

KNOTS FOR CLIMBERS.

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FOR a long time past the question of the best knots for climbers' use has been regarded as settled. This may be inferred from the fact that writers on mountaineering are almost unanimous in their opinions. They recommend for the end and middle of the rope and for the join respectively :—

The Bowline and the Fisherman's Noose ;  
The Fisherman's Noose ;  
The Fisherman's Knot.

This is redolent of Izaak Walton, and might arouse a suspicion that one had been sent by mistake the journal of a very different club. The association of such widely divergent pursuits is hard to understand, unless Samuel Johnson has somewhere defined a climbing-rope and paralleled his famous definition of a fishing-rod.

Now it will be seen that there has been no advance since the Report of the Committee on Equipment in 1892, published in Volume 16 of the ALPINE JOURNAL. Rather there has been retrogression, for the Fisherman's Noose has invaded the domain of the Bowline, and fantastic methods of making it tend to supplant the simpler and sounder recommendations of the Report.

Brief as it is, the summary above fairly represents the position at present. For, even though an authority on climbing may mention some other knot, it is in such a diffident way that an impression is left that he has never put it to the test. A few knots so mentioned may be noticed at this stage and dismissed once for all. The Reef Knot is one, but it remains a mystery by what magic it can be used to make an end-noose without undergoing conversion into a slipknot at the first jerk and into a deathtrap at the next. The Double Bowline on the Bight, tempting to make in the position suggested by its name and offering the benefit of a double turn round the waist, loses every merit but some degree of safety, if the two parts of the rope are pulled in opposite directions, and should never be used in the middle of the rope. The Manharness, most delightful of knots to make, provided only that the neatest method be known, and excellent for a steady haul on a rope

which is itself under tension from end to end, may become a slipknot when pulled about by alternate straining and slacking. Now these are just the conditions that occur in climbing, and they exact as the first quality in a good knot that it shall be unaffected by intermittent strain.

The weakness in the knots hitherto recommended lies, in fact, in the middle noose. The Fisherman's Noose is a slipknot in one direction and it might well have been put out of court by such a grave defect, though it is said by optimists, a term necessarily including all climbers, never to be apparent in practice. Yet there seems to have been no serious rival, for the authorities are at one in condemning the Openhand Noose, although it is still in high favour with Swiss guides.

Dissatisfaction with the middle noose was, then, the origin of this inquiry. It seemed as if it ought to be possible with a little ingenuity to discover a reliable noose. But contempt for the Fisherman's Noose soon extended to dislike of the Fisherman's Knot. The prejudice, in face of reason and fact, became in time a conviction, and the inquiry, somewhat widened in scope, was definitely set on foot as an attempt to discover any good knots that might be of use in climbing.

### THE END NOOSE.

The search for new knots ended in partial failure in the section, which, though tackled last, must be treated first on account of its importance. The Bowline, backed by its derivatives, could not be ousted from its position as the best noose for the end of the rope. In adaptability and convenience it surpasses the nooses devised for the middle of the rope and described further on, although they rival it in other respects and are quite reliable as end-nooses. The Rover Noose, in particular, is excellent in this position. It is a worthy compeer of the Bowline, quite as reliable and much stronger, and, when once tautened, shows no tendency to work loose.

In the Bowline the tendency to spring loose is usually met by taking some half-hitches round the bight at the waist. An absolute safeguard is the use of an eyed rope, for then there is no loose end to work through the knot. But this device does away with the great merit of the Bowline, the ease and speed with which the rope can be passed round the waist and the noose knotted, fitted and secured almost in a moment. It will be found that this can be done a trifle more quickly by the method given below than by that which is generally

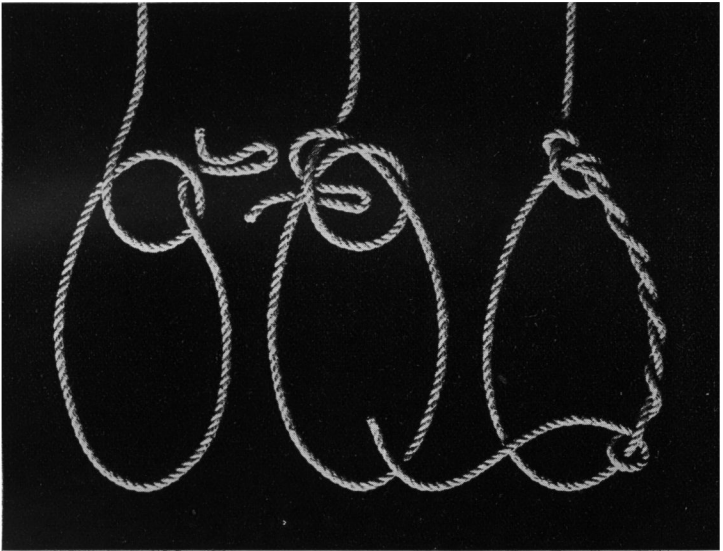
followed merely because it has been slavishly copied from one book on knots to another. The difference consists solely in the direction in which the initial loop is formed, and this is indicated, here and further on, by the terms, screw-wise and counterscrew, which have been preferred to others more ambiguous on the ground that most climbers are familiar with some form of screw. Sailing men, accustomed always to coil a rope right-handed, or with the sun, will probably begin instinctively with the righthand or counterscrew loop. A trial of the method will reveal the distinct advantage that one movement fewer is required, and further, that the movements are peculiarly natural and easy in forming a Bowline at waist-level.

### **The Bowline** (Figure I).

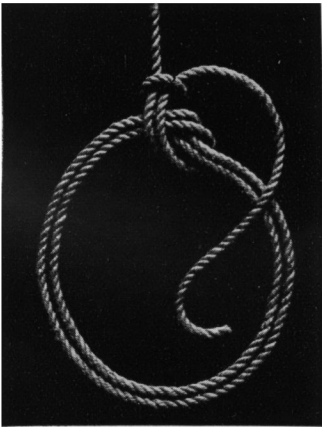
The standing part of the rope, running towards one from the rest of the party, is held in the left hand, and with the right hand a small bight is drawn out to the right between the thumb and fingers of the left hand. The bight is, at the same time, twisted upwards and over towards one with a counterscrew movement of the right hand and is formed into a righthand loop. The end must next be passed under the left shoulder round the waist and down through the loop. One movement of the right hand now suffices to bring the end round the standing part of the rope and up through the loop.

Those who care to splice an eye, a span or more long, on their rope can make the **Bowline on an Eyed Rope** in the same way, but after being passed through the loop, the eye must be drawn well down, the right hand is then passed through the eye, the bight of the noose grasped and drawn back through the eye, bringing the knot with it. The eye now encircles the rope above the loop and will slip into its place, if the noose be drawn out and stretched. Perfect security is given by this Bowline, but only with the sacrifice of a very great convenience, for it cannot be made directly round the waist, unless the climber himself is able and willing to pass through the eye of a rope.

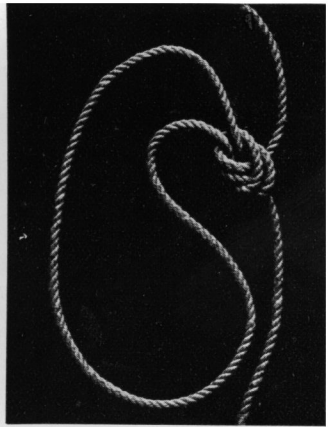
The adoption of the counterscrew twist in beginning the Bowline may appear at first glance to be only a trifling departure from the usual practice. But it must not be despised and ought to be mastered at once, for not only the modifications of the Bowline, but other knots to be described afterwards are begun with the same loop. This makes for uniformity and simplicity, and has the further very great advantage that the knots are made right-handed. Moreover,



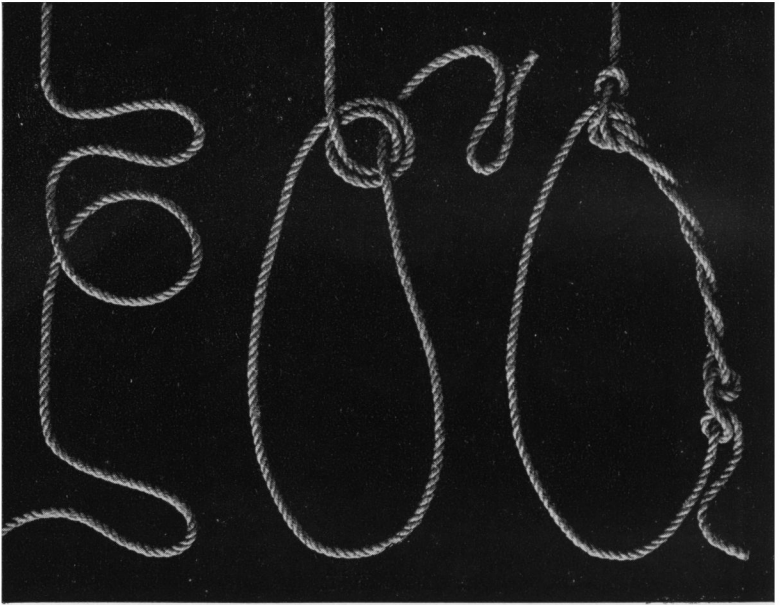
I. BOWLINE.



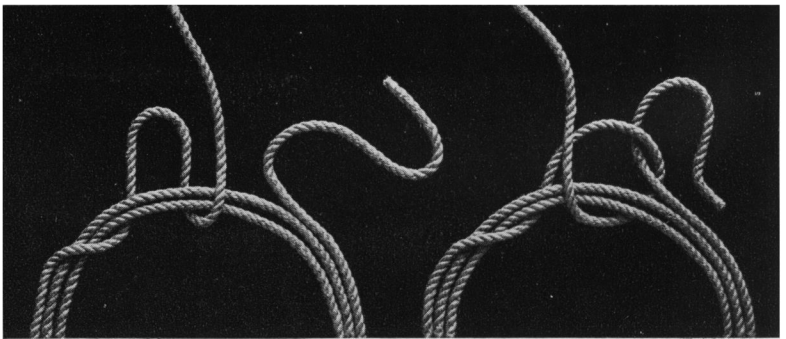
II. DOUBLE BOWLINE.



III. OPENHAND NOOSE.



IV. DOUBLE-KNOTTED BOWLINE.



V. BOWLINE AND COIL.

in the Bowlines it suits the lay of the rope, closes the knot more firmly, and controls the end better, than if the knot were begun with the reverse loop.

It is bad practice to make the common Bowline and leave the end hanging, for the spring of the rope may loosen the knot and the end work out. The end should be twisted in a few turns round the bight of the noose at the righthand side, or secured with some half-hitches. The latter have always been used by climbers, but the knot is much better, if they are preceded by a few turns in the same direction. The turns should be made to suit the lay of the rope, and with the usual lay they must be made upwards inside the rope at the waist (Figures I and IV). So made, they tend to keep the knot closed, as it lies in a better form. If, on the other hand, the Bowline be begun with a loop in the opposite sense, made with a screw-wise twist of the hand, the turns tend to keep the knot open. Thus in security, as well as in facility, there is a great gain in beginning the Bowline with a counterscrew loop.

Of the derivatives of the Bowline, which have now to be considered, the first and simplest is begun with a double loop, so as to form a double knot. The double turn seems to grip the end more tightly and to ease the strain on the rope at its entry into the knot. Whatever the reason, this slight modification, which adds only one second to the time required to make the knot, increases its strength out of all proportion to the extra time and manipulation. So much so that, where a single Bowline will serve the purpose, the common Bowline should always be replaced by the double-knotted form.

### **The Double-Knotted Bowline** (Figure IV).

Begin by making a counterscrew loop just as in the Bowline. Take up a small bight in the rope just beyond the loop and turn it back in the same sense to form a second loop, which must be laid on the first. Pass the end down through the double loop, round over the rope and up through the double loop again.

Secure the end with a few turns and a couple of half-hitches made upwards inside the rope at the waist.

Another very strong form of single Bowline can be made by closing the common Bowline with the Waist-Rope Hitch, which is described later. The initial loop is made as before, the end passed to the left round the waist, and rove through the loop in a Waist-Rope Hitch instead of the usual knot. It makes a strong noose, included later in the table of tests

as the **Bowline with Waist-Rope Hitch**, and affords a fairly good way of dealing with the end, which may be left hanging free but not too short.

The **Double Bowline** (Figure II) affords another good way of making the end secure, but it is not a strong noose. It is equivalent to the Double Bowline on the Bight, but is made in quite a different way to enable it to be formed round the waist. A single Bowline is first made; the end is left long and passed back to the right round the waist to follow the lead of the noose already made; it is then threaded through the knot beside its lead and left to hang.

The Bowline round the waist is all the more comfortable for being double, as in the last knot, and were it still thicker, the pressure on the ribs might be greatly eased in a severe fall. In the next, the Bowline and Coil, it can either be made double, or, just as easily, several turns can be taken up and caught securely in the knot. This is probably the most convenient method of carrying surplus rope and enables an end-man to reduce an overlong rope by twenty feet without discomfort. The ease with which the coil can be made and the knot tied illustrates the adaptability of the Bowline, and gives this form of it the preference over any noose in point of convenience.

This application of the Bowline is as interesting as it is useful. With a single Bowline before one's eyes as a guide it would appear almost impossible by such a simple expedient to include and secure in a Bowline knot a coil of rope already wound round the waist.

### **The Bowline and Coil** (Figure V).

Make as many turns round the waist as may be desired, passing the end always to the left, until the rope where it enters the coil and the end where it leaves the coil come close together in front. Take the rope at its entry into the coil in the left hand and with the thumb push a bight down inside the coil. Bring the bight forward under the coil (Stage 1) and press the rope a little to the left to lie across the bight. This forms the same righthand loop as in the simple Bowline, but with the difference that the loop encircles the coil. Just as before pass the end down through the loop (Stage 2), then to the left over the rope and up through the loop. Finish off the end by giving it a few turns round the bight of which it is the continuation and a couple of half-hitches round the coil, passing the end upwards inside the bight or coil.

To make a **Double-Knotted Bowline and Coil** is easy and interesting, but the double knot, though it may be useful when

the coil is thick, has no strengthening effect in this combination. The bight is drawn out under the coil just as in the last knot, but much longer, and is then passed down inside it once more and drawn out underneath. The two turns thus formed round the coil to the right of the bight are loosened and laid down on the bight, with which they form the double loop.

With an eyed rope the advantage of taking up a coil of rope is partly lost, for the turns must be made and the knot finished, before the coil is put round the waist. It has then to be fitted by passing the spare rope round the turns towards and through the knot. The preparation of the noose takes a little more time, but it may be worth while to have the comfort of the double turn with the security given by the eyed rope.

### **Bowline and Coil on Eyed Rope.**

Make a loop on the rope just as in the single Bowline and in the same direction. Pass the eye down through the loop to make the first turn. Bring it on round in the same direction and down through the loop to make another turn, and repeat this until the coil is complete. Draw the coil, bringing the loop with it, through the eye, which settles round the rope and can be drawn down into the knot.

The coil can also be made first and the loop formed by drawing a bight of the rope underneath the coil as in the knots just described.

The Bowlines have now been presented in all their variety, and they are a versatile family. At their best they have only one rival for the end of the rope. The Rover Noose, designed for the middle, and derived, as it was, from an improved Manharness, is still classed in the next section. But it fulfils quite as well, or even better, all the requirements of an end-noose, and must be considered with the best of the Bowlines, before a final choice is made.

With this important addition the series offers the climber who wishes to choose only among the best a noose of unrivalled convenience in the Bowline and Coil and two of great strength in the Rover Noose and the Double-Knotted Bowline.

### **THE MIDDLE NOOSE.**

The noose hitherto accepted as the best for the middle of the rope is called the Fisherman's Noose. In some books on mountaineering it masquerades as the Middleman Noose, a misnomer adopted by devotees for the sake of implying that



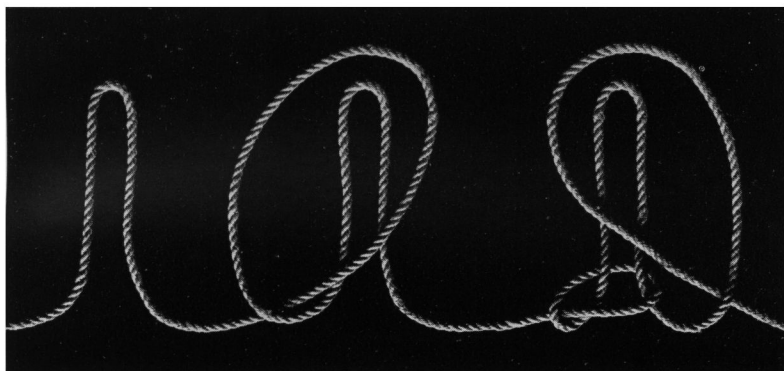
it stands alone. Now, so far from being the only middle noose, if the slight change of term be an improvement, there are in existence a few well-known nooses of this class and others may be invented. Among the latter at any rate, it may be said at once that there are several nearly as faulty and just as unsuitable for the middle of the rope, so that the Fisherman's Noose is by no means without a rival even at its own weight.

None the less it is a great favourite with climbers, and with the detached affection of Izaak Walton they deal with it as though they loved it. Their treatment of it is a remarkable commentary on the scant attention given to methods of making knots. There are eight ways, and may well be more, of making this too well-known knot, and it passes comprehension, by what mischance, for it can hardly have been deliberate choice, some of them have found their way into books on climbing. One distinguished climber gives a method which has no merit but slowness, not even the proverbial sureness. Another adopts the method of a puzzle-knot and offers the simple-minded climber a fisherman's knot as made by a conjurer. Climbing, fishing, conjuring! It sounds like a passage from Alice in Clamberland. Yet a third recommends the same method without the option of an alternative, but complains that it is hard to explain to his readers. Well, naturally. It was devised to prevent an audience from following what was being done, and it requires a little sleight-of-hand, that is as much out of place on rock or glacier as are all other manifestations of juggling and angling.

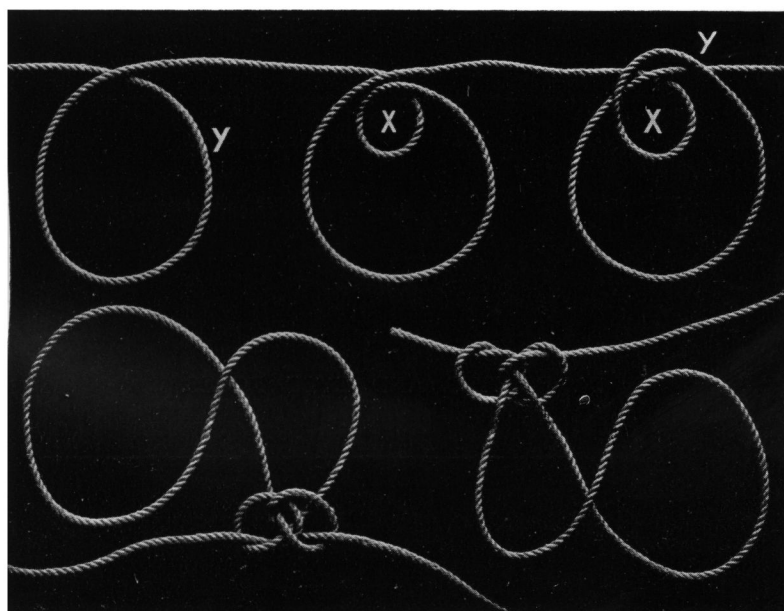
No greater contrast in manipulation could be found than the noose which is now described as the nearest equivalent. It is, perhaps, the best instance in this paper of exceptionally simple and natural movements in handling a rope.

### **The Half-Hitch Noose (Figure VI).**

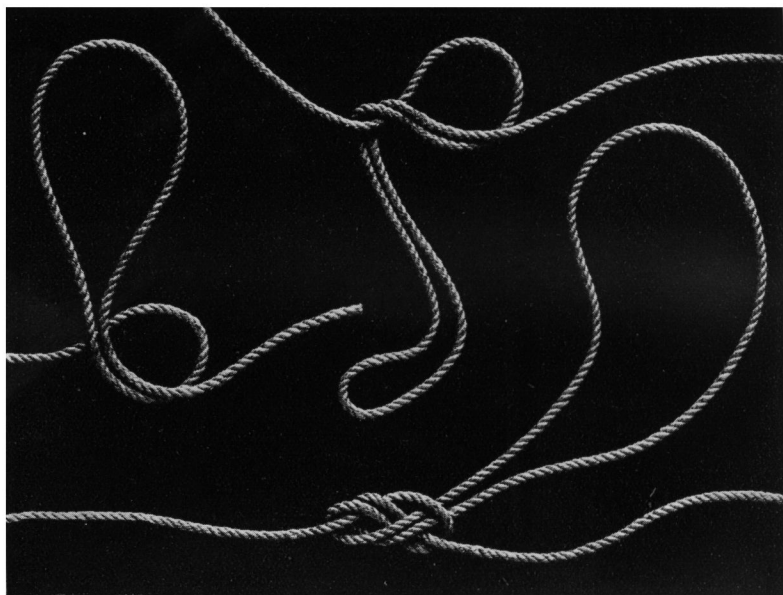
Take a short bight of the rope in the right hand and hold it pointing upwards, the parts of the rope running to the left and right (Stage 1). Stretch out the left hand and grasp the lefthand rope with the thumb outside pointing along the rope. With a sweeping movement bring the left hand round in front and inwards until it is just in front of the right hand (Stage 2). This movement forms a loose half-hitch. Lay it over the bight. Release it and take the bight in the left hand above the half-hitch. If the right hand be run down the bight, the half-hitch will follow it and settle



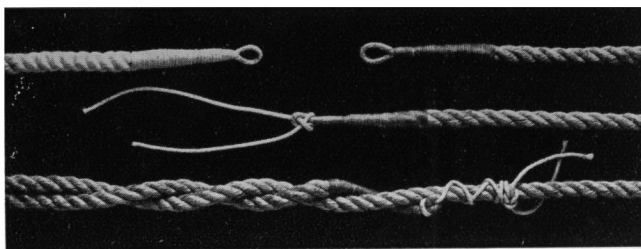
VI. HALF-HITCH NOOSE.



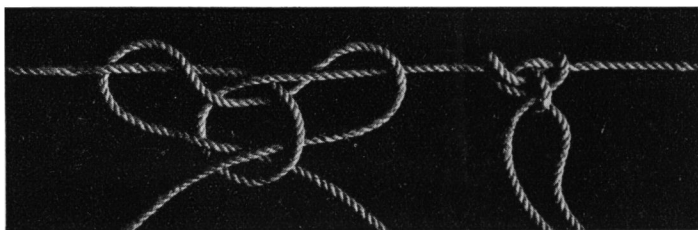
VII. BUTTERFLY NOOSE.



VIII. ROVER NOOSE.



IX. POINTED AND EYED ROPES.



X. TWO-WAY HITCH.

in its place. Now grasp the righthand rope with the thumb outwards, and bring the hand round and inwards to form another half-hitch (Stage 3). Drop it over the bight and let it settle into position just above the former half-hitch. Strain the rope a little and press the two half-hitches close together.

Better if put on with the parts of the noose crossing in the middle of the knot; otherwise they tend to stretch the knot.

The noose is named in order to impress on the memory the method of making it with two half-hitches. The looser it is left the better, for tautening weakens few knots more than this. With the least possible tautening and with the two half-hitches brought closely into contact, it is a satisfactory middle noose and much better than its barbarous prototype.

At first glance it would appear to be an easy task to supply a really good middle noose, for the **Openhand Noose** (Figure III) has not yet been quite discarded from the position and yet it is a good example of defects to be avoided. Made by a simple Overhand Knot on a bight of the rope, it is reliable and will not dislocate or shift its position. These are its merits; now for some defects. In respect of wear it is very severe on the rope. It is a tight knot and may be very difficult to open. Since it is a short as well as hard knot, it has no spring and will not help to ease a sudden jerk by its resilience. The two parts of the rope enter the knot together in the same direction, and consequently, when they are strained apart, either one or the other must take the strain at a very sharp angle. It is the same very serious defect, the lack of a straight entry, which also forbids the use of the stronger, but clumsier, Figure-of-Eight Noose in the middle of the rope.

These points give some idea of the qualities kept in view in the search for a suitable noose. Some of the neatest that were found resembled the Manharness in the ease with which they could be made, a very important quality, but had to be rejected, because they might suffer dislocation, even though it were only in very unlikely conditions. Some that were reliable and yet easy on the rope, two requirements rather hard to reconcile, were somewhat complicated to make. But all of them possessed in a straight entry the one quality that is especially desirable in a middle noose. The ropes should run into the knot without any sudden turn that would constitute a weakness under a violent strain.

Of the two knots about to be described both have this essential property, and the ropes enter them in opposite directions, which is the normal position of the rope when in

use. The Butterfly Noose, though slightly less strong, probably approaches the ideal more closely and is an excellent middle noose. It is naturally a very loose knot and nothing is gained by tightening it. The bights in the knot move on each other with a peculiar hinge-like freedom that makes the knot very easy on the rope. In spite of its looseness it keeps its position, and once it is nearly in its proper form, a severe strain in the rope merely tautens the knot without taking up any of the noose, even when the latter is quite slack. Neither very neat nor good to look upon, its merits will be better appreciated after long acquaintance.

### **The Butterfly Noose** (Figure VII).

Hold the rope with the two hands, the thumbs pointing towards each other and separated by a length of rope more than ample for the waist. Bring the hands together, the right in front, to form a righthand loop, which hold hanging in the left hand with the fingers passing through the loop from behind (Stage 1). With the right hand take the righthand part of the loop at Y fairly close to the neck, and with a movement of the right hand make a small righthand loop or turn round the left fingers at X. Keep it in position by placing the left thumb over it and keep it open with the left fingers (Stage 2). Pass Y up over the rope (Stage 3) and through X from behind. In pulling it through, take it with the right hand and give it a half-twist screw-wise, which will cross the parts of the noose at the base and make it easier to draw the rest of the noose after it. In doing this do not pull the knot taut. It is better to strain the ropes and bring the knot into its proper form before tautening it.

Put the noose on and adjust it to fit by passing the spare through the knot, keeping its form by holding it firmly in the left hand.

The noose should always be put on so that its parts cross each other in the middle of the knot, the position into which they naturally fall.

Tauten the knot but little.

Open by drawing the wings of the butterfly apart, or pulling the noose back through the knot.

In the illustration the finished knot is shown twice. In the figure to the right the knot has been turned over merely to show the inner side. The figure to the left gives its normal appearance.

The Rover Noose is formed by a handsome knot, which should be drawn rather tight, but it bears tightening well and is quite easy on the rope. In pulling it into its final shape, it is well to watch that the rope coming from the climber's right lies always to the right of its lead in every part of the knot.

This means that, wherever two ropes lie parallel in contact in the knot, the rope entering the knot from the right should lie on the righthand side of that running side by side with it. If this precaution be neglected, the knot is still quite reliable, but it is looser and its appearance suffers. With this precaution, which is little trouble, it is much snugger and the two ropes are much more widely separated at their emergence from the knot, a distinct merit in a middle noose.

Both this knot and the last, though designed for the bight of the rope, make reliable end-nooses; but with neither of them is it possible to take up several turns of rope, as can be done so easily and quickly with the Bowline. The Rover Noose, as already stated, is an excellent end-noose. It is much stronger than the Bowline in the end position and may be much safer than the latter, unless the loose end of the Bowline is carefully secured.

If there were any advantage in having the same noose for all positions on the rope, were it only to save the novice the strain of learning a second knot, the Rover Noose would seem to be the most suitable as an all-round noose.

### **The Rover Noose (Figure VIII).**

Take up the rope with the hands a span apart. With a swing of the right hand make a small righthand loop round the fingers of the left, and, continuing the movement upwards, draw the noose up past the loop; make the left thumb and fingers pass round the base of the noose and meet in the loop (Stage 1). Pass the noose backwards, release it, and let it hang down behind the left hand (Stage 2). Pass the right hand from the front under the ropes; grasp the noose and bring it forwards and upwards and through the loop from the front.

The knot is much better if the righthand rope emerges to the right of its lead through the knot, that is, the ropes come out of the knot as far apart as possible. This must be ensured at the beginning by using the left thumb to hold the righthand rope in the proper position against the loop. When this knot is made in an end-noose, it is essential that the lefthand rope is that running to the rest of the party and that the righthand rope is the free end.

The importance of the caution just given cannot be exaggerated. It is explained by the utter lack of symmetry in the knot. In one direction it forms the strongest of all nooses; in the reverse or righthand direction its strength falls by one-sixth and in this form it is quite unsuitable for the end of the rope.

Even in the reverse direction it is still good in the middle of the rope, but to get the best out of it, it is well before making it to consider a moment from which side the greater strain is likely to come and to work with the rope from that direction in the left hand.

The inequality in the reverse knot is characteristic of middle nooses, but it concerns the climber much less in those, like the Butterfly, that are nearly symmetrical from end to end. The difference in the symmetry of the two knots shows up clearly in their behaviour under breaking tests, in which it is advisable always to measure the extreme load of middle nooses in both directions and to determine once for all at which end they are stronger.

To meet the lack of symmetry it is better for the sake of consistency to make a simple convention with regard to the middle nooses. In making the knots one is supposed to work with the lefthand rope running to the leader, or more accurately, for the case is altered in a descent, in the direction from which strain more frequently comes.

This rule is important, because it ensures that the middle nooses are used at their full strength, while they are still made by the simplest methods; but it has the complication that, when the noose is passed directly over the shoulders, the knot is found to lie at the righthand side. If the rope is required at the right, the procedure is correct and some untidiness in the knot must be tolerated. The fact is, rather luckily, for it might be just the other way, that both these knots lie much more naturally at the left side when the noose is round the waist. The lefthand rope in the illustrations will then run from the climber's left side towards the leader, as is the usual practice, unless there is a steep downward slope to the left of the party. To bring the knot into this position after it has been made it is necessary either to step over the rope into the noose and pull it upwards into place, or to pass the rope over the head to the left side and draw the noose downwards.

The nuisance of passing the rope across the body seems to be inherent in these nooses, for it can be avoided only by adopting complicated methods of making knots, a much greater inconvenience, or by reversing the direction of the knot by making it on a reversed section of the rope. Oddly enough a bad noose is immune. The explanation of the apparent paradox is that the defect, where it arises, is bound up with that best of good qualities, a straight entry. The ideal noose of this type is necessarily one-sided; when it is

made by the simplest method, with the leader on the right, and then put on directly, the knot must lie in its neatest form at the left side. These are the conditions of the problem which the Butterfly Noose so nearly satisfies, but a full solution is likely long to elude climbers unpractical enough to take an interest in knots.

Meanwhile, until the ideal is discovered and the Rover Noose perhaps banished to the section to which it more typically belongs, some precautions must be taken. For strength and safety in making the Rover as end-noose it is essential that the lefthand rope leads to the rest of the party; and for uniformity in making the middle nooses it is better to work with the leader to the left and to pass the rope to the other side before putting on the noose. Even the climber who is quite careless about the life of his rope and the neatness of his knots cannot afford to neglect the warning given above and make an end-noose wrongly. He may, however, regard as niggling the hints which follow about the Rover and the Butterfly as middle nooses. If so, let him ignore them and put the noose on anyhow, confident that with these excellent nooses he will at the worst be in no worse case than with the best of the old knots.

### THE WAIST ROPE.

So far as memory serves, only one writer on climbing was found to make any reference to the use of a waist-rope, and in his opinion it was to be condemned as bad practice. Why it should be so was hard to understand, for there seems to be some convenience in two middlemen hitching themselves to the main rope by means of a separate rope round the waist. But a little consideration gave the clue to the mystery. None of the well-known hitches would quite satisfy a climber. He must have a hitch that will stand a strain in either direction. The Two-Way Hitch was designed to meet this requirement and nothing else was found that was both simple and effective.

The Two-Way Hitch is begun exactly like the knot in the Bowline and its principle is the same, but it is a symmetrical knot and takes a strain equally in either direction.

#### **The Two-Way Hitch** (Figure X).

With the right hand draw out a bight of the rope and with a counterscrew twist make it into a loop; pass the cord down through the loop, then towards the right, up over and behind the rope and



up through the loop from below. This movement is just as in the Bowline, and the knot is now half made. Pass the end of the cord on over and round under the lefthand part of the rope and down through the loop. Tauten a little.

Once this knot can be readily made, the step to the next is easy. One great test of a knot is to try how it stands, when one cord is thicker than another. Now, if the Two-Way Hitch is made loosely, a condition in which it is still usually secure, of light cord on rope, and if there is a jerk or violent strain on the rope, while the cord remains slack, the loop in the rope may be pulled out flat and the knot dislocated. The conditions are not likely to occur in climbing, but it is better to be on the safe side. When the knot is half made, a couple of turns are taken round the cross of the loop, the knot is finished as before, and now affords a secure Waist-Rope Hitch.

### **The Waist-Rope Hitch** (Figure XI).

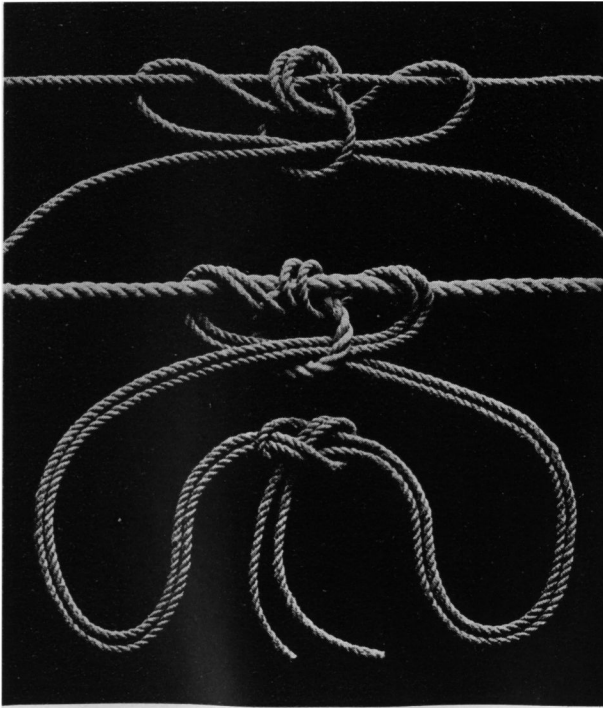
Proceed as in the Two-Way Hitch, but at the half-way stage take two turns with the cord round the cross of the loop to remove the possibility of its being flattened out by tension. Tauten the cord, but it is better not to tauten the loop in the main rope too much.

The waist-rope had better be of thinner rope, two-thirds the girth, and doubled exactly in two so that it ends in a bight. The hitch is made by reeving the bight through the loop on the main rope, one turn round the cross being sufficient, if the waist-rope is double. The rope is now brought to the side preferred without regard to the direction of greatest strain, which is immaterial with a symmetrical knot. The waist-rope is passed round the body in such a way that its parts cross each other in the middle of the hitch, and is closed by fastening the ends to the bight with a sheet bend (Figure XI).

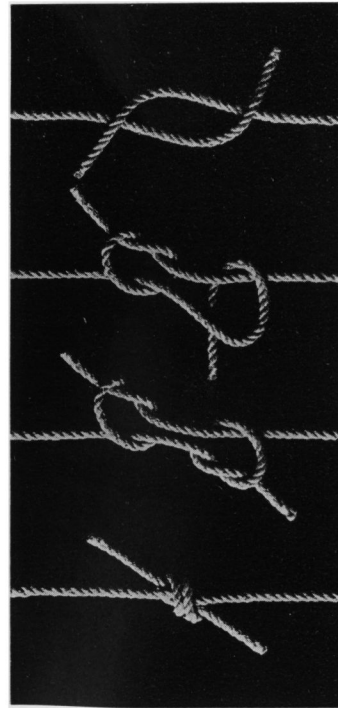
The great strength and reliability of this hitch should remove any objection to the use of a waist-rope. As it is symmetrical and equally good in either direction, it would seem to be stronger on the whole than any of the middle nooses.

### THE BEND.

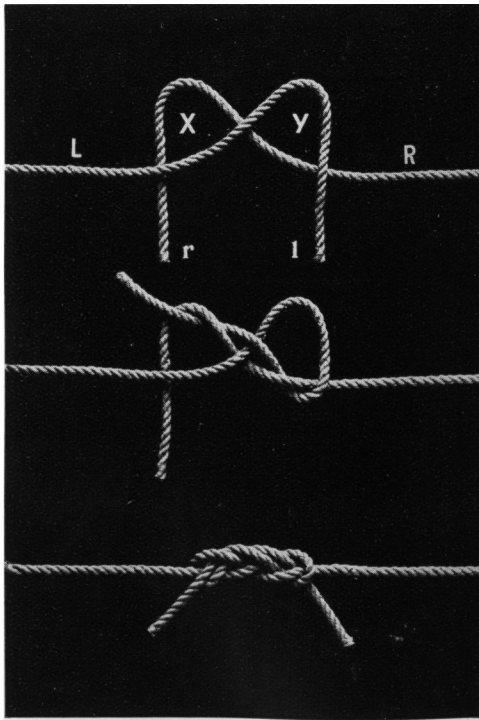
The Fisherman's Knot has long stood alone as a tie for two climbing-ropes. It is used by anglers to join two pieces of gut. On one end of gut an overhand knot is made which



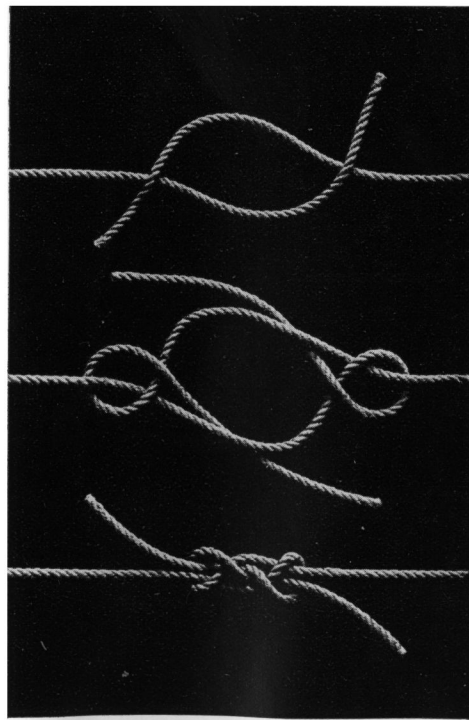
XI. WAIST-ROPE HITCH.



XII. FISHERMAN'S KNOT.



XIII. THE SENNIT KNOT.



XIV. THE REEVER KNOT.

encircles the other piece. The two are then turned round and a knot made on the other loose end to encircle the first piece of gut. This device of reversing the gut at the half-way stage ensures that both knots are made with the same hand, and the knot is in the concordant form, which is slightly stronger. It is the form adopted in the Report of 1892, which recommends the making of two separate righthand knots even when it is used to form a middle noose. Now it is not uninteresting to note that in recent syncopated methods of making this noose it is always the discordant form that arises, consisting of a righthand knot on a lefthand knot, and further, that this weaker form, for a reason which quite escapes its advocates, is slightly the better in a middle noose.

### **The Fisherman's Knot** (Figure XII).

Either of the following methods gives the concordant form and ensures that it is made with the lay :

1. Half-knot method.—Begin with a half-knot just as in the Reef Knot, with the righthand rope behind (Stage 1). The lie of the ends now shows the direction in which each end must be brought on round the other rope in forming the overhand knots.

2. Threading method.—Turn the righthand rope back towards the right, and on its end make a righthand overhand knot. Turn the knot back towards the left and thread the lefthand end through it (Stage 2 of method above). On this end make a righthand knot encircling the other rope (Stage 3 of method above).

Tauten the knots before drawing them together.

In climbing it is the stronger concordant form that should always be used as a join. Though better than the discordant form, it is lumpy and not very neat in appearance, and it is severe on the rope. The last point, however, important as it may be in a middle noose, matters less in this case, for the ends can be cut away when they show signs of wear. It must be well tightened, and is then a hard knot, in which the strain is taken solely by the touching surfaces of two overhand knots. The knot is without any spring or resilience, but none the less it is reliable and effective.

If a knot is to possess resilience, there must be some interlacing of the ropes, which will distribute the strain among the various turns in the knot and spare the rope. This involves a longer knot, but length, unlike thickness, is no disadvantage, provided neatness be not sacrificed.

Of the knots now suggested as suitable for use in climbing,

the first is particularly neat and handsome. If left loose and open, and then strained, it may take a form that is without neatness, though still quite secure. It ought to be thoroughly tautened by pulling on the ends and on the ropes alternately and by kneading it with the fingers, until it is flat and compact. It has then the reliability and much of the neatness of a splice.

In view of suspected defects its behaviour under breaking tests was closely watched. In spite of the high tension it finally withstood, it retained its handsome form to the last and no signs of collapse were apparent when the cord snapped.

### **The Sennit Knot** (Figure XIII).

Take up the ropes with the ends towards each other so that in either hand there is a bight with the end hanging down; bring the right over to the left hand and behind it; then change hands on the bights, overlap them and bring them into the form shown (Stage 1). If the bights have been made small, this arrangement can easily be held in the left hand. With the right hand pass *l* backwards under *R*, through *Y* from the back, over the crossing ropes and through *X* from the back (Stage 2). In the same way pass *r* from the front through *X*, forwards over the cross and from the front through *Y*. Tauten well by pulling on the ropes and the ends alternately and by working the knot with the fingers.

Make sure that either end is passed through both bights from the same side, in one case through both bights from the front, in the other case through both from the back.

To open, if very taut, grasp the ropes and the ends together just outside the knot and compress it a few times. The ends are then easily withdrawn.

The next knot is simpler than the Sennit Knot, and at first trial would appear to be easier to make, but it offers some scope for error.

### **The Reeve Knot** (Figure XIV).

Bring the ends together as in beginning a reef knot, but keep the centre of the half-knot open in the form shown. Note that the ends lie above the ropes (Stage 1). Next give each end a turn round the other rope and bring it back towards the centre and down through the space. At this stage, to avoid the chance of a mistake, which might lead to a reef knot, keep each end pressed into the angle of the opening and well away from its own rope (Stage 2). Now pass each end on through the eye at the other end of the knot to lie beside its own rope.

Tauten by pulling ends and ropes alternately. Opened easily by compression.

Only a short reference need be made here to the rule that knots should be made with the lay of the rope. The joins, like the reef knot, are begun with the righthand rope behind the other for the sake of conforming to the usual lay. Since the strands run screw-wise in the rope, the ropes should lie together counterscrew-wise in the knot. The run of the rope through the knot may be reversed as an experiment by beginning with the left hand behind. The point is well illustrated in the contrast between the two edges of the flattish Sennit Knot, which is made with the lay along the thinner edge, where the strain is greatest. Along this edge the ropes enter and are spirally twisted in such a way that the strands lie in the general direction of the ropes and knot. Along the thicker edge, on the contrary, the ends lie spirally counter to the lay in such a way that the strands run across the knot and are more opened by the slighter strain. In the Bowline, as already explained, the knot holds better for being made with the lay in direct opposition to the practice of the authorities. On the whole, however, the principle is of little account in climbing, for it must be violated, when, as in the middle nooses, it clashes with more important considerations. One eminent authority, in fact, seems tacitly to recognize this. After laying down the law that knots must be tied with the lay, in his illustrations he shows them, either out of facetiousness, or unconsciously for a more obvious reason, made left-handed and consequently always against the lay.

The knots just described have been preferred to others equally strong, because they grip the ends firmly when the rope is slack. The repeated slacking which is inevitable in climbing tries a knot severely, tending to ease the nip on the ends and let them work loose. In this respect the knots are safe, even if the projecting ends be left quite short. Moreover, the ends emerge side by side with the ropes and are less liable to catch in obstacles. For that matter they can be tied in smoothly, if, instead of the usual whipping, they are pointed and finished off with an eye or becket, through which a short piece of string may be rove. This may be a refinement, but there are rare occasions, lassoing, for instance, or throwing a rope with any object, when it might be useful to fasten a light cord to the rope, and that cannot be done neatly and securely, unless there is an eye in the rope.

It should be noted in favour of the pointed and eyed rope that no neater or safer finish can be given to any of the Bowlines than by passing the end as usual in a few turns round the rope at the waist and then lashing the two together by means of a cord rove through the eye (Figure IX).

The small eye or becket used as a neat finish to a pointed rope is quite different from the spliced eye or loop mentioned in connection with the Bowline. The latter, a span long, is awkward, and has for sole advantage the security it gives to the Bowline. The former, no wider than the diameter of the rope, is never in the way, is no hindrance to any use of the rope, and enables a cord to be attached to it securely and very quickly.

### CONCLUSION.

Now that the methods of making the new knots have been given, climbers who have borne the tedious descriptions with patience will probably be glad to have the comments that are scattered through the notes brought together in a summary :

- I. The Double-Knotted Bowline and the Rover Noose, of nearly equal merit, are the best nooses for the end of the rope. The Bowline and Coil, though weaker, provides the most useful and adaptable end-noose.
- II. If there is any gain in having the same noose for end and middle of rope, the Rover Noose is the best all-round noose.
- III. In the middle of the rope the Butterfly Noose surpasses the Rover Noose. The Half-Hitch Noose, though effective, is much inferior to either.
- IV. The use of a waist-rope is justifiable with a strong and reliable hitch like the Waist-Rope Hitch.
- V. For bending two ropes together the Sennit Knot is neater than the Reeve Knot, which is otherwise equally strong and good. The Fisherman's Knot is also reliable and only slightly weaker.

This summary may be put more practically in a series of hints, which will enable the climber to suit his own aims and to confine his study of knots to a small selection. Thus novices who wish to learn one knot and no more will find their heart's desire in the Rover Noose. Expert climbers who wish to go further, but take little interest in the vagaries of

knots, who like the Bouvier, but object to the bottle, would do well to master and apply the Bowline and Coil for the end of the rope and the Butterfly Noose for the middle. Others who value strength in a knot and wish their rope to have the greatest margin of safety on difficult and exposed routes have their requirements met by the Double-Knotted Bowline or the Rover Noose for the end of the rope and the Waist-Rope Hitch for the middle.

For the sake of referring briefly to the new knots it was inevitable that they should be given distinctive names. In making the selection, which proved a critical and troublesome matter, regard was had to the purpose or appearance of the knot, so that the name might be suggestive and easily remembered. Usually the difficulty was to coin an appropriate name without sacrificing simplicity. Thus Rover Noose is simple in form, but is cumbered with the far-fetched implication that it will go anywhere on the rope. The term, Bowline and Coil, is briefly descriptive of this useful adaptation of the Bowline. Two-Way Hitch and Waist-Rope Hitch convey the purpose of the knot. The Reeve Knot is named rather at random, because there is some reeving in the making of it and because it has some analogy with the reef knot. The Sennit Knot is very close to the flat plaited rope called sennit. The Butterfly Noose is so styled on the basis of a more or less fanciful resemblance imagined in the form of the knot.

Running through this paper there will have been traced an heretical idea that climbing is worthy of its own knots. It is a short step to the belief that knots specially designed for use in climbing must inevitably surpass casual adoptions from tamer and duller pursuits. But, none the less, it must not be thought that the new knots have been put forward without due consideration. The merits of old and new have been weighed and the preference given to those that were fairly simple to make, neat in appearance, easy on the rope and reliable under intermittent strain.

To follow out the methods of the Report in making a selection the new knots were submitted to a breaking test, which had to be conducted on a small scale with cord instead of rope. The cord selected was an excellent line of Italian hemp, laid up like rope and resembling it closely in every particular. It turned out to be exceptionally strong, for with a diameter of only  $\frac{1}{37}$  of an inch its average breaking strain in fourteen tests was 21 lb. 1·3 oz.



As a check on the results some of the older knots were included, and they all showed much higher percentages than in the Report. In one case, the Openhand Noose, the difference is so great that it may be questioned whether the same knot was used. In other cases the higher figure may be explained in part by differences in pliability and roughness, which would greatly affect the nip of the knot, and in part by the great difference in thickness between cord and rope, which may tell in favour of the former. In any case the discrepancy must be due to some cause which affects all knots in common, and the use of a fine cord need not invalidate the results, since, in all probability, the relative position of the knots is unchanged.

The nooses were all tested as end-nooses, but their proper

## STRENGTH OF KNOTS.

Recom- mended.	Use.		Report of 1892.	Percentage Strength.	Percentage Variation.	Breaking Strain.
		Cord . . . . .		100	4.3	3373
		Joins				
		Reef Knot . . . . .	53.4	62.8	9.6	2118
		Carrick Bend . . . . .		63.2	9.4	2134
		Thumb Knot . . . . .	57.7	69.7	9.4	2351
		Diamond Bend . . . . .		69.9	1.2	2358
		Fisherman's Knot, Discordant . . . . .		70.9	7.1	2392
*	J	Fisherman's Knot, Concordant . . . . .	61.7	81.2	9.5	2741
**	J	Sennit Knot . . . . .		86.2	10.8	2908
		Unnamed Knot . . . . .		86.3	5.3	2910
**	J	Reever Knot . . . . .		86.4	8.9	2914
		Carrick Bend laid up . . . . .		94.2	8.5	3178
		Nooses				
	E	Double Bowline . . . . .		72.5	6.3	2445
	E	Fisherman's Noose . . . . .	65.0	73.6	12.0	2482
	M	Rover Noose, Reverse . . . . .		76.5	6.8	2580
*	M	Half-Hitch Noose . . . . .		77.6	11.5	2617
	E	Bowline . . . . .	72.4	77.8	7.6	2626
	E	Double-Knotted Bowline and Coil . . . . .		79.1	13.2	2670
**	E	Bowline and Coil . . . . .		79.5	5.4	2681
		Openhand Noose . . . . .	64.1	79.6	8.6	2686
**	M	Butterfly Noose . . . . .		84.9	8.2	2865
	M	Butterfly Noose, Reverse . . . . .		85.1	6.9	2870
	E	Bowline with Waist-Rope Hitch . . . . .		87.6	5.6	2956
**	M	Waist-Rope Hitch . . . . .		89.3	6.5	3013
**	E	Double-Knotted Bowline . . . . .		92.0	7.3	3103
**	E M	Rover Noose . . . . .		92.5	5.0	3121

position on the rope is indicated in the table by the letters E and M. The middle nooses were in two cases tested in both directions, and the result on the righthand rope is entered against the reverse knot. A perfectly symmetrical knot like the Waist-Rope Hitch would, of course, not show any difference.

The fourth column of figures gives the average weight which the knot just bore without breaking, measured in tenths of an ounce and based on some seven to thirteen tests in each case. The smaller unit has been adopted instead of the ounce, because the figures as they stand can equally be read as the weight in pounds which the knots would bear, if made on a full-size rope equivalent to the cord. In the second column the breaking weight for each knot is expressed as a percentage of the breaking load of the cord. In the next column is a percentage derived from the range covered by the results for any one knot and giving approximately the possible deviation of a knot from its average strength; the smaller the number the better and more consistent the knot.

As a further test the average time which it takes to make the knots was ascertained to the nearest half-second, and may be of sufficient interest to be recorded here. It was thought that the times might be some guide to the usefulness of the knot, but they were not much help, for they differed less than was expected, and after all, provided a knot holds well, it matters little to a climber whether it takes five seconds more or less to make.

TIME OF MAKING THE KNOTS.

	Secs.		Secs.
Fisherman's Knot . . . . .	10½	Manharness . . . . .	6
Sennit Knot . . . . .	17	Fisherman's Noose . . . . .	8
Reever Knot . . . . .	13	Half-Hitch Noose . . . . .	8
Carrick Bend laid up . . . . .	91	Rover Noose . . . . .	7½
		Butterfly Noose . . . . .	9
Bowline . . . . .	14		
Double-Knotted Bowline. . . . .	15	Two-Way Hitch . . . . .	11
Bowline and Coil . . . . .	28	Waist-Rope Hitch . . . . .	16½

The Bowlines, though easy, take an unexpectedly long time, but much of it is spent in securing the end. The middle nooses have still to be adjusted. They differ by little, but all

take more than the six seconds of the Manharness, which was included for the sake of comparison.

The Fisherman's Noose compares favourably with others of its class. But it did not show to advantage at first, for it was made by a novel and ingenious method, recommended in a work on climbing, which took no less than twenty seconds. This seemed so needlessly long in comparison with similar nooses that other methods of making it were devised. Not only were they simpler, but much quicker, taking 8,  $8\frac{1}{2}$ , 9 and 10 seconds respectively. Thus, although speed cannot be used to discriminate between knots, it is a good test of method. A knot cannot be made quickly, unless the movements required by the method are easy and natural, and the great difference just noted shows that it is well worth while to seek and learn the best way of making even a widely known knot.

In the case of the new knots no pains have been spared to discover the neatest and simplest methods, and climbers who learn and apply them should be safe from the annoyance of having ultimately to discard them for better.

These knots are new in the sense that no earlier record of them has been traced. But it might be rash to claim that they have never been used before. To echo a well-known writer, very old are all knots. Their age was recently brought home to our minds by the discovery of a clove hitch that had been made in the Valley of the Kings three thousand three hundred years ago. In comparison with such antiquity mountaineering is a thing of yesterday, and the knots are new, at least, in their application to climbing. They have been devised to satisfy the exacting requirements of a pursuit in which life might depend on the security of a knot, and they are now left to the judgment of others in the belief that they will not be rejected without a thorough test, and in the hope that the approval of climbers may make amends for the time and labour devoted to the inquiry.

Though higher than Sinai, Hermon<sup>1</sup> is far less interesting. In order to avoid frontier troubles, and the carrying of much gear, we made Damascus our headquarters, and one afternoon drove out to Katana. A long, hot climb took us at nightfall to Kala'at Jendal, where there is no inn. The inhabitants, however, took pity on our plight, gave us blankets on the mud floor of an empty house, and provided us with eggs and 'tea.'

The ascent from this point to the summit need not take longer than five or six hours. The maps are unsatisfactory, but once the ridge is struck the way is obvious. The snow was hard in the morning, but in the afternoon had considerably softened; instead of being able to glissade, we plunged in up to the knees at every step. Although it lay deep in drifts, the rocks were uncovered right up to the top. The descent to Rasheya takes about four hours, and is perfectly straight-forward; and in the village there is an inn of the most extreme simplicity. We were fortunate in finding a car to take us back to Damascus.

Our party consisted of (in Sinai) Messrs. A. St. G. Walsh, R. G. R. West and myself, whilst West and I were on Hermon alone.

## KNOTS FOR CLIMBERS (II).

BY C. E. I. WRIGHT AND J. E. MAGOWAN.

### THE LAY AND THE BOWLINE.

#### THE LAY.

IN the current discussion of knots so many references have been made to the lay of the rope and to making knots with the lay that the subject must be treated more fully. It was thought that it might be avoided altogether by giving directions which ensured that knots were made to suit the usual lay. For a rope with the less common lay it would then be left to the reader to suit the lay, either by beginning his knots with the initial loop in the opposite sense, or by making them left-handed, or in the case of the joins by beginning with the left hand behind the right.

To save space the remarks which follow must be taken as

<sup>1</sup> For an ascent and illustration of Hermon see *A.J.* 26, 32-6.

applying to the usual right-hand rope. If a remark is to hold for a left-hand rope, it must be read with every term of direction replaced by the opposite.

A right-hand rope is best defined as a rope with its strands lying in the same sense as the spiral of a corkscrew, or the thread of an ordinary screw.

Coil a right-hand rope on the floor. It should be done with the right hand moving round in the direction of the hands of a watch lying face up on the floor. A right-hand rope must be coiled right-handed in this way, or the turns will not lie flat and the rope will kink when drawn out.

Take a rope and make a single small turn in the same direction, until the rope crosses itself. It now forms a loop. For the moment the point is that it forms a right-hand loop.

Take a round stick in the left hand. Put the end of a cord under the left thumb, and wind the cord round the stick with the right hand. Examine the last turn. It is a right-hand loop, just as was formed a moment ago.<sup>1</sup>

Examine the coil just made. It is a spiral, and its direction is counterscrew.

Make a right-hand loop again. Observe whether it runs counterscrew. A counterscrew loop and a right-hand loop are the same.

Take a yard of rope or cord with the usual lay. With an end in each hand twist it so as to increase the lay, that is, with left-hand twist. Twist, until it forms a small loop in the middle. Twist a little more and pull the ends. The loop tightens and tends not to flatten out. It is that annoying object, a kink.

Note in passing, that the small right-hand loop formed on a right-hand rope by a similar process, but with reverse twist, flattens out readily, and consequently is not a kink.

Take a round stick in the left hand and wind a right-hand cord round it to form a coil ; but this time wind it backwards

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<sup>1</sup> Not so, however, if left-hand movements are made with the right hand, as by a friend, who claimed, nevertheless, that he was right-handed.

In this paper twist, loop, turn, coil and spiral, if made with a natural movement of the right hand, are described as right-hand. It is held that a man ascending a spiral staircase, keeping his right hand towards its axis and turning continually to the right, traces out a right-hand spiral. Any reader is at liberty to say that all these similar counterscrew spirals are left-hand, but he can scarcely claim that his convention is simpler and less perverse.

or, what is the same thing, left-handed. Take an end of the cord firmly in each hand to avoid any untwisting; shake the stick out of the coil and draw out the cord. It forms one or more kinks.

Carefully study the kinks formed in both ways. Make sure of the direction of the short spiral formed by the kink. It is screw-wise and therefore left-hand.

A kink is a left-hand or screw-wise loop on a right-hand rope.

Take a bit of rope with the end in each hand. Twist it left-handed to increase the lay. It forms a kink, and then winds round itself. Continue twisting. The ropes lay themselves up in counterscrew spirals.

Examine the two spirals. On the outer side of each the strands of the two original ropes lie in the direction of the two-ply rope now formed. The ropes have laid themselves up with the lay.

If the end of a right-hand rope be laid up round its own part, it must be laid up counterscrew or right-hand and twisted at the same time to increase the lay.

Dissect a bit of rope to see how the component yarns are twisted. The yarns are twisted left-hand. They run counterscrew or right-hand in the strand. The strand runs screw-wise in the rope. The rope, as just seen, must run counterscrew, if laid up, or if it is to be tied with the lay.

The reader who has checked these points is now in a position to decide for himself any question of lay.

#### THE BOWLINE.

The Bowline can only be made in two ways that are in the least distinct.

In this paper it is strongly recommended that the knot should be begun with a counterscrew loop, and the recommendation has not been made without rime or reason.

The older method, which shall be distinguished as orthodox, is that given in the Report of 1892, in all works on climbing, in all books on knots, even in the Admiralty Manual. Dare the climber attack it, who is not an expert in knots? Yes, if he has a shred of common sense, and will only rely solely on its guidance.

Let him remember that the orthodox method is begun with a screw-wise loop. Let him recall the definition of a kink, which he has just appreciated, as a small screw-wise loop on a right-hand rope. Let him ask himself whether it is advisable

to begin any knot with a kink. In face of the Admiralty Manual let him follow the lead of reason and dare to answer the simple question with a single obvious word.

When he has settled the point, he may suspect that there is hardly any difference between beginning a knot with a left-hand loop and making a knot against the lay.

After having been thus teased with questions, he may feel annoyed at being now told that his answer is of no consequence, even though it settle the way in which the Bowline ought to be made. The fact is, if the view be accepted that only climbing considerations have any weight, it matters as little to us, how the Bowline is made in orthodox circles, as it did to a primitive savage, what happened to the sabre-tooth tiger when it overtook his mother-in-law.

#### THE CLIMBER'S BOWLINE.

For the climber the important point is that the knot lies closer in a certain position, as can be seen in any Bowline, however made. Make one, and take the rope in one hand and the bight of the bowline in the other. Strain and jerk the knot. The end is forced across the knot into a new position. Force it back and the very movement opens the knot a little. Tauten the knot well again, until the end comes back into its proper oblique position across the knot. It now points in the direction round the rope, in which the half-hitch must be made, if it is to help in keeping the knot close and good.

It is useless to pass on unless this important property of the Bowline Knot has been fully appreciated.

It must not be fancied from a glance at the illustrations that the proposed method of making the Bowline differs from the older only as a knot seen from the back differs from the original. The difference is far more than this. It is the difference between a knot and its reflection in a mirror, between left-handed and right-handed, between screw-wise and counter-screw. Moreover, the distinction is important because it is inherent in the construction of the rope.

Let us now observe a very eminent authority on mountaineering while he is making his Bowline. He knows that all knots must be tied with the lay, for he has said so in print. He begins with a screw-wise or left-hand loop; clearly it is the orthodox method he favours. He finishes the simple Bowline. Now watch him add the half-hitch. It will be interesting, very interesting. For he has told us knots must be tied with the

lay, and he has just shown us seven knots, every one made against the lay. Quite incredible, yet a fact. Clearly, this time too, he will make the half-hitch against the lay. To our amazement he makes it with the lay. You chuckle at his being right only once in eight shots. Marvellous! It is marvellous, far more of a marvel than you imagine, for this is the only occasion of the eight when the knot must be made against the lay. Weirdly illogical and inconsistent on our part? Not so. Made with the lay, the half-hitch tends to keep the knot open.

Make the Bowline again by either method and haul on it until the knot is taut and the end thrown obliquely across the knot. The end points in the direction in which it must be passed to make the half-hitch correctly.

If the half-hitch is to help the knot to lie neat and close, begin the Bowline screw-wise and make the half-hitch against the lay, or else begin with a counterscrew loop and make the half-hitch with the lay.

The latter is preferable, to word it very mildly. It is equivalent to beginning with the lay and making the half-hitch with the lay. It is consistent, no small merit. Whether it is orthodox or unorthodox, technically correct or technically the very deuce, matters not a fig. It is better suited to climbing.

Suppose for a moment that it is correct to begin the Bowline with a screw-wise loop. Is it, then, correct for a Climber's Bowline? No. It is quite wrong.

The climber's knot is a Bowline and Half-Hitch and the addition of the latter upsets the apple-cart. The climber has no option.

The method is better suited to climbing, because it is easy to work at waist-level, keeps the knot better closed, and is made throughout with the lay.

These three reasons are decisive. The point is no longer a matter of opinion or preference.

In the Climber's Method the Bowline is begun with the lay with a counterscrew or right-hand loop and is secured with a half-hitch made right-handed or with the lay.

If the end be treated by laying it up backwards along the bight round the waist, the foregoing remarks apply equally. The climber has still no choice of direction: he must work with the lay and he must, therefore, begin with a counterscrew loop. This method, even with the end hanging free, but not too short, is a good way of dealing with the loose end and would probably withstand hours of climbing. If, after several turns round the



bight, the end be seized or lashed to the bight, there is no better way of making the Bowline secure. The important point is that, as the turns are being made round the bight at the waist, upwards inside the rope, the end must be twisted continually so as to increase the lay. It is the twist in laying it up that keeps the end in place. A yachtsman puts the rule for laying up a rope in a jingle that is offensively easy to remember :

Twist as you lay,  
And lay the other way.

### THE MIDDLE LOOP.

It would have been simpler had fewer knots been recommended in the earlier part of this paper, but, as its aim was to submit suitable knots for consideration without making a final choice, it was tempting to put forward three knots in each section. The temptation was, of course, strongest in the case of the middle of the rope, just because it has always been the crux, and it led to the Rover Knot being kept in this section.

Now the objection to this knot is that it is much stronger in one direction than in the opposite, and that it is better made with its stronger end in the direction of probable strain. Perhaps it would be as well to avoid the difficulty, with its call for mental effort, by confining the choice to knots equally strong in either direction.

The Half-Hitch Loop satisfies the condition and has its good points. On the other hand, it was chosen for description, in a moment of weakness, in deference to the widespread approval of the Fisherman's Noose, solely to give admirers of the latter a similar form, that is easy to make, and yet is modified in such a way as almost to preclude the risk of its becoming a slipknot.

Thus there is only one knot left to recommend, but it, at any rate, is equally strong at either end, and in no circumstances can it ever become a slipknot. Yet the Butterfly, as made by the easy method given in the paper on knots, was handicapped in that, to have it lie in its best form, the rope had to be passed to the other side of the body before the loop was slipped on. It has now been found possible to avoid this nuisance by making the knot by another method, which appears at first to be more complicated than the easy method, but has the great advantage over it that the right hand is not changed from one bight of rope to another.

**The Butterfly** (Figure XV).

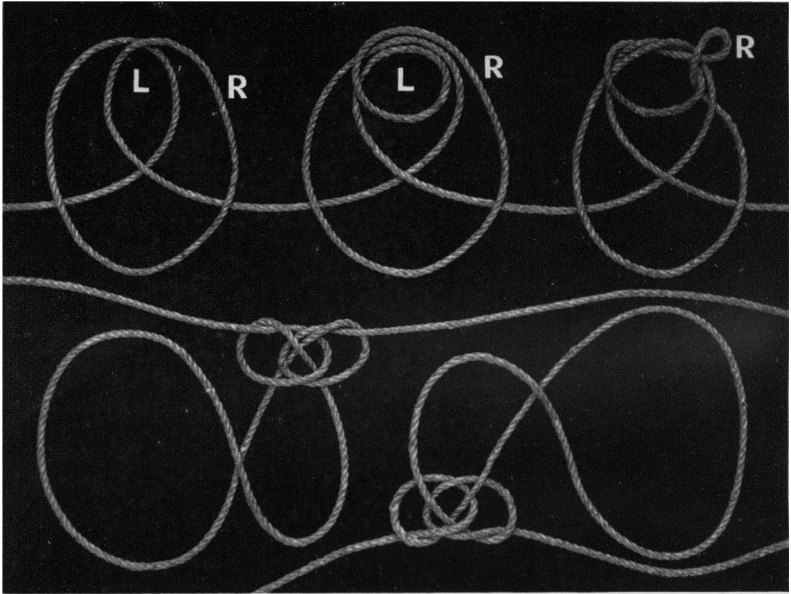
Stretch out the hands in either direction and grasp the rope with the fingers underneath and the thumbs above pointing outwards along the rope. Bring the hands round in front to meet with the thumbs pointing inwards. Bring the right hand in front of the left and lay the bight in it over the left fingers at L (Stage 1). Keep hold of the righthand part of the loop at R and with a movement of the right hand make a small right-hand loop or turn round the left fingers at L, and keep it open with the left fingers (Stage 2). Pass R up over the small loop and through L from behind. When it is just through, take it with the right hand and give it a half-twist screw-wise and draw the knot thus made fairly taut (Stage 3). The half-twist crosses the base of the loop in the knot, and makes it easier to pull the rest through after R, until it is nearly taut. Then strain the ropes, and the knot takes its proper form as seen from the outside, but upside down (Stage 4). The inner side of the knot will come to the front as the bight is drawn up (Stage 5).

It will be seen that the effect of this method is to reverse the ropes and, when they are finally strained, to reverse the knot. This is why the ropes cross each other behind the hanging bight (Stages 1, 2, 3) with the result that the method appears complicated in a figure. Actually the manipulation, which takes less than 6 seconds in all, is extremely simple in practice, since the right hand deals with the same bight of rope throughout.

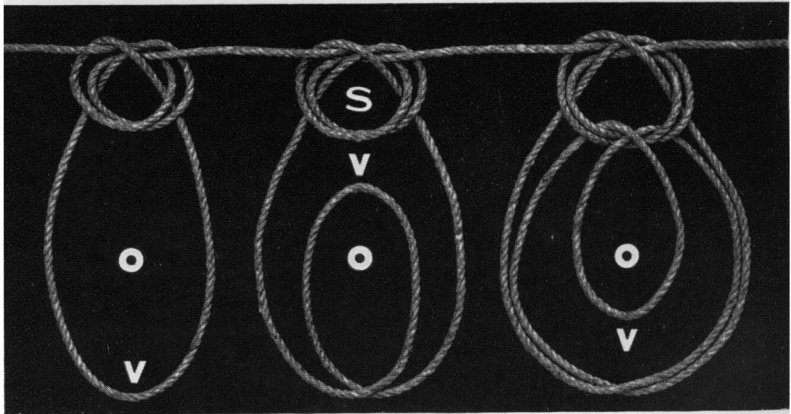
Made in this way the knot can be put on directly, and then lies against the waist in its best and flattest form.

When this method is adopted and the loop put on directly, the knot should be worked with the leader to the right, if the knot is to lie at the left side. If, however, the rope is required at the right, the knot should be made with the lefthand rope running to the leader.

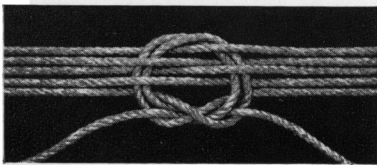
An effort to do with the Butterfly what had been done with the Bowline and force it to take several turns of rope met with some success after countless failures. Though not so simple as the Bowline and Coil, the method is not complicated and is well worthy of a trial. By beginning with a single Butterfly and forming the three stages shown in the figure it should be easy to make the triple loop in the hands. This method makes no great demands on the climber's time and patience. The drawback is the time it will take him to put on the coil and adjust it by passing the spare round it and through the knot. It is better and simpler in practice to effect the doubling round the waist, when the whole operation can be finished in



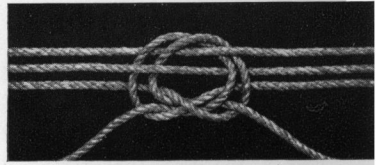
XV. Butterfly.



XVI. Triple Butterfly.



XVII. Triple Butterfly.



XVIII. Five-fold Butterfly.

72 seconds. It may be noticed in the figure that the operator, standing near O and facing the knot, might make the turns by swinging the bight, V, alternately backwards and forwards over his head, not unlike a skipping-rope and, as it turns out, with exactly the same movement of the hands. The method may be used to triple any loop round the waist.

### **The Triple Butterfly** (Figure XVI).

Make a single Butterfly with a very large bight. Raise the bight and the knot will come up with its inner side (as in Figure XV, Stage 5) against the waist.

A. Take the sides of the bight with each hand and swing it backwards over the head (Stage 1). Pass the parts of the bight on round the waist simultaneously, changing hands on them as they meet and cross at the back and bringing them forward again to the sides. Then swing the bight forwards over the head (Stage 2). Pass the bight from the inner side through the space, S, in the knot. In drawing it through give it a half-twist screw-wise to cross its parts in the knot. Draw the bight, V, out, leaving two turns round the waist.

Repeat the operation A with the new bight if a five-fold loop is desired.

B. To finish off, however often A has been repeated, swing the bight, V, backwards over the head to form the last turn (Stage 3).

See that the turns run continuously round the waist. Tighten them by passing the spare round them and through the knot. Reverse this to ease the loop and take it off. The triple form, after removal, is opened at once by pulling or merely shaking the last turn.

For the sake of clearness the bight, V, does not overlap the other turns in the figure. Of course, each swing will send it farther than shown.

The advantage of the triple coil is that its three turns are more comfortable than one, especially in case of a severe strain on the rope. The five-fold loop takes up some fourteen feet more rope than the single bight and is useful in shortening a rope. This is as far as it is worth while to go in repeating the operation described, but it is interesting to make the seven-fold coil once at least, as the distinctive character of the knot is not so evident when it is made with only a few turns.

Perhaps too much has already been said in favour of the Butterfly Knot. Here it need only be added that in some points, as in its flatness and good entry, it is improved by being made with a triple coil.

## SUPPLEMENTARY NOTES.

**CORD FOR TESTS.** It will be remembered that the cord used in testing the knots bore a tension of 21 lb., though it was only  $\frac{1}{37}$  of an inch thick—ample, it may be repeated, for determining relative strength. The cord was supplied with others as Italian hemp, and only its remarkable breaking-load, equivalent to a ton and a half on a full-size rope, led to a suspicion that it might be flax. The manufacturers have confirmed this suspicion and it becomes necessary to correct the statement that the line used was Italian hemp.

**TIES ON UNEQUAL ROPES.** A further oversight in connexion with the tests was the omission of any reference to the difficulty of joining unequal ropes. It is well known that the Reef Knot, for instance, will not hold with unequal cords. A similar defect in a Climber's Bend would be such a serious matter that, even if it were not mentioned, it could not have been overlooked. Both the Sennit and Reeve Knots were tested with ropes differing two to one in thickness, and were found to hold well. In fact, they hold with differences in diameter much greater than need be considered by the climber.

**METHODS OF MAKING KNOTS.** The temptation to range the ropes on a flat surface in learning a knot should be overcome as soon as possible. The instructions for making the knots should then be followed closely, at least until a better method is discovered. They are given in detail in the hope of imparting the neatest method of handling a rope on the mountain side. The Butterfly Knot, for instance, can be made by ranging the rope on a rock, but not in 6 seconds, nor even in 16, whereas with the natural method just proposed it can be made with speed and certainty amid a tangle of hanging ropes. Similarly, in the Sennit Knot, once the ropes are crossed, they must be held in the left hand with the thumb and forefinger on the central cross of the knot, so as to leave the right hand free to manipulate the ends.

**TERMINOLOGY.** If there has been some carelessness in the use of terms in the earlier part of this paper, it only reflects the slipshod terminology of knots. Two points alone require some explanation.

The term 'Thumb Knot' is still occasionally used for Overhand Knot, but this usage has never crept into the paper. The Thumb Knot of the paper is always the Weaver's Thumb Knot, included in the tests of 1892 as the Weaver's Knot.

It then appeared to be nearly as strong as the Double Sheet Bend, and was over 10 per cent. stronger than the Sheet Bend, the weakest knot tested in 1892.

The use of the word 'noose' throughout the paper is less defensible. In every instance it is set down against the writers' conviction. It seemed to be a simple expedient to adopt the term 'Middleman Noose,' out of deference to authorities on mountaineering, in the vain hope of avoiding discussion.

The fact is that a new word is badly needed for a loop closed with a fast knot. Loop is not available, for it is needed in the stricter sense defined a few pages back in connection with the lay of the rope.

THE COIL HITCH, a double Marling Hitch, would seem to be the best knot for finishing off a coil of rope. The coil is held in the left hand with the end running towards the right; the end is given two or three turns round the coil, each turn lying to the left of that just made, and the end is then passed to the right under the turns to lie in its original direction.

THE ROVER KNOT. A correspondent <sup>2</sup> has pointed out that this knot is liable to be turned inside out in loosening it and converted into a slipknot. The dislocation is effected by turning the single bight in the knot backwards over the knot. It was a bit hard to discover, and it probably would not occur readily, but climbers may feel that even a mere possibility is not to be tolerated.

THE WAIST-ROPE AND EYE has recently been recommended <sup>3</sup> as the only attachment which lets the full strength of the rope come into play in a fall. An eye, which is better served over to prevent chafing, is spliced at the end of the rope, and the Waist-Rope (Figure XI) is threaded through the eye and fastened round the body.

This attachment, hardly to be called a knot, is as strong as it is revolutionary, and in virtue of its strength it may have to be considered with the knots recommended in this paper for the end of the rope. Its most serious disadvantage is that a loop-splice is almost certain to jam in roping-down. Moreover, as long as it is in use at both ends, the rope must always be used at the same length. It is, thus, the least adaptable of all

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<sup>2</sup> Mr. Thomas D. Cabot of Boston, Massachusetts. It is worth noting that Mr. Cabot adds: 'In spite of this danger, I agree that the Rover is the best all-round knot that has been devised.'

<sup>3</sup> Dr. Karl Huber, *Die Festigkeit von Bergseilen*, D. & C. A.-V. Mitt., 1928, p. 97.

attachments, but less inconvenience would be felt, were it used only at one end of the rope.

With this restriction, then, it might be recommended, for it offers the further advantage that two ropes, each with a loop-splice at one end, admit of the easiest and strongest of ties. In making it, the eye of one is slipped over the other, and then the whole of the first rope is drawn through the second eye.

A MIDDLEMAN BOWLINE can only be formed by locking two distinct Bowlines together. As two ends are required, the rope must be in separate sections. Thus the knot enables short lengths of rope to be carried and joined up round a long-suffering middleman, and it is, in any case, a sound method of joining short ropes. A Bowline is made round the waist with the end of one rope; the end of the other is now threaded through the initial loop of the first Bowline, entering the knot where the first end emerges, and passed round to meet its own rope at the opposite side of the waist. The second Bowline knot is made by the device employed in the Bowline and Coil, so as to include the turn of rope already round the waist. In this way the Bowlines are kept from slipping apart, and any strain is evenly distributed, because each knot grips the bight of the other Bowline.

A SLING FOR AN INJURED MAN. Hitherto the best plan has been to use a three-looped Bowline. A Bowline is made, as if single, on a doubled bight of the rope; the end of the double bight, corresponding to the loose end in the single Bowline, is left long enough and is used as a third loop. This is quite an effective sling and must not be confounded with the Bowline on a Bight, which has sometimes been recommended, but is useless for the purpose,

It is better, however, to use the Bowline and Coil, because each loop is adjusted as it is made and there is less disturbance of the patient.

THE BOWLINE AND COIL as sling for an injured man. Stand at the patient's right. Take the rope in the left hand placed against his waist, so as to leave an end long enough for four turns round his body. Pass the end from his left side behind his back to make the first turn round his waist. Make the second turn round his thigh, the third round the other thigh, and the fourth round the waist. At the end of each turn pass the rope, always in the same direction, across the upturned palm of the left hand. Now knot the Bowline and Coil by the device already described. Push a bight of the rope downwards under the turns in the left hand. Lay the standing part of

the rope for a moment towards the patient's feet and across the bight to form the loop of the Bowline. Pass the end down through the loop and finish the Bowline and Coil.

A perfect sling is made by adding a Butterfly Loop some six inches above the knot of the Bowline and adjusting it round the patient's chest under his arms. With this sling it should be possible to lift or lower a patient freely, with as much safety as if he were lashed in a chair or stretcher.

IN CONCLUSION the suggestions previously made in this paper had better be modified slightly.

#### A LIST OF RECOMMENDED KNOTS.

For the end of the rope :—

- The Double-Knotted Bowline.
- The Bowline and Coil.

For the middle of the rope :—

- The Butterfly.
- The Triple Butterfly.
- The Waist-Rope Hitch.

For the tie :—

- The Sennit Knot.
- The Reeve Knot.

#### LA HAUTE CIME DES DENTS DU MIDI.

The following extracts from letters from Mr. Joseph Cooke Smith clear up an intricate point, hitherto unnoticed, of the topography of the Champéry side of the Haute Cime. The point arose on a question as to the late Mr. F. W. Bourdillon's route up the N. face.

CHALET DES TERRASSES,  
CHAMPÉRY, VALAIS,  
SWITZERLAND.  
March 5, 1928.

DEAR CAPTAIN FARRAR,—In answer to your letter of March 2, 1928, just received :

The route given by de Breugel on p. 18 of 'La Dent du Midi' is an easy climb *below* the rock face of the Haute Cime, while the climber is on a slope that faces nearly W. It does not really touch the rocks of the steep N. face of the Haute Cime, except for a short climb up a gully of the ridge separating the western and the northern face.

I do not know, however, that anyone else makes this distinction between a western face and a northern face, yet there is this ridge