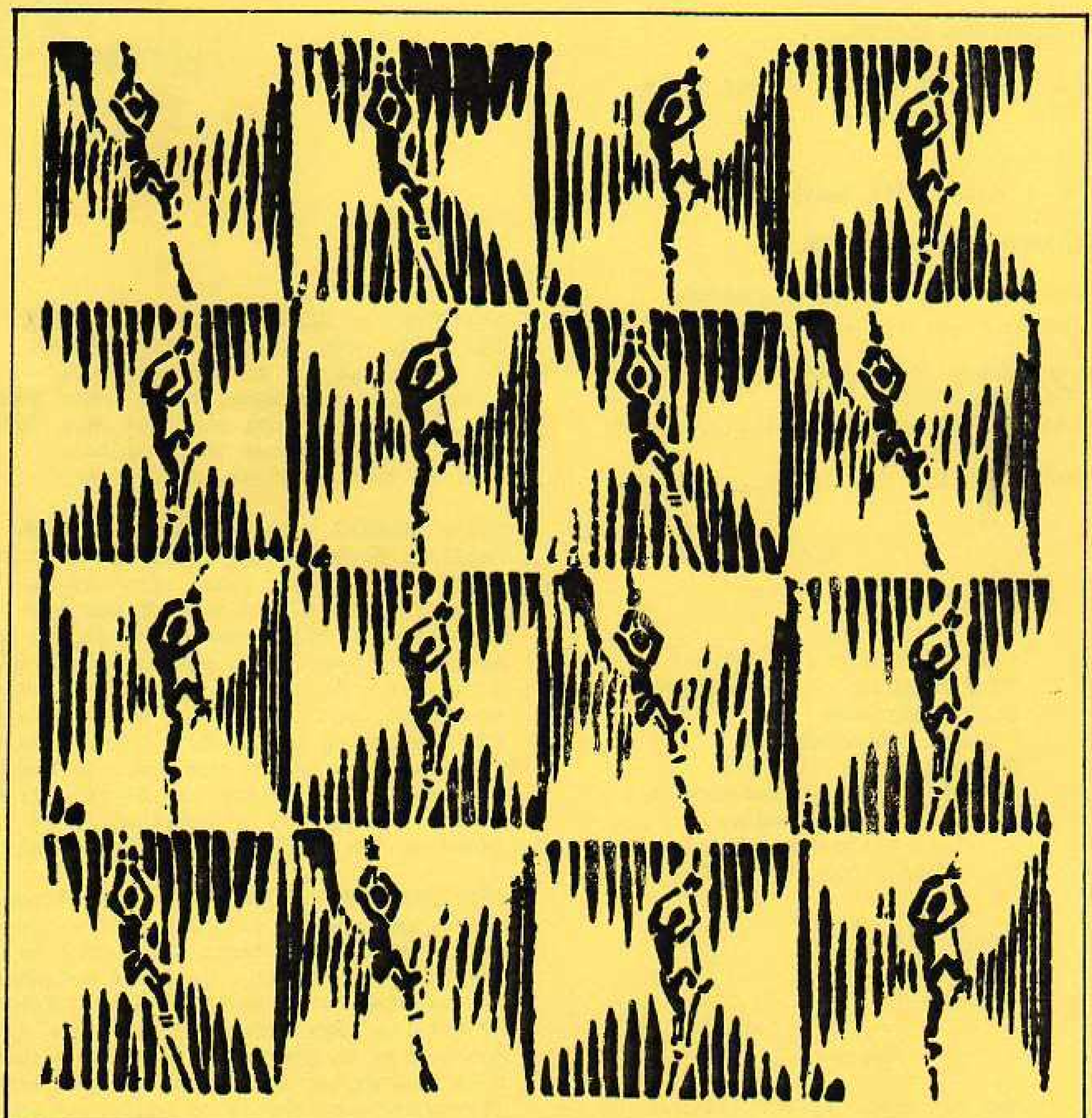
# NYLON HIGHWAY 10

...especially for the vertical caver



# Nylon Highway 10

NSS Vertical Section
February 1979

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### Cover

Super cover art again by Bob Alderson of Blacksburg, VA.

DEADLINE for NYLON HIGHWAY # 11 is April 15, 1979. Articles need to be typed double spaced, if at all possible, and illustrations, graphs, etc., inked ready for final copy. One need not be a Vertical Section member to contribute. Letters to the Editor are welcome.

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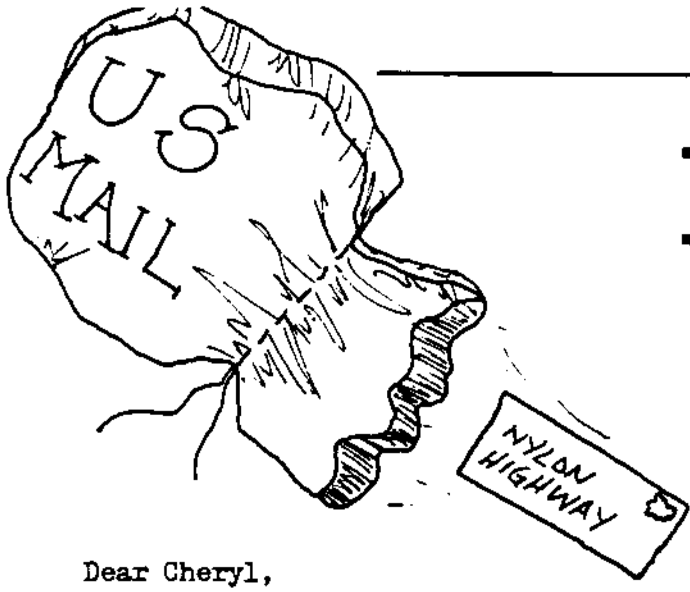


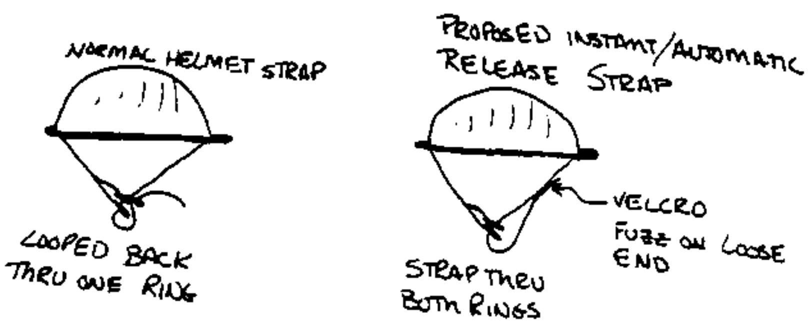

# letter ho!!

Dear Cheryl,

Another letter!

I would like to generate some interest in improving the chin straps on hard hats. The problems of bump-caps and elastic chin straps, at least for vertical caving are obvious. Rigid chin straps of nylon webbing attached to one's helmet at 3 or 4 points are "in". I recently rappelled through a narrow constriction on a frequently used route into a major cave system. Being cautious, I undid my chin strap (nylon webbing with "D" rings) before I started down and sure enough, the hat wedged tight part way down -- I had to slide it through sideways. I would not have been able to release the "D" rings on the strap once it was under tension under these conditions. This same strap problem may have contributed to a fatal accident at exactly the same spot just a few hours later.

I propose that rigid chin straps be fastened either with Velcro or snaps in such a way that they can be instantly released (like cave divers gear) or will release themselves at a reasonable non-neckbreaking force -- say 30 pounds. My Bell Toptex has been modified as shown.

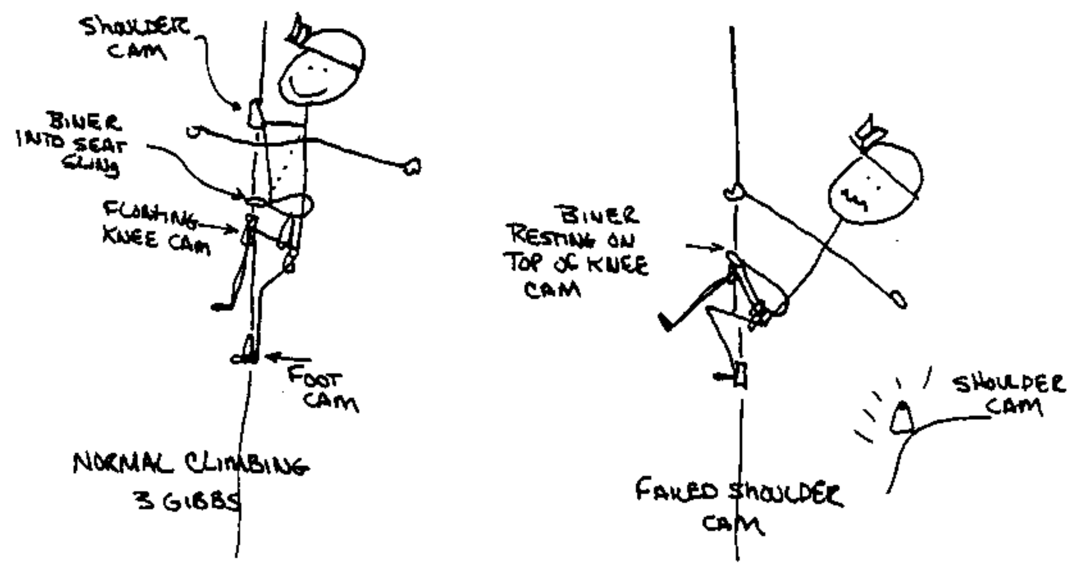



Some helmets (MSR)[1] come equipped with Velcro to keep the end of the strap out of the way. Otherwise it takes two minutes to add your own without any other changes. Just sew it on.

About 2 inches of Velcro was enough to require about 30 lb. of force to remove the helmet. Brass marine snaps (sold by E.M.S.)[2] could possibly be used instead of Velcro, but I haven't tried it. Note that the "D" rings can still be used in the normal way if the same helmet is used outdoors for rock-climbing, etc.

Another subject.

Many people use the 3-Gibbs ascending system with foot, floating knee, and shoulder cams. The system works fine and is very safe unless the shoulder cam becomes completely detached from the harness at which point you will flip upside down, or almost upside down, depending on the individual rig (e.g. Cass Cave accident). I propose that a biner attached to the usual rappel spot on the front of your seat or seat/chest harness be clipped around the climbing rope to serve as a safety in case of shoulder cam failure. This has been tried (by my wife) and it works. You simply squat down, rather than fall backwards, as the biner slides down the rope and hits the shell of the knee cam (see illustration). Purists will arque that this may start the knee cam sliding down, but this doesn't seem to happen, at least with a floating cam. What does happen is that you stay upright and can actually continue to climb, using this position to rest your arms. It isn't comfortable, but it's better than nothing. You can use the same biner you used on your rappel rig. Any comments from people who have tried this?




Keep up the good work!

/s/ Brian Pease

[1]Mountain Safety Research
[2]Eastern Mountain Sports

# Shock Strengths
## of some caving ropes

*Mike Cowlishaw

In November, 1977, I had published a short paper (1) describing a way to compare the ability of ropes to hold the small shock loads experienced in Single Rope Technique caving. This article summarises that paper, and describes the results of tests on many of the low stretch SRT ropes available today. I also include some predictions of the forces you should expect if you do fall onto one of these low stretch ropes.

We can measure a shock load by the amount of energy involved in the shock. Similarly, if we test the elasticity of a rope, we can determine with fair accuracy the tension in it when loaded with a certain amount of energy (see Appendix A in (1)). From these figures it is possible to calculate the amount of energy that will give rise to a given peak force.

I have defined the "Shock Strength" of the rope to be the amount of energy (i.e. the shock load) that it can absorb before the tension in it becomes equal to one half of the breaking force of the rope when new. This makes some allowance for the effects of water, knots, and age.

Obviously, the higher the Shock Strength, the more energy can be absorbed by the rope, and the lower the chances of it breaking.

Unfortunately, the basic safety of a rope is not the only criteria by which we must judge it: a very stretchy rope can absorb a lot of energy, and will have a high Shock Strength; but prusiking up it will be difficult, and it may be more prone to abrasion. Also, a rope's Shock Strength can be improved by increasing the number of fibres used in its construction -- but this will make the rope heavier and more expensive, and (because the rope will stretch less) may mean that the peak force developed in a small fall will be so high that the belay point or ascenders/descender will be broken.

Let's now look at some of the limits for required Shock Strength and peak force; and then see how the ropes we have today compare with these figures.

In the paper I have referred to, it was shown that the worst shock loads will not occur during prusiking or abseiling, but will result when slack is introduced into the rope/SRT system due to human error. For example, a tired caver could slip off the ledge at the top of a pitch while still attached to the SRT rope (getting on or off the rope is the most likely time for an incident of this sort.). The severity of the shock load on the rope is dependent on the slack between the caver and the belay point (the more slack, the worse the shock), however a fall of this nature would not normally exceed fall factor 0.75. This is equivalent to a fall of 3 meters on to a 4 meter length of rope.

From this it may be calculated that the rope would need a Shock Strength of 600 J/m (Joules per meter) if we assume that the caver is a 'dead weight' attached directly to the rope. Since however, the caver's harness and body will both absorb significant amounts of energy in the small falls we are talking about, I would consider the lower figure of 400 J/m to be a more realistic criteria for judging the suitability of an SRT rope in this respect.

In addition to this requirement, we must check that the peak force in the fall will not be too high. Again allowing for the energy absorption of the harness, etc., I have estimated the peak force that could be experienced in practice. This is shown in the second column of figures in the table. A force of 10 kN (one tonne) is a very high value: even a small fall onto Bluewater, for example, id definitely not recommended.

Finally, the third column of figures shows the results of my tests for the stretch of the rope under a load of 80 kg. Here a low figure implies that the rope is easy to prusik up.

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| Rope | Shock Strength J/m | Peak Force kN | Stretch At 80Kg % |
|---|---|---|---|
| Typical Climbing Rope | 1500 | 5.6 | 4.5 |
| Edelrid Super-Static 11mm | 920 | 8.1 | 3.1 |
| Edelweiss (Yellow) | 900 | 6.2 | 2.6 |
| Bridon Nylon Super-Braidline | 780 | 8.1 | 3.7 |
| Interalp 11mm (Diagonal markings) | 730 | 8.4 | 2.1 |
| Edelrid Super-Static 10mm | 700 | 8.4 | 2.9 |
| Bluewater II | 650 | 10.4 | 1.1 |
| Mammut Speleo | 620 | 8.7 | 1.6 |
| Downs Polyester (Australia) | 600 | 10.3 | 1.5 |
| 3-Strand Staplespun Polypropylene | 510 | 6.2 | 3.5 |
| Marlow 16-Plait Matt Polyester 10mm | 340 | 8.8 | 2.0 |
| Bridon Polyester Super-Braidline | 280 | 10.5 | 2.1 |

Notes: Figures for Shock Strength and Peak Force are +/- 15%.
Figures for stretch at 80 kg are for NEW DRY ropes. Most Nylon ropes become two or three times more elastic at low loads when wet, and this can noticably alter their prusiking characteristics.

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It will be noticed that in general, the polyester ropes have a lower shock strength than Nylon ones: this will come as no surprise to most people.

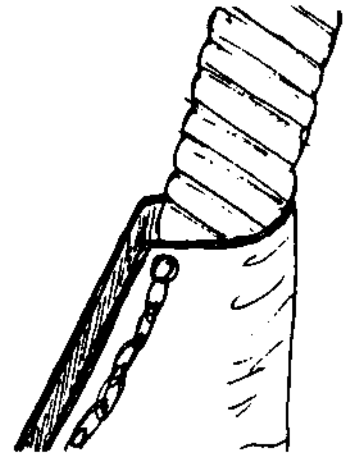
Generally, those ropes nearer the top of the table are to be preferred, however, only the two ropes at the bottom of the table fail to meet my criteria for required shock strength. When making any sort of choice between the others, due consideration must be given to the other parameters by which a rope can be judged. For example, the low abrasion resistance and melting point of polypropylene ropes rules out its use except for short pitches, even though it has adequate strength and energy absorption.

Other important factors include flexibility, ease of use, weight, size, etc.

cont'd
p. 20

# shoulder cam, floating knee

# A Vertical Rig



*Bill Arney

*Pete Sauvignc

The purpose of this article is to describe a climbing rig which has proven its effectiveness in many caves around Southwest Virginia. It is not claimed to be the ultimate rig. Prusik knots are much cheaper. Jumars are easier to rig, especially for multiple short drops or where equipment is to be shared. The strong points of this design are ease of climbing and safety. If you make a rig from these plans, feel free to modify it to suit yourself; you'll be climbing in it.

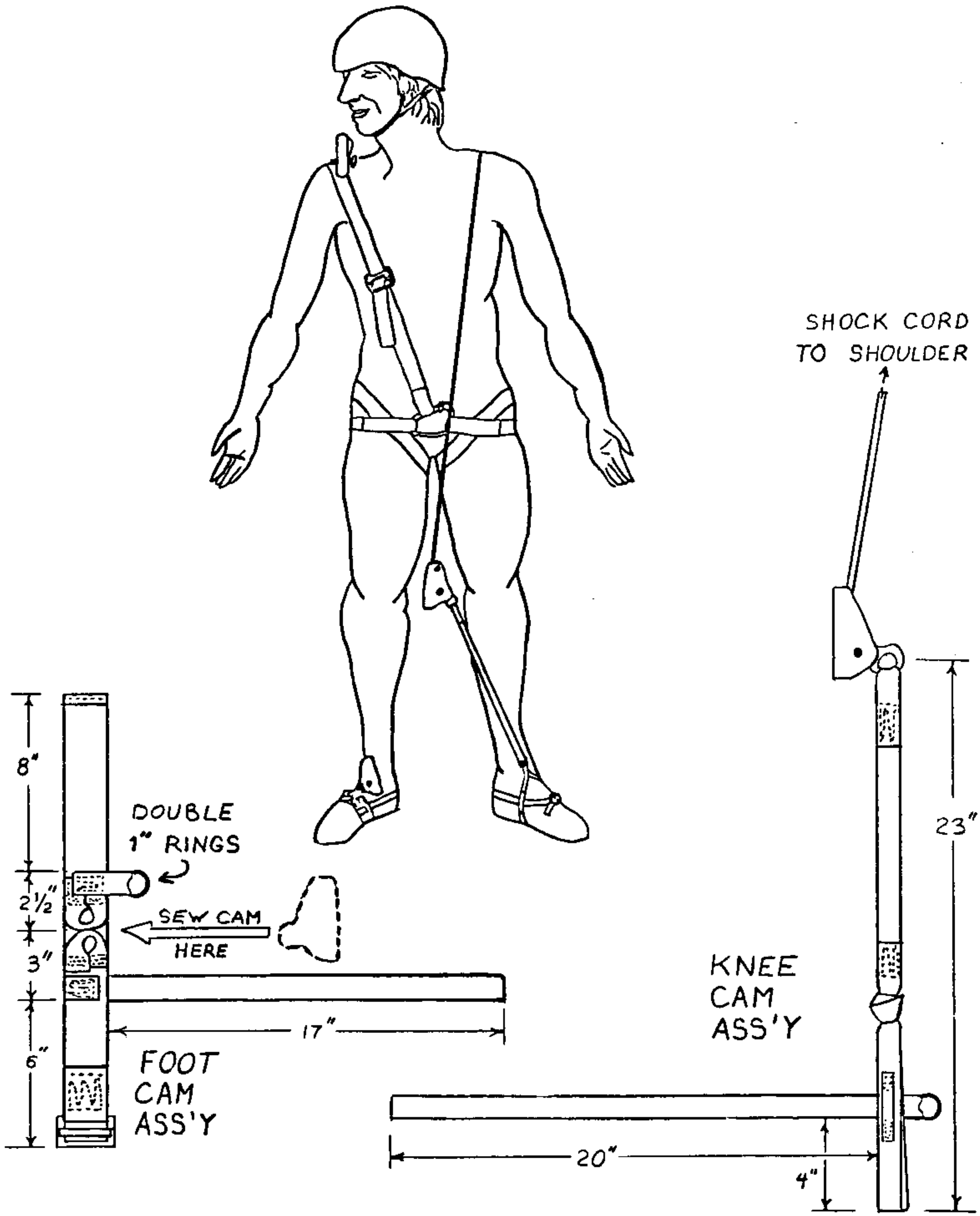
Basically, it's a 3-point cam rig. There are 3 Gibbs ascenders (cams) in contact with the rope. The foot cam straps onto the right foot. The floating knee cam straps onto the right foot. The floating knee cam is attached to the left foot by a length of sling and is held in suspension in the vicinity of the left knee by an elastic shock cord which goes over the shoulder. The foot and knee cams do all of the work when climbing. Simply raising one foot after another allows the caver to walk up the rope. The shoulder cam is necessary to keep the body upright, to provide a rest position, and to permit climbing to continue in the event of a failure in the foot or knee cam. The seat which attaches to the shoulder cam also serves as a rappel seat, and is significantly more comfortable than tied 1 inch sling.

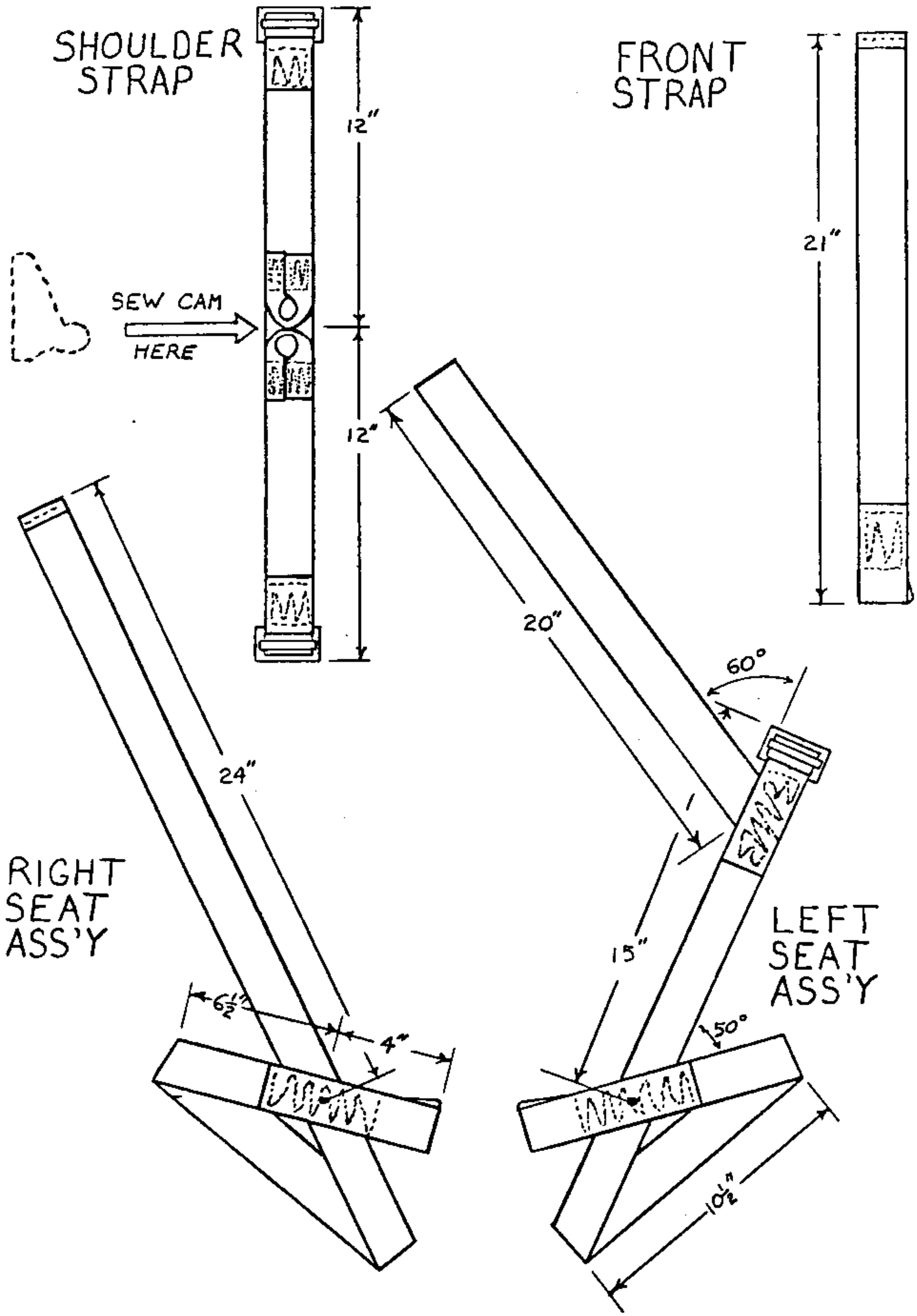
CONSTRUCTION:

You'll need 3 Gibbs, 20 feet of parachute webbing, 4 parachute buckles, 4-6 feet of shock cord, 4-1 inch rings (round or "D"), 10 feet of 1 inch sling, and a large steel locking carabiner (this biner must be extra strong since it will take loads in unusual directions). All sewing must be done with an awl or a sewing machine so that lock stitching results. You'll find that hand stitching with an awl will take from 16 to 20 hours. A parachute rigger has the knowledge, 45-50 pound test synthetic thread, and heavy duty sewing machine necessary to sew a rig that you will be able to trust with your life.

The FOOT CAM assembly is constructed so that the Gibbs will ride on the top of the arch. If you wear bulky hiking boots, you may have to make the straps longer than indicated. Use your own judgement. The buckle should ride on the outside so that an upward pull tightens it. The 1 inch sling is a safety strap that goes around the heel so that if all else fails, you will havg by the foot (infinitely better than an air rappel). The cam is attached by looping 1 inch sling through its eye. Keep excess slack out of this 1 inch sling to avoid a sloppy fit. The distance from the center of the cam eye to the rightmost peice of 1 inch sling should not exceed 2½ inches, or the main buckle may run out of adjustment room before coming completely apart.

The KNEE CAM assembly is made of all 1 inch sling. The foot loop should be tied with an overhand knot to keep tension off the stitching. The strap with the loose end goes around the heel, through a guide in the foot loop, and to a double ring adjuster near its origin. This strap is not just a safety, it is required to keep the assembly on the foot. Drill an extra hole in the cam shell, feed the shock cord through, and secure with an overhand knot on the outside. The shock cord should run over the left shoulder and through a guide, belt loop, etc., in the back. It should be secured so that it is fully stretched when standing.


SHOCK CORD
TO SHOULDER
8"
DOUBLE
1" RINGS
2½"
SEW CAM
HERE
3"
17"
6"
FOOT
CAM
ASS'Y
KNEE
CAM
ASS'Y
23"
20"
4"


SHOULDER STRAP
12"
SEW CAM HERE
12"
FRONT STRAP
21"
24"
20"
60°
RIGHT SEAT ASS'Y
6½"
4"
15"
LEFT SEAT ASS'Y
50°
10½"

The RIGHT SEAT assembly clips into the seat biner, forms a leg loop, and attaches to the other half of the seat by a buckle in the rear. Do not make the leg loops too tight. The dimensions shown fit me, they may not fit you. Since the buckle need never come completely apart,you're advised to fold the end of the webbing to form a knob, as in the foot cam.

The LEFT SEAT assembly similarly slips into the seat biner, forms a leg loop, and buckles to the right seat assembly. An additional back strap goes off near the buckle. This strap will go through a buckle on the shoulder strap to adjust the shoulder cam. Don't bother putting a knob on this strap, since you'll be taking the buckle completely apart to remove the shoulder cam for rappelling.

The SHOULDER STRAP has a buckle on either end so that it can be adjusted to put the cam on the top of the shoulder. One inch webbing attaches the cam to the main strap, similar to the foot cam arrangement.

The FRONT STRAP clips into the seat biner and attaches to the front buckle on the shoulder strap. Again, a knob on the strap's end is advised to prevent the buckle from coming completely apart.

USING THE RIG:

To rappel, only the seat assembly (both halves) will be needed. Clip the front together with the large biner, tighten the buckle in the rear, and clip into your rack, doubles, etc. You'll find a strap dangling behind you, but you can ignore it.

To climb, you'll need to put the entire rig on. The main buckle on the foot cam should be tight. Don't tighten the 1 inch safety strap too much, or the main buckle may begin to loosen. Adjust the buckle connecting the two halves of the seat before adjusting the shoulder cam. Then adjust the cam to be snug on the top of the shoulder. Don't over-tighten this strap. When your weight is supported by the shoulder cam, it will tise up well off your shoulder and support you by the seat. If you adjust the buckles enough to pull the cam back down, it will cause pain when you start to climb.

The rig is easiest to use when the rope is completely vertical. If it is somewhat less than vertical, you'll have to adjust the shoulder cam to the front. This will prevent your face from being pulled into the wall. On slopes you can slip your arm out of the shoulder cam strap and let the cam ride about waist level. This configuration is safe since the cam is still functional, only relocated.

Many of the design features of this rig were originated by other people, especially Don Davison, Jr. and Gary Moss. Some of the ideas were my own. If you know of something else you would like to include in your rig, do it. This design is not claimed to be ideal, but it will get you up and down a rope in a very respectable fashon.

"Dr. Karl Prusik died in May, 1961, at the age of 65. The inventor of the Prusik knot had served twice as president of the Osterreichischer Alpenklub and is said to have pioneered some 70 new ascents or routes. Many individuals not knowing the source of the name misspell the well-known knot." (THE POTOMAC CAVER, Vol. 6, 1963.) Thanks to Anne Whittemore.

## V.S. offers $ for sense

# Equipment Testing Grants

Interested in testing caving equipment? Have testing facilities available for your your use? Just need some dough to purchase enough equipment to make the tests valid? Then the Vertical Section is interested in you, and is willing to grant some money in return for the results of the tests. The guidlines for the Vertical Section Testing Grants Program are as follows:

1) Arrange to obtain free access to the facilities and equipment that you will need at a university, etc. (The grant money should be used primarily for buying items to be destroyed in testing or other materials that cannot reasonably be obtained free.)

2) Be prepared to submit a report on the test and the results for publication in the NYLON HIGHWAY. The report should be sent to the NYLON HIGHWAY a reasonable amount of time after you receive the money.

3) Send a description of the proposed test and an indication of how the grant money will be used to: Kirk MacGregor
78 King High Ave.
Downsview, Ontario
Canada M3H 3B1

Grant applications will be reviewed by the executive committee of the Vertical Section. Within two months, each person applying for a grant will receive either the grant, or a brief explanation of why the grant was rejected. We are especially interested in innovative tests (e.g. of techniques to stop cave rats from damaging ropes, the effect of side-to-side abrasion on ropes), but we will also support routine tests (e.g. how strong are brand X carabiners?). Our budget being limited, we cannot consider requests for over $100, and prefer requests for significantly less.

We hope this program will help to encourage responsible testing of vertical equipment. Grants will be handed out on a first-come, first-served basis.

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Plymouth Cordage Company has resumed maufacturing Goldline rope. The "new" Goldline is a slightly different color of gold, and is reportedly able to better withstand ultraviolet light. Although this may not seem to be of importance to cavers using the rope underground, it must be considered by those cavers frequently storing their ropes in direct sunlight, whether it be in a dorm room or rear deck of a car.

# Single Rope Solo Rescue Techniques

* Warren Hall

That's an SRSRT for you initial freaks. Having recently been exposed to poison ivy and solo rescue techniques at the National Cave Rescue Seminar, I found the PI a bit boring and the solo rescue tech quite interesting. In SRT, Montgomery also goes into solo rescue tech. What struck me was the assumption that a second line was always available and muscle power was in the right place at the right time. Okay, we can all figure out how to climb up or down to a person in trouble on a single rope and lower them to the bottom of a drop. But what the hell do you do when you are at the bottom of a deep dark shaft and have to haul your buddy out alone; or perhaps he or she is stuck halfway up a waterfall and the best way out is up and the nearest extra rope is 50 miles down the road. Here are two methods that work.

METHOD #1: (Fig. 1 & 2) A basic system.

Using standard climbing techniques, common sense and published rescue techniques (Montgomery and NCRC Rescue Manual) get victim into this position (fig. 1). This can be done on the bottom or on rope as need be. Use the victim's highest secure ascender above the pully. If a waist cam is used, you might have to extend it with a biner or webbing. If they have a non-locking device such as a chest box or shoulder pully, leave it on to hold them in. If they don't have an ascending rig on, use a sling and cam as a seat harness with a biner or small pully at the chest to hold them into the rope in a vertical position. A prusik knot at this point will cause problems. Clip the end of the rope to your waist and climb -- this is hard but can be done. Slow and steady wins the race. At the top, rig a cam to hold victim's weight while you put in a nice, high anchor point. If you have a pulley on top, use it to set up a Yosemite Lift. No pulley? Use a biner. The same anchor point as the main line can be used if this is all you have, however the higher you are anchored above the lip, the easier it is to swing the victim over it. Now use your foot cam on the Yosemite Lift to haul your buddy up and over the lip. It ain't easy, but it works.

METHOD #2: (Fig. 3 & 4) Wherein we plan ahead and have a few extras with us to make life easier and safer.

The victim is locked on by his cam while you climb the main line extending the system. To do so, release the rachet cam and top cam. Move the top cam as high as it will go, leaving enough haul line to haul down with. You then reengage the rachet cam and go into your rest position. Use your knee cam or whatever to haul down on the haul line. Whatever cam you use will have to be reattached to the mainline which will be under tension. Keep hauling until the pullies are close together. Then release the rachet and lower the victim a few inches until the victim's cam engages. You are now free to climb again and extend the system. You will be able to extend the system further each time. At the lip, the victim is held by his or her cam while you rig an anchor and then sit down to haul. If room permits, you can use both knee and foot cams to increase power and speed of hauling.

This system uses 3 cams and 2 pullies. Where do you get them? Well, you can use your foot cam for one while you climb with two others in an inchworm manner, as there is no extra weight on you while climbing. Then take two cams from the victim. (If he isn't conscious, then he'll never know anyway.) I use a 3 Gibbs rig and carry a

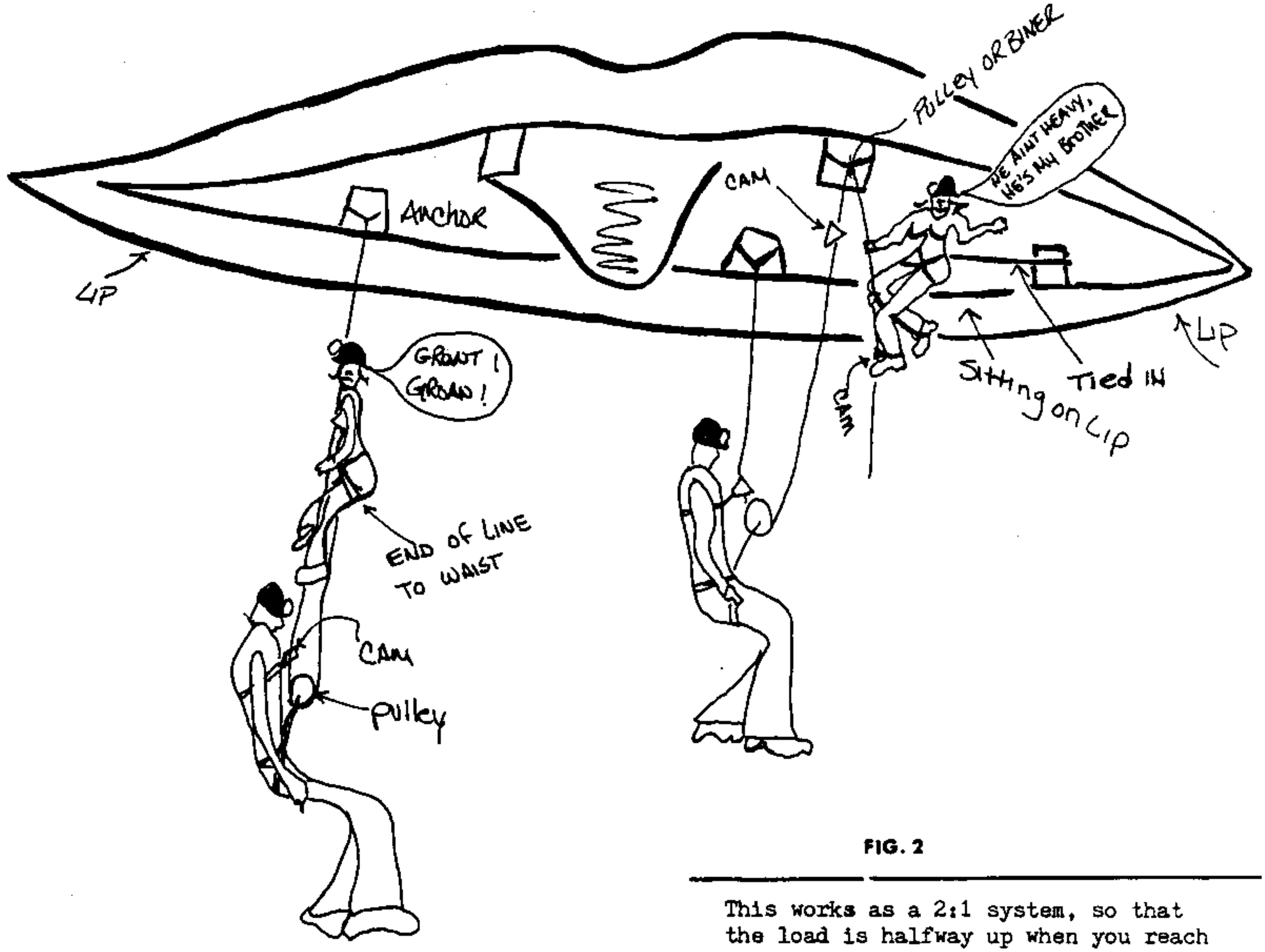


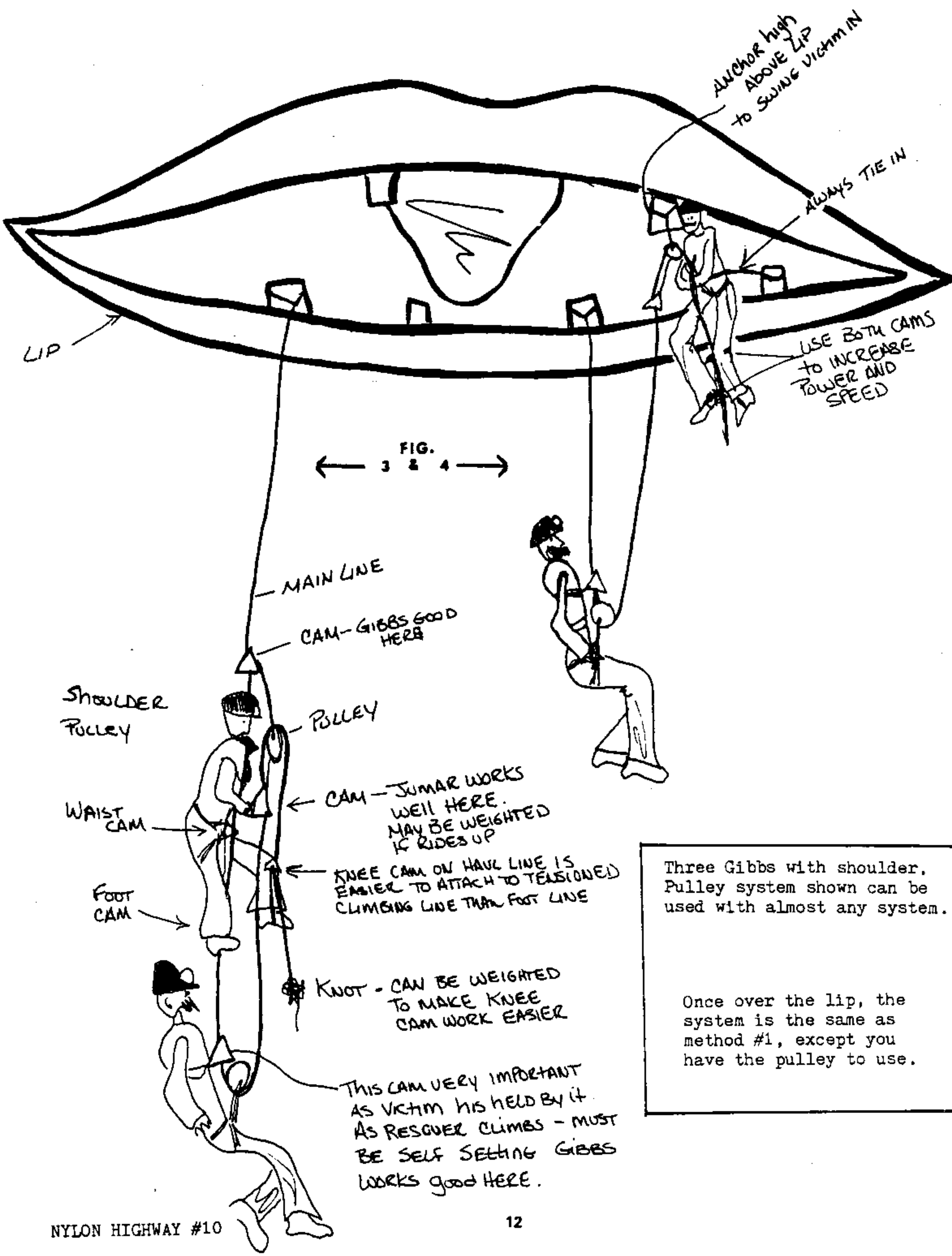

FIG. 1

FIG. 2

This works as a 2:1 system, so that the load is halfway up when you reach the lip. The full weight is on you the whole trip. This works, but is hard on both victim and rescuer. Once weight is off the rescuer, it is much easier to haul victim up to the lip.

Equipment Used:
- 1 Pulley
- 1 Cam for victim
- 2 or 3 cams for rescuer

At the top, it's nice to have another pulley or use a biner to change direction so that you use legs to push down. Using biners instead of ;ulleys upts a lot of friction into the system. At the top, use one of your cams as a rachet to rest legs and to hold victim when needed.




Three Gibbs with shoulder. Pulley system shown can be used with almost any system.

Once over the lip, the system is the same as method #1, except you have the pulley to use.

Jumar, which is handy for lips and change-overs, going over knots and stuff like that. So I always have 2 ascenders I can use (Jumar and foot Gibbs). Everyone should carry a pulley in their cave pack, two is better. Use your pully and your buddie's; biners can be used but put a lot of friction in the system. If you plan ahead, you'll have 10 feet of rope on the bottom which makes it easy to set up this system. In non-standard cases -- improvise like hell.

I have been told that cavers should be able to haul someone up a pit on a straight 1:1 system as is done with packs, ropes, etc. This may be the case when one is well rested and a strong climber. I, for one am rarely well rested and not a particularily strong climber and doubt my ability to haul someone 1:1 at the end of a long, ardous cave trip. Loaded loops hanging below a lip are know to cause twisting and entangling trouble. These problems may occur while using this hauling method, but will generally be easy to remedy as the rescuer is always in a position where he/she can seperate ropes by pulling laterally.

Some practices shown in the drawings are unsafe.

1. Never haul or let someone rest for long periods by a chest harness alone. A person should be hauled using a harness that distributes weight in such a manner that the seat portion is load-bearing and the chest portion serves to hold the caver into the rope. Good examples of this are waist located cams with either chest boxes or shoulder pulleys.

2. In the drawings the rescuer is shown tied in behind and away from the hauling operation. Should he/she fall, they would swing down and laterally-- a bad situation. A better method would be to tie in high and indirectly adjacent to the anchor point of the pulley in such a manner that you cannot go over the lip. This also provides better balance while hauling. A separate anchor is desirable in case the main anchor point comes out.

The above points are shown the way they are in the drawings for the sake of clarity, and are not meant to show acceptable practices.

Please remember that these are emergency methods of rescue in which only a single line and limited equipment and manpower are available. Amuch more ideal situation would be a large work area, adequate people, multiple ropes and lots of equipment to set up a piggyback system to haul up a victim in a litter and a helicopter standing by at the top of the pit. But it is seldom that we are this fortunate.

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## A Machine for Continuous

# Rope Climbing Practice

*Darrell Tomer

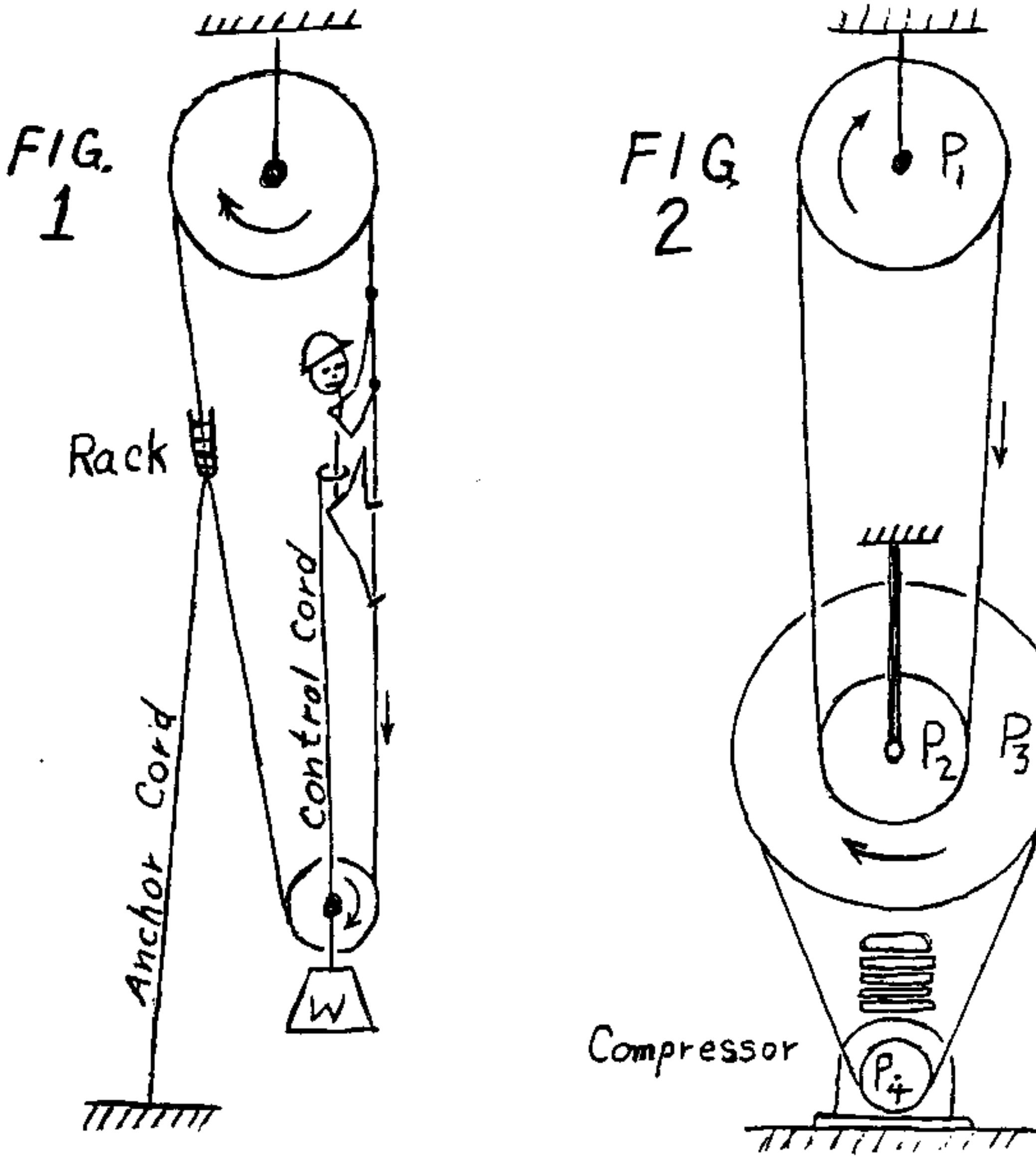
How is it that a man 63 years old can climb 400 feet of rope in less than 7½ minutes? No doubt, there are a number of factors, but I believe the important ones are efficient climbing and a schedule of regular practice. My article in NH #8 on the Gossett System described its advantages and gave reasons why it is the most efficient. This time I will explain the basics of a device that can make climbing practice practical. Recommending practice is easy; arranging for practice is not.

Do you have a four hundred foot rope and a convenient place to hang it for daily practice? If not, you may be interested in the idea of using a short length of rope spliced to make a continuous loop passing through an overhead pulley. While you perform on one section of the loop, another part of it is passing through an energy sink that absorbs the work you put in. The energy sink is also the speed control and it can feed you the rope at a fixed pre-set rate or it can automatically vary the speed to keep you at a constant level whether you climb fast or slow. The constant rate control lets you discover and practice the fastest pace you can keep up over the 400 foot climb. The automatic mode will allow you to warm up slowly, increase your pace at will, and finish with a sprint.

Years back, a constant level, continuous loop, climbing device was described in a caving publication. Figure 1 illustrates its principles, but not the actual construction. The energy sink is a brake bar rack anchored firmly from below. Automatic control results from the property of the rack that causes it to increase resistance as the rope below increases its tension. A weighted, free running pulley at the bottom of the loop supplies tension to keep the rack locked up. When the climber rises to a point where the control cord attached to his belt begins to lift the weight of the pulley, he is at the control level. The next step up lifts the weight from the rope, relaxing the rope tension, so the rack lets the rope slip through dropping the climber. He falls only a few inches until the weight puts tension back on the rope and the rack locks up again, holding him steady. The big difficulty with this rig is getting a splice the rack can't tell from the rest of the rope. At least, the splices I make are inevitably stiffer, and likely a little larger, than the rest of the rope, and they always hang up in the rack. Even with a faultless splice, I suspect this arrangement would develop heat and excess wear problems in the rack.

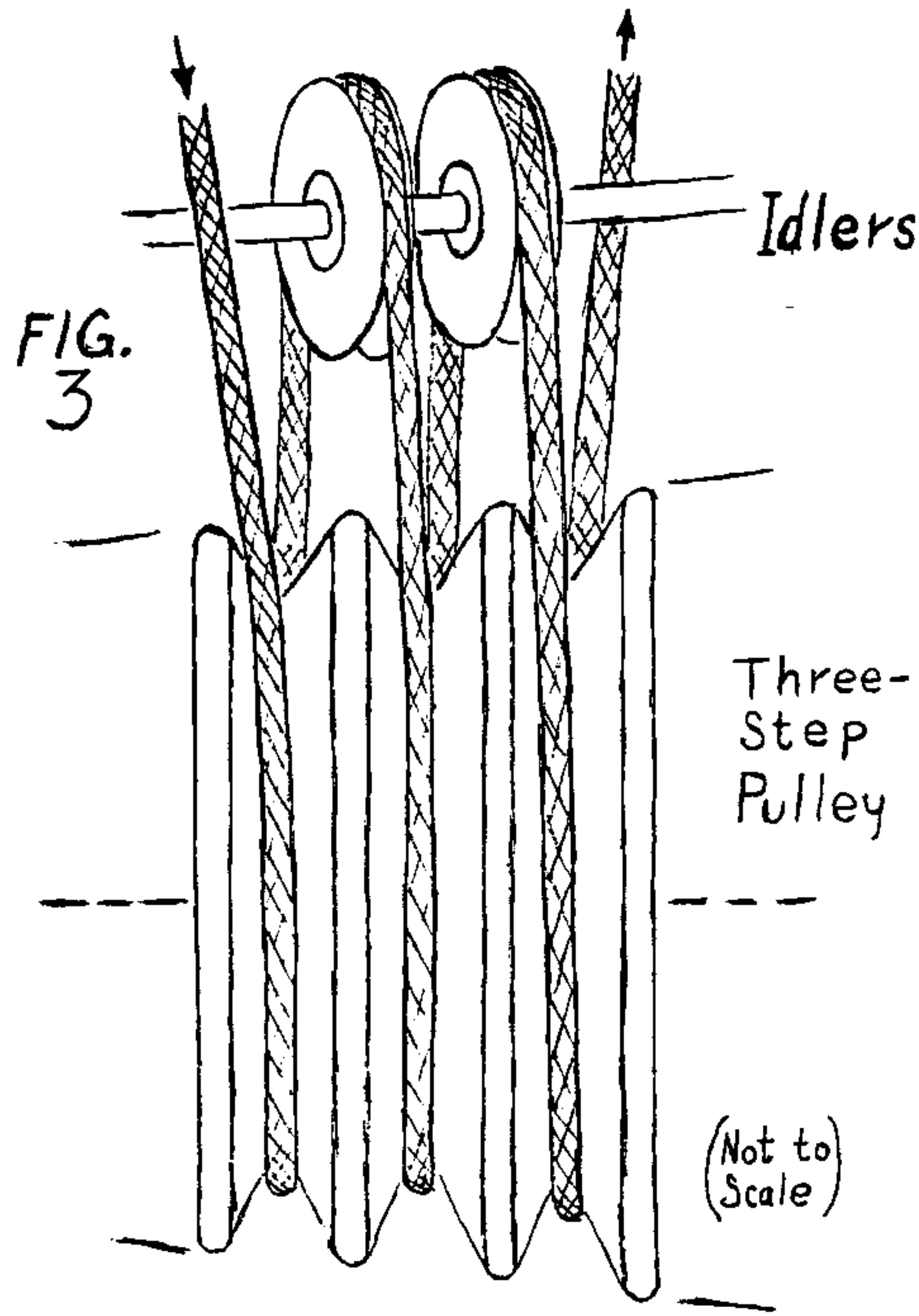
Figure 2 diagrams the principles of a more complex system that does not develop heat problems, and is not so sensitive to the properties of the splice. It can be made to provide both the constant rate and constant level modes of operation. As before, there is an overhead pulley, but down below, the rope turns around a three-step pulley directly connected to a large V-belt pulley that drives an air compressor. The compressor works better than any previous energy sink device I have tried. Some of these were: (1) an auto fan blade turning in a tub of water, (2) a centrifugal brake, (3) resistance loaded auto alternator, and (4) an electric motor with variable voltage input.

Now that you have seen the forest, take a look at the trees: The three-step pulley, labelled P2 in Figure 2, is shown in more detail in Figure 3. The rope goes around it three times and each V-groove is ¼ inch larger in diameter than the preceeding V-groove. This demands that the rope stretch as it proceeds from one groove to the next, so the increased tension pulls it deeper into the grooves preventing slippage. In order for the rope to pass smoothly from one groove to




the next, it must first run over an idler pulley whose axis is slightly askew compared to the three-step pulley axis. The diagram shows the middle two idlers. Actually there are four. The first helps guide the incoming rope into the first V-groove and the fourth guides the outgoing rope to avoid rubbing. The 5-inch diameter step-pulley is constructed like a stack of hotcakes. Plywood discs are cut from scrap and assembled to give the rough shape, then sanded to final shape after glueing. The large 18" V-pulley is made in the same way, and both could be one solid piece. Mine are mounted separately on the same arbor. The idler pullies are separate, free running, and of any convient diameter, but remember that a larger pulley is less sensitive to the irregularities of the rope splice.

The air compressor has a 2-3/4 inch bore and a $1\frac{1}{2}$ inch stroke, but any similar, single-stage compressor should work. This compressor is listed in the 1978 Montgomery Ward Fall and Winter Catalog on page 969 at $73. Also on page 153 of the 1978 Silvo Hardware (107 Walnut St., Philadelphia, PA, 19106) Catalogue, at $59. Why not try the junk yard? The moving parts need be only in fair shape and the head with its valves is not needed. Make a substitute head from a $\frac{1}{4}$ inch, or thicker, metal plate. Drill two holes for the head bolts, and in the middle,




holes for the head bolts, and in the middle, drill and tap a hole for a 3/4 " or 5/8" bolt. Turn the bolt solidly into the hole, then cut off and grind smooth any part that sticks through the bottom side, so the piston will not hit it. On the top side, cut the bolt off square at $\frac{1}{2}$ inch above the plate. Drill all the way down through this bolt and tap it to take a $\frac{1}{4}$" x 28 bolt. (See figure four.) This bolt-within-a-bolt becomes the constant speed control when a longitudinal, tapering, slot is filed in the lower part of the $\frac{1}{4}$ " bolt. By turning this bolt in or out, more or less of the slot is exposed as a pathway for air to blow in and out of the compressor cylinder. If you aren't up to this tapping, just drill a half-dozen very small holes through the plate, and plug each with a round wooden toothpick. Then, the more toothpicks you pull out, the faster you will have to climb to stay on the rope.

A second modification of the compressor is necessary. The combination flywheel and V-pulley is much too large as a pulley, but is advantageous as a flywheel. Since it occupies most of the space on the exposed end of the crankshaft, grind off enough of its hub to make room for a $3\frac{1}{2}$ inch V-pulley on the same shaft. This job is easier if the extra pulley does not have an extended hub.

A third modification of the compressor is advisable. If a heavy climber gets on the rope, the inertia of the flywheel may override the force of atmospheric pressure, causing the compressor to run free without absorbing energy. To cure this, turn the flywheel until the piston is at bottom dead center, then drill a 1/8 inch hole through the cylinder wall so the drill comes into the cylinder just grazing the top of the piston. (See Figure Four) You may need more than one such hole to give the compressor a sufficient mouthful to choke it.

Now that you have seen the trees, I leave the branches up to you. With the avcve information, you should be able to assemble a practical machine on a frame of your own design. As you build, think safety. It is no fun falling to the ground from even six feet high. For each part, think of what might happen if it comes loose or breaks. Figure Five shows my latest arrangement. I was lucky to have a large tree to support the overhead pulley. Also when a pine tree fell on the lot next door, I went over with my chain saw and cut out the 150 pound post that constitutes the combination frame and ballast. My present rope loop is PMI, but you will be better off with Bluewater as it has less body, is more flexible, and splices with less objectionable bulk.

FIG. 4

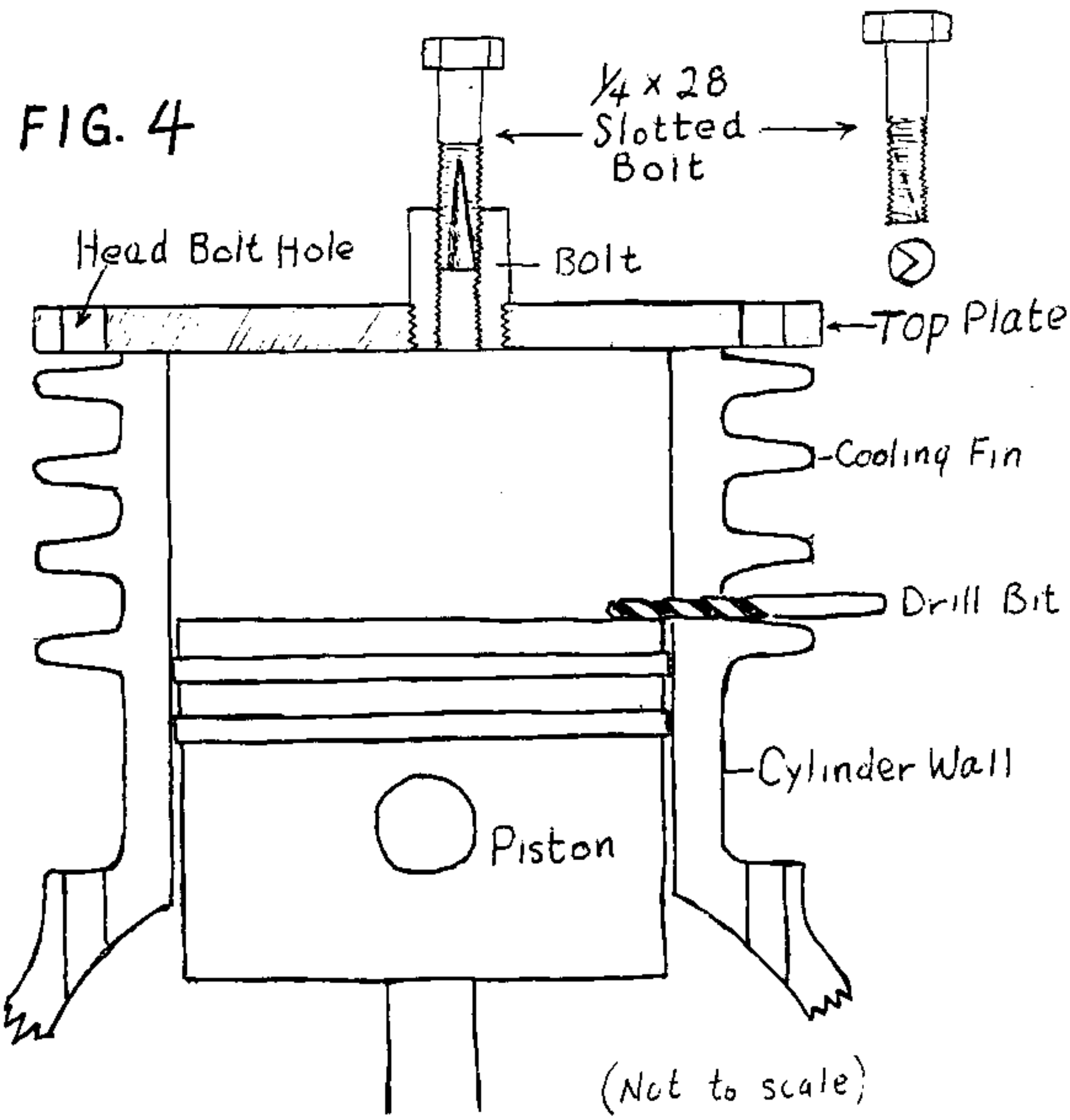
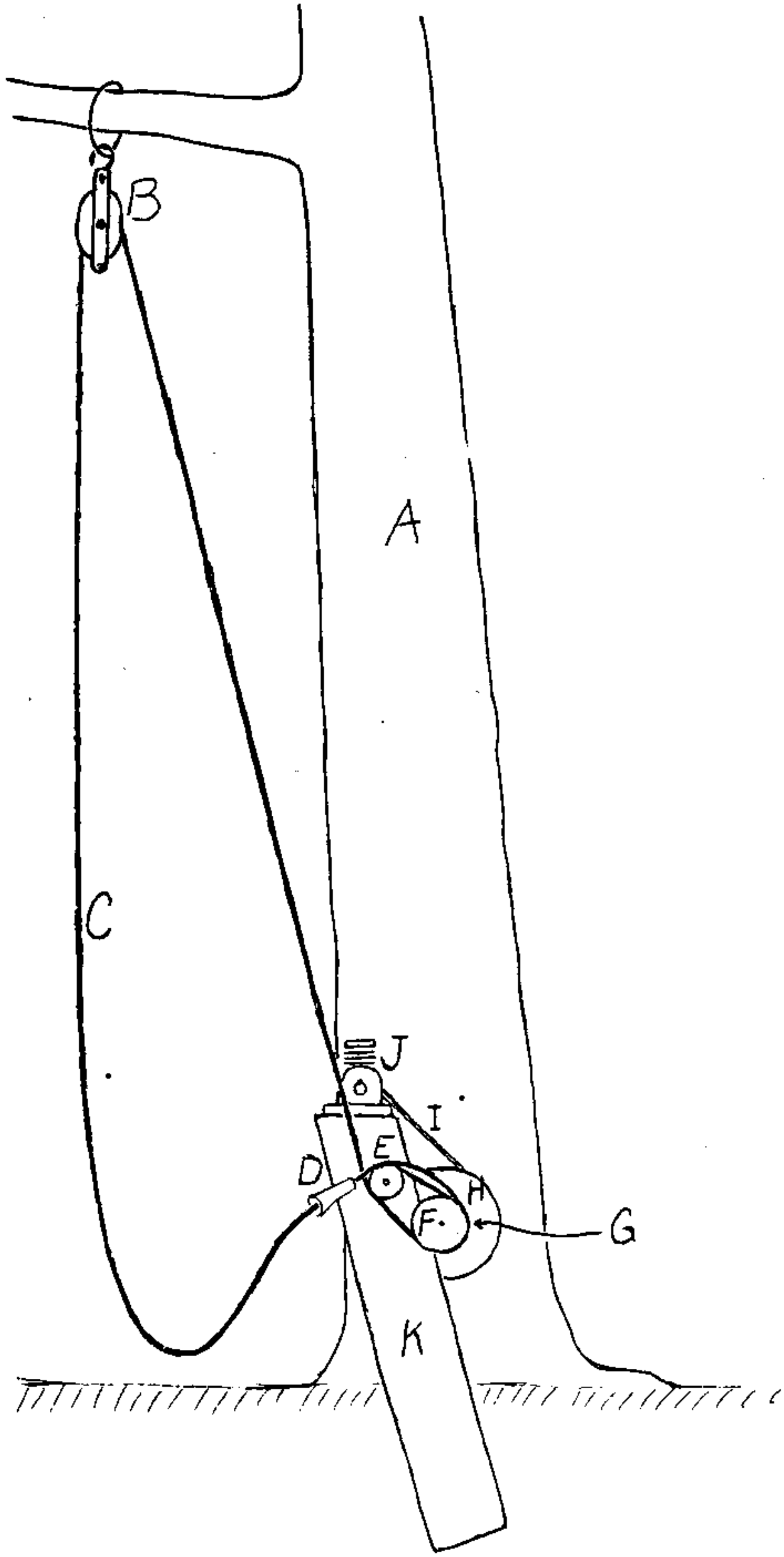


FIG. 5




A Monterey Cypress
B Overhead pulley
C Climbing Rope
D Tubular Guide
E Idlers
F Three-Step Pulley
G Arbor and Pillow Block
  Bearings Between F & H
H Large V-Pulley
I V-Belt
J Compressor
K 150 lb. Post

In a later issue, I will describe my less-than-perfect method of splicing kernmantle rope. Meanwhile, try your own ingenuity; maybe you will come up with a better technique. Also, I will write about an odometer and the automatic level control for the rope machine. If I have inspired you to construct a rope machine, let me hear about your new ideas and improvements, or any troubles I might help resolve.

I you want to live a long time, get daily exercise climbing a rope. Compared to jogging, it involves more muscles in natural climbing motions appropriate for creatures whose ancestors lived in trees. It will give your heart and lungs a workout they won't soon forget, and it will not produce chronic side effects often caused by jolting jogging on a hard road.

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# 78 - Membership - 79

Tony Barron
John Barnes
Michael J. Bounk
Don Broussard
Richard Breisch
Larry Caldwell
Doug Carter (6946)
James M. Chester
Capt. William Combs
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NSS numbers listed for names with a couple faces to avoid confusion. Any errors? Anyone left out? Let me know!

Acknowledgements:

I would like to acknowledge the help of the following rope manufacturers who have carried out load/extension tests for me:

Marlow Ropes Ltd. (Hailsham)
Bridon Fibres and Plastics Ltd. (London)
Arova (Switzerland)

Reference:

(1) "The Shock Strength of Ropes for SRT". BCRA Bulletin 18, Nov. 1977.

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NEEDED: COVER ART, ARTICLES, TIDBITS, AND CARTOONS TO MAKE US LAUGH.

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# !OOPS!

The author of "The Gossett System" in NH #8 was DARRELL TOMER. Sorry!



R.E. Whittemore related the details of a recent caving accident in Mexico. It seems that upon reaching the bottom of Golondrias, a caver found a donkey which had obviously fallen from the rim of the pit. Moving the donkey aside to investigate, he found a man in a sequined suit. Smoothing out the back of the jacket, the caver read the glittering words: "Poncho Kneivel".