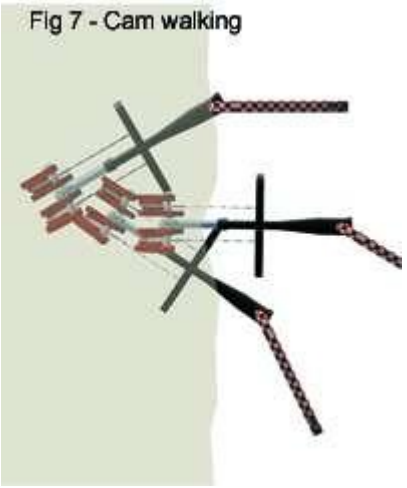
How Cams Work # 2

There are a few more factors that it is useful understand about how cams work and govern how they will react to the rock when they are placed. These do not impinge on the design quite as much as the basic principles already covered but nevertheless are important factors in the make up of your Friends to enable Friends to be used most successfully.

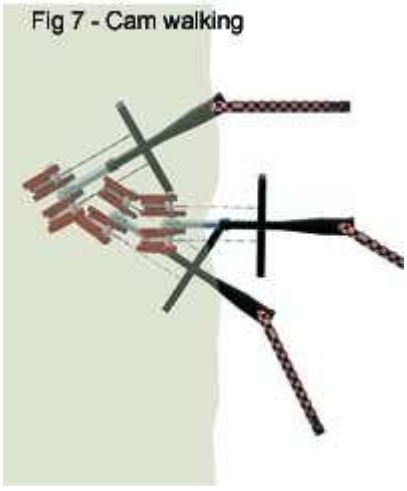
Plane of Rotation



As the cams rotate about the axle (known as the plane of rotation) the force that they transmit to the sides of the crack is directional. Thus Friends should be placed - whenever possible - so that the stem is aligned in the direction of the anticipated load from the falling climber and directing the stem downwards generally works best.

Sometimes this is not always possible and the fall may not load the cams in a downwards direction, but the single stem is designed to allow the unit to swivel and align itself correctly in most circumstances - See Fig.6.

If the load is not applied in the plane of rotation - the cams can slip sideways. Remember the ladder. If you present the ladder other than at a right angle to the house it will be unstable and can slip sideways as you climb up it.



Walking

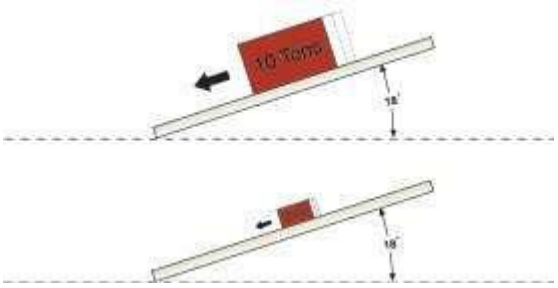
If you place a Friend in a smooth sided crack and move the stem, one pair of cams will grab the sides of the crack whilst the second pair will slide deeper into the crack. If the stem is moved in the opposite direction the second pair of cams will grab, and the first pair slide in deeper - see Fig 7.

This is called walking and can cause a cam to move into a placement that is less safe - possibly making it move to a wider part of the crack where the cams no longer work. Because rope movement and rope drag can cause the Friend to move we use strong springs to help to keep the unit in the position the leader intended.

Sometimes the tiring leader may curse the design specification but the springs have been carefully developed to provide the maximum placement stability.

Flared Cracks and Friends

To go back to the friction test again, the same result would be obtained if a block of alloy the size of a sugar cube or a block weighing two tons were used. The angle at which the block will start to slip is independent of the load applied. What this means in practice is that if you place a cam in a flare and pull on it, and it does not come out, (and so long as you do not disturb the placement), the cam will hold up to the limit of the unit or the rock.



A diagram to illustrate the 'flare' principle - if a cam holds it will hold however much pressure there is on it.

To fully appreciate this, think back to the ladder. If the ground where the ladder was placed sloped down hill there would still be a spot where the ladder would hold and beyond which the foot of the ladder would slip. As the angle at which the ground slopes increases, there will come a point at which the ladder will never hold. The same is true of flared cracks. Depending on the type of rock there will be an angle of flare in which the Friend will never hold.

Conclusion

Climbers develop skills in seeing opportunities for placing nuts and the same is true of Friends. Whilst these skills overlap, they are distinct. Some climbers can make great nut placements but, usually because they don't fully understand them, are less successful at placing Friends. Selecting the right size of unit first time requires experience and using them is a skill and as such needs to be learnt and practised. Your safety is enhanced by this skill.

Understanding how cams work, the design parameters and the limitation of friction, cam angle and rock type will help to increase your safety further. As with all climbing gear, when the chips are down, a marginal placement made with a complete understanding of the dynamics of cam design is better than no placement and informed and intelligent misuse of your equipment is better than having no gear at all.

Ray's original friend prototype and the first ever Friend were guided by the principles we've outlined.