ROPE FOR MOUNTAINEERING

By P. J. H. UNNA

While the objects with which the recent paper by Mr. R. P. Mears, *The Climbing Rope Defined*,[1] has been presented to the Alpine Journal are all to the good, it seems doubtful whether some of the principles suggested are logically sound, and also whether the rather technical details will be properly appreciated by many climbers. Comment may, therefore, not be out of place.

To start with, the late Captain J. P. Farrar hit the nail on the head—discard the rope at the end of the season (at least two months for Farrar), and earlier if it has been put to very strenuous use. This at once raises the questions of when to discard, of testing the potentialities of rope originally of reasonably good quality after a period of use, and of the hitherto unsolved problem of defining the symptoms which show when a rope is no longer fit for use—the seaman's method of judging from the appearance of the inside surfaces of the strands seems rather crude. Undue emphasis on laboratory tests of new rope may cause people to draw misleading conclusions.

It is an undoubted fact that for many people there is a temptation not to discard soon enough, to avoid having to buy, and more especially having to use, new rope. But the inconvenience of new rope soon disappears after the dressing has been removed, and if the turns are systematically taken out before the rope is dried. It is understood that the dressing is used in manufacture, and is left in to preserve the rope against the weather; but the degree to which climbing rope, as compared with rope for other purposes, is exposed to the weather is almost negligible, and any reluctance to buy new rope can easily be overcome by halving the cost. Then the period of use can also be halved, and the rope will have greater efficiency at the end of its shorter climbing life, even if its initial quality be not quite so high.

This calls for amplification, and I can only speak up to 1939—before the days of nylon—though as regards manilla the argument will still hold good. Yacht racing was carried on regardless of expense, and if rope sold for climbing had been more efficient, it would have been used for racing, whereas that actually used was Bannister's best white yacht manilla; and tests show that the difference in quality, if any, as compared with what was sold as climbing rope, was insignificant. Its cost was just half that of so-called climbing rope; and by using it, and discarding twice as frequently, greater efficiency at the end of the rope's climbing life could be attained, and that is the efficiency which counts. The only difference is that, as with rope in general, it is sold by the lb. as cut from the coil, so that the buyer has to whip the ends himself; but any climber should know how to whip a rope in the ordinary way. The palm and needle method recommended in the paper is an un-

[1] *A.J.* 57. 325.

necessary refinement, on the hills as well as at sea, where everyone, without exception, is capable of renewing a whipping in a couple of minutes. [A][2]

Next as to specification. That is always useful as a guidance to manufacturers, provided that it does not tell them more than is really wanted, and so put up the cost, and provided that they will guarantee that it has been complied with ; though it must be realised that climbers have no practical remedy in the event of non-compliance. The alternative of systematic inspection and testing on behalf of the buyer is scarcely a practical proposition, where members of the general public obtain the minute quantities they require from various retailers. So the ordinary procedure of buying rope made by a reputable firm will still have to suffice ; but the retailer should disclose the maker's name, and should not pose as the manufacturer, as is believed to have been done in at least one instance. The other essential is that people should treat their ropes with due care, so as not to shorten their useful life.

Strength and stretch.—Mr. Mears seems to lay more stress on stretch than strength, but with the proviso that more lives have probably been lost through the rope not breaking than through its breaking. Both qualities are essential. To take two extremes, a rope which has lost all ability to stretch must obviously be in bad condition, while excessive stretching may also render it useless. Farrar found this when he tried a silk rope. He said that, apart from its costing too much, it stretched so easily that it was quite unusable.

From the energy-absorption point of view, it is the stretch after the pull becomes heavy that chiefly counts. Stretching while the pull is still light takes very little energy. And in calculating from test diagrams how much energy a rope can absorb, that part of the energy absorbed after the pull has exceeded the knotted strength of the rope, about 60 per cent. of its total strength, must be ignored. This about halves the theoretical energy capacity ; for although there are said to be devices for eliminating the weakness due to knots, are they likely to be generally adopted for genuine mountaineering ? [B] For instance, no one seems to have bothered about using the quite ancient device of having a thickish waist rope with an eye splice in one end, the other end being passed through an eye splice in the end of the climbing rope. That entirely eliminates all weakness due to knots. [C]

Mr. Mears' paper chiefly deals with manilla rope, and the energy which that kind of rope will absorb is only a small part of the energy which the top man will acquire during a steep fall. If he is to be held, the rest of the energy has to be taken up by breaking his ribs, or otherwise damaging him, by give on the part of the man trying to hold him, and by the rope being allowed to render over rock or snow ; and it may be exceedingly difficult to control rendering over rock in an effective way. Until the pull on the falling man exceeds his weight—if he is falling clear—he continues to gain energy, and so continues to fall

[2] The capital letters in square brackets refer to Mr. Mears' notes at the end of this paper.—*Editor*.

with increasing speed; while that pull must not exceed knotted strength, or the rope will break. Once again, the devices for getting over this difficulty, in which the man holding the rope ties himself to the mountain, and allows the rope to render over his own body, may or may not be all right for short rock climbs, but are they practical mountaineering propositions? And, after all, what is the good of knowing the breaking strength of a rope, if you do not know what intensity of jerk will kill a falling man, and whether a jerk of that intensity will not occur well before the breaking strength is reached? [D]

But to come down to actual figures, it seems, according to Fig. 1 in the paper, that a top man falling vertically will acquire about four times as much energy as that taken up by a knotted manilla rope before it breaks, if the rope weighs 5 lb. to the 100 ft.; but that a nylon rope, also of 5 lb. to the 100 ft, would absorb 60 per cent. of his energy. That, of course, is an extreme and quite unusual case, and the man would probably be killed in any event, if he had run out a considerable length of rope, even if a break did not occur. In fact, vertical falls are usually confined to crevasses and cornices; and then any rope in reasonable condition will suffice, but it must not be absolutely rotten as in the Pigne d'Arolla and Zumsteinspitze accidents.

Another problem is raised by nylon, which weight for weight is half as strong again as manilla, and has two other advantages—greater ability to stretch, and smaller increase in weight when wet. A $1\frac{1}{8}$ in. nylon rope is as strong as the standard size manilla one, of $1\frac{3}{8}$ in.; and the question is whether $1\frac{1}{8}$ nylon serves the purpose. Now the $1\frac{3}{8}$ measurement was arrived at in the quite early days of the club, either on the basis of some quite arbitrary decision as to desirable breaking strength, or as being the *smallest* convenient for handling—more probably the latter. A sounding line measures $1\frac{1}{8}$ in., and only has to cope with a hand lead weighing about 10 lb., so that its size is not dictated from the point of view of strength; and, in comparison, a climbing rope, which has to deal with a man's body, is none too large. It therefore becomes questionable whether one should be satisfied with less than $1\frac{3}{8}$ inches for nylon, especially as it is so smooth when new. [E]

To sum up: rope testing is all to the good, for a good workman cannot do good work unless he has good tools, and it is most useful if it is directed towards prevention of the use of rope which ought to be discarded; but it is unlikely that any improvement in the quality of new rope will improve the standard or even the safety of climbing; and undue emphasis on that quality must not be allowed to mask the fact that the skill of a climber is to be judged not so much by what he does, as by how he does it.

Comments by R. P. Mears.

[The late Mr. Unna asked us to let Mr. Mears see the proofs of this paper before publication. We believe that he himself would have wished Mr. Mears' comments to be published with the paper.—*Editor*.]

I am very grateful to the late Mr. Unna for the consideration that he has given to my paper entitled *The Climbing Rope Defined* and appreciate his practical outlook derived from long experience of both summer and winter mountaineering. I would comment on his remarks as follows :—

A. *Whipping the ends of rope.*—' Palm and needle ' is specified for *new* rope since it is more lasting than ordinary methods.

B. *Weakening effect of knots in ropes.*—Mr. Unna has overemphasised this point. It may be stated that where ropes have broken in mountaineering, with few exceptions the break has not occurred at the knot. (*Vide* paper on ' Experience with Climbing Ropes ' published in current issue.)

C. *Eye splice in the end of a climbing rope.*—The use of any form of *permanent loop* at the end of a climbing rope is not recommended. Sooner or later the first to descend a long rock pitch will do so to near the limit of the length of the rope in the search for a safe stance where the rope may be taken off and hauled up for the descent of the next climber. A rope with a loop at its end will in such circumstances be liable to jam and to dislodge stones. The same purpose may be readily attained by substituting a ' Tarbuck ' knot for a spliced loop. Tests have shown that the strength of a Tarbuck knot like that of a spliced loop is little short of the strength of the unknotted rope and this type of knot is readily tied and untied. It is one of the few knots that should be known to all users of climbing rope.

D. *Breaking his (the fallen climber's) ribs and the intensity of jerk that will kill a falling man.*—At the time of writing, fifty-five cases have been recorded on written evidence where a falling leader has been sustained on the rope. While in some of these cases the leader has been killed, in none is this attributable to the jerk in the rope. So far only two cases have been found where a climber's death was caused by jerk. (*Vide* paper on ' Experience with Climbing Ropes.') It may be stated that the ' indirect belay ' eliminates this risk and greatly lessens that of rope breakage.

E. ' *It therefore becomes questionable whether one should be satisfied with less than* $1\frac{3}{8}$ *inches (circumference) for nylon* ' and ' *now the* $1\frac{3}{8}$ *measurement was arrived at in the quite early days of the club . . . as being the smallest convenient for handling.*'

No ALPINE JOURNAL reference is given for the latter statement. Anyway in the quite early days of the club Alpine guides were strong men having powerful arms and trusted to their strength of grip for holding ropes, just as was done by amateurs half a century ago ; such methods being somewhat analogous to those of members of tug-of-war teams. Now body friction is always made use of in handling ropes which greatly lessens the necessary reliance on grip and Mr. Tarbuck has taught us how to hold falls by friction without depending on grip. Consequently the nylon ' full ' of about $1\frac{1}{4}$ inches in circumference and weighing $4\frac{1}{4}$ lb. per 100 lin. feet is amply large and, for really good climbers well versed in rope technique, the nylon ' medium ' is generally sufficient.

This weighs only 2½ lb. per 100 lin. feet when dry and little more when wet. The saving in weight carrying and in bulk is a great asset.

I would again express my appreciation of the points raised by Mr. Unna and regret that I cannot thank him personally.

I hope that all these references to actual experience with climbing ropes will result in members favouring me with accounts in writing of incidents involving rope known to them and of cases where snap-links have failed either for lack of sufficient strength or through opening under critical conditions.