a couple of sticks, arranged as in the drawing, serve pretty well to direct a flash. Sight the distant object through the holes in the two bits of paper, A and B, at the ends of the horizontal stick; and, when you are satisfied that the stick is properly adjusted and quite steady, take your mirror and throw the shadow of A upon B, and further endeavour to throw the white speck in the shadow of A, corresponding to its pin-hole in it, through the centre of the hole in B. Every now and then lay the mirror aside, and bend down to see that A B continues to be properly adjusted.



In short reconnoitring expeditions with a small detachment of a party, the cattle or dogs are often wild, and certain to run home to their comrades on the first opportunity; and, in the event of not being able to watch them, owing to accident or other cause, advantage may be taken of their restlessness, by tying a note to one of their necks, and letting them go and serve as postmen, or rather as carrier-pigeons.

Fire-beacons, hanging up a lantern, setting fire to an old nest high up in a tree—make night-signals; but they are never to be depended on without previous concert, as bushes and undulations of the ground may often hide them entirely. The smoke of fires by day is seen very far, and green wood and rotten wood makes the most smoke. It is best to make two fires 100 yards apart. In the old-fashioned semaphores, or telegraphs, with arms to them, it is a common rule to allow, for the length of the arms, one foot for every mile it is intended to be seen from, and the eye is supposed to be aided by a telescope.

A line of men can be turned into a line of semaphores, by making them each hold a cap or something black and large in their hands, and mimic the movements of one another. Only a few simple signals could be transmitted in this way with any certainty. There are four elementary signals, which deserve general adoption. I fear the use of more would perplex. The men ought to be practised at these four.



No. 1. No. 2. No. 3. No. 4.

No.		Signal.
1.	Attend to me; or, come to me	Wave.
2.	All right; or, yes. Affirmation signal ..	Both arms raised.
3.	All wrong; or, no. Negation signal	Both arms lowered.
4.	Stop	Both arms spread.

Energetic movements, of course, intensify the meaning. To use the signals, wave until you are answered; then make your signal while you count five, and wait five. Continue this till your friend does the same, then make a rapid "all right;" he does the same, and all is concluded. In order that you may be seen, try and stand in a position where your friend would see you against the sky.

A kite has been suggested as a day-signal; and also a kite with some kind of squib let off by a slow-light and attached to its tail, as one by night. (Col. Jackson.)

A common signal for a distant scout is, that he should ride or walk round and round in a circle from right to left, or else in one from left to right.

"At other times they will lie concealed near a road, with scouts in every direction on the look-out; yet no one venturing to speak, but only making known by signs what he may have to communicate to his companions or leader. Thus he will point to his ear and foot on hearing footsteps, to his eyes on seeing persons approach, or to his tongue if voices be audible; and will also indicate on his fingers the numbers of those coming, describing also many particulars as to how many porters, beasts of burden or for riding, there may be with the party." (Parkyns.)

Sect. 4.—Lost Path.—If you fairly lose your way in the dark, do not go on blundering hither and thither till you are exhausted; but make a comfortable bivouac, and start at daybreak fresh on your search.

The banks of a watercourse, which is the best of clues, afford the worst of paths, and are quite unfit to be followed at night. The ground is always more broken in the neighbourhood of a river than far away from it, and the vegetation is more tangled. An exploring party travels easier by keeping far away from the banks of streams; they have fewer broad tributaries and deep ravines to cross.

If in the daytime you find that you have quite lost your way, set systematically to work to find it. At all events, do not make the matter doubly perplexing by wandering further. Be careful to ride in such places as to leave clear tracks behind you. Break twigs if you are lost in a woodland, or drag a stick to make a clear trail. Marks scratched on the ground to tell the hour and day that you passed by, will guide a relieving party; and a great smoke is visible a long way. See p. 147; and *Heliostat*, p. 151.

A man who loses himself, especially in a desert, is sadly apt to find his presence of mind forsake him, the sense of desolation is so strange and overpowering; but he may console himself with the statistics of his chance—viz., that travellers, though constantly losing their party, have hardly ever been known to perish unrelieved.

When the lost traveller is dead beat with fatigue, let him lay a strong control on himself; and, erecting some signal—as conspicuous a one as he can—with something fluttering upon it, sit down in the shade, and, listening keenly for any sound of succour, bear his fate like a man. If he gives way to his terror, and wanders wildly about hither and thither, he will do no good and exhaust his vital powers much sooner. His ultimate safety is merely a question of time, for he is sure to be searched for; and, if he can keep alive for two or three days, he will, in all human probability, be found and saved.

When you discover you are lost, ask yourself the following three questions: they comprise the A B C of the art of path-finding, and I will therefore distinguish them by the letters A, B, and C respectively:—

A. What is the least distance that I can with certainty specify, within which the caravan-path, the river, sea-shore, &c., that I wish to regain lies?

B. What is the direction, in a vague general way, towards which the path or river runs, or the sea-coast tends?

C. When I last left the path, &c., did I turn to the left or to the right?

As regards A, calculate coolly how long you have been riding or walking, and at what pace, since you left your party; subtract for stoppages and well-recollected zigzags; allow a mile and a half per hour as the pace when you have been loitering on foot, and three and a half when you have been walking fast. Occasional running makes an almost inappreciable difference. A man is always much nearer the lost path than he is inclined to fear.

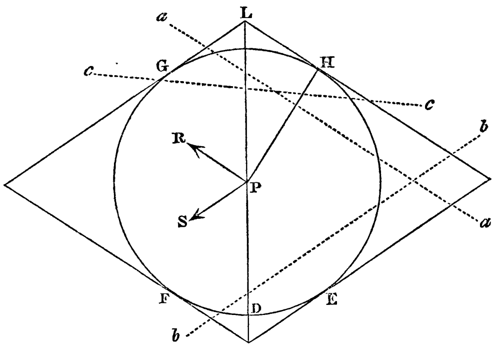
As regards B, if the man recollects C, and also knows the course of the path within eight points of the compass (or one-fourth of the whole horizon), it is a great gain; or even if he knows B to within twelve points, say 120°, or one-third of the whole horizon, his knowledge is admissible. For instance, supposing a man's general idea of the run of the path is, that it goes in a northerly and southerly direction; then he is sure of the fact within eight points, if he is positive that the path does not deviate more than to the N.E. on the one side, or to the N.W. on the other. Similarly, he is sure to twelve points, if his limits, on either hand, are E.N.E. and W.N.W. respectively.

C requires no further explanation.

Now, if a man can answer all three questions, A, B, and C, he is four and a half times as well off as if he could only answer A; as will be seen by the following considerations. A knowledge of B in addition to A is of only one-third the use that it would be if C also were known.

1. Let P be the point where the traveller finds himself at fault, and let P D be a distance within which the path certainly lies; then the circle, D E F, somewhere cuts the path, and the traveller starting from P must first go to D, and then make the entire circuit, D E H F D, before he has exhausted his search. This distance of P D + D E H F D = P D + 6 P D nearly, = 7 P D altogether, which gives the length of road that the man must be prepared to travel over who can answer no other than the question A. Of course, P D may cut the path, but I am speaking of the *extreme* distance which the lost man may have to travel.

2. Supposing that question B can be answered as well as



question A, and that the direction of the line of road lies certainly within the points of the compass, P S and P R. Draw circumscribing parallelogram, G L H E M, whose sides are respectively parallel to P S and P R. Join L M.

By the conditions of this problem, the path must somewhere cut the circle D E F; and since L M cuts L H, which is a tangent to it, it is clear it must cut every path—such as *a a*, parallel to L H, or to P R—that cuts the circle. Similarly, the same line, L M, must cut every path parallel to P S, such as *b b*. Now, if L M cuts every path that is parallel to either of the extreme directions, P R or P S, it is obvious that it must also cut every path that is parallel to an intermediate direction, such as *c c*, but

$$P\,L = \frac{P\,H}{\cos H\,P\,L} = \frac{P\,D}{\cos \frac{1}{2}\,R\,P\,S};$$

the consequence of which is that P L exceeds P D by one-sixth, one-half, as much again, or twice as much again, according as R P S = 60°, 90°, 120°, or 140°.

The traveller who can only answer the questions A and B, but not C, must be prepared to travel from P to L, and back again through P to M, a distance equal to 3 P L. If, however, he can answer the question C, he knows at once whether to travel towards L or towards M, and he has no return journey to fear. At the worst, he has simply to travel the distance P L.

The *probable* distance, as distinguished from the utmost possible distance that a man may have to travel in the three cases, can be calculated mathematically. It would be out of place here to give the working of the little problem, but I append the rough numerical results in a table. The words, "least distance," mean the least distance that the traveller can specify,

	Extreme length of Road it may be necessary to travel.	Probable length of Road it will be necessary to travel.
Knows A, alone	7 times the "least distance"	2 times the "least distance."
Knows A; and B to within 8 points. Not C..	4¼ " "	2¼ " "
Knows A; and B to within 12 points. Not C.	7½ " "	3¾ " "
Knows A and C; and B to within 8 points	1½ " "	¾ " "
Knows A and C; and B to within 12 points..	2½ " "	1¼ " "
Knows A and C; and B to within 13 points..	3½ " "	1¾ " "

with absolute confidence, as that within which the path, &c., he wishes to regain, is situated.

1. The epitome of the whole is this :—1. If you can only answer the question A, you must seek for the lost path by the tedious circle plan; or, what is the same, and a more manageable way of setting to work, by travelling in an octagon, each side of which must be equal to four-fifths of P D. See fig. 2.

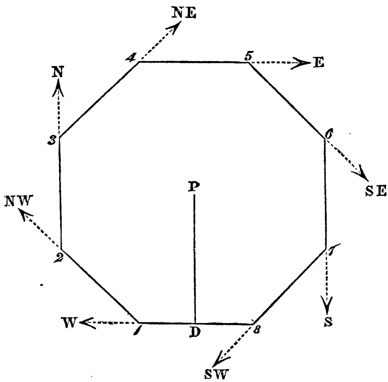


Fig. 2.

That is to say, look at your compass and start in any direction you please; we will say to the south, as represented in the drawing. Travel for a distance, P D; then, supposing you have not crossed the path, turn at right angles, and start afresh,—we will suppose your present direction to be west,—travel for a distance $\frac{2}{5}$ of P D, which will take you to 1; then turn to the N.W. and travel for a distance $\frac{4}{5}$ of P D, which will take you to 2; then to the N. for a similar distance, which will take you to 3; and so on, till the octagon has been completed.

2. If you know B to eight points, and not C, adopt the L M system; also, if you know A and C, and B to within thirteen points (out of the sixteen that form the semicircle), you may still adopt the L M system; otherwise, not. A rough diagram scratched on the ground with a stick would suffice to recall the above remarks to a traveller's recollection.

Faintly-marked paths over grass (blind paths) are best seen from a distance.

Napoleon, when riding with his staff across a shallow arm of the Gulf of Suez, was caught in a fog. He utterly lost his way, and found himself in deeper water. He ordered his staff to ride from him in radiating lines, in all directions, and such of them as should find the water to become shallow, to shout out.

Prairie on fire.—The line of fire, when the grass is below the knee, is so narrow that a man could almost jump across it. Even if a line of twelve feet broad be burnt, it is sufficient to stop the progress of the fire. Travellers accordingly do this to the windward of their camp, beating down the fire with blankets if it extends too far, and then the camp is made secure and the grass is saved for the cattle. (Palliser.)

Sect. 5.—Climbing, &c.—A notched pole or a knotted rope makes a ladder. Colonel Jackson, in his book, 'How to Observe,' gives the following directions for climbing palm-trees and others with very rough barks:—"Take a strip of linen, or two towels or strong handkerchiefs tied together, and form a loop at each end, for the feet to pass tightly into without going through; or, for want of such material, make a rope of grass or straw in the same way. The length should embrace a little more than half of the diameter of the trunk to be climbed. Now, being at the foot of the tree, fix the feet well into the loops, and opening the legs a little, embrace the tree as high up as you can. Raise your legs, and, pressing the cord against the tree with your feet, stand, as it were, in your stirrups, and raise your body and arms higher; hold fast again by the arms, open the legs, and raise them a stage higher, and so on to the top. The descent is effected in the same way, reversing, of course, the order of the movements. The ruggedness of the bark, and the weight of the body pressing diagonally across the trunk of the tree, prevent the rope from slipping. Anything, provided it be strong enough, is better than a round rope, which does not hold so fast. A little practice will soon render this mode of climbing perfectly easy." We hear of people who have tied sheets together to let themselves down from windows, &c., when making an escape. The best way of making a long rope from sheets, is to cut them into strips of about six inches broad, and with these to twist up a two-stranded rope, or plait a three-stranded one.

Descending cliffs with ropes is an art which naturalists and others have occasion to practise. It has been reduced to a system by the inhabitants of some rocky coasts in the Northern seas, where sea-birds build largely, and whose ledges and crevices are crammed with nests full of large eggs, about the end of May and the beginning of June. They are no despicable prize to a hungry native. I am indebted to a most devoted rock-climber, Mr. Woolley, for the following facts. The whole population are rock-climbers in the following places:—St. Kilda, in the Hebrides; Foula Island, in Shetland; the Faroe Islands generally; and in the Westmaröer Islands off Iceland. Flamborough Head used to be a famous place for this accomplishment, but the birds have become far less numerous; they have been destroyed very wantonly.

In descending a cliff, two ropes are used: one a supple, well-

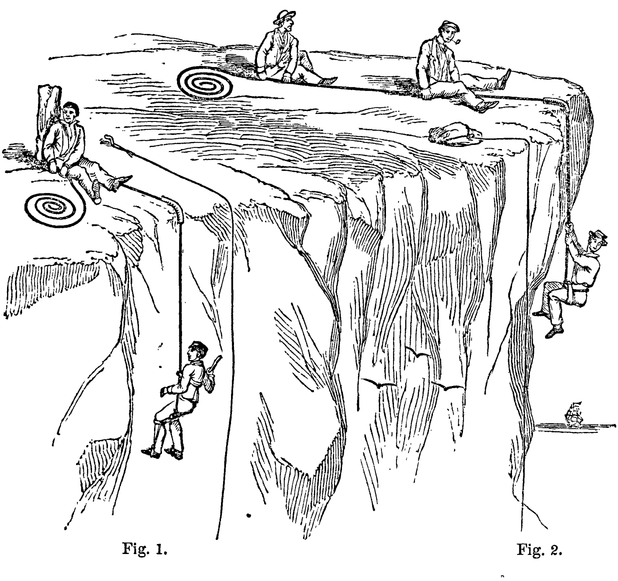


Fig. 1. Fig. 2.

made, many-stranded inch-rope, to which the climber is attached, and by which he is let down; the other is a much thinner cord, left to dangle over the cliff, and made fast to some stone or stake above. The use of the second rope is for the climber to haul upon when he wishes to be pulled up. By resting a large part of his weight upon it, he can make the task of pulling him up much more easy. He can also convey signals by jerking it. A usual rock-climbing arrangement is shown in fig. 2. One man with a post behind him, as in fig. 1, or two men, as in fig. 2, are trusted with the letting down of a comrade to the depth of 100 or even 150 feet. They pass the rope either under their thighs or along their sides, as shown in the figures. The climber is attached to the rope, as shown in fig. 2. The band on which he sits is of worsted. A beginner ought to be attached far more securely to the rope.

(I have tried several plans, and find that which is shown in fig. 2 to be thoroughly comfortable and secure. A stick forms the seat; at either end of it is a short stirrup; garters secure the stirrup leathers to the knees; there is a belt under the arms.)

It is convenient, but not necessary, to have a well-greased leather sheath, a tube of eighteen inches in length, through which the rope runs, as shown in fig. 1. It lies over the edges of the cliff, and the friction of the rock keeps it steadily in its place.

It is nervous work going over the edge of a cliff for the first time; however, the sensation does *not* include giddiness. Once in the air, and when confidence is acquired, the occupation is very exhilirating. The power of locomotion is marvellous: a slight push with the foot, or a stick, will swing you twenty feet to a side. Few rocks are so precipitous but that a climber can generally make some use of his hands and feet; enough to cling to the rock when he wishes, and to clamber about its face. The wind is seldom felt against the face of a precipice: it may blow a gale above, but the air will be comparatively still upon its face; and there is no practical danger in a chance gust dashing the climber about the rocks. A short stick is useful, but not necessary.

Cautions.—1. As you go down, test every stone carefully. If the movement of the rope displaces one of them, after you have been let down below it, it is nearly sure to fall upon your head.

Some climbers use a kind of helmet as a partial protection against these very dangerous accidents. 2. Take care the rope does not become jammed in a cleft, or you will be helplessly suspended in mid-air. 3. Keep the rope pretty tight when you are clambering about ledges; else, if you slip, the jerk may break the rope, or be too much for the men who are holding it above.

Turf or solid rock is much the best for the rope to run over. Good ropes are highly valued. In the Faroes they tar them excessively; they are absolutely polished with tar. In St. Kilda, leather ropes are used: they last a lifetime, and are a dowry for a daughter. A new rope spins terribly.

Snow Mountains.—The following is a short account of the suggestions for Alpine travellers that are given by the editor of 'Peaks, Passes, and Glaciers, by Members of the Alpine Club.' The real dangers of the high Alps may be reduced to three:—1. Yielding of snow-bridges over crevices. 2. Slipping on slopes of ice. 3. The fall of ice, or rocks, from above. Absolute security from the first is obtainable by tying the party together at intervals to a rope. If there be only two in company, they should be tied together at eight or ten paces apart. Against the second danger, the rope is almost equally effective. For climbing steep slopes of ice, the axe is necessary, though authorities are not yet agreed upon the best shape for the axe. Crampons are not in favour, but double-headed steel screws, to be screwed into the sole and heel, are generally liked: they are sold by Lund of Fleet-street. Alpenstocks should be of tough ash, well seasoned, and shod with a point of hardened steel three inches long. Against the third danger there is no resource but circumspection. Ice falls chiefly in the heat of the day; the falling rocks nearly always come from limestone cliffs. (See *Mountaineering* and *Snow* in Index.)

Leaping-poles, &c.—In France they practise a way of crossing a deep brook by the help of a rope passed round an overhanging branch of a tree growing by its side. They take a run and swing themselves across, pendulum fashion. It is, in fact, the principle of the leaping-pole reversed.

Sect. 6.—Points of the Compass.—The confusion between true and magnetic bearings is puzzling and endless. Sir Thomas Mitchell's exploring party very nearly sustained a loss by mistaking one for the other. I should certainly recommend that the points of the compass, viz. North, N.N.E., &c., should be used for none except true bearings; and the degrees, as 25° (or N. 25° E.), for none except magnetic. There is no reason why the two nomenclatures should interfere with one another, for a traveller's recollection of the lay of a country depends entirely upon true bearings—on sunrise, sunset, and the stars; but his surveying data, which find no place in his memory, but are simply consigned to his note-book, are invariably registered in degrees. To carry out this principle, I should advise a little round of paper to be pasted in the middle of the traveller's pocket-compass card, almost large enough to hold the rhumbs in the centre of it, but leaving the degrees round its rim quite untrespassed upon. On this the points of the compass should be so marked as to be as true as possible for the country about to be visited.

It will be found a great advantage to have the bottom of the compass, as well as the top, made of glass, and arrowheads cut in the card parallel to the due north and south line; for at night, by holding up the compass between the eye and the sky, the position of the cuts can plainly be seen. Otherwise in the dark, which is precisely the time when a compass is most needed, it is impossible to consult it; the light of a pipe or cigar being insufficient. The pivot on which the card turns should be fixed into a slight cross-bar, which the bottom glass protects from injury.

The compass-needle is often found to be disturbed, and sometimes quite bewitched, when laid upon bare masses of granitic rocks, such as are frequently found at the tops of mountains. Hornblende, a common constituent of granitic rocks, contains thirty per cent. of iron, and hence the disturbance. Explorers naturally select hills as their points of triangulation; but, for the above-mentioned cause, and also because of the occasional presence of other iron-bearing ores in rocky strata, the compass results, if unchecked by the sun, are never so reliable as those taken on a plain.

Bearings by moss, &c.—The moss that grows strongest on the north side of firs and other trees, in the latitude of Europe, gives, as is well known, a clue by which a course may be directed through a forest. For, looking on the surrounding masses of trees, much more moss will be observed in some one direction than in any other; and that moss, lying as it does on the north side of the several trees, is of course due south with reference to an observer standing opposite. And as he walks on, and fresh trees come constantly in sight, he is able to correct any slight error of direction into which the peculiarities of particular trees may at first have led him.

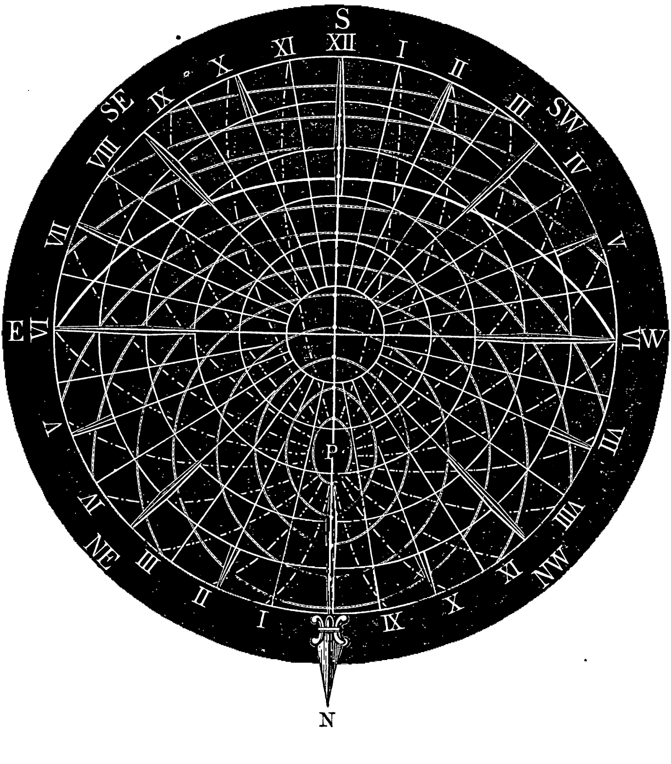
The Siberians travel guided by the ripples in the snow, which run in a pretty fixed direction, owing to the prevalence of a particular wind. The ripples in a desert of sand are equally good as guides; or the wind itself, if it happens to be blowing, especially to a person pushing through a tangled belt of forest.

It requires very great practice to steer well by stars, for, on an average, they change their bearings even faster than they change their altitudes. In tropical countries, the zodiacal stars—as Orion and Antares—give excellent east and west points. The Great Bear is useful when the North Pole cannot be seen, for you may calculate by the eye whereabouts it would be in the heavens when its "pointers" were vertical, or due north; and the Southern Cross is available in precisely the same way. The true North Pole is three diameters of the full moon to the side of the Polar star, and between it and the Great Bear.

In the old days, coasting sailors sometimes took pigeons with them, and, when at fault, let one fly, which it did at once to the land.

An almanac, calculated to show the bearing, and not only that, but also the times of moonrise and moonset for the country travelled over, as well as those of sunrise and sunset, is a very great convenience. (See *Instruments*, p. 277.)

The following diagram is intended to be traced out in lines of different colours, when it will be found to be far less confused than it now appears to be.



Its object is to enable a traveller to use the sun, both as a rude watch and as a compass. It is calculated for the latitude of London, but will do with more or less accuracy for the whole of England. A traveller to other countries may draw up a sufficiently complete one, and on a larger scale, if he prefers it, for himself, by using the Azimuth tables and the Horary tables of Lynn.

The diagram represents, 1st, circles of equal altitudes ; 2ndly, the path of sun, stars, &c., for each 10th degree of declination; 3rdly, the hour angles, all projected down upon—4thly—the level compass card.

Thus, six circles are drawn round the centre of the compass card at equal distances apart, each ring between them representing a space of 15° in altitude.

The following was then calculated for each 10th degree of declination in turns, viz. :—What is the height of the sun, &c., at each point of the compass that is crossed by it, when above the horizon? 2ndly, what is the bearing of the sun at each consecutive hour? These points were all dotted out; and, by joining the several sets of them, the card was drawn,

The broken lines which radiate in curves from P, are the hour lines; those which surround P in more or less complete ovals, are the paths of the sun, &c., for each 10th degree of declination, the prominent line running from E. round to W. being its path when on the Equator.

The diagram, when it is traced out for use, should have the names of the months written in coloured ink on either side of the south line at places corresponding to the declination of the sun during those months; viz, :—

Jan.	S. 23°	to	S. 17°	July	N. 23°	to	N. 18°
Feb.	S. 17	,,	S. 8	Aug.	N. 18	,,	N. 8
March	S. 7	,,	N. 4	Sept.	N. 8	,,	S. 3
April	N. 5	,,	N. 15	Oct.	S. 3	,,	S. 14
May	N. 15	,,	N. 22	Nov.	S. 15	,,	S. 22
June	N. 22	,,	N. 23	Dec.	S. 22	,,	S. 23

To use the traced out card.—Begin by drawing a broad pencil line, which may afterwards be rubbed out, corresponding to the date of travel, and there will be no further confusion.

Then, to know what o'clock it is, "span out" roughly the altitude of the sun; and when the altitude obtained crosses the pencil mark, there will be the position of the sun. The hour is at once read off; and the compass card is adjusted by holding it level, and turning it round until a line, drawn from its centre through the point in question, points towards the sun. See "Spanning," p. 285.

As to the moon or a star, if its declination be unknown, but its bearing and altitude be given, its declination and path will be found, and therefore the time since its rising or before its setting; a most useful piece of information to a traveller.

Watches break, and compasses cannot be used on the road without stopping, and therefore this diagram, of which any number of copies may be traced out, may serve for common rough purposes.

HEAVY BODIES, TO MOVE.

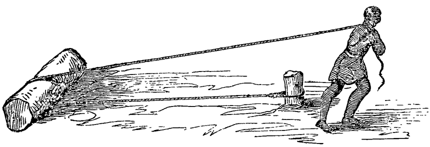
§ 1. Heavy Bodies, to Move.—§ 2. Knots.—§ 3. Substitutes for String and Cord.

Sect. 1.—Any heavy Body can be raised by levering up its ends alternately, and building underneath them when lifted up. After a sufficient height has been gained, it is often practicable to build a sloping causeway down to the place to which the mass has to be moved, and along which it may be dragged, with the assistance of rollers and grease. If the mass be too awkwardly shaped to admit of this, it may at all events be raised by passing poles underneath it, and raising the ends of these poles alternately. Mr. Williams, the well-known missionary of the South Sea Islands, relates how his schooner of from seventy to eighty tons had been driven by a violent hurricane and rising of the sea on one of the islands near which she was anchored, and was lodged several hundred yards inland; and thus describes how he got her back:—

"The method by which we contrived to raise the vessel was exceedingly simple, and by it we were enabled to accomplish the task with great ease. Long levers were passed under her keel, with the fulcrum so fixed as to give them an elevation of about forty-five degrees. The ends of these were then fastened together with several cross-beams, upon which a quantity of stones were placed; the weight of which gradually elevated one end of the vessel, until the levers reached the ground. Propping up the bow thus raised, we shifted our levers to the stern, which was in like manner elevated; and, by repeating this process three or four times, we lifted her in one day entirely out of the hole (which she had worked for herself, and which was about four feet deep). The bog that lay between her and the sea was then filled up with stones, logs of wood were laid across it, rollers were placed under the vessel, the chain cable passed round her; and, by the united strength of about 2000 people, she was compelled to take a short voyage upon the land, before she floated in her pride on the sea." (Williams' 'Missionary Enterprise.')

In some cases, the body of a cart may be taken down, and deep ruts having been dug on each side of the mass, the wheels can be backed, till the axletree comes across it; then, lashing and making fast, the mass can be drawn away upon wheels.

Parbuckling.—A round log or a barrel is to be rolled, not dragged; and many irregularly-shaped objects may have bundles



of faggots lashed round them, by which they become barrel-shaped and fit to be rolled. In these cases, parbuckling gives a double purchase; one or more ropes have one of each of their ends made fast in the direction to which the log has to be rolled, while the other is carried underneath the log, round it, and back again. By pulling at these free ends, the log will be rolled on. An equivalent plan, and in some cases a more practicable one, is to make fast one end of the rope to the log itself; then, winding the rope two or three times round it, like cotton on a reel, to haul at the free end as before. Horses can be used, as well as men, for this work.

The huge blocks of marble quarried at Carrara are shipped in the small ships of the country as follows:—at low water the vessel is buried bodily in the sand, and a temporary railway laid down from the quarry to withinside of it. Along this the blocks are conveyed, and when deposited in the ship the sand is dug away from under them, and they settle down into its hold, and the ship floats away at the returning tide.

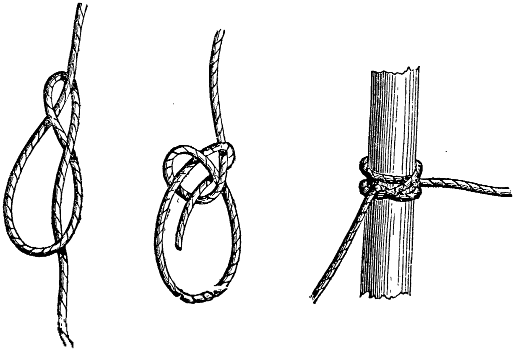
If the weight be in water, a boat, raft, &c., may be brought over it and sunk to its gunwales; then, making fast, the boat can be baled and the thing floated away.

"Although from its bulk several men might be puzzled to lift a cow-fish from the water when dead, yet one single Indian will stow the largest in his montaria without assistance. The boat is sunk under the body, and rising, the difficult feat is accomplished." (Edwards' 'Amazon.')

In some cases, a raft may be built round the mass, which can be floated away by the tide, or a flush of water; or a sledge may be built under it, upon which it may be dragged away by a team.

South American Indians are said to avail themselves of their forest trees, and the creepers which stretch from branch to branch, in moving very heavy weights, as in lifting a log of timber up on a stage to be sawn, in the following ingenious manner. The labourer gets hold of one of these creepers that runs from the top boughs of a tree in the direction in which he wants to move his log, and pulling this creeper home with all his force, bending down the bough, he attaches it to the log; then he goes to another creeper and does the same with that; and so on until he has the accumulated strain of many bent boughs, urging the log forward and of sufficient power to move it.

Sect. 2.—Knots.—The three elementary knots, which every one should know, are here represented,—viz., the Timber-hitch, the Bowline, and the Clove-hitch. (See also *Knots*, in Index.)



The virtues of the timber-hitch are, that, so long as the strain upon it is kept up, it will never give; when the strain is taken off, it is cast loose immediately.

The bowline makes a knot difficult to undo; with it the ends of two strings are tied together, or a loop made at the end of a single piece of string, as in the drawing. For slip-nooses, use the bowline to make the draw-loop.

The clove-hitch binds with excessive force, and by it, and it alone, can a weight be hung to a smooth pole, as to a tent-pole. A kind of double clove-hitch is generally used, but the simple one suffices, and is more easily recollected.

The following additional remarks deserve attention:—

A timber-hitch had better have the loose end twisted more than once; it is liable to slip, if not.

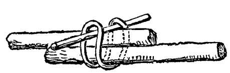
To tie a bowline, or any other knot for temporary purposes, insert a stick into the knot before pulling tight. The stick will enable you, at will, to untie the knot—to break its back, as the sailors say—with little difficulty.

A bowline is firmer, if doubled; that is, if the lower loose end in the figure be made to wrap round a second time.

A double clove-hitch is firmer than a single one; that is, the rope should make two turns, instead of one turn, round the pole beneath the lowest loose end in the figure.

To make a large knot at the end of a piece of string, to prevent it from pulling through a hole, turn the end of the string back upon itself, so as to make it double, and then tie a common knot. The string may be quadrupled instead of doubled, if required.

A toggle and strap is a tourniquet. A single or a double band is made to enclose the two pieces of wood it is desired to lash together. Then a stick is pushed into the band and forcibly twisted round. The band should be of soft material, such as the strands of a rope that has been picked to pieces on purpose. The strands must, each of them, be untwisted and well rubbed with a stick to take the kink out of them, and finally twisted in a direction opposite to their original one.



Sect. 3.—Substitutes for Thread, String, and Cord.—Thongs cut spirally, like a watch-spring, out of a piece of leather or hide, and made pliant by working them round a stick.

Sinew, see p. 184.

Catgut, &c., see p. 183.

Inner bark of trees: this is most easily separated by long steeping in water. Chewing it is better.

Roots of trees, as the spruce-fir, split to the proper size.

Woodbines, runners, or pliant twigs twisted together.

Some seaweeds. The only English one of which I have heard, is the common olive-green weed called *Chorda Filum;* it is like a whip-thong, slippery to the touch, and will grow to a length even of thirty or forty feet. When half dried, it is skinned and twisted into fishing-lines, &c.

Hay-bands.

Horse-hair ropes, or even a few twisted hairs from the tail of a horse.

The stems of numerous plants afford fibres that are more or less effective substitutes for hemp. Those peculiar to the country visited should be noticed.

"Indian grass" is an animal substance attached to the ovaries of small sharks, &c.

Pulleys and blocks do not fall within the province of this book. They require what travellers can rarely get: abundance of good rope and a place to make fast to.

See also *Sheeting ropes*, p. 160; and *fishing lines*, p. 251.

CARPENTRY AND SMITH'S WORK.

§ 1. Tools and Fixtures.—§ 2. Lashings of raw Hide.—§ 3. Seasoning and bending green Wood.—§ 4. Bark, to procure.—§ 5. Blacksmith's Work.—§ 6. Tinsmith's Work.

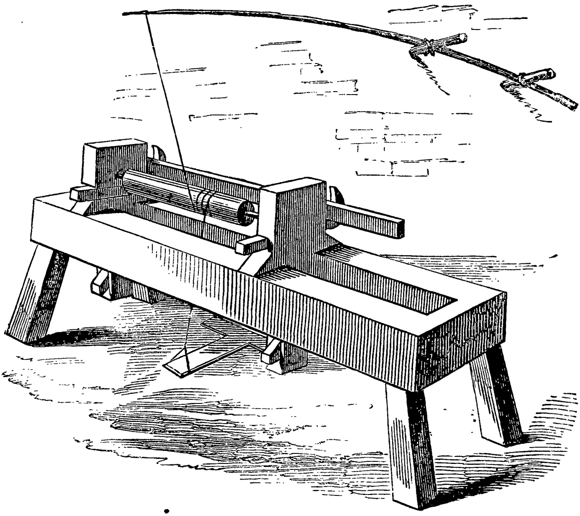
A MAN will get through most work with his tools, if he stops from time to time to sharpen them up. The son of Sirach says, speaking of a carpenter,—"If the iron be blunt, and he do not whet the edge, then must he put to more strength; but wisdom is profitable to direct."—*Eccles.*

Sect. 1.—Tools and Fixtures.—A great deal of joinery can be done with a small axe with a hammer-head, a very small single-handed adze, a mortise-chisel, a strong gouge, a couple of medium-sized gimlets, a few awls, a small Turkey-hone, and a whetstone. If any saw be taken, it should be of a sort intended to cut green wood.

In addition to these, a small tin box full of tools, all of which fit into a single handle, is very valuable; many travellers have found them of the greatest convenience. Unfortunately, they are rather difficult to be met with, as there is now no general demand for them. Those should be taken that are made by one of the best makers. The box that contains them is about six inches long by four broad and one deep; their cost is from 20*s.* to 30*s.* Lastly, a saw for metals, a few drills, and small files, may be added with advantage. It is advisable to see that the tools are ground and set before starting. A small "hard chisel" of the best steel, three inches long, a quarter of an inch wide, and three-eighths thick—which any blacksmith can make—will cut iron, and will chisel marks on rocks, and give wonderful help in numerous emergencies.

Tools of too hard steel should not be taken; they splinter against the dense wood of tropical countries, and are very troublesome to sharpen. The remedy is to heat them red hot and to quench in grease to re-temper them. A little iron axe, with a file to sharpen it, and a few awls, are (if nothing else can be taken) a very useful outfit.

A lathe is of universal use; the pulleys necessary for a large sailing-boat, and the screw for a carpenter's bench, cannot be



made without one; and cups and bowls may easily be turned. The sketch will call to mind the original and now almost forgotten machine. It is obvious that very makeshift contrivances can be set up on this principle, two steady points being the main things wanted. A forked bough will make a treadle, that need not be hinged to the ground in any way. The Burmese lathe is still simpler; neither pole nor treadle is used, but an assistant takes one end of the string in one hand, and the other end in the other hand, and hauls away in a see-saw fashion.

For turning hollows, a long spike is used instead of a short point. Then, a hole is bored into the wood to the depth of the intended hollow, and the spike is made to abut against the bottom of the hole.

Sect. 2.—Lashings of raw Hide.—These supersede nails for almost every purpose. It is perfectly marvellous how a gun-stock, for instance, that has been broken into splinters, can be made as strong again as ever, by raw hide sewn round it and left to dry; or, instead of sewing it on, the skin of an ox's leg may be drawn like a stocking over it. It is well to treat your bit of skin as though parchment (p. 183) was to be made of it, burying it and scraping off the hairs before sewing it on. In this way it makes no eyesore. Tendons and any stout fish-skin, such as shagreen, may also be used on the same principle. An axletree, cracked lengthwise, can be mended with raw hide, and a broken tire may be replaced with rhinoceros or other thick hide; if the country to be travelled over be dry.

Sect. 3.—Seasoning and bending green Wood.—Green wood cannot be employed in carpentry, as, besides being very weak, it warps, cracks, and becomes rotten, and wood dried too quickly loses its toughness as well as pliability. Green wood is thoroughly seasoned by steaming the sap out of it in a boiler, and then drying it thoroughly. A makeshift way of doing all this at one simple operation, is to dig a long trench, and make a roaring fire in it; when the ground is burning hot, sweep the ashes away, deluge the trench with boiling water, and in the middle of the clouds of steam that arise, throw in the log of wood, shovel hot earth over it, and leave it to steam and bake. A log thick enough to make an axletree will thus be somewhat seasoned in a single night-time. And there seems no reason why the seasoning should not be perfect, if care was taken in acting up to the theory of the operation. The log would be steamed all the more easily if it were saturated with boiling water before it was put in the trench, and that can always be done by laying it into a deep narrow puddle, and shovelling hot stones into the water. All crowbars, waggon-lifters, &c., should undergo this process at least, as green wood is far too weak for such uses.

The proper way of seasoning is to leave the timber to soak long in water, that the juices may be dissolved out. Fresh water is better than salt, but a warm mineral spring is excellent for the purpose. Parties travelling with a waggon ought to fell a little timber on their outward journey, and leave it to season against their return, in case of strained axletrees, broken poles. &c. They might, at all events, cut a ring round through the bark and sap-wood of the tree, and leave it to die, to discharge its juices, and become half-seasoned as it stands.

To bend wood, or to straighten it if bent, it must be steamed, or, at least, be submitted to hot water. A rod of green wood may be taken, passed through the ashes of a smouldering fire, and, when hot, bent and shaped with the hand; or, if the wood be dry, it must first be soaked in a pond or puddle, till thoroughly wet, and then treated in the same way. If the puddle is made to boil by shovelling in hot stones, as described a few lines back, it makes the subsequent operation all the more easy. The long straight spears of savages are often made out of wood that was bent in many ways, when cut from the tree, but straightened by them in the ashes of their camp fires. A thick piece of wood may be well swabbed with hot water, forcibly bent, as far as can be safely done, tied in position, and steamed as for seasoning, in a trench. After a quarter of an hour, it must be taken out, bent further, and again returned to steam, and so on till it is of the shape required; when bent, it should be left quiet in the trench to season thoroughly. Dry wood can be bent in the same way, and more effectively, but not so quickly as green wood.

The heads of dog-sledges, and the pieces of wood for snow-shoes, &c., are bent, after being well swabbed with hot water, and are then secured in the regular shape and are dried quickly and thoroughly.

Sect. 4.—Bark, to procure.—Bark is universally used in Australia for roofs of huts and temporary buildings; the colonists learnt the use of it from the natives, and very probably some trees, at least, in every forest country might be found as well fitted for that purpose as those in Australia. The bark admits of being easily removed only when the sap is well up in the tree, but a skilful person will manage to procure bark at all seasons of the year, except in the coldest winter months; and even then he will light on some tree, from the sunny side of which he can strip broad pieces. The process of bark-stripping is simply to cut two rings right round the tree (usually from six to nine feet apart), and one vertical slip to join them; starting from the slit, and chipping away step by step on either side, the whole cylinder of bark is removed. The larger the tree the better, for if the tree is less than eighteen inches, or so, in diameter, the bark is apt to break when flattened out. When stripped for huts, it is laid on the ground for some days to dry, being flattened out on its face, and a few stones or logs put on it. The ordinary bark of gum-trees is about half an inch to three-eighths thick, so that a large sheet is very heavy. Most exploring expeditions are accompanied by a black, whose dexterity in stripping bark for a wet night is invaluable, as, if the bark will "come off" well, he can procure enough of it in an hour's time to make a shelter for a large party. See p. 67.

Sect. 5.—Blacksmith's Work.—It is of no use attempting to do blacksmith's work if you have not a pair of bellows. These can be made of a single dressed goat-skin, and are sufficient, in skilful hands, to raise small bars of iron to a welding heat. The goat's head is cut off close under the chin, his legs at the knee-joint, and a slit is made between the hind legs, through which the carcase is entirely extracted. After dressing the hide, two strongish pieces of wood are sewn along the slit, one at each side, just like the ironwork on each side of the mouth of a carpet bag, and for the same purpose, *i. e.* to strengthen it. Then, after opening these and pulling out the skin, they are suddenly shut, and made to enclose a bagful of air; this, by pushing the skin flat home, is ejected out of the neck, into which a nozzle must be inserted. These bellows require no valve, and are the simplest that can be made: they are in use throughout India.

The tubes to convey the blast may be made of clay or loam, plastered together with grass and moulded round a smooth pole.

Welding composition for iron or steel, is "Borax 10 parts, sal ammoniac 1 part; pounded, melted, run out on an iron plate, and, when cold, pounded for use."

Fuel.—Dry fuel gives out far more heat than damp or undried. As a comparison of different heating powers, 1 lb. of dry charcoal raises 73 lbs. of water from freezing to boiling; 1 lb. of pit coal, about 60 lbs.; and 1 lb. of peat, about 30 lbs. Some manure-fuel gives intense heat, and is excellent for blacksmith's purposes, in default of charcoal. That of goats and sheep is the best. Camels' dung is next, but not nearly so good; then that of oxen. Last in the list comes horses': it is of little use, except as tinder in lighting a fire.

Case-hardening is the name given to a simple process, by which the outside of iron tools can be turned into steel. Small tools, fish-hooks, keys, &c., are usually of iron, case-hardened—finished first, and case-hardened afterwards: because, while steel is hard, iron is tough; and anything of iron, coated with steel, combines the advantages of both metals. Take a scrap of leather, hide, hoof, horn, flesh, blood—anything, in fact, that has animal matter in it (even *vegetable* charcoal does)—dry it into hard chips before a fire, and powder it. Then put the iron that has to be case-hardened, with some of this powder round it, into the midst of a lump of loam. This is first placed near the fire to harden, and then quite into it. It should attain to a blood-red heat, and no higher. Lastly, break open the lump, take out the iron, and drop it into water to harden.

Steel.—A mixture of 100 parts of soft iron, and two of lamp-soot, melts as easily as ordinary steel—more easily than iron. This is a ready way of making cast-steel where great heat cannot be obtained.

Lead is a very useful metal to a traveller, as he can easily melt his bullets and cast them into any shape, with the aid of paper or wood or earth, partly buried in the earth. The lead in the ladle should not be so hot as to char a strip of paper to blackness; much less, so hot as to set fire to it.

Fig. 1 shows how to cast a plate, useful for inscriptions, as notices to other parties. When minced into squares, it makes a substitute for shot. Fig. 1 represents two flat pieces of wood, enclosing a folded piece of paper, and buried in the earth; the lead is poured into the paper.

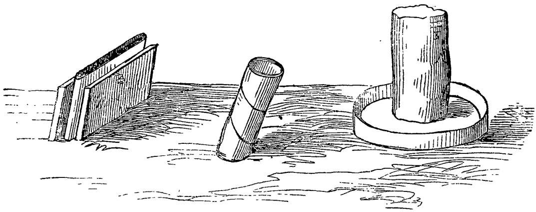


Fig. 1. Fig. 2. Fig. 3.

To cast a rod, roll up a piece of paper (fig. 2), and bury it in the earth. It makes a mould for a pencil, or a rod, which, when cut into short lengths, makes slugs.

To cast a lamp, a bottle, or other hollow article (fig. 3), use a cylinder of paper buried in the ground, and a stick held fast in the middle, while the lead is poured round. Loose shaky articles often admit of being set to rights by warming the joints, and pouring a little melted lead into the cracks.

Sect. 6.—Tinsmith's Work.—Solder for tin plates is made of one or two parts of tin, and one lead. To solder, the surfaces must be quite bright and close together; and the contact of air must be excluded during the operation, else the heat will tarnish the surface. The borax and resin commonly in use effect this. The point of the soldering-tool must be filed bright. A traveller ought certainly to have an hour's practice in soldering before he starts.

Copper, to tin.—Clean the copper well with sandstone; heat it, and rub it with sal ammoniac, till it is quite clean and bright. The tin, with some powdered resin, is now placed on the copper, which is made so hot as to melt the tin, and allow it to be spread over the surface with a bit of rag. A very little tin is used in this way. It is said that a piece as big as a pea would tin a large saucepan (twenty grains of tin to a square foot of copper).

SKINS, HORNS, ETC.

§ 1. Curing Skins and dressing them.—§ 2. Parchment and Catgut.—
§ 3. Horn, Glue, and Isinglass.

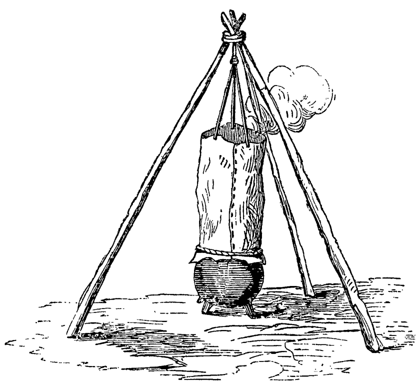
Sect. 1.—Curing Skins and dressing them.—Dressed skins are so essential to a traveller in an uncivilised country—as they make his packing-straps, his bags, his clothes, shoes, nails, and string—that no hides should be wasted. And I may here again remark, that all leather articles should be now and then well rubbed with fat, when used in hot, dry climates: it makes a difference of many hundred per cent. in their wear. It is a great desideratum to be possessed of a supply of fat, and it is not easy to obtain from antelopes and other sinewy game. The French troops adopt the following method, which Lord Lucan copied from them when in the Crimea:—the marrow-bones of the slaughtered animals are broken between two stones; they are then well boiled, and the broth is skimmed when cold. After a hide is flayed from a beast, if it is not intended to "dress" it, it should be pegged out in the sun. If simply sun-dried it will keep: most small furs that reach the hands of English furriers, are merely sun-dried. If rubbed over with wood-ashes, and also sun-dried, it will keep better. If with salt, better still. Smoking hides over a smouldering fire for some days has a strong preservative effect, especially against the effects of water. Hides are salted before being shipped for Europe to be tanned, to preserve them; and, although a cured skin is injured for dressing by the hand, it is not entirely spoiled: and therefore the following extract from Mr. Dana's 'Two Years before the Mast' may be of service to travellers who have shot many head of game in one place, or to those who have lost a herd of goats by distemper.

Hide-curing.—"The first thing is to put the hides to soak. This is done by carrying them down at low tide, and making them fast in small piles by ropes, and letting the tide come up and cover them. Every day we put 25 in soak for each man, which with us made 150. There they lie 48 hours, when they are taken out and rolled up in wheelbarrows, and thrown into vats. These vats contain brine made very strong, being sea-water with great quantities of salt thrown in. This pickles the hides, and in this they lie 48 hours: the use of the sea-water into which they are first put being merely to soften and clean them.

"From these vats they are taken to lie on a platform 24 hours, and are then spread upon the ground and carefully stretched and staked out, so that they may dry smooth. After they were staked, and while yet wet and soft, we used to go upon them with our knives, and carefully cut off all the bad parts: the pieces of meat and fat, which would otherwise corrupt and affect the whole if stowed away in a vessel for months, the large flippers, the ears, and all other parts that prevent close stowage. This was the most difficult part of our duty, as it required much skill to take off everything necessary, and not to cut nor injure the hides. It was also a long process, as six of us had to clean 150; most of which required a great deal to be done to them, as the Spaniards are very careless in skinning their cattle. Then, too, as we cleaned them while they were staked out, we were obliged to kneel down upon them, which always gives beginners the back-ache. The first day I was so slow and awkward that I only cleaned eight; at the end of a few days I doubled my number, and in a fortnight or three weeks could keep up with the others, and clean my proportion—twenty-five."

Skin-dressing.—There is no clever secret in dressing skins: it is hard work that they want—either continual crumpling and stretching out with the hands, or working and trampling about with the feet. A goat-skin takes one person a whole day, an ox-hide takes two persons a day and a half, or even two days' hard labour. It is the simplest plan to begin upon the skin half an hour after it is flayed. If once allowed to dry, it must be softened again by damping, not with water in any case, for that makes it dry hard, but with whatever the natives generally employ: thus, clotted milk and linseed-meal are used in Abyssinia; cow-dung by the Caffres and Bushmen. When a skin is put aside for the night, it must be rolled up, lest it should become dry by the morning. Some grease is usually required by the time that the skin is half-dressed, to make it thoroughly supple.

Smoking Skins after they are dressed.—"The greater part of these skins, however, go through still another operation afterwards (besides dressing), which gives them a greater value, and renders them much more serviceable—that is, the process of smoking. For this, a small hole is dug in the ground, and a fire is built in it with rotten wood, which will produce a great quantity of smoke without much blaze, and several small poles of the proper length stuck in the ground around it, and drawn and fastened together at the top (making a cone), around which a skin is wrapped in form of a tent, and generally sewed together at the edges to secure the smoke within it: within this the skins to be smoked are placed, and in this condition the tent will stand a day or two, enclosing the heated smoke; and by some chemical process or other, which I do not understand, the skins thus acquire a quality which enables them, after being



ever so many times wet, to dry soft and pliant as they were before, which secret I have never seen practised in my own country, and for the lack of which all our dressed skins, when once wet, are, I think, chiefly ruined." (Catlin.) A single skin is conveniently smoked by sewing the edges together so as to make a tube of it; the lower end is then tied round an iron pot with rotten wood burning inside, the upper end being kept open with a hoop, and slung to a triangle.

Sect. 2.—Parchment and Catgut.—The same sort of substance as that which is called parchment when made from sheep or goat skins, and vellum when from calves, kids, or dead-born lambs, can be made also from any other skin. The raw hide is buried for one or two days, till the hair comes easily off; then it is taken out and well scraped. Next, a skewer is run in and out along each of its four sides, and, strings being made fast to these skewers, the skin is very tightly stretched out; as it lies on the stretch, it is carefully scraped over, squeezing out the water; and lastly, the skin is ground with rough stones—as pumice-stone, sandstone, &c. It is now allowed to dry, the skewers being tightened out from time to time. If used for writing, the above will be found rather greasy, but ox-gall will probably remedy this (see p. 193). In the regular preparation of parchment, before taking off the hairs, the skin is soaked for a short time in a lime-pit, to take out the grease.

Catgut, to make.—Steep the intestines of any animal in water for a day; then peel off the outer membrane, which will come off in long strips: these should be twisted up between the hands, and hung out to dry; they form excellent *sewing-thread for skins, &c.* The next step is to turn the gut inside out. This is easily done by the following artifice, viz.:—turn ever so short a piece inside out, just as you would turn up the cuff of a sleeve; then,

catching hold of the turned-up cuff, dip the whole into a bucket, and scoop up a little water between the cuff and the rest of the gut. The weight of this water will do what is wanted: it will bear down an additional length of previously unturned gut; and thus, by a few successive dippings, the entire length of any amount of intestine, however narrow it may be, can be turned inside out in a minute or two.

Having turned the intestine inside out, scrape off the whole of its inner soft parts; what remains is a fine transparent tube, which, being twisted up tightly and stretched to dry, forms catgut.

Sinews.—Any sinews, that are long enough, will do for making string; the fibres being twisted or plaited together into long pieces. The sinews lying alongside the back-bone are the most convenient. After the whole sinew is dried, straight strips are torn off as required, of the proper size. They are wetted, and scraped into evenness by being drawn through the mouth and teeth; then, by one or two rubs between the hand and the thigh, they become twisted and their fibres retained together.

Sect. 3.—Horn, Glue, and Isinglass.—Horn is so easily worked into shape, that travellers, especially in pastoral countries, ought not to be in ignorance of its properties. By boiling, or exposing to heat in hot sand, horn is made quite soft; it can be moulded in what shape you will, and when cold it will keep it. Not only this, but it can be welded by heating and pressing two edges together, which, however, must be clean and quite free from grease—even the touch of the hand taints them. Sheets of horn are a well-known substitute for glass. Ox-horn is left to soak for a fortnight in a pond; then well washed, to separate the pith, and boiled again for half an hour. After this, it is sawn lengthwise and boiled continually till it is ready to split into sheets: this is done with a chisel. The sheets are again boiled, scraped of a uniform thickness, and set in shape to dry. Tortoiseshell and whalebone can be softened and worked in the same way.

Glue is made by boiling down hides, or even tendons, hoofs, horns, &c., for a long time, taking care they are not charred, drawing off the fluid, and letting it set.

Isinglass is made readily by steeping in cold water, and then gently boiling into a jelly, the stomach and intestines of fish. This is spread into sheets and allowed to dry. The air-bladders of sturgeons make the true isinglass.

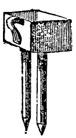
Some seaweeds will yield gum.

The white of eggs is a substitute for gum, with paper, &c.

CANDLES, SOAP, POTTERY, CHARCOAL, &c.

§ 1. Candles, Wax, &c.—§ 2. Soap, and its Substitutes.—§ 3. Pottery.—§ 4. Charcoal, Tar, &c.

Sect. 1.—Candles, Wax, &c.—It is usual, when on an expedition, to take tin moulds and a ball of wick, for making candles, from time to time, when fat can be obtained. The most convenient mould is of this shape. It is unnecessary to explain



how to use it; save that, after the tallow has been poured in, the mould should be dipped in cold water. A gun-barrel, with a cork or wad the required length down the barrel, has been used for a mould. Pull the candle out by the wick after heating the barrel. Two wads might be used, the one strongly rammed in to insure the tallow from passing it, the other merely as a support for the wick. Perhaps, even paper moulds might be used: they would be made by gumming or pasting paper in a roll. Mutton-suet mixed with ox-tallow makes the best candles of all. Tallow should never be melted over a hot fire: it is best to melt it by putting the pot in hot sand. Candles that are dipped, gutter and run much more than mould candles, if they have to be used as soon as made. The way of dipping them is to tie a number of wicks to the end of a wooden handle, so shaped that the whole affair looks much like a garden-rake—the wicks being represented by the teeth of the rake; then the wicks are dipped in the tallow, and each is rubbed and messed by the hand till it stands stiff and straight; after this, they are dipped altogether, several times in succession, allowing the fresh coat of tallow to dry before another dipping. A strip of cotton, $1\frac{1}{2}$ foot long, drenched in grease, and wound spirally round a wand, will burn for half an hour.

Candlestick.—A hole cut with the knife in a sod of turf, or a potato; a nail hammered right through a piece of wood, the candle being stuck on its point; a hollow bone; an empty bottle; a strap with the end passed the wrong way through the buckle and coiled inside; and a bayonet stuck in the ground,—are all used as makeshift candlesticks. "In bygone days, the broad feet, or rather legs, of the swan, after being stretched and dried, were converted into candlesticks." (Lloyd.)

Wax.—Boil the comb for hours, till it is thoroughly melted, together with a little water to keep it from burning; then press the melted mass, through a cloth, into a deep puddle of cold water. This makes bees'-wax. A lump of bees'-wax, with a tatter of an old handkerchief run through it, makes a candle on an emergency. To find the way to bee-hives, see p. 87. Fat, to procure, see p. 180.

Lanthorn.—A wooden box, a native bucket, or a calabash, will make the frame, and a piece of greased calico stretched across a hole in its side will take the place of glass; also, a small tin, such as a preserved meat-case, with a hole at the bottom and an opening in the side or front (see *Horn*, p. 184).

Lamps may be made of hard wood, hollowed out to receive the oil; also of lead (see p. 179). The hoof of a beast is sometimes used.

Sect. 2.—Soap, and its Substitutes.—The lye of ashes and the gall of animals (p. 193) are the readiest substitutes for soap. The sailor's recipe is well known, but it is too dirty to mention. Bran, and the meal of many seeds, is good for scouring, and also some earths, like fuller's-earth. Therefore, if you want a good day's washing, boil an abundance of ashes in water, strain off the lye, adding the gall of any animal you may have killed, and let the clothes soak in it. Next morning, take them to the water-side, and wash and beat them with a flat piece of wood, or lay them on one broad stone and beat them with another. Many countries possess plants that make a lather with water.

In choosing plants to burn for ashes, as above, for the sake of the potash they contain, it must be recollected that stalks of succulent plants—as reeds, maize, broom, heath, furze, and such like—are very far better than those of any trees; and that twigs are better than timber. Pine and fir-trees are the worst of all.

10,000 parts of	pine or fir	contain	4 parts of potash.
,,	poplar	,,	7 ,,
,,	beech-wood	,,	14 ,,
,,	oak	,,	15 ,,
,,	willow	,,	28 ,,
,,	elm, maple, and wheat-straw	,,	39 ,,
,,	thistles, flax-stems, and small rushes	,,	50 ,,
,,	large rushes	,,	72 ,,
,,	stalk of maize	,,	175 ,,
,	bean-stalks	,,	200 ,,

The ashes of most kinds of seaweed yield abundance of alkali.

Soap is fat kept constantly simmering in lye of ashes for some days; adding fresh lye as the water boils away, or is sucked up by the fat. After one or two trials, the knack of soap-making is easily caught. The presence of salt makes the soap hard; its absence, soft. Many ashes contain a good deal of salt, and these may make the soap too hard, and will have to be mixed with other sorts before being used. Experience must teach this. Any native woman will attend night and day to the pot-boiling for a small payment.

Inferior soap may be made by simply putting some grease into a tub of *strong* lye, and letting it remain for two or three weeks, without any boiling, but stirring it once every day.

Marine soap is made of soda-lye and cocoa-nut oil; it makes a lather with salt water, but is very bulky.

"In a very cold climate, when fire, water, and the means of drying are scarce, it will be found that rubbing and beating in snow cleanses all clothing remarkably well, particularly woollens." (Dr. Rae.)

Sect. 3.—Pottery.—Most savages have pottery, but few know how to glaze it. One way, and that which was the earliest known, of doing this, is to throw handfuls of salt upon the jar when red hot in the kiln.

Sect. 4.—Charcoal, Tar, &c.—Charcoal is made in the simplest way by digging a hole in the earth, or choosing some old well or gigantic burrow, and filling it with piles of wood, arranging them so as to leave a kind of chimney down the centre. The top of the well is now covered over, excepting the chimney, down which a brand is dropped to set fire to the wood. The burning should proceed very gradually, and be governed by opening or shutting the chimney-top with a flat stone; for the wood should smoulder, and never attain to a bright red: it will take from two days to a week to make charcoal. The tarry products of the wood drain to the bottom of the well.

Tar is made by burning larch, fir, or pine, as though charcoal had to be made; dead or withered trees, and especially their roots, yield tar most copiously. A vast deal is easily obtained. It collects at the bottom of the pit, and a hole should be cleanly dug there into which it may drain.

Pitch is tar boiled down. Turpentine is the juice that the living pine, fir, or larch tree secretes, in blisters under the bark; they are tapped to obtain it. Resin is turpentine boiled down.

WRITING MATERIALS.

§ 1. Paper.—§ 2. Book-binding.—§ 3. Quills, Brushes, Pencils.—§ 4. Ink, Lampblack, Ox-gall.—§ 5. Wafers, Signets.

Sect. 1.—Paper.—*Substitutes for Paper* are chips of wood, inner bark of trees, calico and other tissues, lead plates, and slaty stone. I have observed an eminent engineer, who habitually jotted down his pencil memoranda on the well-starched wristband of his left shirt-sleeve, pushing back the cuff of his coat in order to expose it.

The natives in some parts of Bengal, when in the jungle, write on any large smooth leaf with the broken-off moist end of a leaf-stalk or twig of any milky sap-producing tree. They then throw dust upon it, which makes the writing legible. If the leaf be so written upon, the writing is imperceptible until the dust is sprinkled. This plan might, therefore, be of use for concealed writing. A person could write on the leaf without detaching it from the tree.

The coarsest foreign paper can be sized, so as to prevent its blotting when written on, by simply dipping it in, or brushing it well over with, milk and water, and letting it dry. A tenth part of milk is amply sufficient. Messrs. Huc and Gabet inform us that this is the regular process of sizing, as used by paper-makers in Thibet.

Metallic-paper is made by rubbing a paste of a little weak glue, with bones burnt to whiteness and pounded, on the surface of the paper.

Tracing-paper.—The transparent kind can hardly be made by a traveller, unless he use waxed paper; but he may prick out the leading points of his map or other design, and then—laying it on a sheet of clean paper—charcoal, &c., can be rubbed through. Waxed paper is made by strewing small pieces of wax on a thin sheet of paper, covered with blotting-paper, and ironing it with a hot flat-iron, or some equivalent, until the wax is thoroughly melted, and has spread evenly over the paper. Black tracing-paper is made by rubbing a mixture of soap, lampblack, and a little water, on the paper; and, when dry, wiping off as much as possible with a cloth.

Sect. 2.—Book-binding.—Travellers' unbound books become so terribly dilapidated, that I think it well to give a detailed description of a method of book-binding, which a travelling relative of mine has adopted, for many years, with remarkable success and to a great extent. The books are not tidy-looking, but they open flat, and never fall to pieces. Take a cup of paste; a piece of calico or other cloth, enough to cover the back and sides of the book; a strip of strong linen—if you can get it, if not, of calico—to cover the back, and abundance of stout cotton or thread. 1st. Paste the strip of linen over the back, and leave the book in the sun, or near a fire—but not too near it—to dry, which it will do in half a day. 2ndly. Open the book, and look for the place where the stitching is to be seen down the middle of the pages, or, in other words, for the middle of the sheets. If it be an 8vo, it will be at every 16th page; if a 12mo, at every 24th page, and so on. Having once hit upon this, it is a mere matter of semi-mechanical reckoning to know where each succeeding stitching is to be found. In this very volume, there is stitching at pages 156, 180, 204, &c., the interval being 24 pages. Next, take the cotton and wind it in between these sheets where the stitching is, and over the back, round and round, beginning with the first sheet, and going on, sheet after sheet, until you have reached the last one. 3rdly. Lay the book on the table, back upwards; daub it thoroughly with paste; put on the calico cover as neatly as you can, and set it to dry as before. When dry, it is complete.

Sect. 3.—Quills, Brushes, Pencils.—*Quills for writing.*—Any feather that is large enough can be at once made into a good writing-quill. It has only to be dipped in hot sand, which makes the membrane inside the quill shrivel up, and the outside membrane split and peel off. A few instants are sufficient to do this. The operation may be repeated with advantage two or three times. The proper temperature of the sand is about 340°. Flat fish-bones make decent pens.

Paint-brushes.—Wash the bit of tail or skin, whence the hair is to be taken, in ox-gall till quite free from grease. Then snip the hairs off close to the skin, put them points downwards resting in a box, and pick out the long hairs. When a quantity are obtained of about the same length, a piece of string is knotted tightly round them, and pulled as firm as possible, with the aid of two sticks. A quill, that has been soaked for a day in water to soften it, is then taken, and the pinch of hair is put into the large end of the quill, points forward, and pushed right through to the other end with a bit of stick; and so the brush is made. Several can be made at the same time with little more trouble than one.

Pencils.—Lead pencils were literally made of lead in former days. There are some parts of the world, as in Arabia, where these are still to be met with. A piece of lead may be cast into a serviceable shape in the method shown in p. 179, and will make a legible mark upon ordinary paper. Of course, it is just the thing for metallic note-books. Another sort of pencil is made by sawing charcoal into narrow strips, and laying them in melted wax to drench for a couple of days; they are then ready for use, as a makeshift.

Sect. 4.—Ink, Lampblack, Ox-gall.—An excellent writing-ink may be made most readily in the bush. The simplest way, and one which is also clean, is to blacken sticks in the fire and rub them well in a spoonful of milk, till the milk has been made quite black. Gunpowder or lamp-soot will do as well as the burnt stick; and water, with a very little gum, glue, or fish-glue (isinglass), is cleaner than the milk, and will not so soon turn sour. Indian ink is simply lamp-soot and some kind of glue: it is one of the best of inks. If water only be used, instead of gum or glue and water, the writing will rub out very easily as soon as it becomes dry: the use of the milk, gum, or glue, being to *fix* it. Anything glutinous will do as well as these. Strong coffee, and many other vegetable products—as the bark of trees boiled in water—make a very legible mark, which stains the paper, and will not rub.

Lampblack.—Hold a piece of tin, or anything, over a flaring wick in a cup of oil, and plenty of soot will collect.

Ink.—To make 12 gallons of good common writing-ink, use 12 lbs. of nut-galls, 5 lbs. of green sulphate of iron, 5 lbs. of gum, 12 gallons of water. (Ure.)

Sympathetic Ink.—Nothing is better or handier than milk. The writing is invisible until the paper is almost toasted in the fire, when it turns a rich brown. The juice of lemons and many other fruits will also do.

To make ink or paint take upon greasy paper, a very little ox-gall should be mixed with it. It is very important to know this simple remedy, and I therefore extract the following information from Ure's Dictionary. I have often practised it.

Gall of Animals, or Ox-gall, to purify.—"Take it from the newly-killed animal, let it settle for 12 or 15 hours in a basin, pour the liquid off the sediment into an earthenware pot, and set the pot into a pan of water kept boiling, until the gall-liquid becomes somewhat thick. Then spread it on a dish, and place it before the fire till nearly dry. In this state it may be kept, without any looking after, for years. When wanted, a piece the size of a pea should be dissolved in water. Ox-gall removes all grease-spots from clothes, &c."

Sect. 5.—Wafers, Signets.—Wafers are made of flour and water, suddenly baked hard. From a sheet prepared in this way, the wafers are punched out. Gum-wafers are made by pouring thick gum and water on a slightly-greased surface (a looking-glass, for example); and another greased glass is put on the top of the gum, to make it dry even. Out of this, when dry, the wafers are punched.

Paste is made stiffer, and also less likely to be attacked by insects, by putting a little alum into it. Corrosive sublimate is a more powerful remedy against insects, but it is by no means an absolute protection, and is dangerous to use. For glue, isinglass, and substitutes for gum, *see* p. 184.

Waterproof Varnish.—Black or red sealing-wax, dissolved in spirits of wine, makes a very effective stiff and waterproof varnish, especially for paper or cardboard boxes, &c. It might be useful in keeping some iron things from rust: it is the same material that is used to cover toy magnets. I have used it as a paint for marking initials on luggage, by cutting out the letters in paper and dabbing the red stuff through. When made stiff, it is an excellent cement for small articles. Opticians use it a great deal.

Signets.—Allusion has been made to the fact that many excellent and worthy bushmen have the misfortune of not knowing how to write. Should any such be placed in a post of confidence by an explorer, there might be a great use in his cutting himself a signet out of soft stone—such as the Europeans of bygone generations, and the Turks of the last one, very generally employed. The name or device is cut on the seal; and, before using it, the paper is moistened with a wet finger, and ink is dabbed over the ring with another. The impression is then made, just as in sealing a letter.

In setting a man to keep count, who cannot reckon, give him a string of beads. The boxes and parcels that travel by the overland route are, or were, counted in this way by an Arab overseer. He was described as having a cord with great beads strung on it, and the end of the cord was thrown over his shoulder. As each box passed him, he jerked a bead from the fore part of the cord to the back part of it, over his shoulder.

CATTLE.

§ 1. Merits of different Beasts.—§ 2. Kraals and Cattle Bells.—§ 3. Facts about Mules.—§ 4. Milking Wild Cows.—§ 5. Management of Horses, &c.—§ 6. Breaking in Oxen.—§ 7. Vice and Temper.

HAPPY is the traveller who has the opportunity of hiring his cattle with their attendants: for his delay and cares are then reduced to those of making a bargain, and of riding what he has hired; and, when one set of animals are tired or worn out, he can leave them behind and ride on with others. But, for the most part, explorers must drive their own beasts with them: they must see to their being watered, tended, and run after when astray; help to pack and harness them; fatigue themselves for their benefit; and drudge at the work of a cowherd, for, it may be, some hours a day.

In fitting out a caravan, as few different kinds of animals should be taken as possible, or they will split into separate herds, and require many men to look after them.

Sect. 1.—Merits of different Beasts.—The ass is an excellent and sober little beast, far too much despised by us. He is not only the most enduring, but one of the quickest walkers among cattle, being usually promoted to the leadership of a caravan. He is nearly equal to the camel in enduring thirst, and thrives on the poorest pasture, suffers from few diseases, and is unscathed by African distemper. The long desert-roads and pilgrim-tracts of North Africa are largely travelled over by means of asses.

Mules require men who know their habits; they are powerful beasts, and can only be mastered with skill and address. A savage usually fears their heels, and will not assist in packing them. They have odd secret ways, strange fancies, and lurking vice. When they stray, they go immense distances; and it is almost beyond the power of a man on foot to tend them in a wild country: he can neither overtake them easily, nor, when overtaken, catch them. The female is, in most breeds, much the most docile. They suffer from African distemper, but in a less degree than horses.

Oxen, though they are coarse, gross, and phlegmatic beasts, have these merits—they are eminently gregarious animals, and they ruminate their food. The consequence is,—first, that one, two, or more, are very seldom missing out of a drove; and, secondly, that they pick up what they require in a much shorter time than horses, mules, &c., who have to chew as they eat. In fact, oxen require less tending than any other beasts of burden.

Brands and Cattle-marks.—In buying oxen out of the herds of pastoral people, it is very difficult to remember each animal so as to recognise it again if it strays back to its former home: indeed, it requires quite a peculiar talent to do so. All cattle should be marked or branded. A trader in Namaqua Land took red paint, and tied a brush on to a long stick; with this, he made a daub on the hind quarters of the freshly-bought and half-wild cattle as they pushed through the door of his kraal. It naturally excites great ridicule among natives, to paint an ox that he may be known again; but, for all that, I think the trader's plan well worth adopting. The same might be done to sheep, as a slit ear is not half conspicuous enough. A good way of marking a sheep's ear is to cut a wad out of the middle of it with a gun-punch; but it will sometimes tear this hole into a slit, by scratching with its foot.

Camels are only fit for a few countries, and require practised attendants; thorns and rocks lame them, hills sadly impede them, and a wet slippery soil entirely stops them.

The dispositions of the animals that compose a caravan, affect, in no small degree, the pleasure of travelling with it. Now it is to be noticed that men attach themselves to horses and asses, and in a lesser degree to mules and oxen, but camels are rarely made friends of.

The net weights that these different animals carry in trying, long-continued journeys—through stages uncertain in length, sometimes leading to good pasture, sometimes to bad—must not be reckoned on at higher than the following; and an animal draws about 2½ times as much net weight as he carries :—An ass, 65 lbs.; a small mule, 90 lbs.; a horse, 100 lbs.; an ox, 120 lbs.; a camel, 180 lbs. to 200 lbs. In level countries—where there is grain, and where the road is known and a regularity in the day's work can be ensured—the weights that may be carried are fully double those of the above list. Capt. Burton's donkeys, in East Africa, carried immense weights.

Dogs will draw a "travail" of 60 lbs. over 15 miles a-day, for days together, and frequently much more than that. (See p. 217.) For Arctic travel, they are used in journeys after they are three years old; each dog requires eight or ten herrings per day, or an equivalent to them. A sledge of 12 dogs carries 900 lbs.; it travels on smooth ice seven or eight miles an hour; and in 36 days, 22 sledges and 240 dogs travelled 800 miles—1210 wersts. (Admiral Wrangel.)

Sheep-dogs seem to prove of less use to travellers than might have been expected; perhaps the other dogs corrupt them.

Goats are much more troublesome to drive than sheep, neither are they such enduring walkers, nor do they give as much meat; but their skins are of such great use as leather, that it is seldom convenient to make up a caravan without them. She-goats give some milk, even when travelling fast, and in dry countries; but a ewe-sheep is not worth milking under those circumstances, as her yield is a mere nothing. Goats are very mischievous—they make their way out of all enclosures, and trespass everywhere. They butt at whatever is bright or new, or strange to them; and would drive an observer—who employed astronomical instruments on stands—to distraction.

Theory of Loads and Distances.—How should we load our animals, and how should we urge them, in order to obtain the largest amount of effective labour? If they carry a mere feather-weight, they may make long days' journeys; but their value, as animals of transport, is almost nothing. Again, on the other hand, if we load them with an excessive weight, they will soon come to a standstill; and in this case, equally as in the first one, their value, as beasts of transport, is hardly anything. What, then, is that moderate load by which we shall obtain the largest amount of "useful effect"? This is a problem which many of the ablest engineers and philosophers have endeavoured to solve; and the formulæ—partly based on theory, partly on experiment, and partly calculated—which were used by Euler, are generally accepted as a fair approximation. They are very simple, and peculiarly interesting on account of their wide applicability. They are equally true for men, animals, or machines; and are wholly independent of the way in which the power is applied: whether, for instance, a man carries his burden, or draws it, or rows or punts it in a boat; or winds it up with a crank, or by a tread-mill.

Travellers might turn the theory to account on their own behalf, and are well situated for testing its truthfulness by observing the practices of the countries in which they are travelling. Reliable facts upon the extreme distances that can be travelled over, day after day, by the same sort of people—carrying different loads, but equally circumstanced in every other respect—would be very acceptable to me.

The formulæ are as follow:—

Let b be the burden which would just suffice to prevent an animal from moving a step; d the distance he could travel, daily, if unloaded. Also, let b' be some burden, less than b; and let d' be the distance to which he could travel, daily, when carrying b'.

$$\text{Then, } b'd^2 = b(d - d')^2. \qquad (1)$$

Again, the "useful effect" is a maximum, if $b'd'$ is a maximum. When this is the case, then

$$b' = \tfrac{4}{9}b. \qquad (2)$$

And

$$3d' = d. \qquad (3)$$

In other words, an animal gets through most work in the day, if he carries $\frac{4}{9}$ of the greatest load he could just stagger under; in which case, he will be able to travel $\frac{1}{3}$ of the distance he could walk if he carried no load at all. (Machinery requires no repose; and therefore d, the distance per day, is convertible into v, the velocity of movement.)

As an example:—Suppose a man is able to walk 10 miles a-day, with a load of 130 lbs.; and 33 miles a-day, when he carries nothing. Then, from equation (1), the value b (the burden under which he would be brought to a standstill) would be about $267\frac{1}{2}$; and the best load for him, from equation (2), would be 119 lbs., which he would be able to carry, according to equation (3), 11 miles a-day.

Sect. 2.—Kraals and Cattle Bells.—In an open country, where there are no bushes for a kraal, nets must be taken, and stakes cut, to make enclosures for the sheep. If they stray at all, the least thing scares them, and they wander very far, and scatter. Goats are far more social and intelligent. If one, two, or three sheep only be driven, long thongs must be tied to their legs, and allowed to trail along the ground, by which they may be re-caught if they gallop off. When the Messrs. Schlagintweit were encamped at vast heights, among the snows of the Himalaya, they always found it practicable to drive sheep to their stations.

When sheep, &c., are long hurdled at night, near the same encampment, the nuisance of flies and ticks becomes intolerable.

Cattle Bells, in countries where they can be used without danger, should always be taken; it adds greatly to the cheerfulness and gregariousness of the animals—mules positively require them. Hard wood is sonorous enough for bells.

Sect. 3.—Facts about Mules.—"The madrina (or godmother) is a most important personage. She is an old steady mare, with a little bell round her neck, and wheresoever she goes, the mules, like good children, follow her. If several large troops are turned into one field to graze in the morning, the muleteer has only to lead the madrinas a little apart, and tinkle their bells, and, although there may be 200 or 300 mules together, each immediately knows its own bell, and separates itself from the rest. The affection of these animals for their madrina saves infinite trouble. It is nearly impossible to lose an old mule: for, if detained several hours by force, she will, by the power of smell, like a dog, track out her companions, or rather the madrina; for, according to the muleteer, she is the chief object of affection. The feeling, however, is not of an individual nature; for I believe I am right in saying that any animal with a bell will serve as a madrina." (Charles Darwin.)

"After travelling about 14 miles, we were joined by three miners; and our mules, taking a sudden liking for their horses, jogged on at a more brisk rate. The instincts of the mulish heart form an interesting study to the traveller in the mountains. I would (were the comparison not too ungallant) liken it to a woman's; for it is quite as uncertain in its sympathies, bestowing its affections when least expected, and, when bestowed, quite as constant, so long as the object is not taken away. Sometimes a horse, sometimes an ass, captivates the fancy of a whole drove of mules, but often an animal nowise akin. Lieutenant Beale told me that his whole train of mules once galloped off suddenly, on the plains of the Cimarone, and ran half a mile, when they halted, in apparent satisfaction. The cause of their freak was found to be a buffalo-calf, which had strayed from the herd. They were frisking around it in the greatest delight, rubbing their noses against it, throwing up their heels, and making themselves ridiculous by abortive attempts to neigh and bray; while the poor calf, unconscious of its attractive qualities, stood trembling in their midst. It is customary to have a horse in the mule-trains of the traders of Northern Mexico, as a sort of magnet to keep together the separate atoms of the train, for, whatever the temptation, they will never stray from him." (Taylor's 'Eldorado.')

Sect. 4.—Milking Wild Cows.—Many breeds of cows cease to give milk after their calf dies; and the only way of making them continue their yield is to spread out the calf's hide for them to lick, some time before milking them; it retains its effect for a week or more. Messrs. Huc and Gabet give the following graphic account of this contrivance, as applied to restive cows :—"These long-tailed cows are so restive and difficult to milk, that, to keep them at all quiet, the herdsman has to give them a calf to lick meanwhile. But for this device, not a single drop of milk could be obtained from them. One day a Lama herdsman, who lived in the same house with ourselves, came, with a long dismal face, to announce that his cow had calved during the night, and that unfortunately the calf was dying. It died in the course of the day. The Lama forthwith skinned the poor beast, and stuffed it with hay. This proceeding surprised us at first, for the Lama had by no means the air of a man likely to give himself the luxury of a cabinet of natural history. When the operation was completed, we observed that the hay-calf had neither feet nor head ; whereupon it occurred to us that, after all, it was perhaps a pillow that the Lama contemplated. We were in error ; but the error was not dissipated till the next morning, when our herdsman went to milk his cow. Seeing him issue forth—the pail in one hand, the hay-calf under the other arm—the fancy occurred to us to follow him. His first proceeding was to put the hay-calf down before the cow. He then turned to milk the cow herself. The mamma at first opened enormous eyes at her beloved infant ; by degrees she stooped her head towards it, then smelt at it, sneezed three or four times, and at last proceeded to lick it with the most delightful tenderness. This spectacle grated against our sensibilities : it seemed to us that he who first invented this parody upon one of the most touching incidents in nature must have been a man without a heart. A somewhat burlesque circumstance occurred one day, to modify the indignation with which this treachery inspired us. By dint of caressing and licking her little calf, the tender parent one fine morning unripped it : the hay issued from within ; and the cow, manifesting not the slightest surprise nor agitation, proceeded tranquilly to devour the unexpected provender."

The Highlanders used this contrivance, and called it a "Tulchan :" hence King James's bishops were nicknamed

"Tulchan bishops," to imply that they were officials of straw, merely set up as a means of milking the Scotch people of their money in the form of church-dues.

Sect. 5.—Horses.—The actual mode of taking wild horses is by throwing the lasso, whilst pursuing them at full speed, and dropping a noose over their necks; by which their speed is soon checked, and they are choked down.

Mr. Rarey's sixpenny book tells all that can be told on the subject of horse-breaking; but far more lies in the skill and horse-knowledge of the operator, than in the mere theory. His way of mastering a vicious horse, is by taking up one fore-foot, and bending his knee, and slipping a loop over the knee until it comes to the pastern-joint, and then fixing it tight. The loop must be caused to embrace the part between the hoof and the pastern-joint firmly, by the help of a strap of some kind, lest it should slip. The horse is now on three legs, and he feels conquered. If he gets very mad, wait leisurely till he becomes quiet; then caress him, and let the leg down, and allow him to rest. Then repeat the process. If the horse kicks in harness, drive him slowly on three legs.

In breaking-in a stubborn beast, it is convenient to physic him until he is sick and out of spirits, or to starve him into submission.

Salt keeps horses from straying, if they are accustomed to come up to the camp and get it. But it is a bad plan, as they are apt to hang about, instead of going off to feed.

They are so fond of it, that they have been known to stray back to a place where they had been licking it, in front of the doors.

To cut Chaff, tie a sickle against a tree with its blade projecting; then, standing in front of the blade, hold a handful of reeds across it with both hands, one hand on either side of the blade; pull it towards you, and the reeds will be cut through; drop the cut end, seize the bundle afresh, and repeat the process. In this way, after a little practice, chaff is cut with great ease and quickness. A broken sickle does as well as a whole one, and a knife may be used, but the curve of its edge is ill adapted for the work.

Cattle will eat many sorts of herbage, as reeds and gorse, if cut small; but will not touch them, if uncut.

They will eat seaweed and leaves, especially birch and poplar leaves, and will even thrive upon them.

Pulling Cattle out of holes.—The bight of a cord, or of some substitute for one, may be thrown over a horse's head, and he can be dragged out by a team of cattle, with but very little danger to his neck. A crupper under his tail, or a thong as a breeching, may be used. In Canada and the United States, a noose of rope is often run round the horse's neck, and hauled tight—thus temporarily choking the animal and making him still; he is then pulled as quickly as possible out of the hole, and no time is lost in slackening the rope.

Shooting Horse.—Spur him as you will, but never use a whip; else, whenever you raise your gun to fire, he will feel a dread that it may be the whip, and is sure to be a little unsteady.

In climbing a steep hill, hang on to the tail of your horse as you walk behind him. Horses are easily driven in file by securing the halter of each horse to the tail of the one before him.

Horses, to swim, see p. 126; to sleep by, p. 113; to run by, p. 114; to tether, p. 215. (See *Horses*, in Index.)

Sect. 6.—Breaking-in Oxen.—An ox of any age, however wild he may be, can be broken in, in three or four days, so as to carry a pack of about 70 lbs.; though it is true that he will frequently kick it off by the way, and give excessive trouble. It would be scarcely possible to drive more than three of these newly-taught oxen at a time, on account of the frequent delays caused by the unruliness of one or other of them. Much depends on the natural aptitude of the animal in estimating the time required for making a steady pack-ox; some will carry a good weight and go steadily after only a fortnight's travel; some will never learn. But in all cases they prove unruly at the beginning of a journey.

It takes a very long time to train an ox to carry a riding-saddle well and steadily: indeed, very few oxen can be taught to go wherever they may be guided by the rider; they are of so gregarious a nature, that, for the most part, they will not move a step without companions. Hence, those oxen only are thought worth breaking-in which are observed to take the part of leaders of the drove when pasturing, and which are therefore supposed to have some independence of disposition.

To break-in an ox, take a long thong or cord, make a noose at one end of it, and let two or three men lay hold of the other; then, driving all the herd together in a clump, go in among them, and, aided by a long stick, push or slip the noose round the hind leg of the ox that you want, and draw tight. He will pull and struggle with all his might, and the other oxen will disperse, leaving him alone dragging the men about after him. Next, let another man throw a noose round his horns, and the beast is, comparatively speaking, secured. It is now convenient to throw the animal down on his side, which is easily done by judicious tugging at his tail and at the thongs. To keep him on the ground, let one man take the tail, and, passing it round one thigh, hold him down by that, while one or two men force the horns down against the ground. His nose has next to be pierced. A stick, shaped like a Y, eight inches long, is cut of some tough wood; and the foot of it, being first sharpened, is forcibly poked through the wall that divides the nostrils, and a thin thong is tied firmly to either end of this nose-stick.

The thong is gathered together, and wound in a figure of 8 round the two horns, where it henceforward remains while the animal feeds, and by clutching at which, he is at any time caught. Next for the packing: as the ox lies on the ground, scrape a hole in the sand under his belly, and then, having laid a few skins on his back, pass a thong round and round him and them several times; tie the ends fast, and, taking a stick, pass it through and twist it round, until the lashings are extremely tight, when it is secured. Now let the ox go, and get quickly out of his way, in case he should be savage. When the ox gets up, he is sulky and ferocious by turns, and kicks, jumps, and bellows, but at last joins his companions.

If he has been well packed, the skins will keep in place and not fall off; but whether they do or not, he must be re-caught and re-packed every day. A young ox is generally more difficult to break-in than an old one: I do not know why. An ox requires no pack-saddle; his back is too round to carry one with advantage. It is therefore usual to lay what spare skins, &c., are at hand upon him, and over these the bags that have to be packed. A great length of thong is required to lash them. It is convenient to make a pair of very large saddle-bags out of skin or canvas, which require simply to be placed on the ox's back and there girthed.

To train an Ox to carry a Rider.—The first time of mounting an ox to break him in, is a work of almost certain mischance;

for the long horns of the ox will often reach the rider, however far back he may sit, and the animal kicks and bucks in a way that severely tries the best of seats. All riding-oxen's horns should have the tips sawn off. After being mounted a very few times, the ox goes pretty steadily; but it is long before he learns to carry a rider with ease to himself. I should like to hear if Rarey's plan of tying up the foreleg would influence them. Their character is so wholly unlike that of a horse, that I doubt if it would.

In riding, it must be recollected that the temper of an ox is far less quick, though his sensations may be as acute, as those of a horse: thus, he does not start forwards on receiving a cut with the whip, even though he shrink with the pain; but he thinks about it, shakes his head, waits a while, and then breaks gradually into a faster pace. An ox will trot well enough with a light weight; and, though riding myself upwards of 13 stone, I once took an ox 60 miles in a day and a half: this is, perhaps, as much as an ox could in fairness be made to do. An ox can be tied up by his nose-bridle; but, if wild or frightened, he will assuredly struggle till the nose-stick be torn out of his nose, and he is free. It is, therefore, better to tie the bridle to a tuft of grass, or a slender twig, rather than to a tree or to the saddle-bags. Mounting an ox is usually a troublesome business, on account of his horns. To make oxen quiet and tame, scratch their backs and tails—they dearly love it—and hold salt in your hands for them to lick. They soon learn their names, and come to be caressed when called.

Sect. 7.—Vice and Temper.—To make an animal rise when he throws himself on the ground with his pack, and will not get up, it is not of much use to flog him; twisting or biting his tail is the usual way, or making a blaze with grass and a few sticks under his nostrils. The stubbornness of a half-broken ox is sometimes beyond conception.

A jibbing and a balking horse is best treated by Mr. Rarey's common-sense plan.

Horses neighing.—Mungo Park tells how he clutched his horse's muzzle with both hands to prevent his neighing, when he was in concealment and horsemen were passing near.

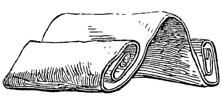
Asses taught not to kick.—Mungo Park says that the negroes where he travelled taught their asses as follows:—They cut a forked stick, and put the forked part into the ass's mouth, like the bit of a bridle; they then tied the two smaller parts together above his head, leaving the lower part of sufficient length to strike against the ground, if the ass should attempt to put his head down. It always proved effectual.

Messrs. Huc and Gabet, who were distracted by the perpetual braying of one of their asses throughout the night, appealed to their muleteer: he put a speedy close to the nuisance by what appears to be a customary contrivance in China, viz., by lashing a heavy stone to the beast's tail. It appears that when an ass wants to bray, he elevates his tail, and, if his tail be weighted down, he has not the heart to bray. In hostile neighbourhoods, where silence and concealment are sought, it might be well to adopt this rather absurd treatment.

SADDLES, BRIDLES, AND PACKING-GEAR.

§ 1. Saddles.—§ 2. Saddle-bags.—§ 3. Girths, Stirrups, Bridles, &c.—§ 4. Pack-saddles.—§ 5. Tethers, Hobbles, and Knee-halters.

Sect. 1.— Saddles.— Sore backs are the plague of beasts of burden—for if the skin be once broken, it will never heal thoroughly again during the whole journey. Every precaution should, therefore, be taken at first starting—such as well-stuffed saddles, ample saddle-cloths, without hem or edging (blankets are as good as any), short journeys, light and carefully-balanced packs, frequent rests of a day or two, and salt-water rubbed in. It is observed that travelling in the very early morning is bad for animals' backs, but that travelling late at night is not so. An Australian correspondent remarks, that a party of travellers or explorers in Australia, on leaving their camp, may invariably be seen saddling their horses with ample saddle-cloths below the saddle, and assisting each other by turns to fold the cloths in various ways. For instance, if the ridge of the back, or wither, is touched, the cloth is folded up, so that the saddle will rest entirely on the two folded pads as in the figure.—Other modes of folding suggest themselves, according as the back may be rubbed.



The first appearance of a sore back is a small hardish swelling or *warble:* this must at once be attended to, by folding the saddle-cloth in some appropriate way, or even by picking out the saddle-stuffing, so as to ease all pressure from off it; otherwise, it will get larger and larger, and a single day will convert what might have been easily cured into a serious and irremediable gall. Girth-galls, on their first appearance, may be relieved, if not cured, by sewing two rolls of soft woollen on to the girth.

In dry climates, take frequent opportunities of greasing every part of the harness.

Good saddles for riding, and especially for packing, are of nearly as great importance as the goodness of the animal who carries them. English saddlers never, I believe, can be induced to stuff a saddle sufficiently; because they have no opportunity of seeing the miserable, scraggy condition of a travelled horse's back, to which they are destined to fit. But an English saddle, restuffed at a bush frontier town, is excellent.

Three rings, and nine of what saddlers call "D's," should be fixed to the saddle, not simply into the leather-work, but firmly riveted or secured into the tree itself. This must be especially insisted on, or frequent disasters will happen. The three rings are fixed on to the pommel—one on its top, and one on each side of it; the nine "D's" are placed as follows:—three along the back of the saddle, two more on each side of the seat, and two in front, for the breastplate.

To these may be tied a light valise in front; a gun-holster on the right of the pommel; and a small bag—containing odds and ends, gunpowder, spare bullets, a few presents, &c.—on the left. On the right of the seat, a sabretasch, or thin leather portfolio-shaped pocket, for paper and writing materials; on the left, the water-canteen and hobbles; behind, the crupper and small saddle-bags. The breastplate is not worth using, except in a very hilly country. This description, of course, applies to the saddle of the horse ridden as a travelling-horse. For shooting purposes, the matter is different; and only the gun-holster, and perhaps the canteen, are taken. An ox carries a saddle precisely like a horse. I rode mine nearly 1600 miles, in South Africa, with a common hunting-saddle and its ordinary girths.

In default of riding-saddles, a pack-saddle must be taken and cushioned (see *Pack-saddles*, p. 212).

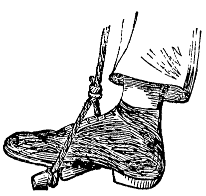
Sect. 2.—Saddle-bags are such troublesome things to open, and require so many straps, that I believe it is best to use simply a bag of macintosh, or canvas, rolled up and tied behind the saddle, resting on a pad. The pad is made of two cushions, each 9 inches long and 4 broad, sewn parallel to one another, and 4 inches apart, on to a piece of leather. The space between the cushions corresponds to the backbone of the horse. To the upper surface of the pad, which is that on which the bag rests, it is usual to stitch four or five laths of wood, running lengthwise, to keep the whole in shape. If there be occasion to carry a bag on horseback for a short distance, pass one of the stirrup-leathers through its string and pull it home; then throw the bag over to the other side of the saddle: it will lie behind the rider's leg, and out of his way, and he will sit upon part of its string.

Australians, as is well known, insist on the merits of a "swag," or a long package formed by rolling all their possessions into their blanket. They carry it over their saddle-bows.

Sect. 3.—Girths, Stirrups, Bridles, &c.—A roll of spare webbing, to patch up torn girths, should be taken; but a good substitute for a girth is made by taking a band of tanned, or even of dressed, leather, cutting it—to within four inches of the end—into seven or nine bands, and plaiting these together.

It takes a beginner just ten times as long to plait a girth as to weave it, and for making more than one girth it is well worth while to make a rude loom. Do this as though you were making a mat. (*See* p. 67.)

Stirrups must be very roomy, enough to admit clumsily-shaped shoes, such as are made in the bush; they must be broad under

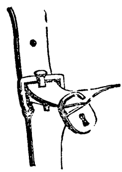


the sole of the foot, and also at the place which rubs against the little toe. Unless they are heavy, it is not easy to find them with the foot; travellers in South Africa cut them out from any thick raw hide—that of giraffe, rhinoceros, or sea-cow does admirably. A wooden stirrup may be cut or burnt out of a block. It should have lead melted into it, to give it sufficient weight. A stick and a thong is a poor makeshift.

Willow, or any other lithe wood, is easily bent into the required shape, especially if its outer edge be nicked with a knife; otherwise it would be a mere loop of wood, such as is represented in the next figure but two.

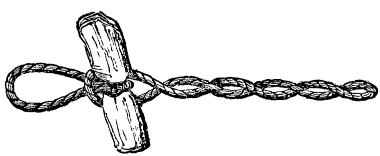
Bridles and Bits.—Leave behind all English notions of snaffles and double reins, and ride with nothing but an easy curb. The horse must also carry a headstall and a halter, and I like one with plenty of tassels to keep off the flies. A temporary substitute for a curb is made by noosing a string, and putting the noose round the horse's lower jaw. If the string be long enough, it can be doubled back again, and tied to the other side of the noose, so as to make a complete bridle. The groom's fashion of giving the halter a hitch, and putting it round the jaw, is well known.

Buckles, Padlocks, Rings.—If the tongue of a buckle breaks, a nail or a peg, pushed through the buckle-hole, will, as in the figure, replace it.

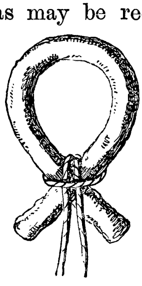


A padlock, locked through the next buckle-hole, prevents pilferers from unbuckling and opening the package. It is well to learn some artful sailor's-knot for tying up bags, which other people cannot meddle with, without your finding it out.

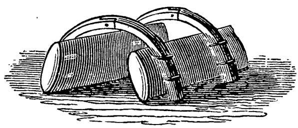
A contrivance like this will often be found useful to replace a buckle and strap; by twisting up the lower thong more tightly, its length can be shortened as much as may be required.

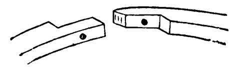


In packing-gear and other harness, use is frequently made of rings. Iron ones may be replaced by a loop of tough wood, such as the peasants of the Campagna always employ: a piece of the thickness of a small walking-stick, and eight inches long, is taken and bent; its arms are notched where they cross, and there nailed or lashed.

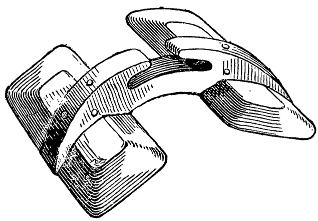


Sect. 4.—Pack-Saddles.—Cut four bent pieces of tough wood, and two small planks; season them as well as you can, and join them together, as in the drawing—using raw hide in addition to





nails or pegs. Stuffed cushions must be tied, or otherwise secured, inside the planks. With a saw and a mortise-chisel the following one would be very easy to make. The art of good packing is to balance the packs accurately, and to lash them very tightly to the saddle. The entire load is then secured to the animal's back by moderate girthing. It is going on a false principle to wind one long cord round the horse, saddle, and packs; making, as it were, a great faggot of them.



To tighten the lashings of a pack, thrust a stick through them, and twist it forcibly round and round till the lashings are screwed tight enough, and then secure the stick.

Half-filled sacks often require to have laths of wood, or a handful of twigs, put between them and the packing-cord, to equalise its pressure: otherwise, they are strangled out of shape and never lie firm.

There has been, perhaps, no journey in which pack-horses were worked so effectively as during the exploration of North Australia under Mr. Gregory. I am much indebted to Mr. Baines, the artist of the expedition,—and who is now with Dr. Livingstone, up the Zambesi,—for the following very interesting account:—

"The pack-saddles were made after a model by Mr. Gregory, and are the best I have yet seen. Two boards of light wood are connected by bows of iron, $1\frac{1}{2}$ inch wide and $\frac{1}{4}$ inch thick, with hooks inserted in either side, for the pack-bags to hook on to. The straps for the breastings, breechings, and girths, were

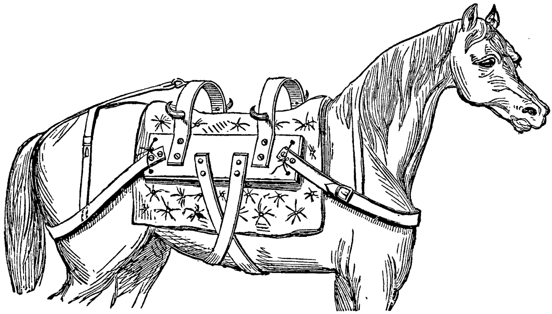


Fig. 1.

screwed to the boards; the crupper passed through a ring on the after bow; and a light pad, which could easily be taken out to be re-stuffed, was secured by small thongs, passed through holes in the ends of the boards. We had two girths, which crossed each other under the horse. (In unloading, the neck-strap is unbuckled on the near side, also the breasting and girths; and the whole is drawn off behind.)

"The pack-bags were made of one width of canvas, turned up so as to have no seam in the bottom. Pear-shaped pieces were sewn in to form the ends, and rope was stitched along the seams, having eyes above, by which the bag was hung upon the hooks. The flour-bags were made of canvas, of the usual width, with a round bottom stitched into them. The mouth was sewn up when full, and an oiled bag of the same size drawn over it.

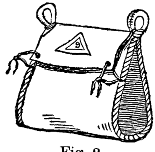
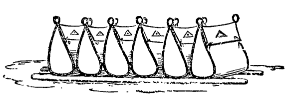


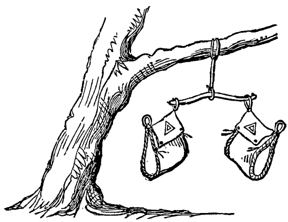
Fig. 2.

"When all our horses were saddled up, the word 'on packs' was given. Dr. Mueller and I used to work together, and had our packs laid out in pairs; so that when each horse was led between his bags, we hooked them on at the same moment. When we halted,



we laid our bags on a couple of poles, to keep them from the ground, as in the drawing.

"The bags sometimes came off, when we were travelling; but it was generally easy to catch the horse and reload him. When a horse rolled over, or fell in a river, it was rather an advantage than otherwise to get clear of them. Our waterproof bags were of leather, lined with waterproof cloth, just large enough to fill one of the canvas pack-bags. They had a brass neck with a worm inside, in which we screwed a plug of soft wood. (There was rarely, if ever, occasion to use them.) Each pair of bags



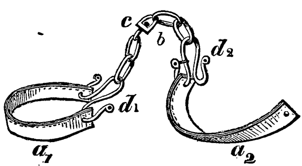
was carefully balanced, one against the other, that the horses might not be unequally loaded. The average weight of stores carried in each bag was 75 lbs., making a load (at starting) of 150 lbs., *exclusive* of bags, packages, or saddlery. Bells were attached to the necks of the horses most apt to stray; but the clappers were tied up with a piece of thong, to keep them quiet on the march; and were loosened at night, so that the sound might guide us in searching for them next morning.

"We watched two hours each, during night; the morning watch boiled the water, and woke the rest at four. We made our breakfast of tea or coffee, damper, and pork which we ate raw, and went out for the horses; which were generally saddled up, and on the move, before sunrise. We travelled till one or two, when we led the horses to water, looked to any sores that might be caused by pressure of their saddles, dressed them and altered the stuffing of the saddle to give them relief, and, after dinner, which was rather a brief ceremony, had the rest of the day for scientific or artistic pursuits,—that is, if something else did not require immediate attention. We could never trust to our guns for provision, as game was very scarce and we had no opportunity of seeking it."

Cruppers for pack-saddles, in very mountainous countries, can readily be made on the spot, like those in use in Norway;

where, instead of a ring encircling the tail and fretting its sides, a short bar of wood, a foot long, is passed under it, and from either end of the bar a cord is tied to the pack-saddle.

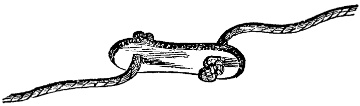
Sect. 5.—Tethers, Hobbles, and Knee-halters.—Cattle may be secured at night by being tethered, hobbled, knee-haltered, or driven into an enclosure made of bushes. The nature of the country, and what dangers are apprehended, determine which plan is most advisable. A knee-haltered horse has a good chance of escape if he scents a wild beast that is creeping up to him; for he can gallop, though with labour, to a short distance. A hobbled horse has no chance at all; though, indeed, they have been known to fight desperately with their teeth and feet, and learn to be cunning and watchful. If the hobbles are of iron, and made like handcuffs, it is hardly possible for robbers—at all events for savages—to unlock or cut them. A horse that is hobbled, or knee-haltered, can graze during the night; but if tied up or pounded, his grass must be cut for him. A horse may be successfully hobbled with a stirrup-leather, by putting its middle round one fetlock; then twisting it half a dozen times; and, lastly, buckling it round the other fetlock. The hobble used by Mr. Gregory takes into five separate pieces, viz., two fetlock straps, a_1, a_2; a chain, b, having a swivel point, c, in the middle; and two double pot-hooks, d_1, d_2, which pass through eyes in the fetlock straps, and also through the end links in the chain. The two ends of both, d_1, and d_2, are thickened and pierced, so as to admit of tying a thong across their mouths, as shown on one side of d_2.



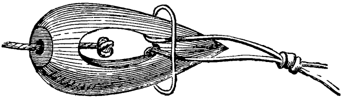
The fetlock strap is made of a strip of thick leather, folded lengthways down its middle, and having its edges sewn together. The sewn edge should always be the uppermost, when on the horse's legs.

Oxen are often picketed to their yokes, and horses tied to the wheels, &c., of the waggon. When you wish to picket horses in the middle of a sandy plain, dig a hole two or three feet deep, and tying your rope to a faggot of sticks or brushwood, or even to a bag filled with sand, bury this in it. (See p. 61.)

The woodcut shows how a makeshift swivel can be fitted to a tether-rope. Without one, the rope will be twisted almost up to a knot by the horse walking round and round his picket peg; with one, the rope will turn freely in its hole, through which its large knotted head prevents it from being drawn.



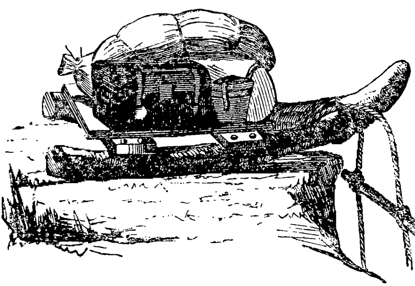
The figure below is a better sort of swivel. It must be made of hard tough wood, like oak: it is six inches in length. It has, I presume, some advantages over those of iron, because in countries where iron abounds, as in Piedmont, it holds its ground against them.



WAGGONS AND DRAUGHT HARNESS.

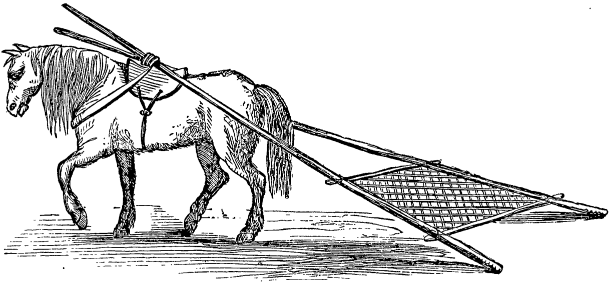
§ 1. Sledges, Waggons, Palanquins.—§ 2. Harness.—§ 3. Drags and Breaks.

Sect. 1.—Sledges, Waggons, Palanquins, &c.—In carrying wood or stones, and for doing other heavy work, a traveller should spare his waggon, and use a sledge. This is made directly, by cutting down a forked tree, lopping off its branches, and shaping it a little with an axe. If necessary, a few bars may be joinered across the fork, so as to make a stage. Great distances may be travelled by one of these, if the country is not very stony. Should it capsize, no great harm is done;

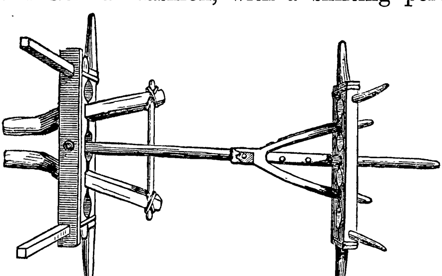


and if it breaks down, or is found to have been badly made, another is constructed with an hour's labour. Sledges come in very usefully where there is abundance of horse or ox power, and no waggon or packing-gear.

In a North American Indian horse "travail" the crossing of the poles (they are the poles of the wigwams) usually rests on a rough pack-saddle or pad, which a breast-strap keeps from slipping back. For a dog, the cross of the poles rests on the back of the neck, and there is a breast or rather neck strap. The poles are wrapped with pieces of buffalo robe where they touch the dog. Captain Blakiston—a very excellent authority—considers that a horse will go 30 miles in the day with about 200 lbs., including a child on the travail and a woman on its back; and that a dog, the size of an average retriever, will draw about 80 lbs., and go the same distance. (N.B. The North American plains are perfectly level.) See p. 197.



Waggons.—A traveller's waggon should be of the simplest possible construction, and not too heavy. The Cape waggons undoubtedly share the ponderousness of all Dutch workmanship. Weight is alone required when crashing through a bushy country, where a waggon must break down all before it. In every other case it is objectionable. It is a great saving to have one large waggon, rather than two small ones; because a driver and a leader are thereby spared. But if one very light waggon has to be taken, I should greatly prefer its being made on the Swiss and German fashion, with a shifting perch, as in the figure.



These are the simplest of affairs, and will split up into two carts—the pole and the fore-wheels forming one, and the perch and the hind-wheels another; and should a great loss occur among the traveller's cattle, it may be very convenient to him to abandon part of what he has, and to build up a cart for carrying on the remainder: the loss of a wheel may also compel him to do this, or even the breaking down of an axletree in a timberless country. Lady Vavasour describes one of these waggons as follows:—"The perch is moveable, and they can make it any length they please; it is of so simple a construction that every farmer can repair his own, and make anything of it. If he has a perch, a pole, and four wheels, that is enough; with a little ingenuity, he makes it carry stones, hay, earth, or anything he wants, by putting a plank at each side. When he wants a carriage for pleasure, he fits it up for that purpose; his moveable perch allows him to make it anything. I counted seventeen grown persons sitting side by side, looking most happy, in one of them, drawn only by a pair of small horses, and in this hilly country."

Two-wheeled drays, and not waggons, are used very generally in Australia. A long bar is crossed by a short one near one of its ends,—this latter forms the axletree; the body of the dray is built where the two cross; and the cattle are yoked or harnessed to the long end of the bar, which acts as a pole.

Tar is absolutely essential in a hot country to mix with the grease that is used for the waggon-wheels. Grease, alone, melts and runs away like water: the office of the tar is to give consistence. A very small proportion of tar suffices, but, without any at all, a waggon is soon brought to a standstill. It is, therefore, most essential to explorers to have a sufficient quantity in reserve. Tar is also of very great use in hot dry countries for daubing over the wheels, and the woodwork generally, of waggons. During the extreme heat, when the wood is ready to crack, all the paint should be scraped off it, and the tar applied plentifully. It will soak in deeply, and preserve the wood in excellent condition, both during the drought and the ensuing wet season. (See p. 189.)

It is not necessary to take the wheels off, in order to grease the axles. It is sufficient to bore an auger-hole right through the substance of the nave, between the feet of two of the spokes, and to keep a plug in the hole. Then, in order to tar a wheel, turn it till the hole is uppermost; take the plug out, and pour the tar in.

Palanquins, carried like sedan-chairs, between two animals—

one going before the other in shafts—are in use in various countries; but I am not aware that explorers have ever properly tried them. Their advantage would lie in combining the convenience of a cart with much of the independence of pack-horses. Whatever is lashed on a pack-saddle must be securely tied up, is severely compressed, and cannot be taken out *en route*. But with a cart or a palanquin there is no such inconvenience: things may be thrown in or taken out; pockets and drawers may be fitted up, and the place affords some shelter in rain. I should think it would be well worth while to try a palanquin. It might be made *en route;* first accustoming the animals, when carrying their packs, to walk between long shafts, then, after some days, taking the load off their saddles, and lashing them on to the shafts. If all went well, a regular palanquin might be constructed. It should have legs, to be let down when the animals are off-packed, and on which it might stand until ready to be again carried onwards. Half a dozen palanquins in file would make a pretty, and, I should think, a manageable and effective caravan. Asses ought to be able to carry them well; and a couple of these would probably carry more than a single pack-horse, and give no greater trouble. If so, their hardihood would make them invaluable.

Sect. 2.—Harness.—*A Horse-collar*, in its simplest form, consists of two stout bars that are a little bent or cut out; they go one on either side of the animal's neck, and are tied together both above and below it. To these bars the traces are fastened, and the bars themselves are very thickly padded.

Traces and Trektows can be made of raw hide; which is cut into a long thong, then bent into three parts and twisted and laid together, as is done in rope-making; the whole is then stretched tight between two trees to dry. An ox-hide will make a trektow for four pairs of oxen. Poles of wood are very generally used as traces; a thong, or a few links of chain, being fastened at either end, by which they can be attached wherever they are wanted.

Sect. 3.—Drags and Breaks.—Every cart and waggon in Switzerland, and, indeed, in the greater part of the Continent, has a break attached to it, and the simplest kind of break is shown in the sketch, which represents a cart tilted upwards. Fig. 1 shows the break itself; fig. 2 explains how it is fitted on to the cart. It will be seen at once that, by tightening the free end of the cord, the break is pressed against the wheels, and of course retards the carriage. The lower part of the place in which the break-bar slides need not be made of iron, as in the sketch: a bar of wood, or even a thong of leather, will suffice. Every explorer's waggon should be furnished with a break.

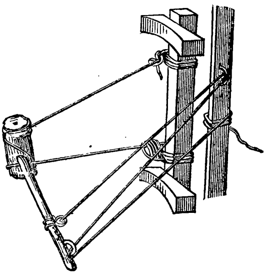


Fig. 1.

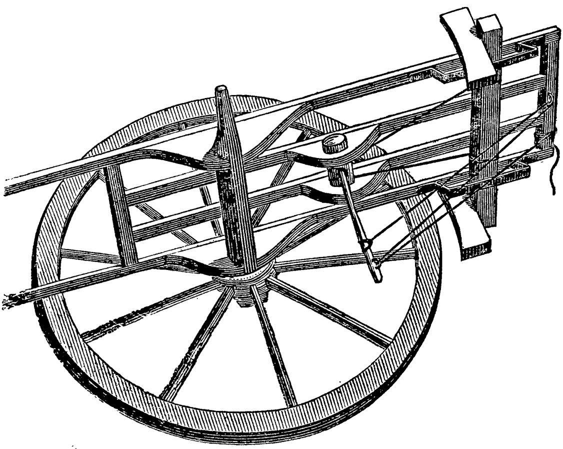
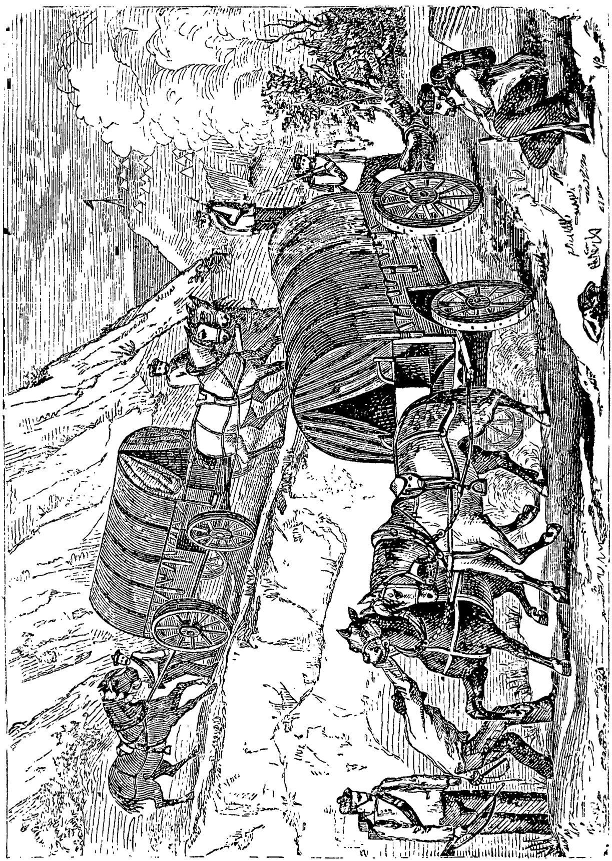


Fig. 2.

In going down a steep hill, a middling-sized tree may be felled; and its root tied to the hind axletree, while its branchy top sweeps along the ground. In the south-west of France, the leaders of the team are unharnessed and taken to the back of the waggon, to which the collar of the front horse is made fast; in this way they can all aid the horses in the shafts. This plan may be seen practised hourly in the Strand, in London, whence



heavy waggons are taken down a very steep and narrow lane to the Adelphi.

In descending short steep pitches, unharness the cattle, and "fasten a rope round the axle of the waggon ; then, passing the other end round a tree or rock as a check, you may let her slide, which she will do without any further trouble on your part." (F. Marryat.)

In some places, the hind wheels are taken off, and sledge runners fitted to the hind axletree. The waggon settles down into a more horizontal position when this has been done to it.

Shoe the wheel on the side *furthest* from the precipice.

If you have to leave a cart or waggon untended, for a while, lock the wheel.

GUNS AND RIFLES.

§ 1. Merits and Demerits of large and small Guns.—Remarks.—§ 2. Hanging up Guns, carrying, and cleaning them.—§ 3. How to dispose of Guns at Night.—§ 4. Mending Injuries to Guns.—§ 5. Powder-flask, Cap-holder, Gun-pricker.—§ 6. Matters of Sportsmanship.—§ 7. Gunpowder, Caps, &c.—§ 8. Bullets and Shot.—§ 9. Wadding, Flints, &c. —§ 10. Poaching Devices.

Sect. 1.—Merits and Demerits of large and small Guns, &c.— American bushrangers advocate a long heavy pea-rifle, on the plea of its accurate shooting, and the enormous saving in weight gained by using bullets of a small size. The only objections to small-bored rifles are those of insufficiency against very large game, even when conical bullets are used,—and a tendency to become foul after a very few shots. A short light rifle, whether with a large or a small bore, is, I believe, utterly worthless. In the hands of a man trembling with running and with exhaustion, it shakes like a wand; and the shorter the rifle, the more quickly does it oscillate, and in the very same proportion is it more difficult to catch the exact moment when the sights cover the object.

I believe I am echoing the opinions of all modern travelling sportsmen, in saying that a Colt's repeating rifle is the best weapon for their purposes. It is not only the five or six shots that can be got out of it, but also the manner in which each bullet is securely fixed, and each charge sealed against damp, by the great lever pressure under which it is loaded. Colt's rifles commonly require to be restocked, to suit an Englishman's method of firing. A long stock is universally advocated by us in England, as essential to good rifle-shooting.

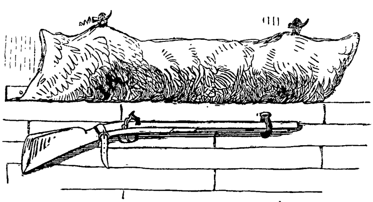
In elephant-shooting, Ceylon sportsmen use enormous guns, and with them they kill elephants with single shots; while in Africa, sportsmen, with ordinary-sized weapons, average no less than twenty shots at each elephant: though Mr. Andersson has, by shooting them behind the fore-legs at very close quarters, occasionally shot them dead. That gentleman now uses a rifle carrying four bullets to the pound. Details of Ceylon sport are given in 'The Rifle and the Hound in Ceylon,' the author of which advocates a single-barrelled rifle, carrying a 4-oz. bullet (No. 4 bore), and weighing 21 lbs.

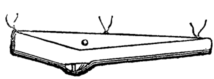
In all cases the hind sight should be far from the eye, even half-way down the barrel: else it becomes quite out of focus and indistinct, when the eye is firmly set on the object aimed at; and this drawback much more than compensates for any advantage that is gained by having the front and hind sights far asunder.

All servants' guns, and indeed those of their masters, should have thin soft-iron ramrods; the bend of these will retain them in the ramrod-tubes; their ends must be forged broad.

In common guns, the screw by which the cock is secured in place, is very liable to get loose, fall out, and be lost; one or more spare ones should certainly be taken.

Sect. 2.—Hanging up Guns, carrying, and cleaning them.—Fix a loop of leather for the muzzle, and a strap and buckle for the





stock, with a piece of sheepskin or canvas nailed so as to hang over it. But a more complete way is to sew a long pocket with a flap to it, which is tied up on to a stick or bar. The gun need simply be lifted out and in. The pocket is made baggy at the part which corresponds to the cocks of the gun.

Waterproof Covers should always be taken. A broad leaf wrapped loosely round the locks of a gun will protect it during a heavy shower.

Carrying Guns.—"Look at the gun, but never let the gun look at you, or at your companions," is a golden rule; for among the chances of death to which a traveller is exposed, that of being shot by an attendant's gun going off accidentally, ranks high. Servants had best carry their guns with the cock down on a piece of rag that covers the cap: take it all in all, it is the best for them. A sportsman will find great convenience in having a third nick cut in the tumbler of his lock, so as to give an additional low half-cock, at which the cock just clears the nipple, and prevents the cap from falling off or receiving a blow. I have long used this plan, and find no objections whatever to it: many pistols are made so. Careless gun-makers sometimes make this half-cock so low, that when the cock is lifted a little back and let go, it strikes the cap by reason of the elasticity of the metal, and lets the gun off: this should be looked to.

As this book may fall into the hands of persons ignorant of the danger of carrying a gun with the cock down on the nipple (to which cause I find, by a list that I used to keep, that three-fourths of gun accidents are owing), I will remark that in a gun so circumstanced, a heavy blow on the back of the cock will explode the cap,—nay, even the jar caused by a gun falling on the ground will do so; or else, that if the cock catch against part of the dress, or against a twig, it will be pulled a little back and, on being released, snap down on the cap, and will in this way, also, explode it. When a gun is at half-cock, neither of these things can happen—the first obviously not; while, if the cock be pulled back and let drop, it falls, not down upon the cap, but to half-cock again, except only in the case where the trigger is also pressed back. The objections to carrying a gun on half-cock are, that careless people may occasionally leave it on full-cock and not perceive the difference, and also a probability of weakening its mainspring, if day after day it be kept on the strain.

Carrying Guns on Horseback.—Allow me very strongly to recommend a trial of the following plan, even for a shooting-pony in Scotland. I and all my party in South Africa used it for a year and a half, and many persons, since, have adopted it.

Sew a bag of canvas, leather, or hide, of such a bigness as to admit the butt of the gun pretty freely. The straps that support

it buckle through a ring in the pommel, and the thongs by which its slope is adjusted fasten round the girth below. The exact adjustments may not be hit upon by an unpractised person for some little time; but, when they are once ascertained, the straps need never be shifted. The gun is perfectly safe, and never comes below the armpit, even in taking a drop leap: it is pulled out in an instant by bringing the elbow in front of the gun and close to the side, so as to throw the gun to the outside of the arm; then, lowering the hand, the gun is caught up. It is a bungling way to take out the gun whilst its barrel lies between the arm and the body. Any sized gun can be carried in this fashion. It offers no obstacle to mounting or dismounting. It is the invention of the Namaquas.

I hear that some sportsmen, who were probably unacquainted with this method, have used a bag or pocket of stiff leather attached to the side of the saddle, just behind the right leg; into this, when tired of carrying the gun, they push its butt. It is said to lie there securely and to give no trouble, the barrel passes forwards under the right arm, and the muzzle is in front of the person.

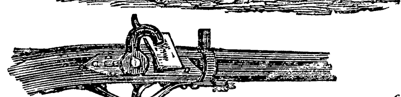
The French dragoons carry a gun in a convenient way for military purposes, because it does not interfere with the immense housings that cavalry soldiers require; but it is not so handy nor so free as the above, nor as well suited for a traveller or a sportsman. The gun is butt downwards as in the Namaqua method, and leans backwards in the same way; but the under side of the gun, instead of being backwards, or towards the horse's tail, is towards his head. The butt lies in a shallow bucket, secured by two straps fixed to the front of the saddle; another strap, leading from the pommel, and passing over the right thigh of the rider, is hitched round the barrel of the gun, and has to be unbuckled and cast off when the gun is taken out.

All ways of carrying the gun with its muzzle downwards are very objectionable; since the jolting tends to dislodge the charge, and risks bursting the gun. A very little shaking in that position will shake the powder out of the nipple, and a gun, so carried, will constantly miss fire.

Gun cleaning.—A bit of rag does as well as tow, and can be used over and over again. A top to the cleaning-rod, with a sponge to it, is convenient. "A leaded barrel must be cleaned with fine sand." (Hawker.) Quicksilver, if it be at hand, will dissolve out the lead at once.

Mercurial ointment is perhaps the best thing to keep rust off iron; as at sea, or in boats. Before embarking for a voyage, it is convenient to enclose the guns in a leaden case, which, on its arrival, can be melted up into bullets. It is remarkable how much better dirty guns withstand rust than clean ones.

Sect. 3.—How to dispose of Guns at Night.—A gun is a very awkward thing to dispose of at night. It has occurred more than once that a native servant has crept up and drawn away his sleeping master's gun, and shot him dead. The following appears to me an excellent plan :—" When getting sleepy, you return your rifle between your legs, roll over, and go to sleep. Some people may think this is a queer place for a rifle ; but, on the contrary, it is the position of all others where utility and comfort are most combined. The butt rests on the arm, and serves as a pillow for the head ; the muzzle points between the knees, and the arms encircle the lock and breech, so that you have a smooth pillow, and are always prepared to start up armed at a moment's notice." (Parkyns' 'Abyssinia.') The longer the gun, the more secure is the sleeper from accident. The sketch is not quite accurate, for, in practice, the weight of the gun is never allowed to rest so entirely on the arm as it is here represented : if it did so, the arm would soon be numbed. The gun-stock may be a little bolstered up, if desired, to avoid any troublesome pressure on the arm.



Sect. 4.—Mending Injuries to Guns.—*Ramrod tubes* often break off, and it is a great inconvenience when they do so. I know of no contrivance whatever to fasten them on again, except by using soft solder, which will not in the least hurt the gun ; ashes, at a dull red heat, must be heaped over the barrel to

warm it sufficiently before applying it. If they be lost, tin tubes may replace them.

The sight of a gun, if it falls out and is lost, can easily be restored. A groove must be cut with a file across the substance of the barrel if the gun be a single one, or across the mid rib if double-barrelled ; into this a piece of iron, ivory, bone, horn, or hard wood, with a projection carved in the middle for the sight, must be pushed, and the metal battered down over it with a hammer or stone, to keep it firm.

A broken stock, however much it may be smashed, can be well mended by raw hide (p. 175). Blacksmith's work and carpentering is seldom sufficient for the purpose. It is within the power of a rough workman to make a gun-stock, but it is a work of great labour to him.

A broken ramrod is to be replaced by cutting a stick from a tree, straightening it in the fire, and then seasoning it. (*See* p. 176.)

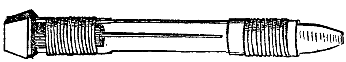
Sect. 5.—Powder-flask, Cap-holder, Gun-pricker.—*Powder-flask.*—It is convenient to carry a very small but roomy flask. The large one, in reserve, may be put in a bag at the front of the saddle.

Powder-horn.—Saw off the required length from an ox's horn, flatten it somewhat by heat (p. 184), fit a wooden bottom into it, caulk the side of it well, and sew raw hide round the bottom edge to keep all tight. The mouth must be secured by a plug, which is sometimes hollowed out to make the charger. Hollow canes and old gunpowder canisters, sewn up in hide, make powder-flasks.

Caps are very conveniently carried by a contrivance which, being old-fashioned and not well suited for sportsmen in England, is rarely to be met with ; but, as it never gets out of order, it is excellent for travellers. I allude to a ring, with two dozen nipple-shaped beads strung on it ; each bead being intended to carry a percussion-cap. The whole is made of metal ; the beads, being cleft down the middle, have a slight springiness, which more effectually secures the caps that are placed upon them ;

the ring is tied by a thong to the belt or button-hole. It is very difficult, without this contrivance, to keep caps free from sand, crumbs, and dirt, yet always ready for use. I can confidently recommend it. Spring cap-holders are, I am sure, too delicate to be trusted in rough travel. Before stalking, or watching at night in rainy weather, wax or grease the edge of the cap as it rests on the nipple: it will thus be proof against water and damp air. Some persons carry a piece of grease with them when out shooting in wet weather, and with it they smear the top of the nipple after each loading and before putting on the fresh cap. It is said that this does not prevent the full action of the cap upon the powder. One sportsman has recommended to me a couple of well-marked caps, into the heads of which small wads of cork had been fitted; he uses them for loaded guns that have to be laid by for some hours or days.

Gun-pricker.—I am indebted for the following plan, both for clearing the touchhole, and also for the rather awkward operation of pricking down fresh gunpowder into it, to an old sportsman in the Orkney Island of Sanday. He takes a quill, and cuts off a broad ring from the large end of it; this is pushed over the small end of the quill, and lies securely there. Next, he cuts a wooden plug to fit the quill, and into the plug the pricker, whatever it may be, is fixed. The whole affair goes safely in the pocket; the quill acting as a sheath to the sharp pricker. Now, when powder has to be pricked down the nipple, the "broad ring" is slipped off the quill and put on the nipple, which it fits; powder



is poured into it, and the rest of the operation is done directly. This little contrivance, which lasts for months, and is so simple and light, is perfectly effective. I have tried metal ones, but, owing to their want of elasticity and lightness, I much prefer the simple quill. A little binding with waxed thread may be put on, as shown in the sketch, to secure the quill from splitting.

Sect. 6.—Matters of Sportsmanship.—*Loading when lying down.*—Put in the powder as you best can, and ram the bullet home, lying flat on your back, with the barrel of the gun athwart your breast. It is easy to load in this way with cartridges.

Loading on horseback.—Empty the charge of powder from the flask into the left hand, and pour it down the gun; then take a bullet wet out of your mouth and drop it down the barrel, using no ramrod; the wet cakes the bullet fairly in its place. "The quickest way of firing is to carry the powder loose in a left-hand pocket, and to use a flint self-priming gun. In firing, do not bring the gun to your shoulder; but present it across the pommel of the saddle, calculating the angle with your eye, and steadying yourself momentarily by standing in the stirrups as you take aim. By practice, a man shoots very accurately in this way." (Palliser.)

Stalking Game.—In creeping after game, the gun is always troublesome; there is no better plan than pushing it as far as the arm can reach, then creeping up to it, and again pushing it forwards.

Tracks.—When the neighbourhood of a drinking-place is trodden down with tracks, "describe a circle a little distance from it, to ascertain if it be much frequented. This is the manner in which spoor should at all times be sought for." (Cumming's 'South Africa.') To know if a burrow be tenanted, go to work on the same principle; but, if the ground be hard, sprinkle sand over it, in order to show the tracks more clearly. It is related in the Apocrypha that the prophet Daniel did this when he wished to learn who it really was, that every night consumed the meat which was placed before the idol of Bel, and which the idol itself was supposed to eat. He thus discovered that the priests and their families had a secret door by which they entered the temple; and convinced the king of the matter, by showing him their footprints.

Crocodile-shooting in Egypt.—Mr. Gilby says, "I killed several crocodiles by digging pits on the sand-islands and sleeping a part of the night in them: a dry shred of palm-branch, the colour of the sand, round the hole, formed a screen to put the gun through. Their flesh was most *excellent eating*—half way between meat and fish: I had it several times. The difficulty of shooting them was, that the falcons and spurwing-plovers would hover round the pit, when the crocodiles invariably took to the water. Their sight and hearing were good, but their scent indifferent. I generally got a shot or two at daybreak after sleeping in the pit."

For night-shooting, a band of white paper must be tied round the muzzle of the gun, behind the sight; and Mr. Andersson—who has had very great experience in this—ties the paper, not round the smooth barrel, but round the sight and all; and, if the sight does not happen to be a large one, he ties a piece of thick string round the barrel, or uses other similar contrivance, to tilt up the fore end of the paper, effectively. By this means, the paper is not entirely lost sight of at the moment when the aim is being taken; otherwise, it is. Mr. Andersson, also, pinches up the paper along the middle of the gun; by doing this, he ensures a more defined foresight.

In the great *battues* of Sweden, where hundreds of people are marshalled, each man has a number, and the number is *chalked* upon his hat.

A string with feathers tied to it at intervals, like the tail of a boy's kite, will by their fluttering scare most animals of the deer tribe; and, in want of sufficient persons, passes may be closed by these. The Swedes use "lappar," viz., pieces of canvas, half the height of a man, painted in glaring colours, and left to flutter from a line. (See p. 241.)

Mr. Lloyd tells us of a peasant who, when walking without a gun, saw a glutton up in a tree. He at once took off his hat and coat and rigged out a scarecrow, the counterpart of himself, which he fixed close by, for the purpose of frightening the beast from coming down, and then went leisurely home, and fetched his gun: this notable expedient succeeded perfectly.

The rush of an enraged animal is far more easily avoided than is usually supposed. The way the Spanish bull-fighters play with the bull is well known. Any man can avoid a mere headlong charge. A racer's speed does not exceed thirty miles an hour, and, I presume, no wild animal's rush is greater than twenty-four miles an hour, or three times the speed of a man.

It is perfectly easy for a person who is cool to avoid an animal, by dodging to one side or another of a bush. Few animals turn, if the rush be unsuccessful. The buffalo does turn; he hunts a man, and is therefore peculiarly dangerous. Unthinking persons talk of the fearful rapidity of a lion's or tiger's spring. It is not rapid at all: it is a slow movement, as must be evident from the following consideration. No wild animal can leap ten yards. Now, think of the speed of a ball thrown, or rather pitched, with just sufficient force to be caught by a person ten yards off: it is a mere nothing. The catcher can play with it as he likes; he has even time to run after it, if thrown wide. But the speed of the springing animal is undeniably the same as that of the ball, thrown so as to make a flight of equal length and height in the air. The corollary to all this is, that, if charged, you must keep cool and watchful, and your chance of escape is far greater than non-sportsmen would imagine. A correspondent assures me that "a dog flying at a man may be successfully repelled by means of a stout stick held *horizontally*, a hand at each end, and used to thrust the dog backwards over, by meeting him across the throat or breast. If followed by a blow on the nose, as the brute is falling, the result will be sooner attained. Few dogs would make a third attack.

"An old poacher, in Wensleydale, fought for a wager, in this style, the most savage bull-dog to be found in the country-side, and effectually cowed him."

In boat-shooting, a landing-net should be taken, as Colonel Hawker well advises, to pick up the dead birds as they float on the water, while the boat passes quickly by them.

When shooting from a river-bank without boat or dog, take a long light string with a stick tied to one end of it, the other being held in the hand. By throwing the stick beyond the floating bird, it can gradually be drawn in.

It is well that the stick should be a solid one, of 1½ or 2 feet long, 2 inches in diameter, and notched at either end; and that it should be attached to the hand-line by a couple of strings, each 6 feet long, tied round either notch. Thus, the hand-line terminates in a triangle (see *drawing of the stirrup*, p. 210), whose two sides are of string and whose base is the stick. A stout stick of this kind can be hove to a great distance, on the same plan as a sailor's deep-sea lead, or, as a man would throw a bola (*see* p. 249).

Claims on Game that is shot.—Some rules are necessary in these matters to avoid disputes, especially between whites and natives; and therefore the custom of the country must be attended to. But it is a very general and convenient rule (though like all fixed rules often unfair) that the animal should belong to the man who first wounded him, however slight the wound might have been; but that he or they who actually killed the animal should have a right to a slice of the meat: it is a further condition, that the man who gave the first wound should not thenceforward withdraw from the chase; if he does so, his claim is lost. Whaling crews are bound by similar customs, in which nice distinctions are made, and which have all the force of laws.

In America the skin belongs to the first shot, the carcase is divided equally among the rest.

When you have shot an animal on a bare plain, you may tie your horse to his horns while you skin him, but it is better to hobble him with a stirrup-leather.

To carry small Game, such as Fallow Deer.—Make a long slit with your knife between the back sinews of both hind-legs and the bone. Cut a thick pole of wood, and a stout wooden skewer 8 inches long. Now thrust the right fore-leg through the slit in the left hind one, and then the left fore-leg through the slit in the right hind one, and holding these firmly in their places, push the skewer right through the left fore-leg, so as to peg it from drawing back. Lastly, run the pole between the animal's legs and its body, and let two men carry it on their shoulders, one at each end of the pole; or, if a beast of burden be at hand, the carcase is in a very convenient shape for being packed. In animals whose back sinew is not very prominent, it is best to cross the legs as above, and to lash them together. Always take the bowels out of game before carrying it; it is so much weight saved. "I rode out accompanied by an after-rider, and shot two springboks, which we bore to camp secured on our horses behind our saddles, by passing the buckles of the girths on each side through the fore and hind legs of the antelopes, having first performed an incision between the bone and the sinews with the *couteau-de-chasse*, according to colonial usage." (Cumming's 'Life in South Africa.') "After he had skinned and gutted the animal, he cut away the flesh from the bones, in one piece, without separating the limbs, so as to leave suspended from the tree merely the skeleton of the deer. This, it appeared, was the Turkish fashion in use upon long journeys, in order to relieve travellers from the useless burden of bones." (Huc's 'Tartary.')

"*To carry ivory* on pack-animals, the North African traders use nets, slinging two large teeth on each side of an ass. Small teeth are wrapped up in skins and secured with rope." (Mungo Park.)

To hide dead game from birds of prey, bush it over. (*See* p. 85.)

Duck-shooting.—Wooden ducks, ballasted with lead, and painted, may be used at night as decoy-ducks, or the skins of birds already shot, taken off and stuffed. They should be anchored in the water, or made fast to a frame attached to the punt and dressed with sedge. It is convenient to sink a large barrel into the flat marsh or mud, as a dry place to stand or sit in. If real ducks be used as decoy-birds, the males should be tied in one place and the females in another, to induce them to quack.

An artificial island may be made to attract ducks, when there is no real one.

Sect. 7.—Gunpowder, Caps, &c.—It is difficult to make good gunpowder, but there is no skill required in making powder that will shoot and kill. The negroes of Africa make it for themselves; burning the charcoal, gathering saltpetre from salt-pans, and buying the sulphur from trading caravans: they grind the materials on a stone. In Chinese Tartary and Thibet, every peasant manufactures it for himself.

To make 8 lbs. of gunpowder, take 1 lb. of charcoal, 1 lb. of sulphur, and 6 lbs. of saltpetre. These proportions should be followed as accurately as possible. Each of the three materials must be pounded into powder separately, and then all mixed together most thoroughly. The mixture must have a little water added to it, enough to make it bind into a stiff paste (about one-tenth part, by measure, of water is sufficient; that is to say, one cupful of water to ten cupfuls of the mixed powder). This paste must be well kneaded together with one stone on another, just as travellers usually make meal or grind coffee. It should then be wrapped up in a piece of canvas, or a skin, and pressed, with as heavy a pressure as can be obtained, to condense it. Next, the cake is squeezed and worked against a sieve made of parchment, in which the holes have been burnt with a red-hot wire, and through which the cake is squeezed in grains. These grains are now put into a box, which is well shaken about, and in this way the grains rub each other smooth. The fine dust, that is then found mixed with the grains, must be winnowed away; lastly, the grains are dried.

Recapitulation.—1. Pound the ingredients separately. 2. Mix them. 3. Add a little water, and knead the mass. 4. Press it. 5. Rub the mass through a sieve (*see* p. 97). 6. Shake up the grains in a box. 7. Get rid of the dust. 8. Dry the grains.

The ingredients should be used as pure as they can be obtained. For making a few charges of coarse powder, the sieve may be dispensed with; in this case, roll the dough into long pieces of the thickness of a pin; lay several of these side by side, and mince the whole into small grains; dust with powder to prevent their sticking together, and then proceed as described.

To procure good Charcoal.—Light woods that give a porous charcoal are the best,—as poplar, alder, lime, horse-chestnut, willow, hazel-nut, elder, &c. It should be used as soon as possible after it is made, and made with the greatest care. It is the most important ingredient in gunpowder.

Sulphur.—The lumps must be melted over a gentle fire; the pot should then be put in a heap of hot sand, to give the impurities time to settle before it cools into a mass. When this has taken place, the bottom part must be broken off and put aside as unfit for making gunpowder, and the top part alone used. Flour of sulphur is quite pure.

Saltpetre.—Dissolve the saltpetre that you wish to purify, in an equal measure of boiling water; a cupful of one to a cupful of the other. Strain this solution, and, letting it cool gradually, somewhat less than three-fourths of the nitre will separate in regular crystals. Saltpetre exists in the ashes of many plants, of which tobacco is one; it is also found copiously on the ground in many places, in saltpans, or simply as an efflorescence. Rubbish, such as old mud huts, mortar, &c., generally abounds with it. (It is made by the action of the air on the potash contained in the earths.) The taste, which is that of gunpowder, is the best test of its presence. To extract it, pour hot water on the mass, then evaporate and purify as mentioned above. (*See* p. 31.)

Substitute for Caps.—When the revolution in Spain (1854) began, "there was a great want of percussion caps; this the insurgents supplied by cutting off the heads of lucifer-matches and sticking them into the nipples. The plan was found to answer perfectly." (*Times*, July 31.)

Carry your Gunpowder wrapped up in flannel or leather, not in paper, cotton, or linen; because these will catch fire, or smoulder like tinder, whilst the former will do neither the one nor the other. Gunpowder carried in a goat-skin bag, travels very safely. Mr. Gregory carried his in the middle of his flour. Each flour-bag, during his North Australian expedition, had a tin of gunpowder in the middle of it.

Rocket-composition is—

Gunpowder 16 parts, by weight; charcoal 3 parts.

Or, in other words,—

Nitre, 16 parts; charcoal, 7 parts; sulphur, 4 parts.

It must not be forgotten, that when rockets are charged with the composition, a hollow tube is left down the middle of it.

Blue fire.—4 parts gunpowder meal; 2 parts nitre; 3 parts sulphur; 3 parts zinc.

Bengal fire.—7 parts nitre; 2 parts sulphur; 1 part antimony.

Sect. 8.—Bullets and Shot.—Travellers frequently omit to take enough shot. It is a great mistake not to do so, as birds are always to be found, while large game is uncertain: besides this, shot gives amusement; and ducks, quails, and partridges are much better eating than antelopes and buffaloes. It must be borne in mind, that a rifle will carry shot quite well enough on an emergency.

Sportsmen, fresh from England, begin by shooting vilely with balls; but they must not be discouraged at what is a general rule.

Common round, or solid conical bullets of lead, are far inferior to similar ones of hard alloy; for the latter penetrate much more deeply, and break bones, instead of flattening against them. A mixture of very little tin, or pewter (which is lead and tin), with lead, hardens it: we read of sportsmen melting up their spoons and dishes for the purpose. A little quicksilver has the same effect. But proper alloy, or spelter, had best be ordered at a gun-maker's shop, and taken instead of lead. Different alloys of spelter vary considerably in their degree of hardness, and therefore more than one specimen should be tried. Round iron bullets are worthless, except at very close quarters; for, on account of the lightness of the metal, the resistance of the air checks their force extremely. Whether elongated iron bullets would not succeed, remains to be tried. Some savages—as, for instance, those of Timor—when in want of bullets, use stones two or three inches long. Bullets should be carried sewn up in their patches, for the convenience of loading, and they should not fit too tight; a few may be carried bare, for the sake of rapid loading. Some good sportsmen insist on the advantage, when shooting at very close quarters, of cleaving a Minié bullet nearly down to its base, into four parts; these partly separate, and are said to make a fearful wound. I suppose that the bullet leaves the gun with the same force as if it were entire; and that it traverses too short a distance for its altered form to tell seriously upon its speed: when it strikes, it acts like chain-shot. Where ammunition is scarce, make a practice of recovering the bullets that may have been shot into a beast. Spelter bullets are found to be very little knocked out of shape, and may often be used again without recasting.

Shot.—Probably No. 7 is the most convenient size, as the birds are likely to be tame; and also because a traveller can often fire into a covey or dense flight of birds,—and the more pellets the more execution. If birds are to be killed for stuffing, dust-shot will also be wanted; otherwise, it is undoubtedly better to take only one size of shot. Slugs are wanted both for night-shooting and also in case of a hostile attack. "Shot can hardly, in practice, be cast by a traveller. We beat the lead quite flat, and cut it into bars about one-eighth of an inch square; which we divided across, so as to form little cubes one-eighth of an inch every way (minced lead like minced meat). These we made as like grains of shot as we could, by putting them into a small metal boiler in the kitchen of the Fort, and rolling them round and round with a smooth stone along with some ashes." (Palliser.) I should procure the bars of lead by twisting up pieces of paper round a small stick; placing them in the ground, and casting lead in them. (*See* p. 179.)

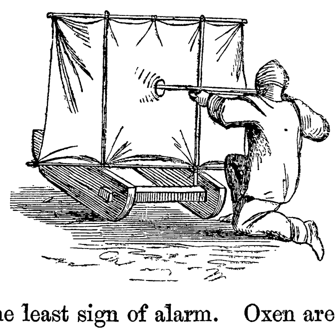
Shot is thus made in manufactories. Arsenic is added to the lead, in the proportion of from 3 lbs. to 8 lbs. of arsenic to 1000 lbs. of lead. If the shot is lens-shaped, there is too much arsenic; if hollow, flattened, or tailed, there is too little. Pewter or tin is bad, as it makes tailed shot. The melted lead is poured through cullenders drilled with *very fine* holes, and drops many feet down, into a tub of water; 100 feet fall is necessary for manufactories in which No. 4 shot is made; 150, for larger sorts. The shot are sorted by sieves, and bad shot are weeded out by letting the shot roll over a slightly-inclined board, when the shot that are not quite round, roll off to the side. Next, the shot is smoothed by being shaken up in a barrel with a little black-lead.

Sect. 9.—Wadding, Flints, &c.—*Wadding.*—The bush affords but little of which wadding can be made, though some birds' nests are excellent for the purpose. I am told that a dry hide will *not* serve as material for wads.

Flints.—According to Ure's Dictionary, the best to choose for gun-flints are those that are not irregular in shape; they should have when broken a greasy lustre, and be particularly smooth and fine-grained; the colour may be anything, but should be uniform in the same lump, and the more transparent it is the better. Gun-flints are made with a hammer and a chisel of steel that is not hardened. The stone is chipped into pieces of the required thickness by the hammer alone, and these are fashioned by being laid upon the fixed chisel and hammered against it. It takes nearly a minute for a practised workman to make one gun-flint.

Olive oil, to purify.—Put a piece of lead in the bottle and expose to the sun, when a quantity of cloudy matter will separate after a few days, and the fine oil may be decanted off.

Sect. 10.—Poaching Devices.—A stalking-horse, cow, &c., is made by cutting out a piece of strong canvas into the shape of the animal, and painting it properly. Then, by sewing loops in different places, it can be stretched into shape by a few sticks; one other stick props up the whole; and, at the proper height, there is a loophole to fire through. The entire thing packs up into a roll of canvas and a bundle of five or six sticks. (See p. 233.) Bushes are used much in the same way. Colonel Hawker made a contrivance upon wheels which he pushed before him. The Esquimaux shoot seals by pushing a white screen before them, over the ice, on a sledge.—(Kane.) Both horses and oxen can be trained so as to shield a sportsman: they are said to enter into the spirit of the thing; and to show wonderful craft, walking round and round the object in narrowing circles, and stopping to graze unconcernedly, on witnessing the least sign of alarm. Oxen are taught to obey a touch on the horn. The way of training them is to hammer and batter the horns for hours together, and on many days successively. They become inflamed at the root and highly sensitive.



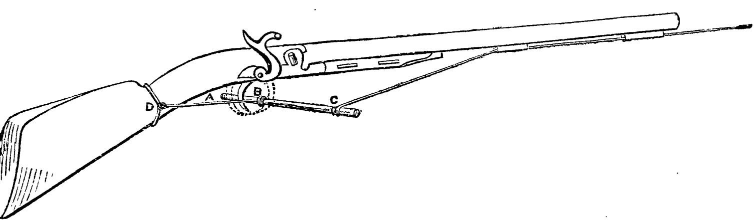
Pan-hunting (used at salt-licks).—" Pan-hunting is a method of hunting deer at night. An iron pan, attached to a long stick serving as a handle, is carried in the left hand over the left shoulder ; near where the left hand grasps the handle, is a small projecting stick, forming a fork on which to rest the rifle

when firing. The pan is filled with burning pine-knots, which, being saturated with turpentine, shed a brilliant and constant light all around ; shining into the eyes of any deer that may come in that direction, and making them look like two balls of fire. The effect is most curious to those unaccustomed to it. The distance between the eyes of the deer as he approaches, appears gradually to increase, reminding one of the lamps of a travelling carriage." (Palliser.)

Setting a Gun as a Spring-gun.—The annexed sketch explains the method I have described in previous editions of this book. The stock is firmly lashed to a tree, and the muzzle to a stake planted in the ground. A "lever-stick," 8 inches long, is bound across the grip of the gun so as to stand upright; but it is not bound so tightly as to prevent a slight degree of movement. The bottom of the "lever-stick" is tied to the trigger, and the top of it to a long fine string, which is passed through the empty ramrod tubes, and is fixed to a tree on the other side of the pathway. It is evident when a beast breasts this string that the trigger of the gun will be pulled.

I have, however, been lately informed of a better plan of adapting the "lever-stick." It is shown in the accompanying diagram. The fault of the previous plan, is the trouble of tying the string to the trigger; since its curvature is usually such as to make it a matter of some painstaking to fix it secure.

A, B, C, is the "lever-stick." Notch it deeply at A, where it is to receive the trigger; notch it also at B, half an inch from A; and at C, 5 inches, or so, from B. In lashing B to the grip of the stock at D, the firmer you make the lashing the better. If D admit of any yielding movement, on C being pulled, the gun will not



go off either readily or surely; as will easily be seen, on making experiment. The string across the pathway should be so fine that, if the beast struggles against it, it should break rather than cause injury to the gun. I should however add, that in the numerous cases in which I have witnessed or heard of guns being set with success, for large beasts of prey, I have never known of injury occurring to the gun. The height of the muzzle should be properly arranged with regard to the height of the expected animal; thus, the heart of a hyena is the height of a man's knee above the ground, that of a lion a span higher. The string should not be tight, but hang in a bow, or the animal will fire the gun on first touching it, and receive only a flesh-wound across the front of his chest. By adjusting the leverage of the stick, this arrangement can be made very delicate, and easy to go off.

The Chinese have some equivalent contrivance with bows and arrows. Mr. Huc tells us that a simply constructed machine is there sold in the shops, by which, when sprung, a number of poisoned arrows are fired off in succession. These are planted in caves of sepulture, to guard them from pillage. They use spring-guns, and used to have spring-bows, in Sweden, and in many other countries.

TRAPPING.

§ 1. Springes.—§ 2. Pitfalls, Traps, &c.—§ 3. Poison.—§ 4. Bird-lime.—§ 5. Bolas and Lasso.

A TRAPPER will never succeed, unless he thoroughly enters into the habits of life and mind of wild animals. He must ever bear in mind how suspicious they are; how quickly their eye is caught by unusual traces; and, lastly, how strong and enduring a taint the touch of man leaves behind it. Our own senses do not make us aware of what is disagreeable enough to confess—that the whole species of mankind yields a powerful and wide-spreading emanation, that is utterly disgusting and repulsive to every animal in its wild state. It requires some experience to realise this fact: a man must frequently have watched the heads of a herd of far-distant animals tossed up in alarm the moment that they catch his wind; he must have observed the tracks of animals—how, when they crossed his own of the preceding day, the beast that made them has stopped, scrutinised, and shunned it—before he can believe what a Yahoo he is among the brute creation. No cleanliness of the individual seems to diminish this remarkable odour: indeed, the more civilised the man, the more subtile does it appear to be; the touch of a game-keeper scares less than that of the master, and the touch of a negro or bushman less than that of a traveller from Europe.

If a novice thinks he will trap successfully by such artless endeavours as, for instance, by putting a bait on the plate of a trap that is covered over with moss, or by digging a pitfall in the middle of a wild-beast's track, he is utterly mistaken. The bait should be thrown on the ground, and the trap placed near it, along the most likely way to it; then the animal's mind, being fixed on the meat, takes less heed of the footpath. Or a pitfall should be made near the main path; this being subsequently stopped by boughs, causes the animal to walk in the bushes, and to crash through the covered hole. The slightest thing diverts an animal's step: watch a path across a forest—little twigs and tufts of grass will be seen to have changed its course, and caused it to curve. It is in trifles of this sort that the trapper looks for auxiliaries.

Sect. 1.—Springes.—Though every schoolboy can set one, I may remark, that the slighter the strain the more delicately can it be set; and also, that a twig should be bent across the path in front of it, or other means taken to induce the animal to step over, and put his foot down exactly where you intend. Catgut (p. 183) makes better nooses than string, because it is stiff enough to keep from twisting out of shape when set; and brass wire that has been heated red hot is excellent, for it has no tendency whatever to twist, and yet is perfectly pliable. Springes are sometimes set with fish-hooks; sometimes a tree is bent down and a cord used, by which large animals are strangled up in the air, as leopards are in Abyssinia. After setting traps, Mr. St. John recommends the use of a small branch of a tree; first, to smooth the ground, and then, having dipped it in water, to use it to sprinkle the place—this entirely obliterates all foot-marks.

Heavy poisoned javelins, hung over elephant and hippopotamus paths, and dropped on a catch being touched, after the manner of a springe, are used generally in Africa. They sometimes consist "of a sharp little assegai, or spike, most thoroughly poisoned, and stuck firmly into the end of a heavy block of thornwood, about four feet long and five inches in diameter. This formidable affair is suspended over the centre of a sea-cow path, at about thirty feet from the ground, by a bark cord, which passes over a high branch of a tree, and thence, by a peg, on one side of a path beneath." (Gordon Cumming.)

Where a trigger has to release a strong spring, one on the principle of a figure of 4 trap is, I believe, the most delicate. The standard may be a branch or the stock of a tree.

Noosing Ducks.—We hear of Hindoos who, taking advantage of the many gourds floating on their waters, put them on their heads, and wade in among wild ducks, and pull them down, one after another, by their legs, under water; wringing their necks, and tying them to their girdle. But in Australia, a swimmer binds grass and rushes, or weeds, round his head; and takes a long fishing-rod, with a slip-noose working over the pliant twig that forms the last joint of the rod. When he comes near, he gently raises the end, and, putting the noose over the head of the bird, draws it under water to him. He thus catches one after another, and tucks the caught ones in his belt. A windy day is generally chosen, because the water is ruffled. (Eyre.)

A noose may be set in any place where there is a run; it can be kept spread out by thin rushes or twigs set crosswise in it. If the animal it is set for can gnaw, a heavy stone should be loosely propped up, which the animal in its struggles may set free, and by the weight of which it may be hung up and strangled. It is a very convenient plan for a traveller who has not time to look for runs, &c., to make little hedges across a creek, or at right angles to a clump of trees, or to an island, and to set his snares in gaps left in these artificial hedges. On the same principle, artificial islands are commonly made in lakes which are destitute of any real ones, that they may become a resort of wild fowl: they are made of piles and faggots.

Sect. 2.—Pitfalls, Traps, &c.—Very small ones, with sharpened stakes, baked hard by the fire and well poisoned, are easily set, but are very dangerous to man and beast. In digging a pitfall for animals of prey, it is usual to ascertain if they are made deep enough, by putting a large dog in; if he cannot get out, it is very unlikely that any wild beast can.

Pitfalls are often dug in great numbers near a frequented watering-place to which numerous intersecting paths lead; then, by stopping up particular paths, any one or no pitfall can be brought into use, and the game are not scared by the smell of one in which animals have been freshly killed. It is difficult to prevent the covers of pitfalls becoming hollow: the only way is to build their roof in somewhat of an arch, so as to allow room for subsidence. If a herd of animals be driven over pitfalls, some are sure to be pushed in, as the crush makes it impossible for the beasts, however wary, to pick their way.

Traps.—Steel traps should never be tied fast, or the caught animal may struggle loose, or even gnaw his leg off. It is best to cut small bushes, and merely to tie the traps to their cut ends. They are of but little use to a traveller.

Condors and vultures are caught by spreading a raw ox-hide, and creeping under it with string, while one or two other men are posted in ambush close by. When the bird flies down upon the bait, his legs are seized, and bound tight in the skin, as in a bag. All his flapping is then useless.

Hawks are trapped by selecting a bare tree that stands in an open space: its top is sawn off level, and a trap put on it. The bait is laid somewhere near, on the ground; and the bird is sure to visit the pole, either before or after he has fed.

Sect. 3.—Poison.—Savages frequently poison the water of drinking-places, and follow, capture, and eat the poisoned animals. Nux vomica or strychnine is very dangerous to use, but it affords the best means of ridding a neighbourhood of wolves, hyenas, &c.: if employed to kill beasts, put it in the belly; if birds, in the eye, of the bait. If pieces of meat be used with a view to killing beasts, they should be set after nightfall; else the crows and other birds will be sure to find them out, and eat them up before the beasts have time to discover them. It would never be safe to eat an animal killed with strychnine, on account of the deadliness of the poison. The Swedes put fulminating-powder in a raw shankbone, and throw it down to the wolves; when one of these gnaws and crunches it, it blows his head to atoms.

Arrows are best poisoned by steeping a thread in the juice, and wrapping it round the barbs. Serpent's venom may always be used.

Sect. 4.—Bird-lime can be made from the middle bark of most parasitic plants, that is to say, those that grow, like misletoe, out of the boughs of other trees. Holly and young elder shoots also afford it. The bark is boiled for seven or eight hours, till quite soft, and then drained of its water and laid in heaps in pits dug in the ground, where it is covered with stones, and left for two or three weeks to ferment. But less time than this is required if the weather be hot. It is watered from time to time, if necessary. In this way, it passes into a mucilaginous state; and is then pounded into a paste, washed in running water, and kneaded till it be free from dirt, chips, &c. Lastly, it is left for four or five days in earthen vessels, to ferment and purify itself, when it becomes fit for use. It ought to be greenish, sour, gluey, stringy, and sticky. It becomes brittle when dry, and may be powdered; but, on being wetted, it becomes sticky again. (Ure's Dictionary.)

Vast flocks of birds frequent, at nightfall and at daybreak, the scattered watering-places of dry countries; by liming the sedges and bushes that grow about them, numbers of these could be caught.

Crows may be killed by twisting up a piece of paper like an extinguisher, dropping a piece of meat in it, and smearing its sides with bird-lime. When the bird pokes his head in, his eyes are gummed up and blinded; and he flies straight up in the air, but soon falls down exhausted, and, it may be, dead with fright. (Lloyd.) Fish-hooks, baited with meat, are good to catch these sorts of birds.

Sect. 5.—Bolas and Lasso.—"The bolas consists of three balls, composed either of lead or stone; two of them heavy, and the third rather lighter. They are fastened to long elastic strings, made of twisted sinews, and the opposite ends of the strings are all tied together. The Indian holds the lightest of the three balls in his hand, and swings the two others in a wide circle above his head; then taking his aim, at the distance of about fifteen or twenty paces, he lets go the hand-ball, upon which all the three balls whirl in a circle, and twine round the object aimed at. The aim is usually taken at the hind-legs of the animals, and, the cords twisting round them, they become firmly bound. It requires great skill and long practice to throw the bolas dexterously, especially when on horseback. A novice in the art incurs the risk of dangerously hurting either himself or his horse by not giving the balls the proper swing, or by letting go the hand-ball too soon." (Tscudi's 'Peru.') It is impossible to learn the use of the lasso without months of practice and instruction.

Hamstringing.—Animals are hamstrung by riding at them, armed with a sort of spear, whose blade is fixed square with the shaft, and has a cutting edge.

Hawking is a disappointing pursuit, from the frequent loss of hawks; and can hardly be carried on except in a hawking country, where the sportsman has a better chance both of recovering and replacing them; and is quite impracticable except where the land is open and bare: it is quite a science. There are some few amateurs who will not hear a word of disparagement about their hawks, but the decided impression that I bear away with me from all I have learnt is, that the birds are rarely affectionate or intelligent.

FISHING.

§ 1. Fishing-tackle.—§ 2. Spearing Fish—Intoxicating them.—§ 3. Otters and Cormorants.

Sect. 1.—Fishing-tackle.—A traveller should take very small, and also middling-sized, hooks; he might have a dozen of each sort whipped on to gut; and at least a couple of casting-lines; also several dozens of tinned iron fish-hooks of various sizes, such as are used at sea, with plenty of line.

Fish-hooks are made of iron, not steel, wire. While the piece is straight, it is laid along a little groove in a block of wood, and there barbed by the stroke of a chisel slantwise across it. The other end is flattened by a tap of the hammer, or roughened, that it may be held by the whipping; then the point is sharpened by a file, and on a stone. The proper curvature is next given, and, lastly, the hook is case-hardened (see *Case-hardening*); proper temper is given by heating the hook red hot, and quenching it in grease.

Gut is made from silkworms; but the scrapings of the membrane (p. 183) in the manufacture of catgut make a fine, strong, and somewhat transparent thread; and twisted horsehair can always be had. Boiling this in soap-lees takes away its oiliness.

Twisted sinews will make a fishing-line. To make a strong fine line, unravel a good silk handkerchief, and twist the threads into a whipcord. (See also *Substitutes for String*, p. 172.)

If the tackle is slight, and the fish large, tie a bladder or other float to the line, and cast it adrift.

Reel.—If you have no reel, make a couple of gimlet-holes,

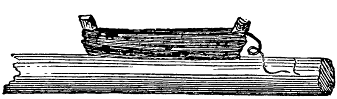


Fig. 1.

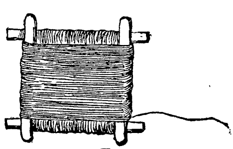


Fig. 2.

six inches apart, in the butt of your rod, at the place where the reel is usually clamped; drive wooden pegs into these, and wind your spare line round them. The pegs should not be quite square with the butt, but should slope a little, each away from the other, that the line may be better retained on them, (fig. 1.) A long line is conveniently wound on a square frame, as shown in the annexed sketch (fig. 2); and a shorter line, as in fig. 3.

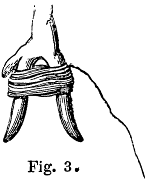


Fig. 3.

Trimmers are well known, and are a convenient way of fishing the middle of a pool with only a short line. Anything will do for the float—a bladder or a bottle is very good.

Otters.—What is called "an otter" may supply the traveller with food. A board of light wood, fourteen inches long and eight inches high, or thereabouts, is heavily weighted along its lower edge, so as to float upright in the water; a string like the bellyband of a kite, and for the same purpose, is fastened to it; and to this belly-band the end of a line, furnished with a dozen hooks at intervals, is tied. As the fisherman walks along the bank, the otter runs away from him, and carries his line and hooks far out into the stream. It is very convenient to have a large hand-reel, to wind and unwind the line upon; but a forked stick will do very well.

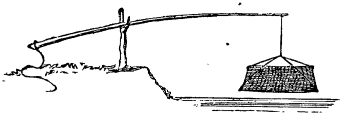
In fishing with a long ground-line and many hooks, it is of importance to avoid entanglements; make a box in which to coil the line, and a great many deep saw-cuts across the sides, into which the thin short lines that the hooks are whipped to, are jammed.

Fishermen who do not use oars, but paddles, tie a loop to their line through which they put their thumb; and they fish as they paddle along.

To recover a lost line, make a drag of a small bushy tree with plenty of branches, that are so lopped off as to leave spikes on the trunk. This is to be weighted with a stone, and dragged along the bottom.

To see things deep under water, use a long box or tube with a piece of glass at the lower end; this removes entirely the glare of the water and the effects of a rippled surface.

Nets.—A small square net may be best turned to account in this way:—sinking it in holes and other parts of a river which fish frequent; throwing in bait to attract them over it; and then hauling up suddenly.



A seine net may be furnished with bladder for floats, or else with pieces of light wood charred to make them more buoyant. The hauling-ropes may be made of bark steeped for three weeks, till the inner bark separates from the outer, when the latter is twisted into a rope. (Lloyd.) Where the small fish are swimming near the surface in shoals, there the water is sure to be rippled.

Sect. 2.—Spearing Fish.—Intoxicating them.—The "grains" are made much like Neptune's trident, and the length of the handle gives steadiness to the blow. In spearing by torch-light, a broad oval piece of bark is coated with wet mud, and in it a blazing fire is lighted. It is fixed on a stage, or held in the bow of the boat, so high as to be above the spearman's eyes. He can see everything by its light, especially if the water be not above four feet deep, and the bottom sandy. But there are not many kinds of wood that will burn with a bright enough fire; the dry bark of some resinous tree is often used. If tarred rope can be obtained, it may simply be wound round a pole fixed in the bow of the boat, and lighted. Fish are also shot with a bow and a barbed arrow, to which a string is attached.

Intoxicating Fish.—Lime kills fish, and the properties of *cocculus Indicus* are well known. Throughout tropical Africa, and in South America, the natives catch fish by poisoning them. Dams are made, which, when the river is very low, enclose deep pools of water with no current; into these the poison is thrown—it intoxicates the fish, which float and are taken.

Sect. 3.—Otters and Cormorants are both used to catch fish; and dogs are trained by the Patagonians to drive fish into the nets, and to frighten them from breaking loose when the net is being hauled in. Cormorants, in China, fish from October to May—the winter months—working from 10 A.M. to 5 P.M.; then they are given their dinner. When they fish, a straw tie is put round their neck to keep them from swallowing the fish, and yet so as not to slip down and choke them. A boat takes out ten or twelve of these birds. They obey the voice: if disobedient, the water near them is struck with the back of the oar; as soon as one has caught a fish, he is called to the boat, and the oar is held out for him to step upon.

MEDICINE.

§ 1. Drugs.—§ 2. Diseases.—§ 3. Remedies.

Sect. 1.—Drugs.—A traveller, unless he be a professed physician, has no object in taking a large assortment of drugs. He wants a few powders, ready prepared; which any physician, who knows the diseases of the country where he is about to travel, will prescribe for him. These are as follows:—1. Emetic, mild; 2. ditto, very powerful, for poison (sulphate of zinc). 3. Aperient, mild; 4. ditto, powerful. 5. Cordial for diarrhœa. 6. Quinine for ague. 7. Sudorific (Dover's powder).

It will save infinite trouble with weights and scales, if these be all so mixed up that one measureful of each shall be a full average dose for an adult; and if the measure to which they are adapted be cylindrical, and of such a size as just to admit a common lead-pencil, and three-quarters of an inch long, it can at any time be replaced by twisting up a paper cartridge.

In addition to the above powders, the traveller will want cold-cream; heartburn lozenges; lint; a small roll of diachylon; lunar-caustic, in a proper holder, to touch old sores with, and for snake-bites; a scalpel and a blunt-pointed bistoury, to open abscesses with (the blades of these should be waxed, to keep them from rust); a good pair of forceps, to pull out thorns; a couple of needles, to sew up gashes; waxed thread. A mild effervescing aperient, like Moxon's, is very convenient. Seidlitz-powders are perhaps a little too strong for frequent use in a tropical climate.

The medicines should be kept in zinc pill-boxes, all of the same diameter, with a few letters punched both on their tops and bottoms, to indicate what they contain, as Emet., Astr., &c.; and the pill-boxes should slip one above another into a long zinc box lined with flannel, and lie there like sovereigns in a *rouleau*.

The sulphate of zinc may be invaluable as an eyewash; for ophthalmia is a scourge in many countries—as in parts of North and South Africa, and in Australia. The taste, which should be strongly astringent, is the best guide to the strength of its solution.

For emetics, drink a charge of gunpowder in a tumblerful of warm water or soap-suds, or even tickle the throat.

Vapour-baths are used in many countries, and the Russian plan of making them is often the most convenient. They heat stones in the fire, and put them on the ground in the middle of their cabin or tent; on these they pour a little water, and clouds of vapour are given off. Elsewhere, branches are spread on hot wood-embers, and the patient placed on these, wrapped in a large cloth; water is then sprinkled on the embers, which soon covers the patient with a cloud of vapour. The traveller who is chilled or over-worked, and has a quiet day before him, would do well to practise this simple and pleasant remedy.

Ointment.—Simple cerate is equal parts of oil and wax; lard and wax will do.

Seidlitz-powders are not often to be met with in the form we are accustomed to take them in, in England; so their recipe is annexed:—

1½ oz. Carbonate of Soda 3 oz. Tartarised Soda .	For the blue papers.
7 drachms Tartaric Acid	For the white papers.

These quantities make 12 sets.

Sect. 2.—Diseases.—Fevers of all kinds, diarrhœa, and rheumatism, are the plagues that most afflict travellers; ophthalmia often threatens them. Change of air, from the flat country up into the hills, as soon as possible after the first violence of the illness is past, works wonders in hastening and perfecting a cure. With a bad diarrhœa, take nothing but broth, and it may be rice, in very small quantities at a meal, until quite restored. The least piece of bread or meat causes an immediate relapse.

The number of travellers that have fallen victims to fever is terrible, and it is a matter of serious consideration whether any motives short of imperious duty could justify a person in braving a fever-stricken country. In the ill-fated Niger expedition, three vessels were employed, of which the "Albert" stayed the longest time in the river, namely, two months and two days. Her English crew consisted of 62 men; of these, 55 caught fever in the river, and 23 died. Of the remaining seven, only two ultimately escaped scot-free; the others suffering, more or less severely, on their return to England. In Dr. McWilliams's Medical History of this expedition, it is laid down that the Niger fever, which may be considered as a type of pestilential fever generally, usually sets in sixteen days after exposure to the malaria; and that one attack, instead of acclimatising the patient, seems to render him all the more liable to a second one. Every conceivable precaution known in those days had been taken to ensure the health of the crew of the "Albert."

Sect. 3.—Remedies.—A great discovery of modern days is the power of quinine to *keep off* fever. A person would, now, have little to fear in taking a passage in a Niger steamer; supposing that vessels ran regularly, and without disaster, up that river. The quinine he would take, beginning at the coast, would render him proof against fever until he had passed the delta; but nothing would remove the risk of a long sojourn in the delta itself. It is a widely-corroborated fact, that a residence on the banks of a river, or in low land, is often less affected by malaria than the low hills that overlook it.

There are certain precautions which should be borne in mind in unhealthy seasons—as, never to encamp to the leeward of a marsh; to sleep close in between large fires, with a handkerchief gathered round your face (natural instinct will teach this); not to start off too early in the morning; to avoid unnecessary hunger, hardship, and exposure.

Drowning.—A half-drowned man must be put to bed in dry, heated clothes; hot stones, &c., to his feet; his head must be raised moderately. Human warmth is excellent, such as that of two strapping men made to lie close up against him, one on each side. All rough treatment is not only ridiculous but full of harm; such as the fashion—which still exists in some places—of hanging up the body by the feet, that the swallowed water may drain out of the mouth.

For Snake-bites, tie a string tight above the part, suck the wound, and caustic it as soon as you can. Or, for want of caustic explode gunpowder in the wound; or else do what Mr. Mansfield Parkyns well suggests, *i.e.* cut away with a knife, and afterwards burn out with the end of your iron ramrod, heated as near a white heat as you can readily get it. The arteries lie deep, and as much flesh may, without much danger, be cut or burnt into, as the fingers can pinch up. The next step is to use the utmost energy, and even cruelty, to prevent the patient's giving way to that lethargy and drowsiness which is the usual effect of snake-poison, and too often ends in death.

Broken Bones.—It is extremely improbable that a man should die, in consequence of a broken leg or arm, *if the skin be uninjured;* but, if the broken end forces its way through the flesh, the injury is a very serious one. Abscesses form, the parts mortify, and the severest consequences often follow. Hence, when a man breaks a bone, do not convert a simple injury into a severe one, by carrying him carelessly. If possible, move the encampment to the injured man, and not *vice versâ.* "When a man has broken his leg, lay him on the other side, put the broken limb exactly on the sound one, with a little straw between, and tie the two legs together with handkerchiefs. Thus, the two legs will move as one, and the broken bone will not hurt the flesh so much, nor yet come through the skin." (Druitt.)

Stretcher.—For description of a stretcher to carry wounded people, see page 108.

Excessive Bleeding.—When the blood does not pour or trickle in a steady stream from a deep wound, but in pulses, and is of a bright red colour, all the bandages in the world will not stop it. It is an artery that is wounded; and, unless there be some one accessible, who knows how to take it up and tie it, I suppose that the method of our forefathers can alone be used by an unskilled traveller: this is, to burn deeply into the part, as you would for a snake-bite ; or else, to pour boiling grease into the wound. It is, of course, a barbarous treatment, and far from being sure of success, as the cauterised artery may break out afresh ; still, life is in question, and it is the only hope of saving it. After the cautery, the wounded man's limb should be kept perfectly still, and well raised, and cool, until the wound is nearly healed. A *tourniquet*, which will stop the blood for a time, is made by tying a strong thong, string, or handkerchief, firmly above the part, putting a stick through and screwing it tight. If you know whereabouts the artery lies which it is the object to compress, put a stone over the place and under the handkerchief. The main arteries follow pretty much the direction of the inner seams of the coat sleeves and trousers.

To cure blistered Feet.—"Rub the feet at going to bed with spirits mixed with tallow dropped from a candle into the palm of the hand ; on the following morning no blister will exist. The spirits seem to possess the healing power, the tallow serving only to keep the skin soft and pliant. This is Captain Cochrane's advice, and the remedy was used by him in his pedestrian tour." (Murray's 'Handbook of Switzerland.') The receipt is excellent ; all pedestrians and all teachers of gymnastics endorse it, and it cannot be too widely known. To prevent the feet from blistering, it is a good plan to soap the inside of the stocking before setting out, making a good lather all over it ; and a raw egg broken into a boot, before putting it on, greatly softens the leather.

After some hours' walking, when the feet are beginning to be chafed, take off the shoes, and change the stockings ; putting what was the right stocking on the left foot, and the left stocking on the right foot. Or, if one foot only hurts, take off the boot, and turn the stocking inside out.

Rarefied air.—On high plateaux or mountains, travellers must expect to suffer somewhat. The symptoms are described by many South American travellers ; the attack of them is there, among other names, called the *puna*. The disorder is sometimes fatal to stout plethoric people ; oddly enough, cats are unable to endure it. At villages 13,000 feet above the sea, Dr. Tscudi says that they cannot live. Numerous trials have been made, but the creatures die in frightful convulsions. The symptoms of the puna are giddiness, dimness of sight and hearing, headache, fainting-fits, blood from mouth, eyes, nose, lips, and a feeling like sea-sickness. Nothing but time cures it. It begins to be felt at from 12,000 to 13,000 feet above the sea. M. Hermann Schlagintweit—whose large mountain experience in the Alps and in the Himalaya, up to the height of 20,000 feet or more, is only paralleled by that of his brother—tells me that he found the headache, &c., to come on when there was a breeze, far more than at any other time. His whole party would awake at the same moment, and begin to complain of the symptoms, immediately on the commencement of a breeze. The symptoms of overwork are not wholly unlike those of the puna, and many young travellers who have felt the first, have ascribed them to the second.

Snow-blindness.—In civilized life blue spectacles are, as is well known, an indispensable accompaniment to snow-mountain expeditions. The Esquimaux adopt the following equivalent. They cut a piece of soft wood to the curvature of the face. It is about two inches thick, and extends horizontally quite across both eyes, and rests on the nose, where a notch is cut to act in the same way as the bridge of a pair of spectacles. This is tied behind the ears; and, so far as I have now described it, would just suffice to exclude every ray of light from the eyes. Next, a long narrow slit, of the thickness of a thin saw-cut, is made along its middle almost from end to end. Through this slit the wearer can see very fairly. It is considerably narrower than the diameter of the pupil of his eye, and, consequently, the light that reaches his retina is much diminished in quantity.

Scurvy has attacked travellers in Australia. Any vegetable diet cures it: lime-juice, treacle, raw potatoes, and acid fruits are especially efficacious. Dr. Kane insists on the value of meat, eaten entirely raw, as a certain antiscorbutic. It is generally used by the Esquimaux.

Teeth.—Tough diet tries the teeth so severely, that a man about to undergo it had much better pay a visit to a dentist before he leaves England. It appears that an unskilled traveller is very likely to make a bad job of a first attempt at tooth-drawing. By constantly pushing and pulling an aching tooth, it will in time loosen, and perhaps, after some weeks, come out.

Suffering from Thirst.—Pour water over the clothes of the man, and keep them constantly wet; restrain his drinking, after the first few minutes, as strictly as you can summon heart to do it. (See pp. 6, 7.) In less severe cases, drink water with a tea-spoon; it will satisfy a parched palate as much as if you gulped it down in tumblerfuls, and will disorder the digestion very considerably less.

Suffering from Hunger.—Two or three mouthfuls every quarter of an hour is, to a man in the last extremity, the best thing; and strong broth is the best food.

Wasp and Scorpion-stings.—The oil scraped out of a tobacco-pipe is good; should the scorpion be large, his sting must be treated like a snake-bite (p. 258).

Poisoning.—The first thing is to give a powerful emetic, to throw up whatever poison may still remain unabsorbed in the stomach. Use soapsuds or gunpowder (p. 256) if proper emetics are not at hand. If there be violent pains and gripings, or retchings, give plenty of water to make the vomitings more easy. Nothing now remains to be done, but to resist the symptoms that are caused by the poison which was absorbed before the emetic acted. Thus, if the man's feet are cold and numbed, put hot stones against them, and wrap him up warmly. If he be drowsy, heavy, and stupid, give brandy, and try to rouse him. There is nothing more to be done, save to avoid doing mischief.

Bleeding.—Physicians say, now-a-days, that bleeding is rarely, if ever, required; and that frequently it does much harm. They used to bleed for everything.

Fleas.—"Italian flea-powder," sold in the East, is really efficacious. It is made from the "Piré oti" (or flea-bane), mentioned in Curzon's 'Armenia,' as growing in that country. It is powdered, and sold as a specific.

Vermin on the Person.—"We had now been travelling for nearly six weeks, and still wore the same clothing we had assumed on our departure. The incessant pricklings with which we were harassed, sufficiently indicated that our attire was peopled with the filthy vermin to which the Chinese and Tartars are familiarly accustomed; but which, with Europeans, are objects of horror and disgust.

"Before quitting Tchagan-Kouren, we had bought in a chemist's shop a few sapeks'-worth of mercury. We now made with it a prompt and specific remedy against the lice. We had formerly got the receipt from some Chinese; and, as it may be useful to others, we think it right to describe it here. You take half an ounce of mercury, which you mix with old tea-leaves previously reduced to paste by mastication. To render this softer, you generally add saliva; water could not have the same effect. You must afterwards bruise and stir it a while, so that the mercury may be divided into little balls as fine as dust. (I presume that blue pill is a pretty exact equivalent to this preparation.) You infuse this composition into a string of cotton, loosely twisted, which you hang round the neck; the lice are sure to bite at the bait, and they thereupon as surely swell, become red, and die forthwith. In China and in Tartary you have to renew this salutary necklace once a month." (Huc's 'Travels in Tartary.')

Travellers are apt to expect too much from medicine, and to think that savages will hail them as demigods wherever they go. But their patients are generally cripples who want to be made whole in a moment, and other such like impracticable cases. Powerful emetics, purgatives, and eyewashes are the most popular physickings.

Let him who is sick, away from help, console himself with the proverb, that "though there is a great difference between a good physician and a bad one, there is very little between a good one and none at all."

PRESENTS, AND ARTICLES FOR PAYMENT AND EXCHANGE.

It is of the utmost importance to a traveller to be well and judiciously supplied with these: they are his money; and without money, a person can no more travel in Savagedom than in Christendom. It is a great mistake to suppose that savages will give their labour or cattle in return for anything that is bright or new: they have their real wants and their fashions as much as we have; and, unless what a traveller brings satisfies the one or the other, he can get nothing from them, except through fear or compulsion.

The necessities of a savage are soon satisfied; and, unless he belongs to a nation civilised enough to live in permanent habitations, and secure from plunder, he cannot accumulate, but is only able to keep what he actually is able to carry about his own person. Thus, the chief at Lake Ngami told Mr. Andersson that his beads would be of little use, for the women about the place already "grunted like pigs" under the burdens of those that they wore, and which they had received from previous travellers. These are matters of serious consideration to persons who propose to travel with a large party, and who must have proportionably large wants.

Speaking of presents and articles for payment, as of money, it is essential to have a great quantity and variety of *small change*, wherewith the traveller can pay for small services, for carrying messages, for draughts of milk, pieces of meat, &c. Beads, shells, tobacco, needles, awls, cotton caps, handkerchiefs, clasp-knives, small axes, spear and arrow heads, generally answer this purpose.

There is infinite fastidiousness shown by savages in selecting beads, which, indeed, are their jewellery; so that valuable beads, taken at hap-hazard, are much more likely to prove failures than not. It would always be well to take abundance (40 or 50 lbs. weight goes but a little way) of the following cheap beads, as they are very generally accepted,—dull white, dark blue, and vermilion red, all of a small size.

It is the ignorance of what are the received articles of payment in a distant country, and the using up of those that are taken, which, more than any other cause, limits the journeyings of an explorer; and the demands of each fresh chief are, of themselves, an immense drain upon his store.

CHAPTER OF ESTIMATES.

As a guide towards estimating the probable duration of a journey, experience shows that 10 English miles per day, measured along the road—or, what is much the same thing, 7 geographical miles, measured with a pair of compasses from point to point—is, taking one day with another, and including all stoppages of every kind, whatever be their cause, very fast travelling for the same caravan; and, in arranging an outfit for an exploring expedition, not more than half that speed should be reckoned upon. Indeed, it would be very creditable to conduct the same caravan 1000 geographical miles, across a rude country, in six months.

For shorter distances, tricks may be played with the cattle. The pace of a caravan across average country is 2½ statute, or 2 geographical, miles per hour, as measured with the compasses from point to point, and not following the sinuosities of each day's course; but every minute lost in stoppages by the way must be recorded, and subtracted from the whole time spent on the road. A careful traveller will be surprised at the accuracy of the results obtainable in this way. These data have no reference to a journey which may be undertaken at a dash, or to one where the watering-places and pasturages are well known; but to one of considerable length, in which a traveller must feel his way, and where he must use every caution not to exhaust his cattle, lest there should be an unexpected call for exertion which they might prove unequal to meet.

But persons who have never travelled—and very many of those who have, from neglect in analysing what has actually been performed by them—entertain most erroneous views on these matters.

Outfit.—To make an expedition effective, it is not possible to contrive any large reduction in the detailed list that is appended to the close of the chapter, which, on the other hand, I hope, will be found to have omitted no object of any real importance.

The result of the estimates is this,—that to know what is the minimum weight that has to be carried by an expedition in rude countries, where nothing except solid food and water can ever be obtained, we must fill up the following formula, and add the whole together :—

FORMULA.

	lbs.
Stores for common use, not articles of consumption, and therefore to a great degree independent both of the number of the party and of the time reckoned on for the expedition (the details are given, pp. 268, 269, under the heads of 'Various,' 95 lbs.; 'Stationery,' 30 lbs.; 'Mapping,' 31 lbs.; 'Natural History,' 30 lbs.; leaving a margin for extras of 14 lbs.) ..	200
Stores for the white men of the party, not articles of consumption—as clothes, bedding, share of cooking things; and those rations of water and food that have always to be carried from stage to stage, whatever the extent of the journey may be; 60 lbs. weight for each white man (p. 270)	
Allowance of articles of consumption to the white men of the party, viz. salt, tea, coffee, tobacco, powder, shot, &c.; 8 lbs. per month to each white man (p. 270)	
Stores for the black men of the party, not articles of consumption, as described above; 30 lbs. weight for each black man (p. 270)	
Allowance of articles of consumption to the black men of the party, viz. salt, coffee, presents, &c.; 3 lbs. per month to each black man (p. 271)	
Extras, viz. :—	
Those pack-saddles that are carried in the waggon, &c., as a reserve, including girths, straps, large leather bags for stowing the articles in, and macintosh overall to keep the pack dry; 30 lbs. each	
Water-tanks, 40 lbs. each (p. 17)	
Water-kegs, 15 lbs. each (p. 14)	
Heavy ammunition (1 lb. weight gives 10 shots)—otherwise each armed man is supposed to carry a long double-barrelled rifle of very small bore, say 70, and ammunition for these is allowed for above	
Presents, from 50 lbs. to, it may be, 300 lbs., or more (p. 270) ..	
Total weight necessary to be carried	
Special extras, as actually weighed, not estimated	
Total	

If meat and bread have to be carried, the burden is enormously increased, for each man's daily ration of these things weighs 3 lbs.; but see p. 97 for lighter kinds of food.

Slaughter animals carry themselves; however, the cattle-watchers swell the list of those that have to be fed.

Now, to transport this weight of things across a wild and unknown country, we estimate that—

	lbs.
An ass will not usually carry more than about (*net weight*)	65
A small mule	90
A horse	100
An ox of an average breed	120
A camel (which rarely can be used by an explorer; see p. 196)	303

It is very inconvenient to take more than six pack-animals in one caravan, that has to pass over broken country, or so much time is lost in re-adjusting packs, that its progress is seriously retarded.

An animal—camels always excepted—will draw upon wheels about two and a half times the weight he will carry.

	lbs.
A light cart, exclusive of the driver, should not carry more than ..	800
A light waggon, such as one or two horses would trot with along a turnpike road, not more than	1500
A waggon of the strongest construction, not more than	3000

A fair estimate in commissariat matters is as follows:—

A strong waggon full of food carries	1000	full-day rations.
A slaughter ox yields, *as fresh meat*	80	,,
A fat sheep yields ,, ,,	10	,,
The pack of an ox carries ..	40	,,
The pack of a horse ,, ...	30	,,

N.B. Meat when jerked loses about one-half of its nourishing powers.

LIST OF SUPPLIES, WITH THEIR WEIGHTS, THAT HAVE TO BE CARRIED BY AN EXPEDITION IN A COUNTRY THAT YIELDS NOTHING BUT OCCASIONAL SUPPLIES OF MEAT AND WATER.

STORES FOR COMMON USE.

VARIOUS—

	lbs.
One or two very small soft-steel axes; a small file to sharpen them; a few additional tools (*see* p. 173); spare butcher's knives	8
A dozen awls for wood and for leather, two of them in handles; two gimlets; a dozen sail-needles; three palms; a ball of sewing-twine; bit of bees'-wax; sewing-needles, assorted; a ball of black and white thread; buttons; two tailor's thimbles ..	3
Two penknives; small metal saw; bit of Turkey hone; large scissors; corkscrew	$1\frac{1}{2}$
Spring balances, from $\frac{1}{4}$ lb. to 5 lbs., and from 1 lb. to 50 lbs. (or else a hand steelyard)	$1\frac{1}{2}$
Fish-hooks of many sorts; cobbler's wax; black silk; gut; two or more fishing-lines and floats; a large ball of line; thin brass wire, for springes	2
Ball of wicks, for lamps; candle-mould; a few corks; lump of sulphur; amadou	$1\frac{1}{2}$
Medicines (*see* p. 255); a scalpel; a blunt-pointed bistoury; and good forceps for thorns	1
A small iron, and an ironing-flannel; clothes-brush; bottle of scouring-drops	3
Bullet-mould, not a heavy one; bit of iron plate for a ladle ..	$0\frac{1}{2}$
Gun-cleaning apparatus; turnscrews; nipple-wrench; bottle of fine oil; spare nipples; spare screw for cock (p. 225)	2
Two macintosh water-bags, shaped for the pack-saddle, of one gallon each, with funnel-shaped necks, and having a wide mouth (empty)	$2\frac{1}{2}$
Composition for mending them, in two small bottles; and a spare piece of macintosh	$0\frac{1}{2}$
Spare leather, canvas, and webbing, for girths; rings and buckles	20
Two small patrol-tents, poles, and pegs (p. 56, &c.)	30
Small inflatable pontoon for one, or even two, men (p. 133) ..	10
Small bags for packing the various articles, independently of the saddle-bags	4
Macintosh sheeting overall, to keep the pack dry	4
	95

STATIONERY—

	lbs.
Two ledgers; a dozen note-books (*see* p. 278); paper	9
Ink; pens; pencils; sealing-wax; gum	$2\frac{1}{2}$
Board to write upon	2
Books to read, say equal to six vols. the ordinary size of novels; and maps	$7\frac{1}{2}$
Bags and cases	3
Sketching-books, colours, and pencils	6
	30

MAPPING INSTRUMENTS (*see* following chapter, p. 272)—

	lbs.
Two sextants; horizon and roof; lantern; two pints oil; telescope for occultations; thermometers; watches; stand for either sextants or telescope	18
Protractors; ruler; compasses; measuring-tape, &c.	3
Raper's Navigation; Nautical Almanac; Carr's Synopsis, published by Weale; small tables, and small almanacs; star maps	4
Bags and baskets, well wadded	6
	31

NATURAL HISTORY (for an occasional collector)—

	lbs.
Arsenical soap, 2 lbs.; camphor, $\frac{1}{2}$ lb.; pepper, $\frac{1}{2}$ lb.; bag of some powder to absorb blood, 2 lbs.; tow and cotton, about 10 lbs.; scalpel, forceps, scissors, &c., $\frac{1}{2}$ lb.; sheet brass, stamped for labels, $\frac{1}{2}$ lb.	16
Pill-boxes; cork; insect-boxes; pins; tin, for catching, and keeping, and killing, animals; nets for butterflies (say, bags and all)	10
Geological hammers, lens, chronometer, &c.	4
	30

(I make no allowance for the weight of specimens, for these accumulate as stores are used up, and seldom in a faster proportion.)

PRESENTS, AND ARTICLES FOR PAYMENT AND EXCHANGE—

They are usually of far greater weight than all the above things put together; 100 lbs. weight of beads does not go far in Africa. Tobacco is the lightest and most generally-prized article of any. (See p. 263.)

WEIGHT OF STORES, NOT ARTICLES OF CONSUMPTION, FOR EACH WHITE MAN OF THE PARTY—

	lbs.
Clothes (see list, p. 77); macintosh rug; ditto sheet; blanket-bag; spare blanket	30
Share of plates, knives, forks, spoons, pannikins, or bowls	2
Share of cooking-things, iron pots, coffee-mill, kettles, &c.	3
Spare knife, flints, steel, tinder-box, tinder, four pipes	2
Reserve :—	
Five days of jerked meat, at 3 lbs. a day (on an average)	15
Two quarts of water (on average), 4 lbs.; share of kegs, 1½ lbs.	8
	60

(These are not properly "articles of consumption," as they have to be carried in reserve, whatever the length of the journey may be.)

ARTICLES OF CONSUMPTION, CALCULATED FOR A SIX MONTHS' JOURNEY, FOR EACH WHITE MAN—

	lbs.
Tea and coffee, 9 lbs.; tobacco, 6 lbs.; salt, 6 lbs.; pepper, 1 lb.	22
Brandy or rum, occasionally served out	6
White sugar, 2 lbs.; arrowroot, 1 lb.; dried onions, &c., 3 lbs.	6
Ammunition for small-bored rifles, with reserve powder and caps.	9
Bags, 6 lbs.	6
(Or at the rate of 8 lbs. per month.)	49

STORES, NOT ARTICLES OF CONSUMPTION, FOR EACH BLACK MAN—

	lbs.
Bedding, &c.	9
Meat and water, as above (about)	19
Share of cooking-things	2
	30

ARTICLES OF CONSUMPTION, CALCULATED FOR SIX MONTHS, FOR EACH BLACK MAN—

	lbs.
Tobacco, 6 lbs.; salt, pepper, &c., 5 lbs.	11
Presents which will have to be made him from time to time ..	6
(Or at the rate of 3 lbs. per month.)	17

INSTRUMENTS

FOR TAKING OBSERVATIONS AND DRAWING UP A MAP.

§ 1. Outfit.—§ 2. Substitutes for Instruments.

Sect. 1.—Outfit.—It will add greatly to the interest which a traveller may take in drawing up a large and graphic route-map of his journey, to be assured of the extreme ease and cheapness with which copies of such a map may be multiplied to any extent by a well-known process in lithography; since these, being available for distribution among persons interested in the matter, will prevent his painstaking from being lost to the world. Sketches and bird's-eye views may be multiplied in the same manner.

The method I refer to is that of autographic ink and paper: they can be obtained, with full instructions, at any lithographer's shop. The paper is prepared by being glazed over with a composition, and the ink is in appearance something like Indian-ink, and used in much the same way. With a pen and this ink, and upon this paper, the traveller draws his map; they are neither more nor less difficult to employ than common stationery, and he may avail himself of tracing-paper without danger. He has one single precaution to guard against, which is, not to touch the paper overmuch with his bare hand, but to keep a bit of loose paper between it and the map as he draws.

As soon as finished, the map is taken to the lithographer, who puts it face downwards on a stone, and passes it under his press, when every particle of ink leaves the surface of the paper, and attaches itself to the surface of the stone precisely as though it had originally been written there: the glaze on the paper, which prevents the ink from soaking into it, makes this transference more easy and complete.

The stone can now be worked with, just as a stone that has been regularly lithographed; that is to say, printing-ink may be rubbed over it, and impressions taken off to any amount. It will be observed that the writing on the paper comes off reversed upon the stone, and is re-reversed, or set right again, in the impressions that are taken from it.

The lithographer's charges for furnishing autographic ink and paper, working the stone, striking off fifty copies of a folio size, and supplying the paper (common white paper) for the copies—in fact, every expense included—need not exceed ten shillings, and may be much less.

If, before drawing out his map, the traveller were to go to some working lithographer, and witness the process, and make two or three experiments in a small way, he would naturally succeed all the better. A map drawn on a large scale, though without any pretension to artistic skill, with abundance of profile views of prominent landmarks, and copious information upon the routes that were explored, written along their sides, would be of the utmost value to future travellers, and to geographers at home.

I reprint here, with some alterations, part of a short paper that I have communicated to the Royal Geographical Society, and which will be found at the end of their volume for 1854. In addition to it, communications are also published there from Lieutenant Raper, Admiral FitzRoy, Admiral Smyth, Admiral Beechey, and Colonel Sykes; the whole being collected under the title of 'Hints to Travellers.'

My own object was to suggest a complete and efficient outfit of the simplest instruments by which explorers could bring back *really good results;* to which end I gave the following list. I must however premise, that I am still ignorant of the merits of the many instruments lately designed by the Astronomer Royal of Scotland to supersede the sextants, &c., in common use. I hear the new Berlin prismatic sextant (which takes any angle) is highly spoken of.

LIST OF INSTRUMENTS.

A SEXTANT—

A sextant of five-inch radius, light in weight, by a first-rate maker, divided clearly, and on platinum, to quarter degrees. It should be capable of measuring *any* angle. It must have a ground-glass screen fixed in front of the reading-off lens, to tone down a glaring light, and coloured glasses to screw on to the telescope for index error purposes, in addition to the coloured shades.

The handle must be adapted for fixing on the telescope-stand.

(It is recommended by Admiral Beechey that the telescope of the sextant should have a horizontal line in its focus, and be fitted with a spirit-level, after the manner of levelling instruments; for, when so fitted and screwed to a stand, altitudes of hills, and of stars when low, may be observed with it.)

A sextant of three-inch radius, graduated boldly to half degrees, and capable of measuring any angle, in a leather case, like that of an azimuth compass, suitable for slipping on to a leather belt, and being worn round the waist, if required.—Reserve, a second five-inch sextant, or other angular instrument of whatever kind the traveller may wish to take.

ARTIFICIAL HORIZON—

The trough must not be less than $3\frac{1}{4}$ inches inside length; it must be of the usual construction for filtering the mercury when it is poured in. The glass screen must be a folding one, and by a first-rate maker.—Reserve, one spare glass and a strong two-ounce glass bottle full of mercury, wrapped up loosely in a roll of clothes, and well tied up and labelled.

(The trough should rest on a metal plate, the size of a thin octavo book, with three knobs of an inch long for legs; this gives a steady rest when the ground is uneven, and raises it above the grass, &c. Dark or inky water will do nearly as well as mercury.—*Report of Sub-Committee.*)

THEODOLITES—

If the traveller prefer it, he may replace the sextants and horizons by theodolites. There is the greatest difference of opinion as to which class of instrument should be recommended to a young traveller for making astronomical observations. Everybody advocates the particular instruments he has had most experience in; and it is scarcely possible to make a fair comparison between the merits of sextants and theodolites, since a traveller's *modus operandi* wholly differs, according to which of the two he adopts. A three-inch theodolite, Admiralty pattern (Cary), for hill triangulation; a five-inch, of the latest pattern, for latitudes and longitudes, especially in combination with a telescope of the description mentioned below; with a chain for measuring base-lines, and also a level fitting to the same stands, would be the alternative to taking sextants and horizons. The theodolites would be much the heavier of the two, but almost essential if a regular survey were to be made, in addition to the astronomical observations; marks being erected (a work of no slight labour and time) for the purpose of triangulation.

WATCH—

A common, strong, silver watch, not too heavy, with an open face and a second-hand; it must wind up at the back. The hands should be black steel, not gilt (except in very moist tropical climates, where all iron rusts), and they and all the divisions should be very clear and distinct. The performance of the watch is really a very secondary matter. 4*l.* is quite enough to give for it.—Reserve, at least two other watches of the same character; these should be rolled up separately, each in a loosely-wrapped parcel of dry clothes, say of old stockings, and they will never come to harm: they should be labelled, and rarely opened. Half a dozen spare watch-glasses, fitting easily; two to each watch. Three spare watch-keys; one might be tied to the sextant-case, one wrapped up with each watch.

COMPASS—

An azimuth compass, graduated from 0° to 360°; and, if the maker understands how to do it, have a shield of brass cut out here and there, to admit light, fixed over the glass.—Reserve, two spare glasses and a second azimuth compass.

Three common pocket-compasses, from an inch to an inch and a half in diameter. Their needles must carry cards graduated, like those of the azimuth compass, from 0° to 360°, in addition to the points. These compasses should be very light in weight, have plenty of depth, and be furnished with catches. The needles should work steadily and quickly. Avoid one that makes long, slow oscillations. (*See* p. 164.)

TELESCOPE—

One of 3½ feet long and 2¾-inch object-glass, with a firm tripod-stand like that of a theodolite, for observing occultations of small stars, and eclipses of Jupiter's satellites. It should be bought at a first-rate maker's. The glasses had better be carried in a well-stuffed box, separate from the tube. If the traveller does not wish to take so valuable and large an instrument, but intends to observe occultations of large stars only, and eclipses of the first satellite, let him by all means test the power of his instrument to his own satisfaction on the planet itself, and be satisfied of the sufficiency of its power, before he commits himself to it.

STANDS—

A clamp, to screw into a tree or a block of wood for the purpose of holding the telescope or sextant; one with three small brass legs is perfectly useless to a traveller, for he has no steady table or anything else to put it on. A theodolite tripod-stand is quite another matter, and a very excellent thing.

The ordinary telescope clamp makes a good rest for a sextant, by clamping a rod of wood, one end of which is weighted as a counterpoise, and the other, ending in a neck, is pushed through an auger-hole in the sextant handle, with a linchpin stuck through its projecting end. Smooth action is not at all wanted for a sextant-rest.

THERMOMETERS—

Four boiling-point thermometers, bought at Casella's, Hatton Garden, and tested at Kew. (Try them yourself against a good barometer, whenever you have an opportunity of doing so, as their index errors seem to have a slow but regular change; and recollect, that, for all usual purposes of determining heights, common water does just as well as distilled water.)

Two or three common thermometers, graduated to 160° at least, if for hot climates. Each thermometer should slip into a tube of vulcanised India-rubber.

A lantern, with a vessel at the top, to boil the thermometer in. Abundance of spirits of wine. A pint will suffice for at least 100 boilings, if the lantern be a small one.

LANTERN—

A "bull's-eye" will do. If used, take a small ball of spare wick and abundance of lamp-oil. A candle-lamp is more clean and convenient: it may be used with Price's, or other similar candles.

MAPPING INSTRUMENTS—

Protractors.—1 large circular brass one, with needle points—4 or 5 inches in diameter; 2 semicircular brass ones, of 3½ inches, all graduated, like your compasses, from 0° to 360°, and not twice over to 180°. Horn protractors warp and crack in hot dry climates, otherwise they are very handy; talc ones are used, but I do not know about them.

A station-pointer of some kind, for protracting sextant angles.

Two or three rulers, of 1 foot each, in ivory; a small square; a set of scales; small parallel-rulers; compasses with pencil and pen; small pair of reserve compasses; fine ruling-pen; a dozen artist's pins. Medium-size measuring-tape, say 12 yards; pocket ditto, 2 yards.

A dozen HHH and a dozen HHHH pencils: they are invaluable.

ADDITIONAL INSTRUMENTS, NOT NECESSARY, BUT CONVENIENT—

A pedometer of the best construction.

An aneroid, with compensation arrangement.

I can hardly recommend an explorer to have anything to do with either a chronometer or a mountain barometer.

STATIONERY—

A light board of the very best mahogany, to rule and draw upon, as large as the writing-case will hold, say 11 inches by 7.

Plenty of note-books, with spare pencils, all of one size, with a leather pouch, having a flap buttoning easily over, and sewn on to the belt, to hold the one in use. (See p. 278 for further particulars.)

Plenty of spare paper; it should be smooth, sufficiently thick, and fold up into 11 inches by 7.

A sheet of blotting-paper cut up, and put here and there in the ledgers.

Tracing-paper, both black and transparent.

Blank map ruled for latitude and longitude.

Two dozen steel pens and holders; half a dozen fine drawing and holder: half a dozen FH pencils; half a dozen HB ditto. (See also *Mapping Instruments*, p. 273.)

Two penknives; India-rubber cut up in 5 or 6 bits.

Ink-powders (in default of vinegar, use plain water). Red ink.

Paints, one cake or half a cake of each—viz. Indian-ink, lake, cobalt, gamboge, ox-gall—in a small tin case.

Half a dozen common paint-brushes; one or two of which are kept in the case.

BOOKS—

Raper's Navigation.

Nautical Almanac for current and future years, well bound; the superfluous part being cut out.

Tables of Logarithms of Society of Useful Knowledge, bound in limp cover.

Tables for boiling-point thermometers.

Carr's Practical Synopsis, a 5*s*. book, published by Weale, is an admirable collection of formulæ and short explanations, bearing on all kinds of physical science subjects. It requires binding with blank sheets at end, for addenda.

Guyot's Meteorological Tables, published by Smithsonian Institution, U.S., latest edition.

Celestial Maps (uncoloured), pasted on canvas (and learn how to use them).

Three or four small 6*d*. or 1*s*. Almanacs of any kind; the Nautical is far too cumbrous and on too bad paper for daily use. (Hannay and Dietrichsen's gives a vast deal of information; the Seaman's Almanac, White's Ephemeris, &c.; they are all useful to select and cut tables out of.)

The best maps of the country you are going to, that are to be got.

An artificial horizon is useless for very low angles. They can be measured to within two or three minutes, by obtaining a vertical point of reference in the following manner:—Tie two pieces of thread, crossing each other at two feet above the ground, put the mercury vessel underneath it, and look down upon it. When the eye is so placed that the crossed threads exactly cover their reflexion, the line of sight is truly vertical; and, if the distant object be brought down to them by the sextant, the angle read off will be $90° +$ altitude.

For want of glass over the mercury, in any observations, gauze stretched over the vessel will answer very tolerably to keep off the wind. The diameter of the pupil of the eye is so large compared to the thickness of the threads of the gauze, that it offers little impediment to a clear view of the image.

Porters.—Entrust instruments and fragile articles to some respectable old savage, whose infirmities compel him to walk steadily. He will be delighted at the prospect of picking up a living by such easy service.

Memoranda and Manuscripts.—I have observed, that almost every traveller who is distinguished for the copiousness and accuracy of his journals, has written them in a remarkably small but distinct handwriting. *Hard* pencil-marks (HHH pencils) on common paper, or on metallic paper, are very durable. Dr. Barth wrote his numerous observations entirely in Indian-ink. He kept a tiny saucer in his pocket, rubbed with the ink. When he wanted to use it, he rubbed it up with his wetted finger-tip, or resupplied it with fresh ink, and filled his pen and wrote. Captain Burton wrote very much, when lying awake at night, in the dark. He uses a board with prominent lines of wood, such as is adopted by the blind. It is very important that what is written should be intelligible to a stranger, after any lapse of time. A traveller may die, and his uncompleted work perish with him; or he may return, and years will pass by, and suddenly some observations he had made will be called in question. It has occurred frequently to me, to be consulted about the best way of keeping MSS. Captain Blakiston paid great attention to the subject: he was fully in possession of all I had to say on the matter; and I gladly quote the method he adopted in North America, slightly modified, according to the results of his experience, and with a few trivial additions of my own. For the purposes of memoranda and mapping data, he uses three sets of books, which can be ordered at any lithographer's :—

1. Pocket Memoranda Book, three and a half by five inches; of strong paper, *not metallic*,—for metallic paper soon becomes rotten, and the leaves fall out; besides that, wet makes it peculiarly soppy. The books are paged with bold numbers printed in the corners; two faint red lines are ruled down the middle of each page, half an inch apart. They enable the book to be used as a field-surveyor's book when required. In this pocket-book, every single thing that is recorded at all, is originally recorded with a hard HHH pencil. Everything is written consecutively, without confusion or attempt to save space. There may easily be 150 pages in each of these books; and a sufficient number should be procured to admit of having at least one per month. Do not stint yourself in these.

2. A Log-Book.—This is an orderly way of collecting such parts of the information as has been scattered over each day in your note-book, and refers to the mapping of your route. It will be neatly written out, and become the standard of future reference. By having a printed form, the labour of drawing it up, on the one hand, and that of consulting it on the other, will be vastly diminished. I give Captain Blakiston's form, p. 280, and I would urge intending travellers not to depart from it without very valid reasons, for it is the result of considerable care and experience. The *size* is not quite accurate, because the pages of this book are not large enough to admit of it, but the *proportion* is kept. The actual size should be five and a half inches high and nine inches wide, so that it opens freely, like all memoranda books, along one of the narrow sides of the page. Four pages go to a day; of these, the pages 1 and 2 are here represented; pages 3 and 4 are left blank.

The bold figures, **17** and **18**, in the right-hand corners, show how the pages should be numbered. The lines in p. **18** should be faint blue.

PAGE 1 OF DAILY "LOG." **17**

DATE.

Place.	Local Time.		Course (true).	Geograph. Miles.		Altitude above Sea.	Nature of Country.	Reference.
	From.	To.		Intervg.	Total.			

	Lat. by Observation. Lat. by Account.		
	Long. by „ „ Account.		
	Chronometer. No.	Error {at noon on G.M.T. at on Local M.T. Rate.	
	Variation of Compass.		

Local Time.	Thermometer.		Barometer (or temp. boiling water.)			Wind.		Weather.	
	Dry.	Wet.	No.	Alt. Ther.	Corrected.	Direction.	Force.		

PAGE 2 OF DAILY "LOG." **18**

†

* For "Plan" of Route (usual scale, 4 miles = 1 inch).
† For "Section" of Route (usual vertical scale, 200 feet = 1 inch).

3. CALCULATION BOOK.—Of the same size and shape as the LOG BOOK. Outline forms for calculations are printed in its pages. The labour and confusion saved by using these, and the accuracy of work that they ensure, are truly remarkable. The instruments used, the observations made, and especially the tables employed, are so exceedingly diverse, that I fear it would be to little purpose if I gave special examples.

However, a traveller would do excellently, who took latitudes by meridian altitudes once in the twenty-four hours; a careful series of lunars once a fortnight, on an average; compass variations as often; and an occultation now and then. He would want, occasionally, a time observation to set his watch by (I am supposing he uses no chronometer). He might prepare himself with outline forms for calculating these observations in the way I shall describe, bearing the following well-known maxims in mind:—

1. Let all careful observations be in *doubles*. If they be for latitudes, observe a star N. and a star S.; the errors of your instruments will then affect the results in *opposite directions*, and the mean of the results will destroy the error. So, if for time, observe in doubles, viz. a star E. and a star W.; also, if for lunars, let your sets be in doubles—one set of distances to a star E. of moon, and one to a star W. of moon.

2. Whenever you begin on lunars at all, give three hours at least to them, and bring away a reliable series; you will be thus possessed of a certainty to work upon, instead of the miserable unsatisfactory results obtained from a set of lunars here and another set there, scattered all over the country, impossible to manage, and mutually discordant. A series should consist of six sets, each set being three simple distances. Three of these sets should be to a star or stars E. of moon, and three to a star or stars W. of moon. Lunars not taken on the E. and W. plan are almost worthless, no matter how numerous they may be. The sextant, &c., might be inaccurate to any amount, and yet no error might be manifest in their results. The E. and W. plan exposes errors mercilessly, and, at the same time, eliminates them. Lastly, as regards lunars, the best authority on these

practical matters, the Astronomer Royal of Cape Town, says to this effect :—"Do not observe the altitude of the star, but compute it. The labour of that observation is better handed over to taking a large number of distances." So much delicacy of hand and of eyesight is requisite in taking lunars that shall prove truly reliable to seven or eight miles, and so small an exertion or flurry spoils that delicacy, that every economy of labour is a matter to be carefully studied.

These things being premised, it will be readily understood that outline forms sufficient for an entire series of lunars will extend over many pages—they will, in fact, require eighteen pages. There are four sets of observations for time :—one E. and one W., both at beginning and close of the whole ; one for latitudes N. and S. ; six for six sets of lunars, as described above ; six for the corresponding altitudes of the stars, which have to be computed ; and, finally, one page for taking means, and recording the observations for adjustment, &c. Each double observation for latitude would take one page ; each single time observation one page ; and each single compass variation one page. An occultation would require three pages in all ; one of which would be for time. At this rate, and taking the observations mentioned above, a book of 500 pages would last half a year.

Taking Notes.—"The practice which I have long adopted is this :—to carry a memorandum-book with Harwood's prepared paper and metallic pencil ; in which, notes and observations, and slight sketches of every description, are made on the spot, and in the exact order in which they occur. These notes are almost ineffaceable, and are preserved for reference. They are thus extended, as far as possible, every evening, with pen and ink, in a suitable book in the form of a journal ; from which, finally, they may be extracted and modified for any ultimate purpose. The speedy extension of memoranda has several great advantages : it secures a deliberate revision of observations, whether of instruments or of nature, whilst further explanation may be sought, and very often whilst ambiguities or contradictions admit of removal by a fresh appeal to facts. By this precaution, too, the risk of losing all the fruits of some weeks of labour, by the loss of a pocket-book, may be avoided. (Forbes' 'Glaciers.') No. 2, page 279, is the "extension" of No. 1.

Sect. 2.—Substitutes for Instruments.—Actual measurement with the rudest makeshift is far preferable to an unassisted guess, especially to an unpractised eye.

Pacing Distances.—"If you count the strokes of either of your horse's fore-feet, either walking or trotting, you will find them to be upon an average about 950 to a mile. In a field-book, as you note each change of bearing, you have only to note down also the number of paces (which soon becomes a habit); and to keep count of these, it is only necessary to carry about thirty-five or forty small pieces of wood, like dice (beans or peas will do), in one waistcoat-pocket, and at the end of every 100 paces remove one to the empty pocket on the opposite side. At each change of bearing you count these, adding the odd numbers to the number of hundreds, ascertained by the dice, to be counted and returned at each change of bearing to the other pocket. You should have a higher pocket for your watch, and keep the two lower waistcoat-pockets for this purpose.

"Now, to plot such a survey, you have only to take the half-inch scale of equal parts (on the six-inch scale, in every case of instruments), and allowing *ten* for a hundred, the half-inch will represent a thousand paces. You may thus lay down any broken number of paces to a true scale, and so obtain a tolerably accurate map of each day's journey.

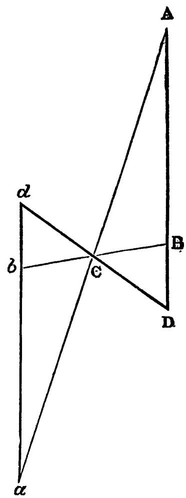
"The latitude will, after all, determine finally the scale of paces; and you can at leisure adjust each day's journey by its general bearing between different latitudes, and subsequently introduce the details." (Sir Thomas Mitchell.)

A traveller, when the last of his watches breaks down, has no need to be disheartened from going on with his longitude observations, especially if he observes occultations and eclipses. The object of a watch is to tell the number of seconds that elapse between the instant of occultation, eclipse, &c., and that, a minute or two later, when the sextant observation for time is made; and all that it actually *does*, is to beat seconds, and to record the number of beats. Now, a string and stone swung as a pendulum will beat time; and a native who is taught to throw a pebble into a bag at each beat will record it; and, for operations that are not tedious, he will be as good as a watch. The rate of the pendulum is, of course, determined by taking two sets of observations, with three or four minutes' interval between them; and, if the distance from the point of suspension to the centre of the stone be thirty-nine inches, and if the string be thin and the stone very heavy, it will beat seconds very nearly indeed. The observations upon which the longitude of the East African lakes now depends (1859) are lunars timed with a string and a stone, in default of a watch.

Units of length.—A man should ascertain his height; height of his eye above ground; ditto, when kneeling; his fathom; his cubit; the span, from ball of thumb to tip of one of his fingers; the length of the foot, and the width of two, three, or four fingers. In all probability, some one of these is an even and a useful number of feet or inches, which he will always be able to recollect, and refer to as a unit of measurement. A stone's throw is a good standard of reference for greater distances. Cricketers estimate by the length between wickets. Pacing should be practised. It is well to dot a scale of inches on the gun-stock and pocket-knife.

Angles to measure.—I find that a capital substitute for a very rude sextant is afforded by the outstretched hand and arm. The span between the middle finger and the thumb subtends an angle of 15°, and that between the forefinger and the thumb an angle of $11\frac{1}{4}$°, or one point of the compass. Just as a person may learn to walk *yards* accurately, so may he learn to span out these angular distances accurately; and the horizon, however broken it may be, is always before his eyes to check him. Thus, if he begins from a tree, or even from a book on his shelves, and spans all round until he comes to the tree or book again, he should make twenty-four of the larger spans and thirty-two of the lesser ones. These two angles of 15° and $11\frac{1}{4}$° are particularly important. The sun travels through 15° in each hour; and therefore, by "spanning" along its course, as imagined, from the place where it would stand at noon (aided in this by the compass), the hour before or after noon, and, similarly, after sunrise or before sunset, can be instantly reckoned. Again, the angles 30°, 45°, 60°, and 90°, all of them simple multiples of 15°, are by far the most useful ones in taking rough measurements of heights and distances, because of the simple relations between the sides of right-angled triangles, whose other angles are 30°, 45°, &c. As regards $11\frac{1}{4}$°, or one point of the compass, it is perfectly out of the question to trust to bearings taken by the unaided eye, or to steer a steady course by simply watching a star or landmark, when this happens to be much to the right or the left of it. Now, nothing is easier than to span out the bearing from time to time.

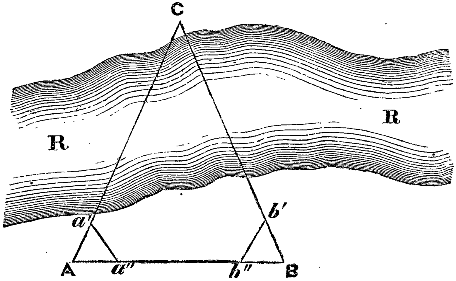
Squaring.—As a triangle whose sides are as 3, 4, and 5, must be a right-angled one (since $5^2 = 3^2 + 4^2$), we can always find a right angle very simply by means of a measuring-tape. We take a length of twelve feet, yards, fathoms, or whatever it may be, and peg the two ends of it, close together, to the ground. Next a peg is driven in at the third division, and then the third peg is held at the twelfth division of the cord, which is stretched out till it becomes taut, and the peg is driven in. These three pegs will form the corners of a right-angled triangle.



Measurements, &c.—To show how the breadth of a river may be measured without instruments and without crossing it, I have taken the following useful problem from the French 'Manuel du Génie.' I may remark that those usually given by English writers for the same purpose are, strangely enough, unsatisfactory, for they require the measurement of an angle. This plan requires pacing only.

To measure A B, produce it any distance to D; from D, in any direction, take any equal distances, D C, C *d*, and produce B C to *b*, making C *b*, = C B; join *d b* and produce it to *a*, where A C produced intersects it; then *a b* is equal to A B. In practice, the points D C, &c., are marked by bushes planted in the ground, or by men standing.

Colonel Everest, the late Surveyor-General of India, has pointed out the following simple way of measuring an angle, and therefore a triangle. A B is the base, R R the river, C an object on the other side. He paces any length A a'; and an equal length A a''; also a' a'', which is the chord of a' A a''. In other words—

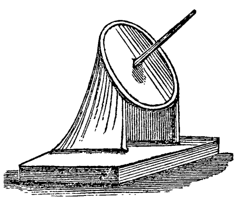


$$\sin. \frac{A}{2} = \frac{a'\ a''}{2\ A\ a'}:$$

in the same way B is found. A B being known, the triangle A B C is known, and the breadth of the river can be found. The problem can be worked out, either by calculation or by protraction. I have made numerous measurements in this way, and find the practical error to be within five per cent.

Sun-dial.—A good temporary dial may be established by pitching a stake, as one might pitch a tent-pole, with three guy ropes; then take a fourth rope and peg it down, so that it shall point to the elevated pole, and use it as the gnomon; next lay out the dial-lines, and mark the hours, if you like it, with pegs, or you may proceed as follows:—Plant a stake firmly in the ground in a level open space, and get ready a piece of string, a tent-peg, and a bit of stick a foot long. When the stars begin to appear, and before it is dark, go to the stake and lie down on the ground, and put the stick in the ground just firmly enough for it to stand steadily, so that its top and the point where the string is tied to the stake shall be in a line with the Pole; then get up, stretch the string so as just to touch the stick, and stake it down with the tent-peg. Kneel down again, to see that all is right, and in the morning draw out the dial-lines: the string being the gnomon. The true North Pole is three full-moons' breadths to the side of the Polar Star, and between it and the Great Bear. The one essential point of dial-making is to set the gnomon truly, because it ensures that the shadows shall fall in the same direction at the same hours all the year round. As to knowing where to mark the hour-lines on the ground, or wall, on which the shadow of the rod falls, it is best to use a watch, or whatever makeshift means of reckoning time be at hand. Calculations are too troublesome, unless the plate is quite level, or vertical, and exactly facing south or north, or else in the plane of the Equinox.

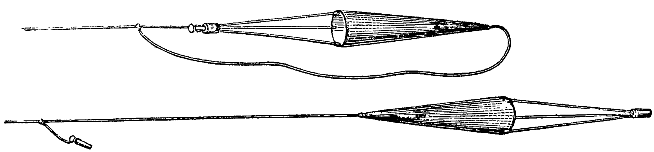
The figure represents the well-known equinoctial sun-dial.



It can easily be cast in lead. The spike points towards the elevated pole, and the rim of the disc is divided into 24 *equal parts* for the hours.

The true North Pole is distant three suns' (or moons') diameters from the Polar Star, and lies *between* it and the pointers of the Great Bear, or, more truly, between it and ζ Ursæ Majoris.

For a log, use a conical canvas bag, thus—



When the peg is drawn out by the usual jerk, it no longer presents its mouth to the water, but is easily drawn in by the line attached to its point.

Signals.—See p. 150.

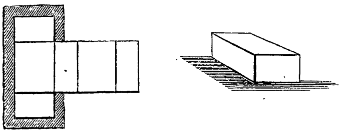
Sound flies at 380 yards a second in round numbers: it is easy to measure rough distances by the flash of a gun and its report; for even a storm of wind only makes 4 per cent. difference in its speed, one way or the other.

Compasses.—See p. 164.

Alphabetical Lists.—Every explorer has frequent occasion to draw up long catalogues in alphabetical order, whether of words for vocabularies, or of things that he has in store: now, there is a right and a wrong way of setting to work to make them. The *wrong way* is to divide the paper into equal parts, and to assign one of them to each letter in order. The *right way* is to divide one paper into parts of a size proportionate to the number of words in the English language which begin with each particular letter. In the first case, the paper will be overcrowded in some parts and utterly blank in others: in the second, it will be equally overspread with writing; and an ordinary-sized sheet of paper, if closely and clearly written, will be sufficient for the drawing up of a very extended catalogue. A convenient way of carrying out the principle I have indicated, is to take an English dictionary; and, after having divided the paper into as many equal parts as there are leaves in the dictionary, to adopt the first word of each leaf as headings to them. It may save trouble to my readers, if I give a list of headings appropriate to a small catalogue. We will suppose the paper to be divided into fifty-two spaces—that is to say, into four columns, and thirteen spaces in each column—then the headings of these spaces, in order, will be as follows:—

A	dul	pal	son
adv	eve	per	sta
app	fin	ple	str
bal	gin	pre	sur
bil	hee	pro	tem
bre	imp	que	tos
cap	int	rec	tur
chi	k	reg	unb
col	lan	ris	une
com	mac	sab	ven
cra	mil	sea	wea
dec	nap	sha	wor
dis	off	siz	x y z
			o

To make Boxes for Specimens.—Use cigar-boxes that have been broken up to lie flat; or, take a strip of pasteboard; cut it half through in three places; add two smaller pieces as wings, one on each side, by means of a piece of gummed paper overlapping them, as in the picture. Any number of these may be carried, like the leaves of a book; and, when wanted, may be turned up, and by the adherence of the moistened gum-paper can be made into a box at a moment's notice. The shaded border represents the gummed paper.



Quills make convenient boxes for minute specimens. They should be dressed (p. 191), and may either be corked with a plug of wood; or, for greater security, a small quill may be pushed, mouth forward, into a larger one—as into a sheath.

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THE END.

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