



LOUISIANA

**Ropes and Rigging for Tree
Removal Operations**

Introduction

This manual is to be used as a tool to assist Chainsaw Teams in the removal of trees after a disaster has occurred. It can be taught as an addition to the Chainsaw training that is offered to Southern Baptist Relief Volunteers. In all cases, personnel safety should come first. If you are unsure of safely performing a job, it is best that you either decline, or contact someone with the correct expertise.

RIGGING

\What is Rigging? To rig, as it applies to arboriculture, is to use ropes, slings, and hardware (the rigging) to remove limbs, dismantle trees, and generate mechanical advantage.

Disaster Relief Chain saw work and the rigging that accompanies it during a disaster is a different challenge from normal tree work. Most of the trees worked on are significantly damaged by wind or the resultant fall. This brings into play a dangerous situation. A tree has what is called "potential energy." This is the stored energy an object has due to its position. A tree that is standing up in a normal position is somewhat predictable. But a tree that has been blown over by high winds, or knocked over by another tree takes added considerations to dismantle.

This section of the Chain Saw training will offer varied ideas on rigging and dismantling damaged trees. There are three things that are a must to be remembered when working with damaged trees. The Disaster Relief worker must be **Cautious**, **Creative** and **Confident** when engineering a rigging plan for the removal of trees in this compromised posture.

Be Cautious:

- of electrical lines and feedback from generators.- of a roof that has been damaged by a tree.
- of abnormal "potential energy" in the tree.
- of footing (pine needles, leaves, sticks, masonite shingles).
- of chain saw operation when on un-level footing.
- of the crew members and property below the work.
- of rotten or broken limbs above the work.
- of trees that have structure flaws (barber chair effect).
- of septic tanks when using a tractor or truck in the yard.
- of an uneven pull when working with machinery.
- of direction control when pulling with a tractor or winch.

Be Creative:

- use the fiber of the tree to help direct the dismantling.
- use the different chain saw cuts to your advantage.
- use other trees in the area to increase rigging possibilities.
- use the downed tree to dismantle itself.
- use machinery such as a tractor to your advantage.

- use a tire with tube inside to diffuse weight when felling big chunks or limbs on a roof.

Be Confident:

- before you make a final critical cut or move be confident in your rigging.
 - if you are not confident in your next move STOP, until you are.
- (The Lord gives us spiritual discernment for times such as these).

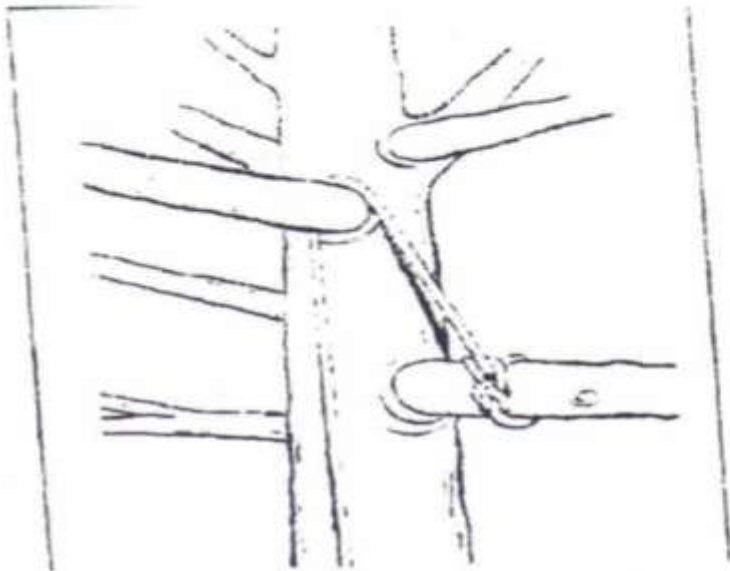
A. Techniques for Removing Wood

1. Cut and Chunk - Cut the tree in small portions and chunk it off the house.

2. Rigging Point Above

- A load line is run through a rigging point above the limb or piece to be removed and then tied to the limb using one of the following techniques.

- Butt-tie: the piece being removed is tied off near where it will be cut.
- Butt-tie and drop: The piece is tied off near the butt; the tip end is allowed to drop when the cut is made.
- Tip-tie and lift: The piece is tied off near the tip, a notch is made in the top side, then a back cut is made to enable the tip to be lifted by workers.

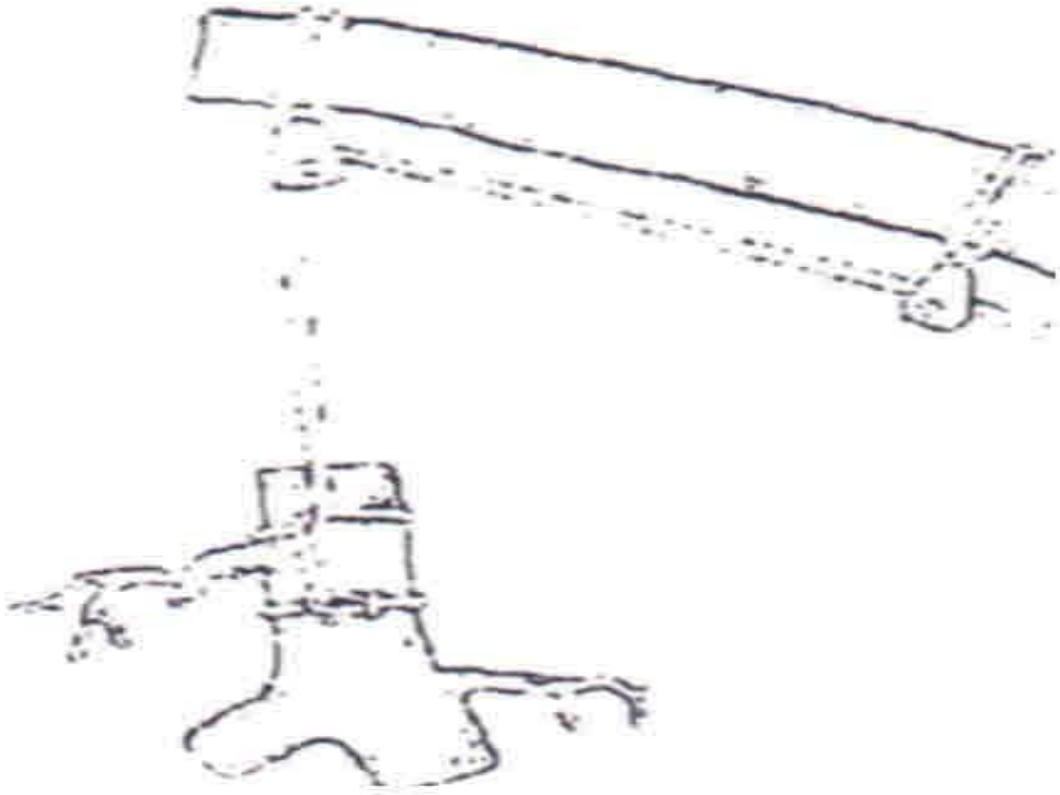


- Balance: When the piece must be removed without dropping either the butt or tip, it can be tied so it is balanced, then lowered to the roof or ground.

3. Rigging Point Below

Is when a rigging line cannot be set above the piece to be cut.

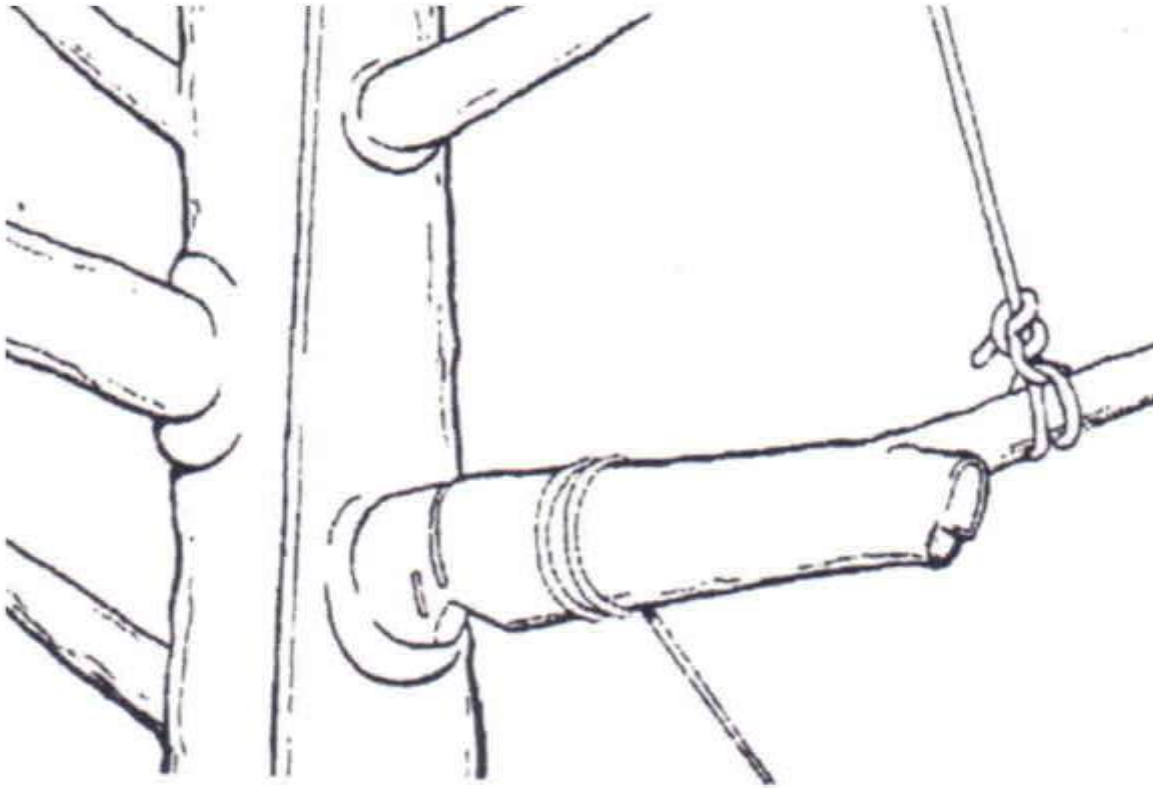
- Butt-hitching or blocking: A piece is tied above the cut, and the line is run through a block or crotch below the cut.
- Fishing-pole technique: This technique is a version of butt-hitching, where the line is run through several blocks or crotches below the piece.



4. Tagline/Pull Line

- A tagline is a rope tied to the piece and controlled by another crew member which is neither run through a rigging point nor is used for lowering.

Picture: (notice the cut)



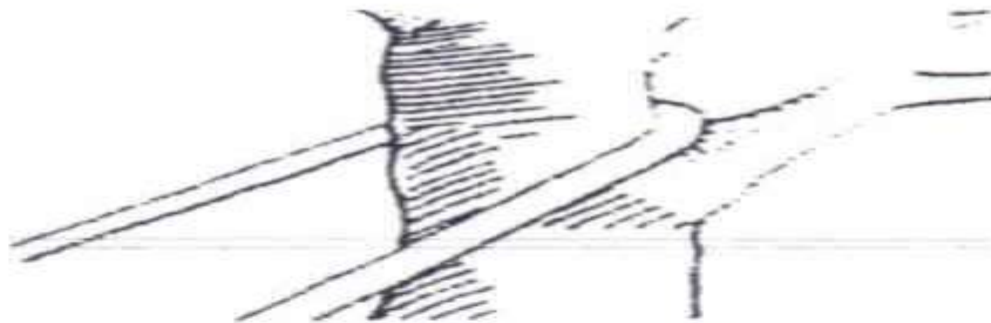
B. Methods to Establish a Rigging Point

1. Natural Crotch

Natural-crotch rigging utilizes arborist blocks or other hardware to establish rigging points. It is fast and convenient, but a natural crotch is not always available where needed, and friction is inconsistent.

2. False Crotch

False-crotch rigging utilizes arborist blocks or other hardware to establish rigging points. The consistent friction and versatility of placement of false crotches is often a great advantage.



Natural Crotch



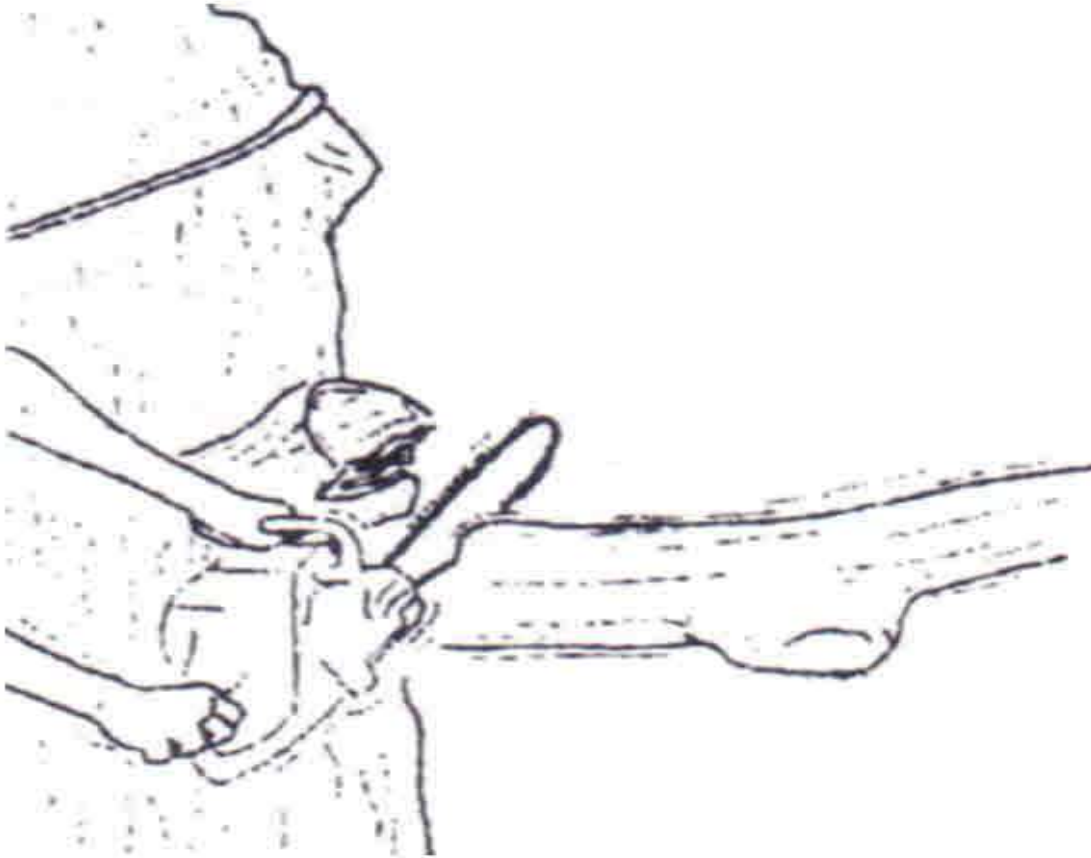
Rope Saver



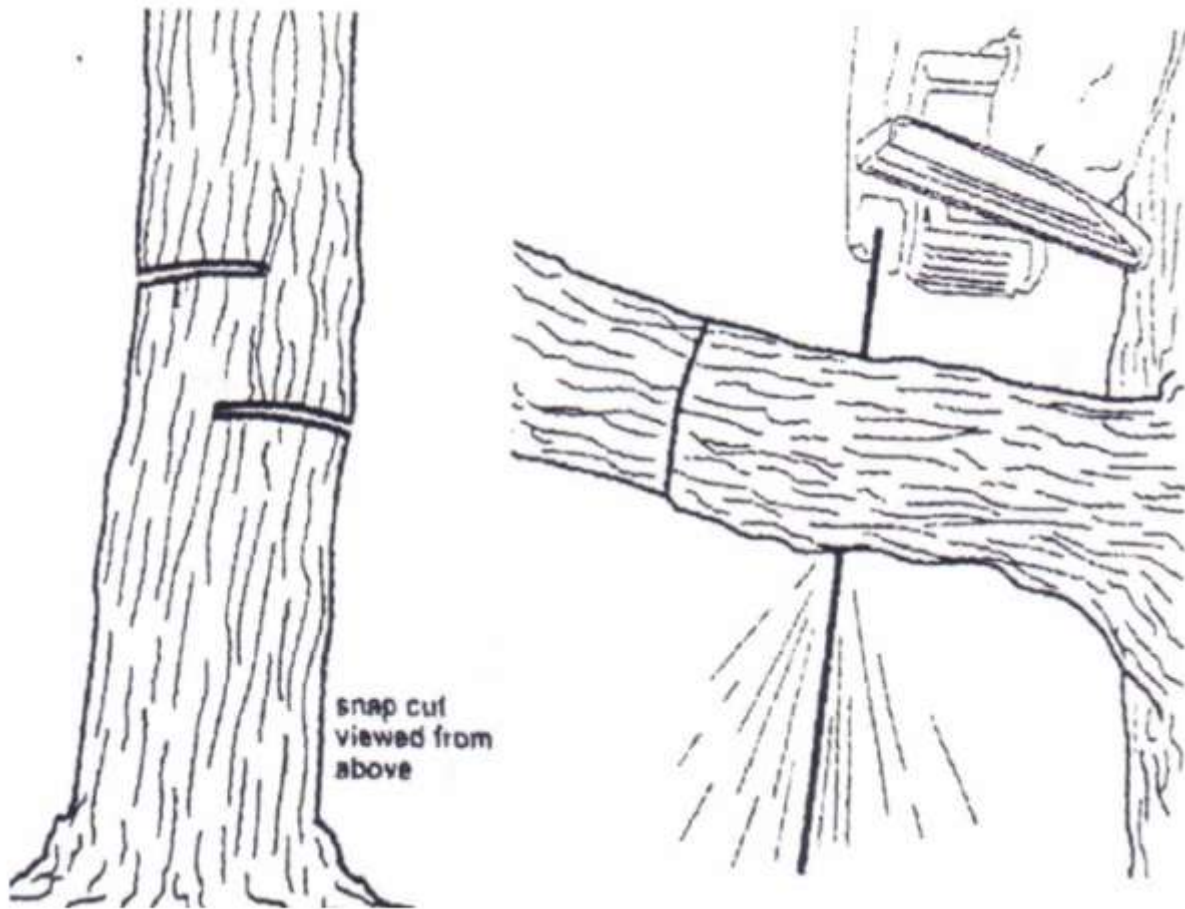
False Crotch

C. Types of Cuts to Assist in Dismantling

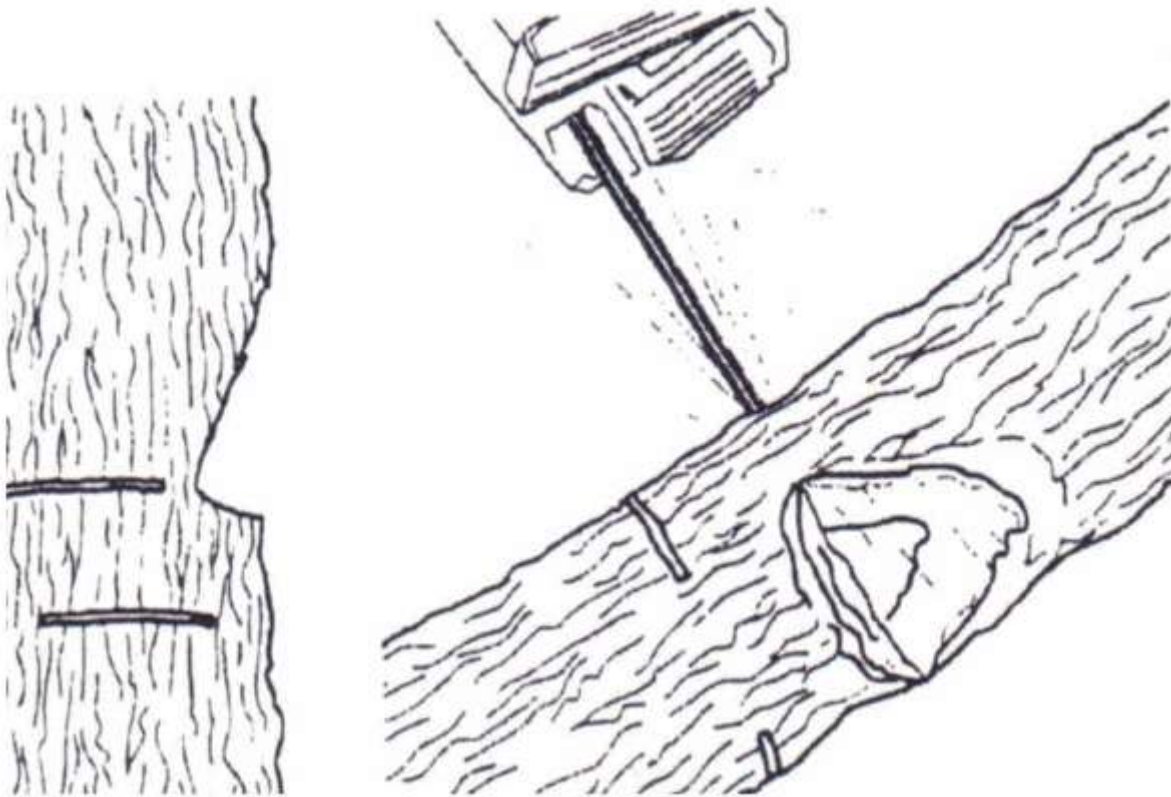
1. **Drop Cut:** For large limbs make the bottom cut first and then make the top cut directly above the bottom cut to eliminate the limb pulling the saw out of the cutters hand.



3. **Snap Cut or "Mismatch Cut:** This is where the cuts overlap from either side so that after the chainsaw has been cut off and up away, the section of wood or limb can be broken off manually



4. **Hinge Cut:** The large cut can be used to help control the swing or drop of a limb. Kerf cuts on the sides limit fiber tearing.

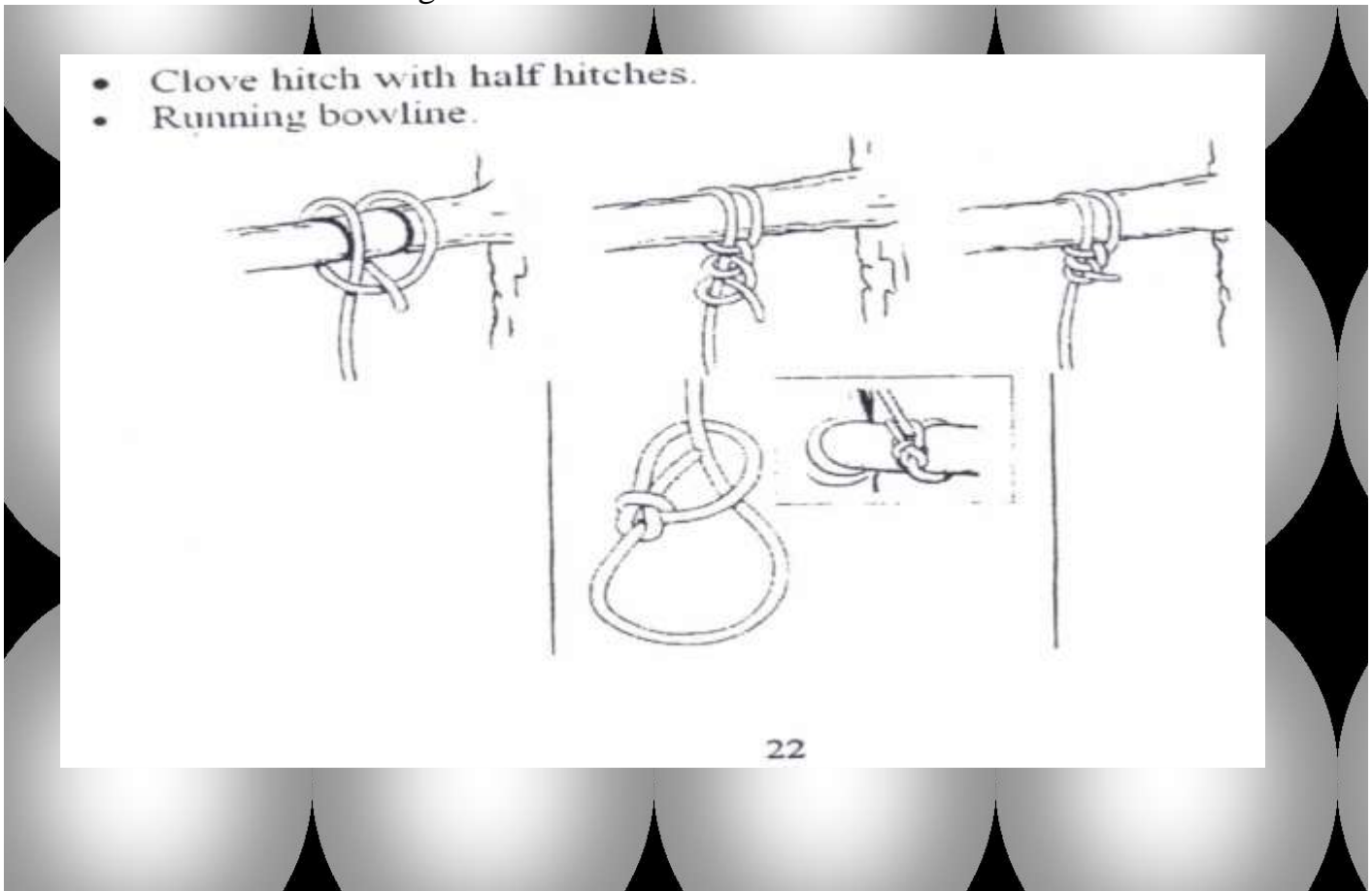


D. Methods of Tying Off Wood

1. Knots

The choice of knot to tie off a section of wood is important, especially for large pieces, or when dynamic loading is a concern. In cases where pieces are rigged from above, and swing is controlled, security is still important, but ease of tying and untying also can be considered. Two commonly used knots are:

- Clove hitch with half hitches.
- Running bowline.



2. Chains and Chokers

Chains and wire-rope choker slings can certainly stand the abuse of tree work, but they have limited adjustability. Also, their high strength and low stretch mean the anchor forces will be much higher than those with rope.

E. Know Your Knots

Knowing your knots and how to tie them for each rigging application is essential for personal and property safety. It is also critical because of the percentage of decrease in rope strength that can range from 30% to 50% at the knot.

Tensile Strength - measures the force required to pull something, such as a rope, to the point where it breaks.

Safe Working Load (SWL) - for most types of rope it is between 15% and 25% of

the tensile strength.

Note: A knot when tensioned cuts the line. Research has shown that the figure eight knot reduces the tensile strength by approximately 35%; other common knots go up to 50%. So tying a knot in a rope can effectively cut the tensile strength in half. These findings must be considered along with the proper knot for the application when rigging is done.

"It is a proven fact that very few ropes ever break at a knot. Usually an old cut, a worn point, or an abrasion point will cause a rope to fail. Internal weaknesses caused from a fall or grit inside the fibers can also shorten the life of a rope."

From *On Rope* by Bruce Smith and Allen Padgett

Knot Terminology

bend: A knot that joins two rope, cord, or webbing ends together.

bight: A doubled section of rope that does not cross itself.

hitch: A knot that secures a rope to an object or the rope's own standing part.

knot: A general term referring to all knots, *hitches*, and bends.

loop: A turn or bight that crosses itself.

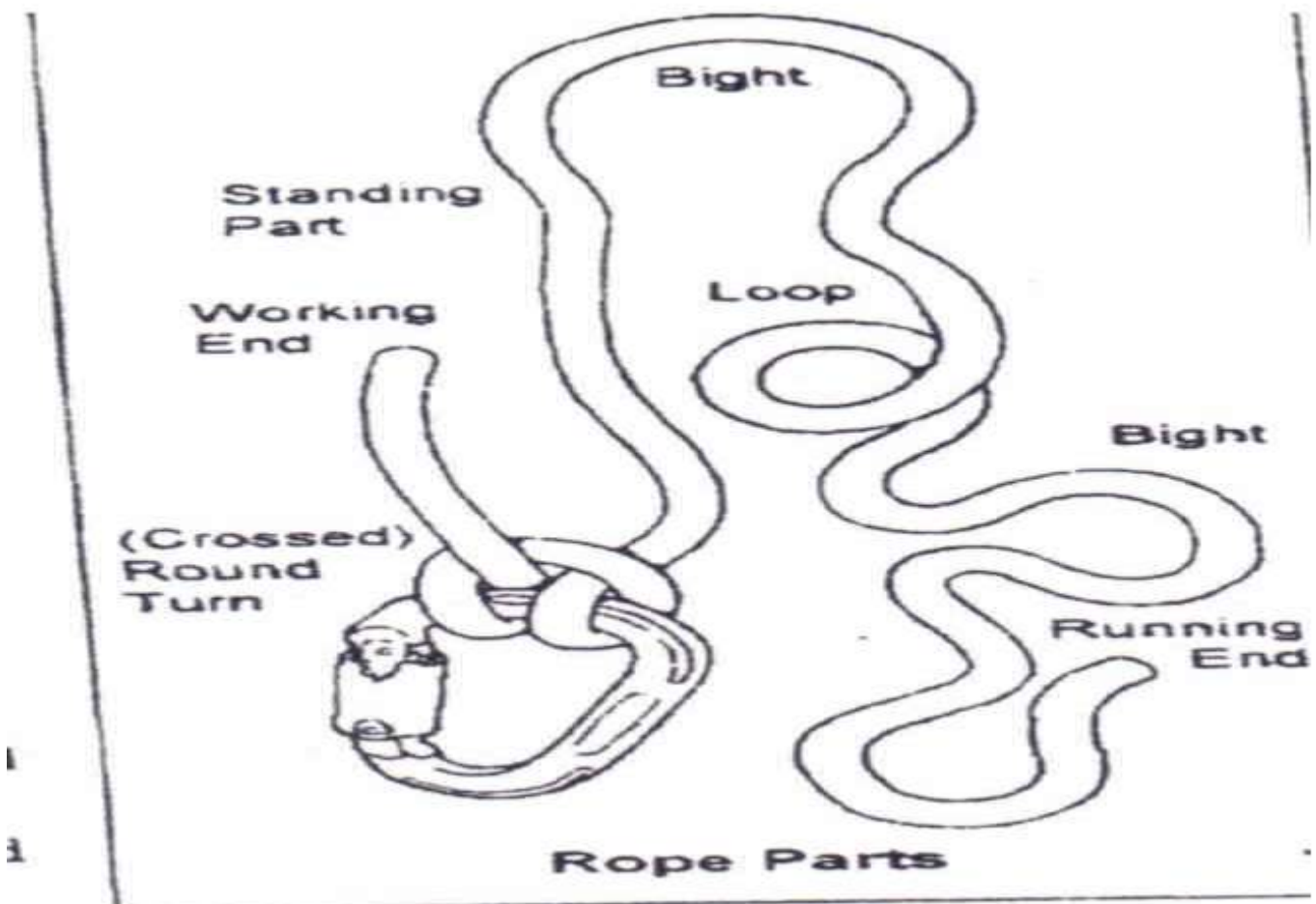
running end: The end of the rope being used to tie your rig with.

standing part: The inactive part of the rope uninvolved with rigging or knots.

round turn: Two *turns* of rope around an object.

turn: One round of rope passing around an object.

working end: The end of the rope used to rig or tie off to something



F. Knot Types and Applications

Attachment Knots - are Commonly used during rigging operations to secure limbs for lowering and connecting rope to a throwbag, carabiner or rope snap.

Knots

Tie, Dress, and Set (T.D.S.) every knot

T - tie

D - dress (align the parts so it looks like the knot in booklet)

S - set (tighten the knot)

Note: A good knot provides the strength and security necessary to safely perform the intended rigging task.

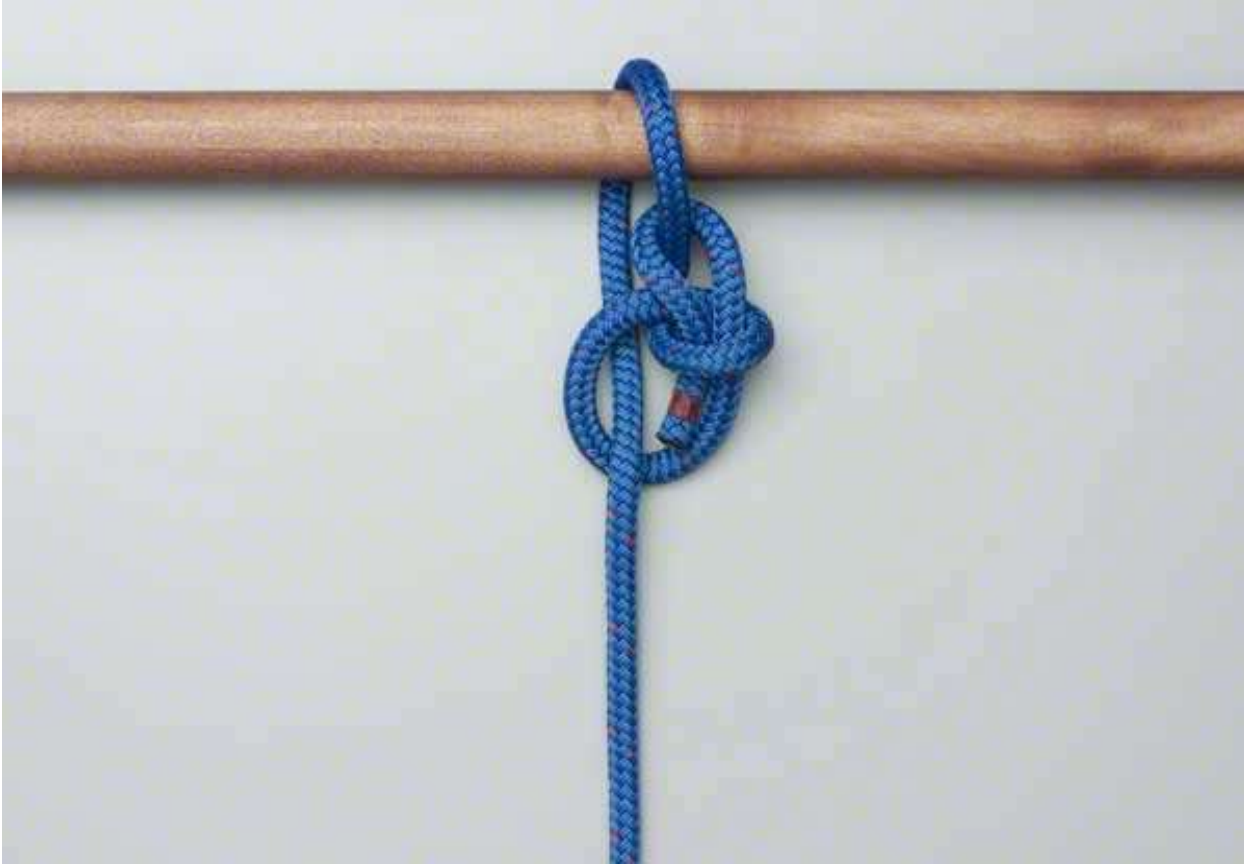
The following are some basic knots that are helpful when removing trees, limbs, etc. But remember **PRACTICE MAKES PERMANENT**, you need to practice tying these knots to become proficient with them, but be sure that you practice them correctly. It won't do any good if the knot that you take time to learn is not tied properly. Nowhere does this fit better than in rigging up to remove a limb or tying off while working at elevations.

1. **Bowline** - The bowline is considered one of the "core" knots that riggers and workers should master. It is used primarily as an "end of line" knot, to attach the rope to a rope snap. It is a strong knot that's easy to tie, inspect, and untie, even after heavy loading.



2. Running Bowline

- The Running Bowline is nothing more than a Bowline tied around its own standing part which allows it to function as a slip knot.
- The Running Bowline has a tendency to loosen from the secured object when it is unloaded.



3. Prusik Knot: Its principal use is allowing a rope to be climbed. Two Prusik loops are alternately slid up the static rope: a long Prusik loop allows the climber to lift himself using leg power



4. Buntline Hitch

Buntline hitches are an extremely simple, quick tying, compact, and secure hitch. A buntline functions as an end-line knot for attaching the rope to a connecting device. This hitch is not recommended for extreme loads when rigging.



5. Anchor Hitch

- This hitch can be snugged against a rope snap or tied to a medium weight limb.



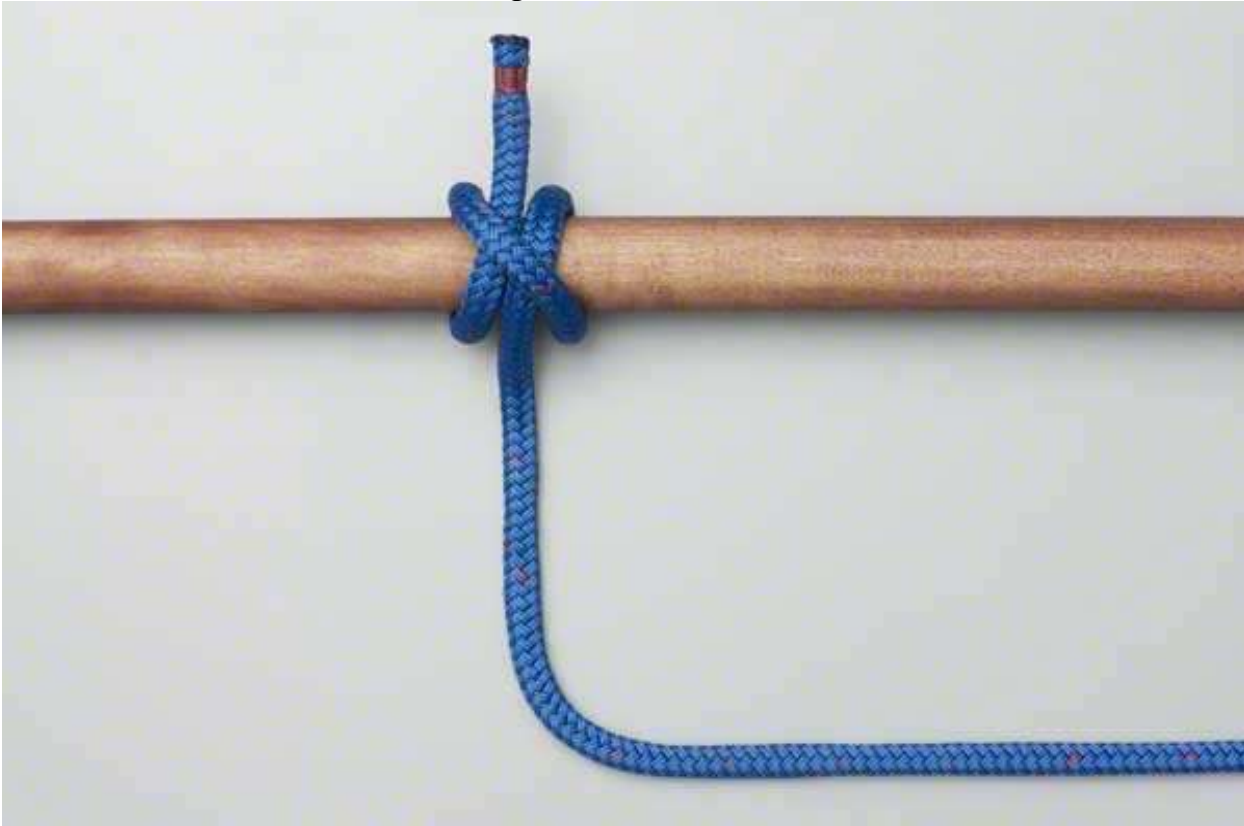
6. Double Fisherman's loop (DFL)

- The DFL is difficult to untie after heavy loading. - Great for a sill) knot to tighten up on a rope snap.



7. Clove Hitch

The clove hitch *is* the best known knot for securing a line to an object. - The hitch can be used to tie off smaller limbs for lowering.



8. Cow Hitch

Used for securing hardware to a tree.



9. Timber Hitch

Used for securing hardware to a tree.

Used for a quick tie on a limb or trunk to pull with.

Use caution when using this hitch lowering a smaller limb (it will roll out).



10. Sheet Bend

- The Sheet Bend is one of the few knots that effectively join two ropes of different diameter and type.



11. Butterfly Knot

- Knot used to have an attachment in a rope other than in the ends.
- The Butterfly knot is used during cabling and tree removal operations for attaching come-alongs, and pulleys.



12. Double Fisherman's Knot

Used for tying two rope ends together.



G. Rope Strength

Familiarity with rope Safe Working Load is a must for safe and efficient rigging. The Safe Working Load of the rope and the load to be lifted must come under the Rule of thumb range. Rule of thumb:

1. A method or procedure based upon experience and common sense;
2. A general principle regarded as roughly correct but not intended to be scientifically accurate. (Websters New Collegiate Dictionary, 1997. G & C Merriam Co., Springfield, MA)

In the rigging trade there is no substitute for years of experience. But when working by rule of thumb alone, many times ropes and other load bearing-parts [the system] are stressed to a point dangerously close to the breaking point without the rigger realizing it. We are not attempting to make professional riggers out of Disaster Relief workers, but they should be able to make simple calculations to check their loads and the strength of their equipment. The element of chance will then be reduced to a minimum.

Decisions, especially where life and property are involved, should not be made from sketchy information.

Rope Safe Working Load (SWL) this is examples of rope that can be found at your local hardware store

Yellow Twisted Poly rope

Size	SWL in lbs.
1/4	113
3/8	244
1/2	420
5/8	700
3/4	1090

Black and Orange Twisted Poly rope Size

Sisal Rope

Size	SWL lbs.
3/8	108

Wire Rope

Size	SWL lbs.
3/16	1050

I. Conclusion

Many of the references in this Ropes and Rigging section came from two great sources. These three books on rigging are recommended as a necessary part of the essential equipment for the Disaster Relief Chain Saw Units.

(The Tree Climber's Companion, 2000, Beaver Tree Publishing, Longville, MN)

(The Art and Science of Practical Rigging, 2001, United Graphics, Mattoon, IL)

(Grog's Index of Scouting Knots,

<http://www.animatedknots.com/indexscouting.php?LogoImage=LogoGrog.jpg&Website=www.animatedknots.com>)

The above information came from these books and many other available sources on rigging.

The internet was helpful in developing and gathering this information.