TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE
PORTLAND, OREGON AUGUST 1997

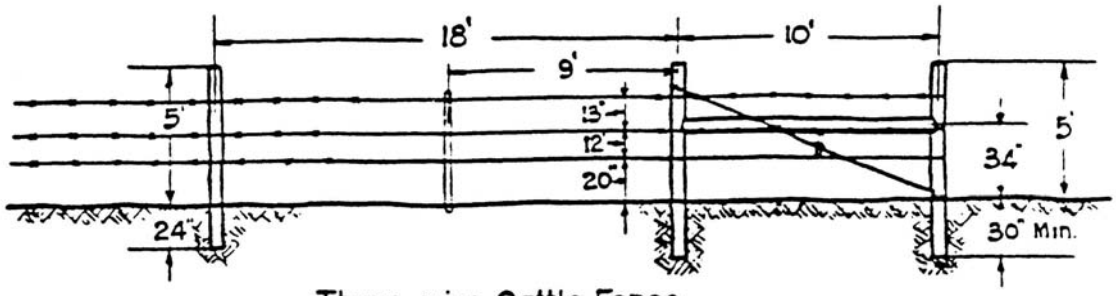
RANGE TECHNICAL NOTE NO. 20

FENCE DESIGNS

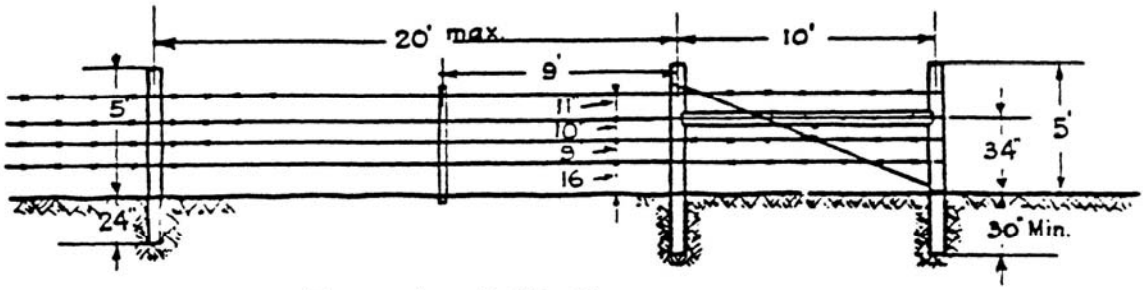
This Technical Note includes standard drawings for a variety of fencing situations. The drawings may be photocopied and included with specifications for conservation practices. Exhibits 1 –35 are from the 382 – Fence specifications from NRCS Nevada. Exhibit 36 is from a commercial source and is used with permission.

These drawings are intended to be an addendum to Range Technical Note #8; Pasture and Range Fences, March 1990 that can be used in a similar manner.

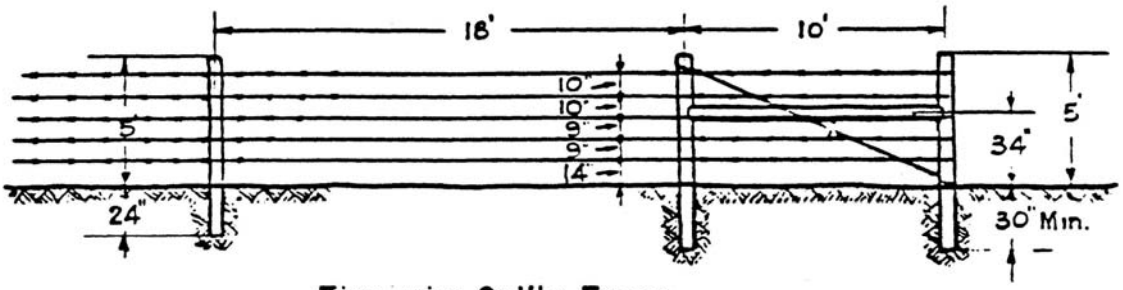
Exhibit 1



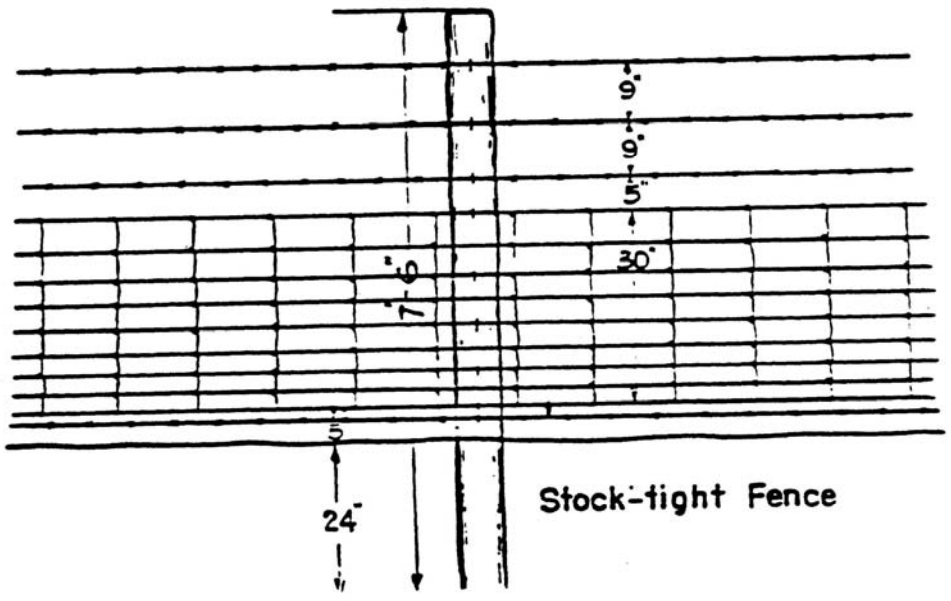
Three-wire Cattle Fence



Four-wire Cattle Fence



Five-wire Cattle Fence



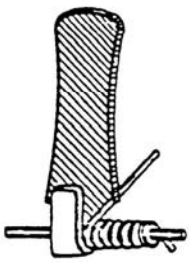
Stock-tight Fence

POST-AND-BARBED-WIRE FENCE

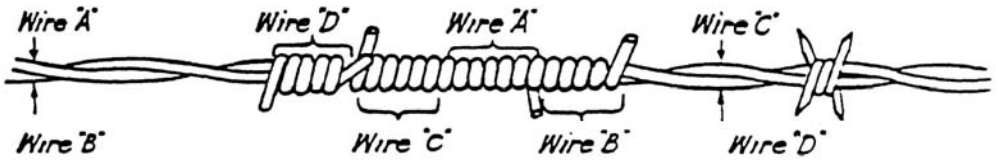
NRCS, NV
February 1996

Exhibit 2

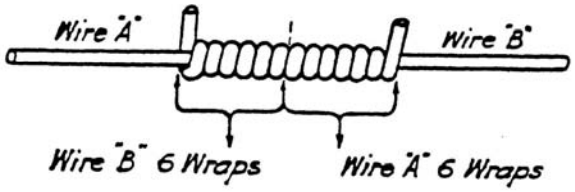
SPLICING TOOL

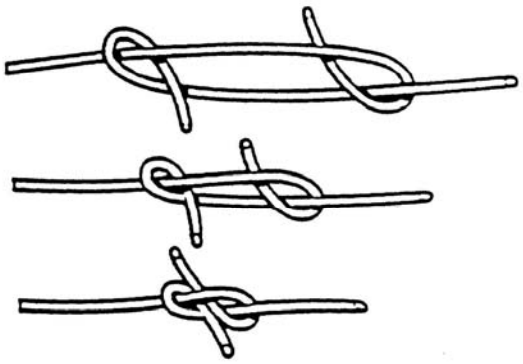


SPLICING BARBED WIRE

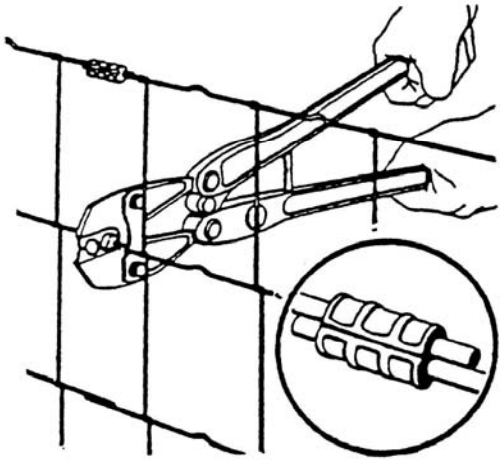


SPLICING SMOOTH WIRE "WESTERN UNION"

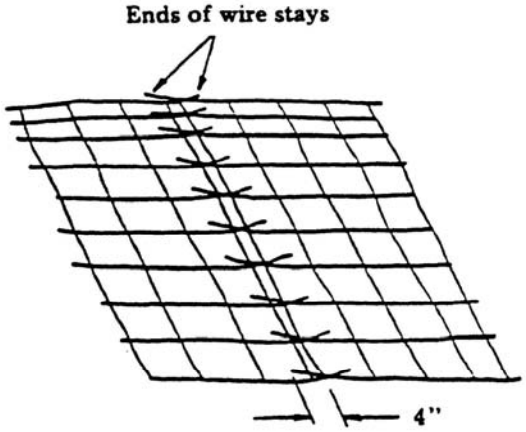




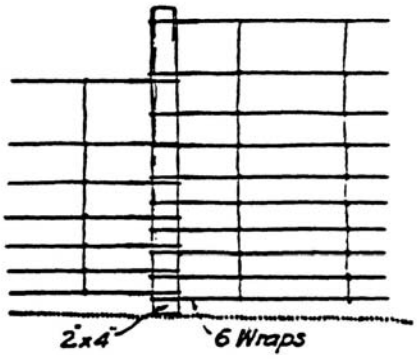
In-line splicing by tying a figure-8 knot.



Splicing wire using a commercial compression sleeve.



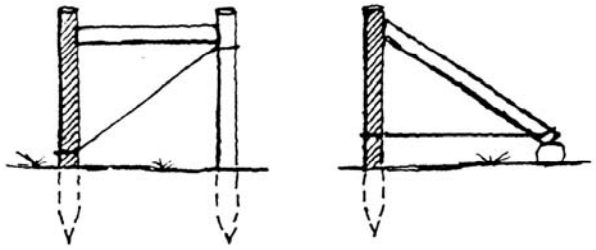
SPLICING WOVEN WIRE OF UNEQUAL HEIGHT



USDI/USFS 2400-Range 8824 2803 (1988)

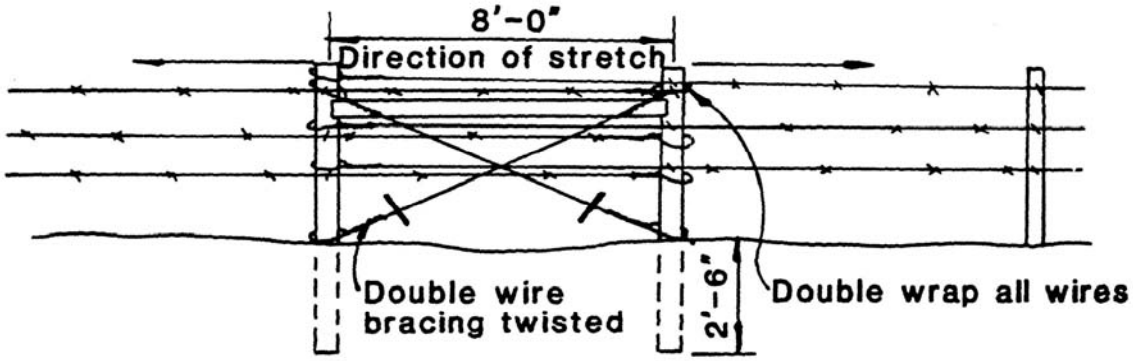
NRCS, NV
February 1996

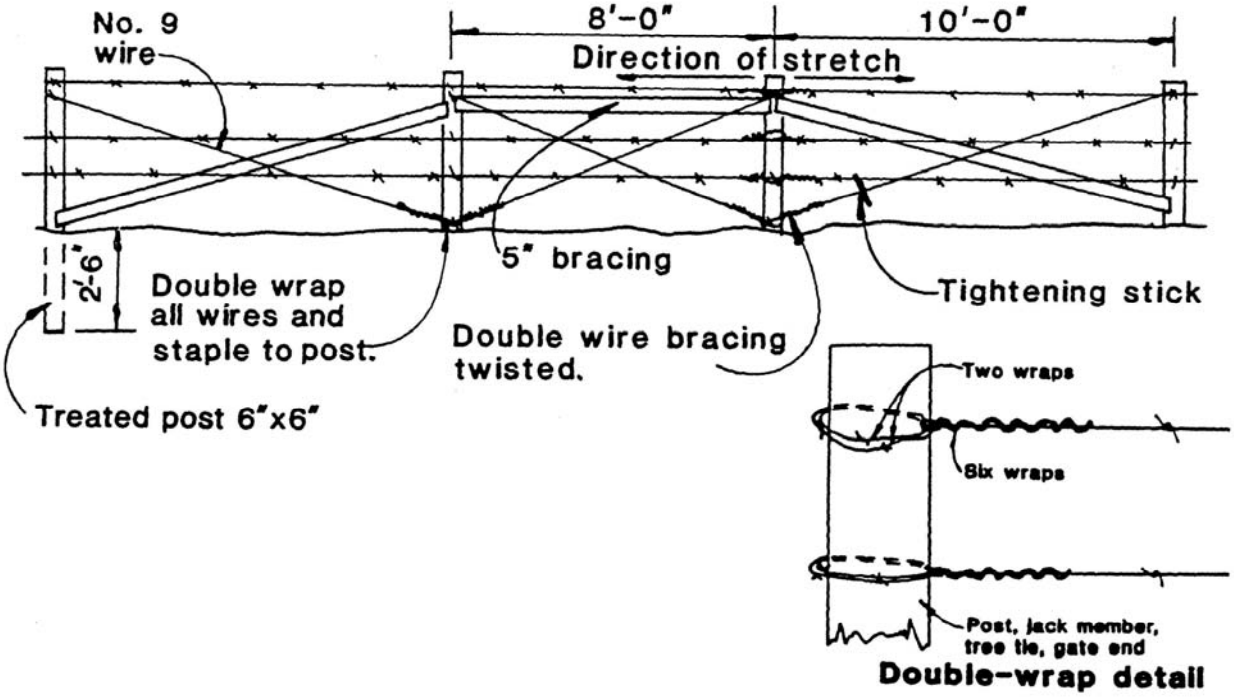
Exhibit 3



HORIZONTAL BRACES DIAGONAL BRACES

LINE BRACE





Double-wrap detail

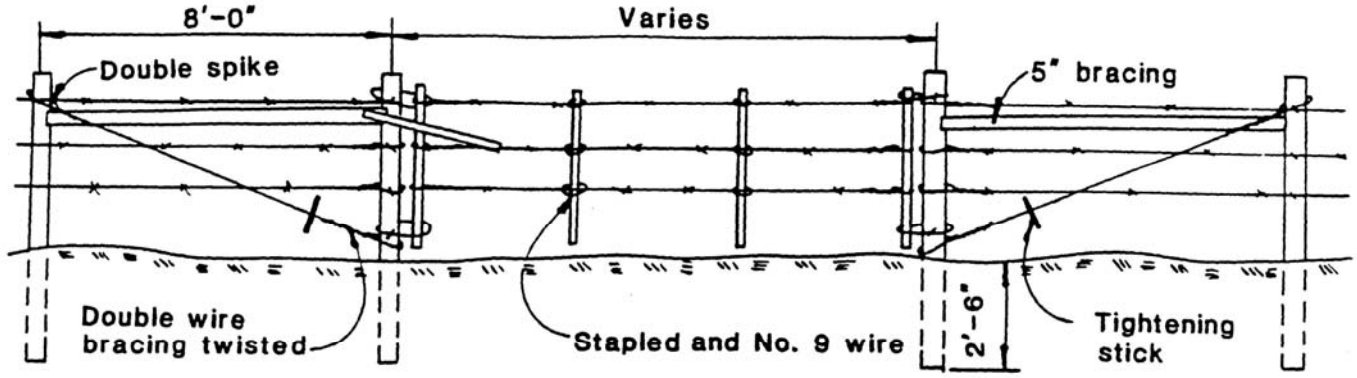
Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)

NRCS, NV
February 1996

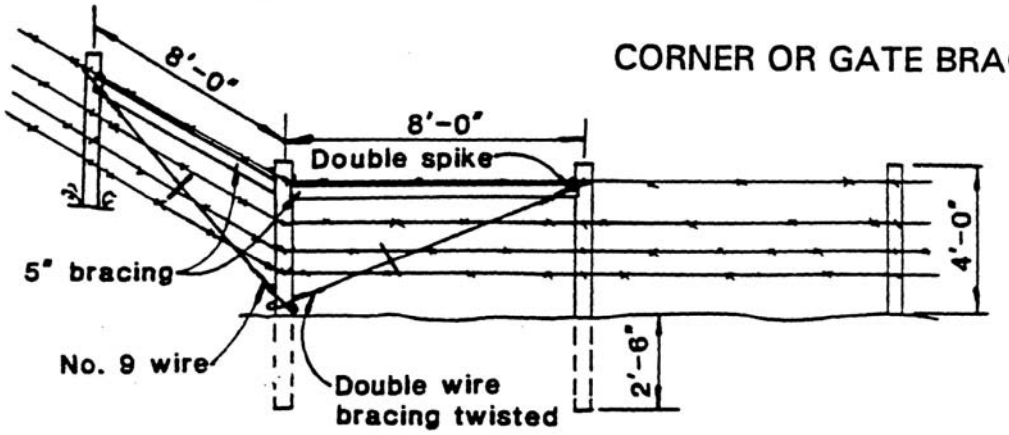
382-17

Exhibit 4

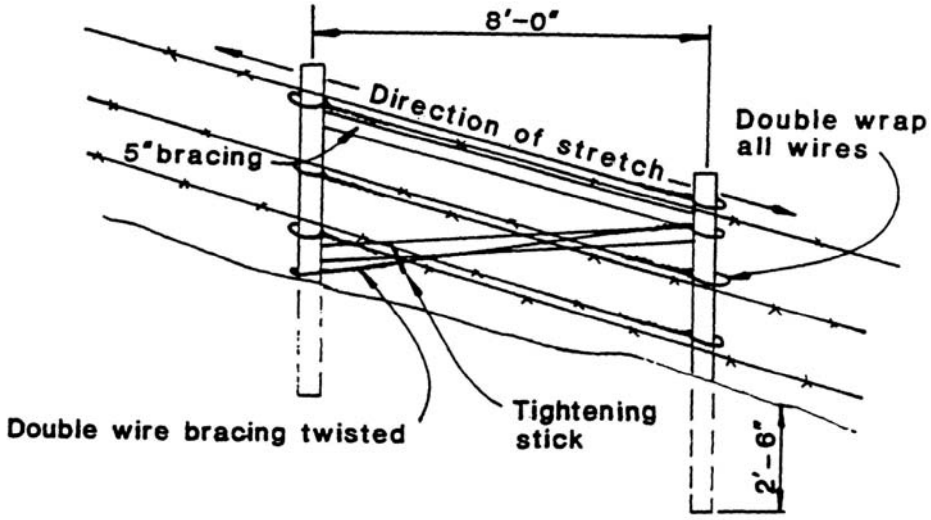
GATE BRACE



CORNER OR GATE BRACE



LINE BRACE FOR SLOPES ABOVE 30 PERCENT



Sanderson et al (1990)

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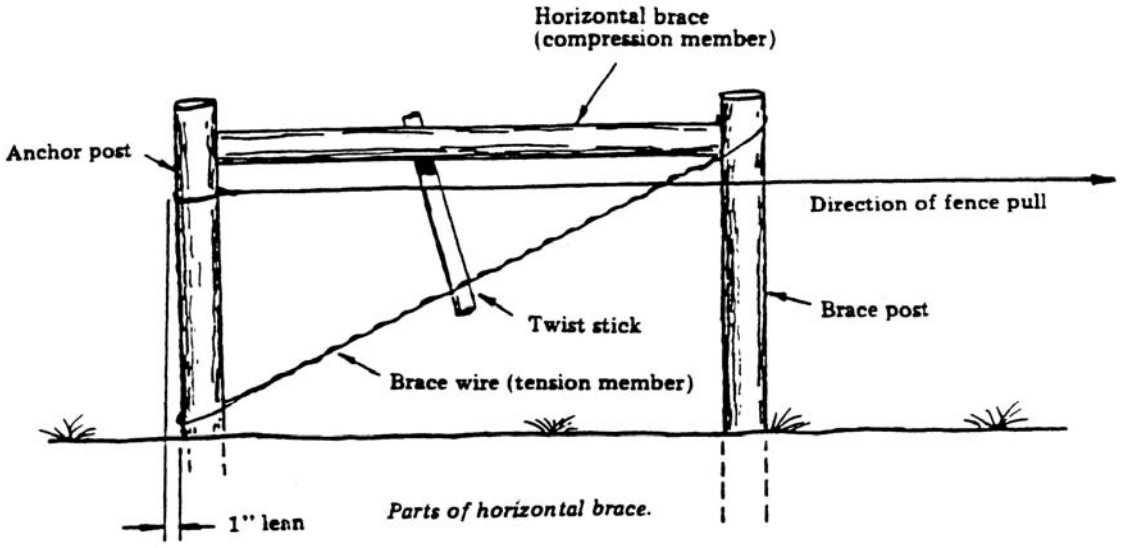
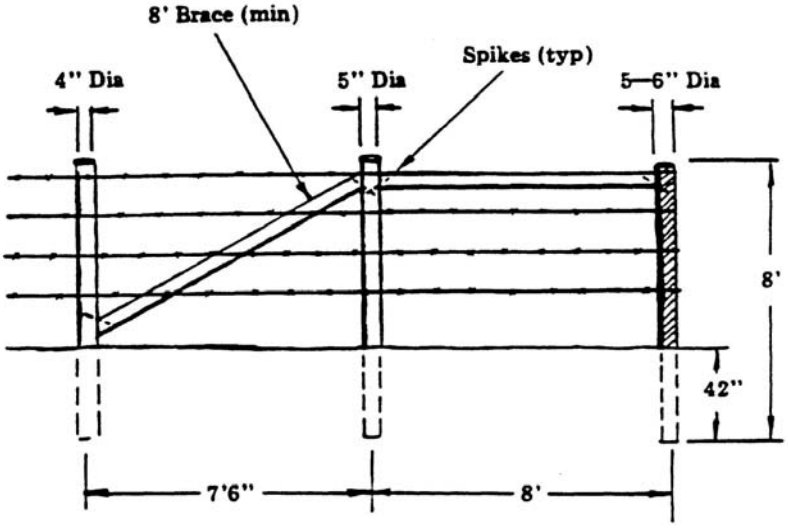
Exhibit 5

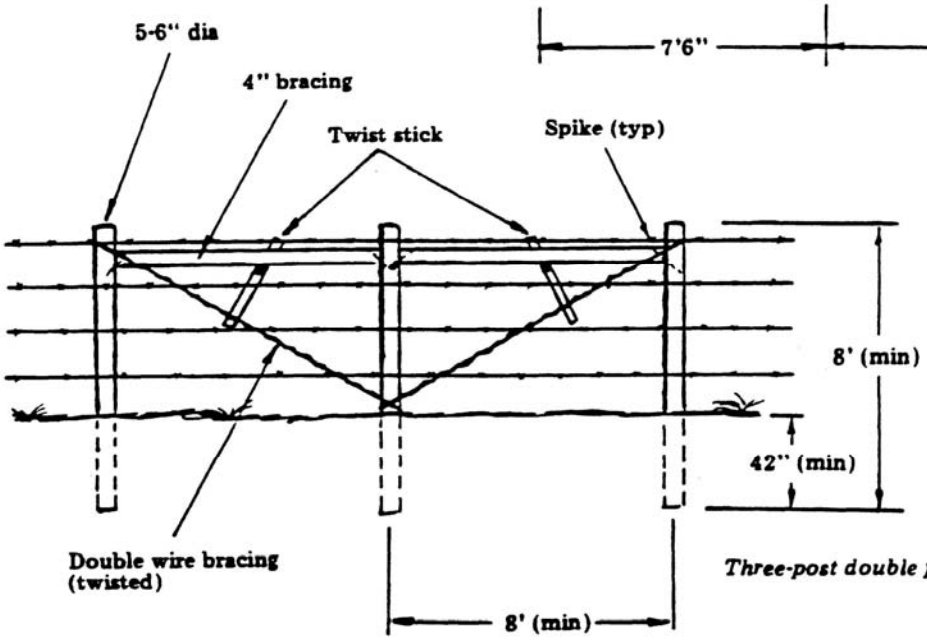


Parts of horizontal brace.

USDI/USFS 2400-Range 8824 2803 (1988)



Double panel end brace.



Three-post double panel brace.

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Exhibit 6

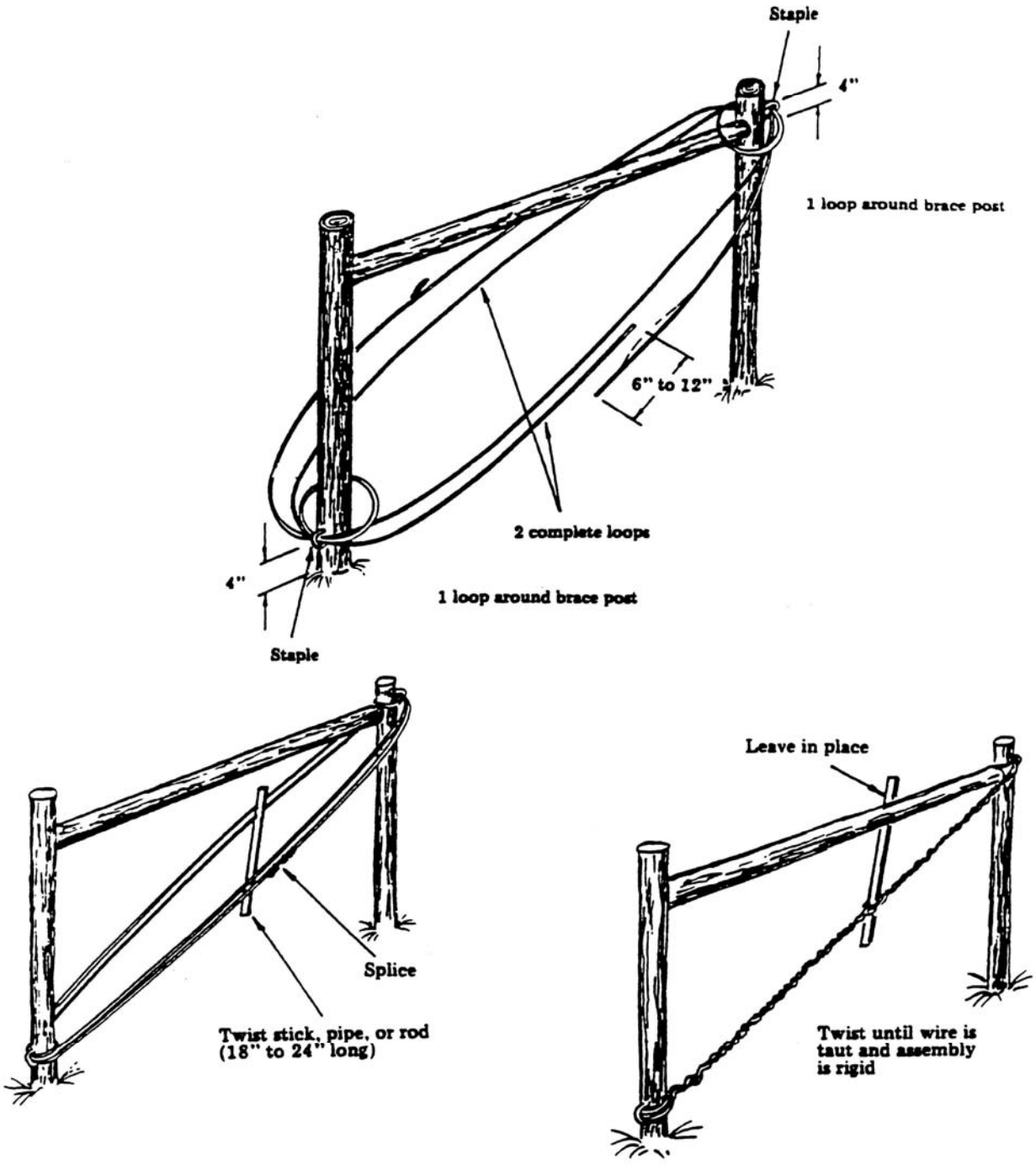
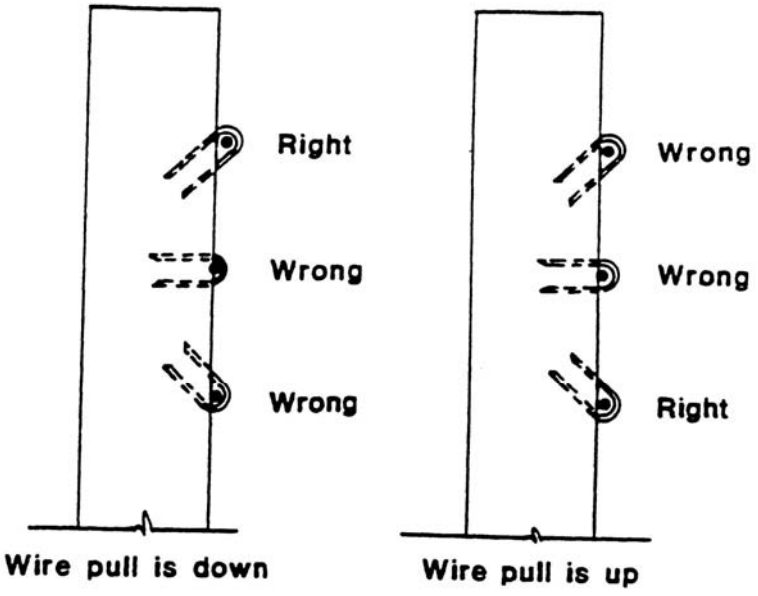

Staple
4"
1 loop around brace post
6" to 12"
2 complete loops
4"
1 loop around brace post
Staple
Splice
Twist stick, pipe, or rod
(18" to 24" long)
Leave in place
Twist until wire is
taut and assembly
is rigid

Exhibit 7



Drive staples at an angle in the same direction as the wire is pulling.

Sanderson et al (1990)

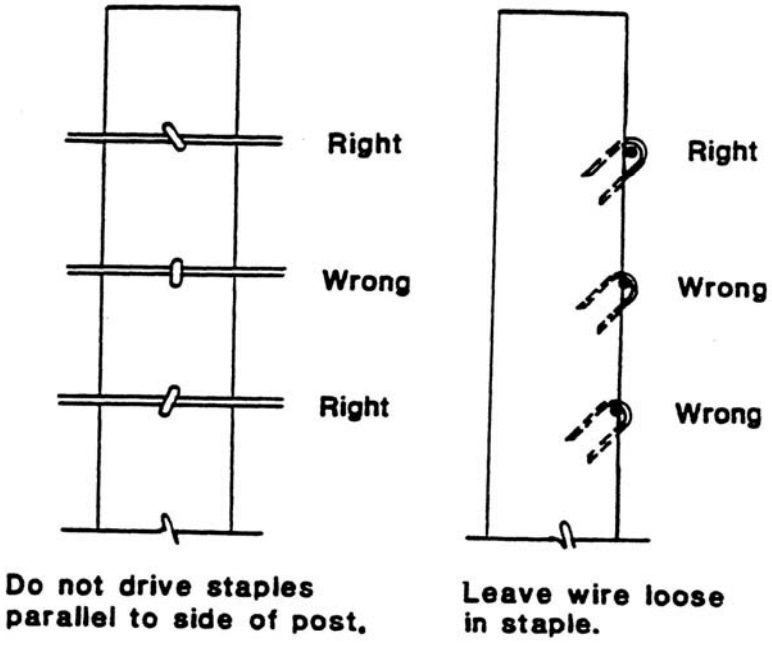


Exhibit 8

Wire Tension

Wire should be tensioned relative to the ambient air temperature at the time of installation. A rule-of-thumb for setting wire tension is to set tension at 550 pounds for the coldest day of the year. Subtract 2.61 pounds for every degree Fahrenheit difference between the air temperature at the time the wire is stretched and the coldest temperature anticipated. For example, if the coldest temperature is -10° F and the present temperature is 80° F, there is a temperature difference of 90°. Multiply 90 by 2.61 and subtract the product, 235, from 550. The proper tension is 315 pounds. The wire should be over stretched on warm days to take out kinks and seat the wire twist, but not over 500 pounds, and then returned to the proper tension. The wire must be loosely supported by staples (or clips) during tensioning to relieve the weight of the wire and to assure that the wire is in the correct position.

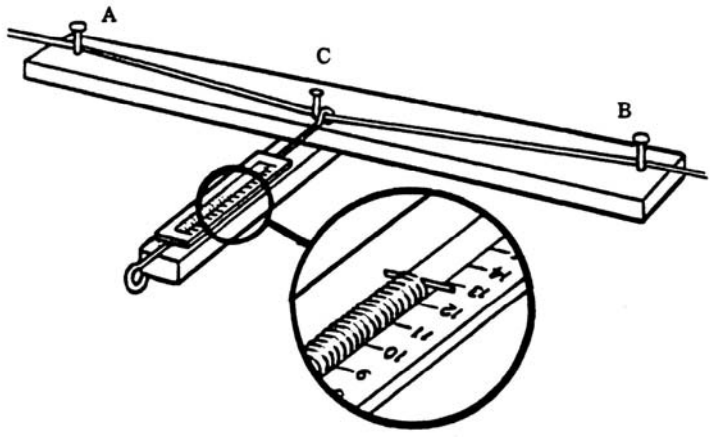
Measuring Wire Tension

There are several wire tensioning tools that can be purchased, including tension indicator springs that measure wire tension or tools that allow tensioning the wire to a pre-set number of pounds.

A simple device can also be fabricated that adequately measures wire tension. On a straight piece of 1-inch x 4-inch board cut 44 inches long, drive two nails (or cup hooks) 40 inches apart and one inch down from the top of the board, points A and B in the figure below. Drive a nail 1/2-inch below the center point of the straight line from A to B, point C in the figure below. Place the wire on the cup hooks (or nails) at points A and B. Attach a spring scale to the center of the wire and pull the scale until the wire touches the nail at point C. Read the number of pounds necessary to pull the wire to point C and multiply by 20 to determine pounds of line tension. For example, a pull of 12-1/2 pounds times 20 equals a tension of 250 pounds on the wire. Construction of this home made tension meter is based on the general static formula for wire tension:

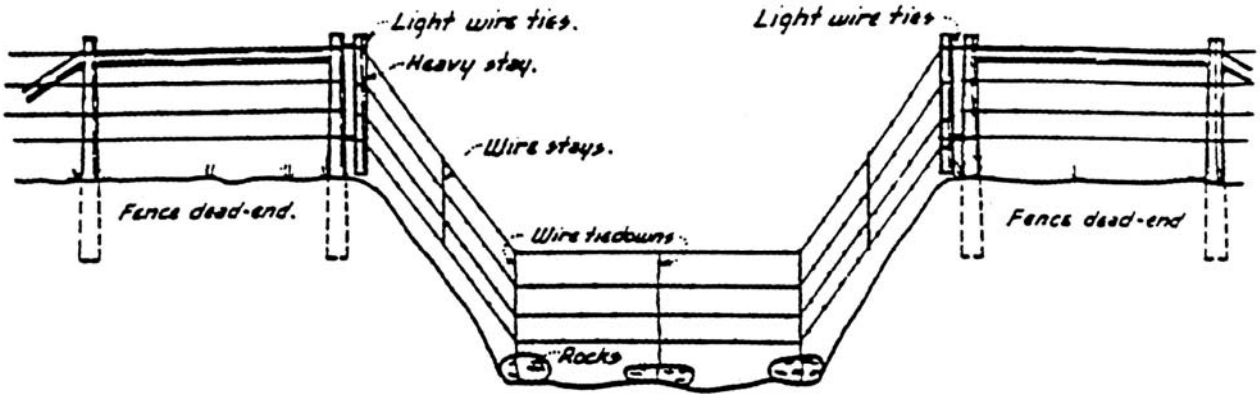
$$\text{Tension (pounds)} = \frac{\text{length (inches) x balance scale reading (pounds)}}{\text{4 x vertical displacement (inches)}}$$

Tension should be measured in the middle of the stretch.

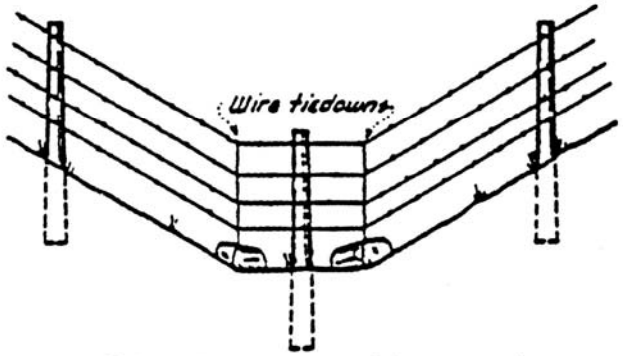


after Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)

Exhibit 9



DETACHABLE WIRE PANEL WITH ROCK ANCHORS FOR DEEP WASHES & LIVE STREAMS.

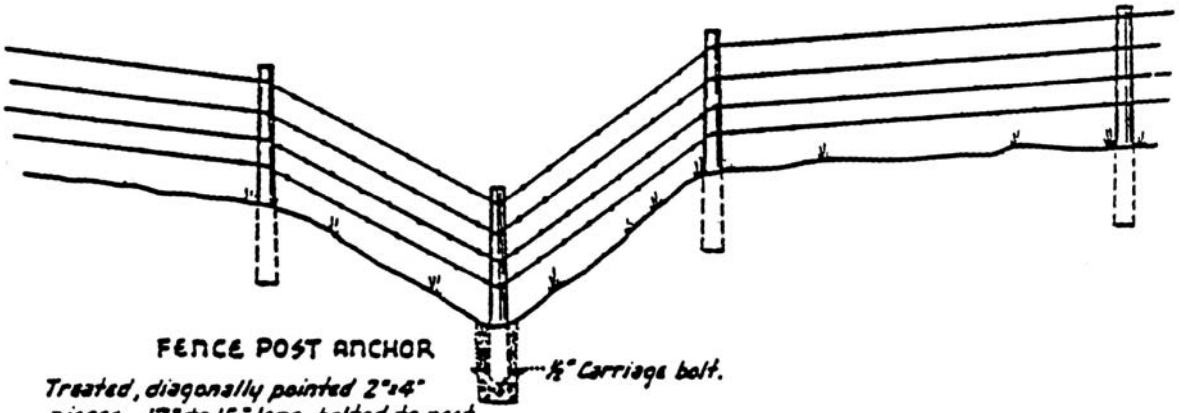


ROCK ANCHORS IN DRY DRAWS

Square rock cribs also useful.

NOTES.

Panels of woven wire or board can be used. Panels built separate, and tied to fence with light wire..... then, during floods, ends can break loose and not disturb main fenceline.



FENCE POST ANCHOR

Treated, diagonally pointed 2"x4" pieces, 12" to 16" long, bolted to post and wedged tightly into sides of posthole & covered with well-tamped gravel & earth.

BARBED WIRE FENCE
FOR CROSSING STREAMS & DRAWS

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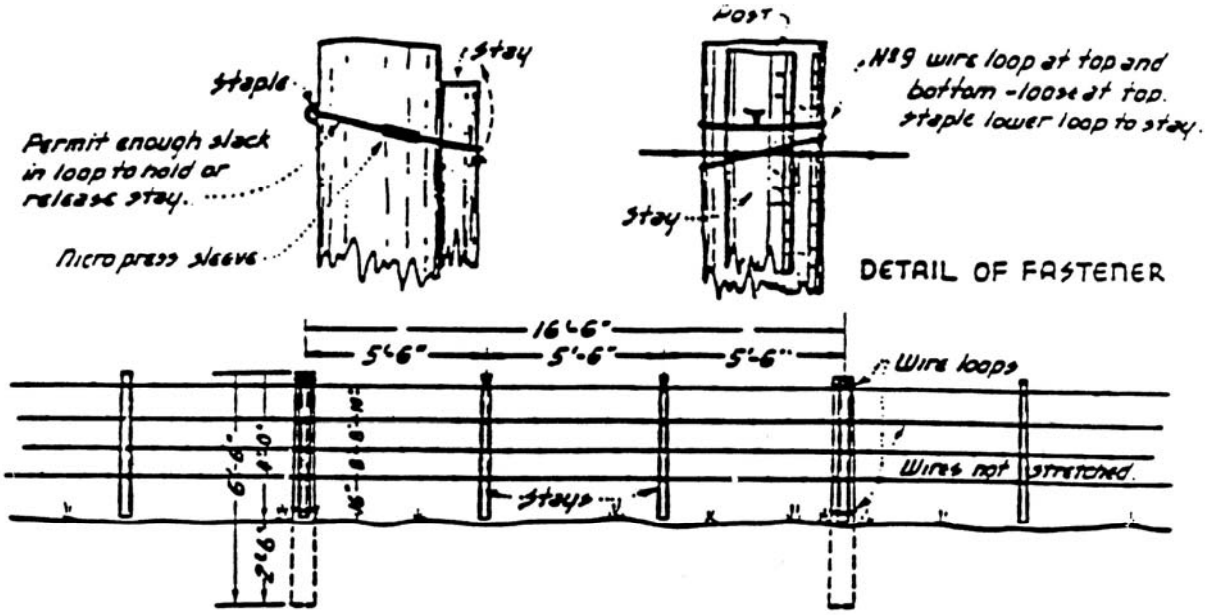
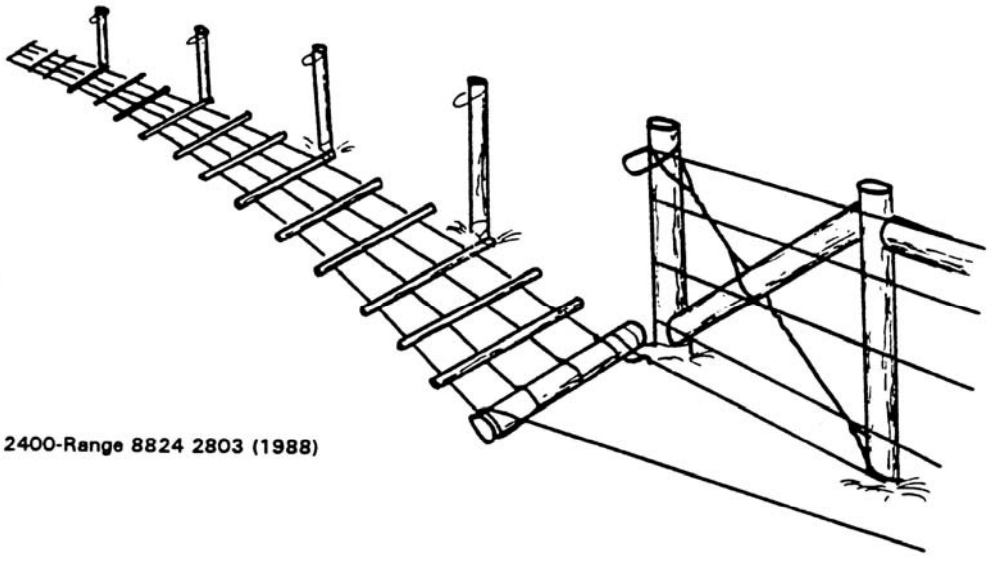
Exhibit 10



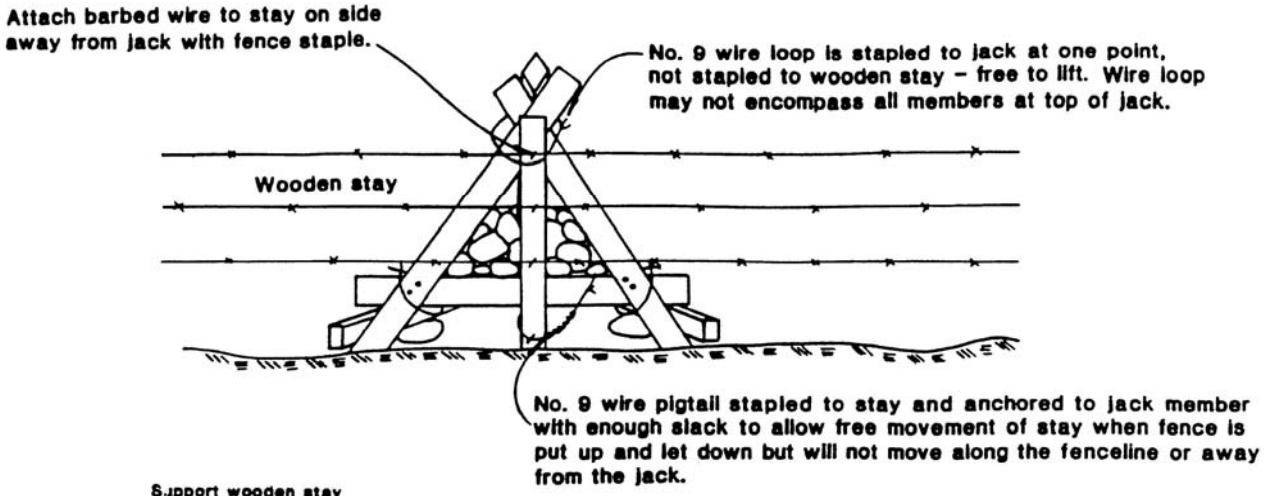
STAY LET-DOWN FENCE

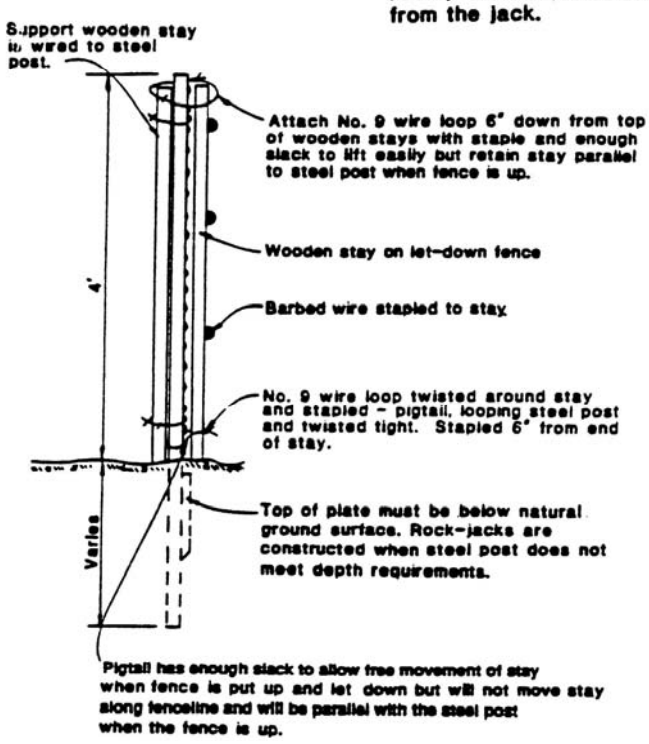


USDI/USFS 2400-Range 8824 2803 (1988)

LET-DOWN FENCE

Exhibit 11





Sanderson et al (1990)

LET-DOWN FENCE

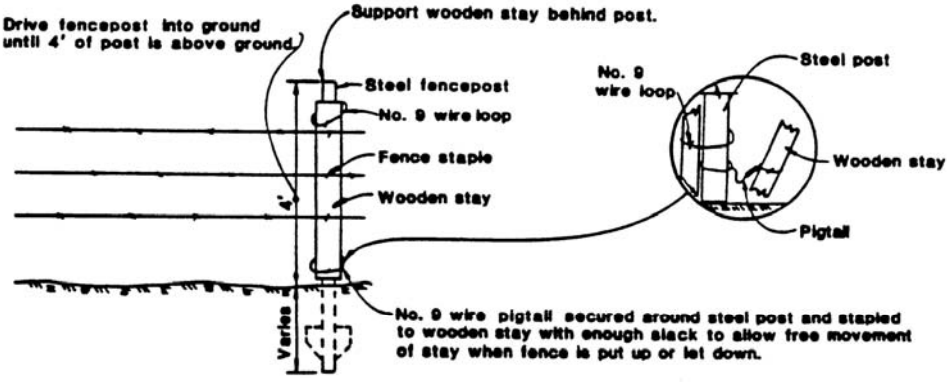


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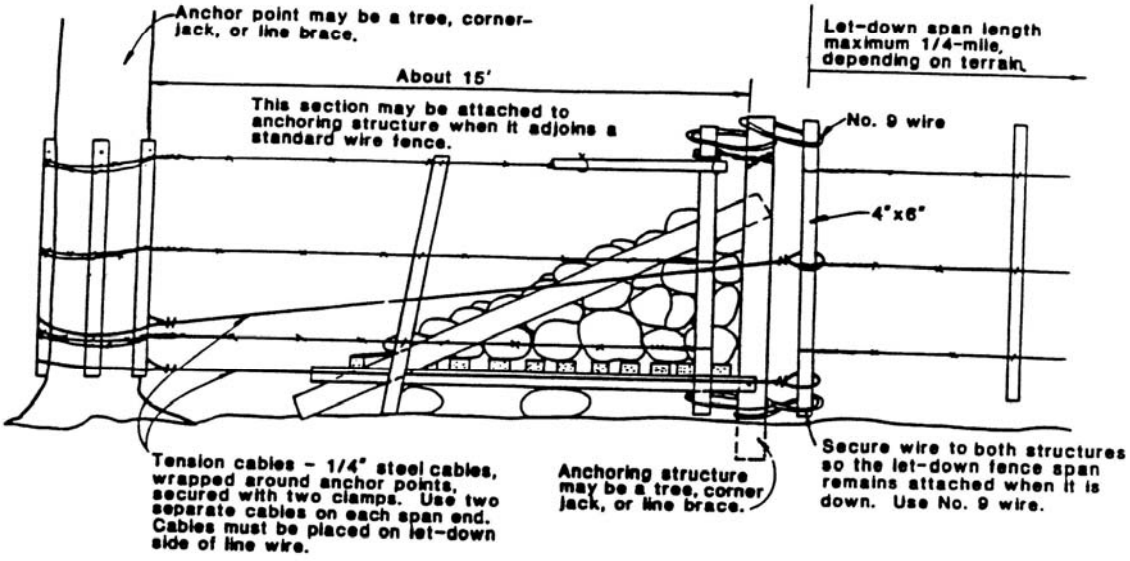
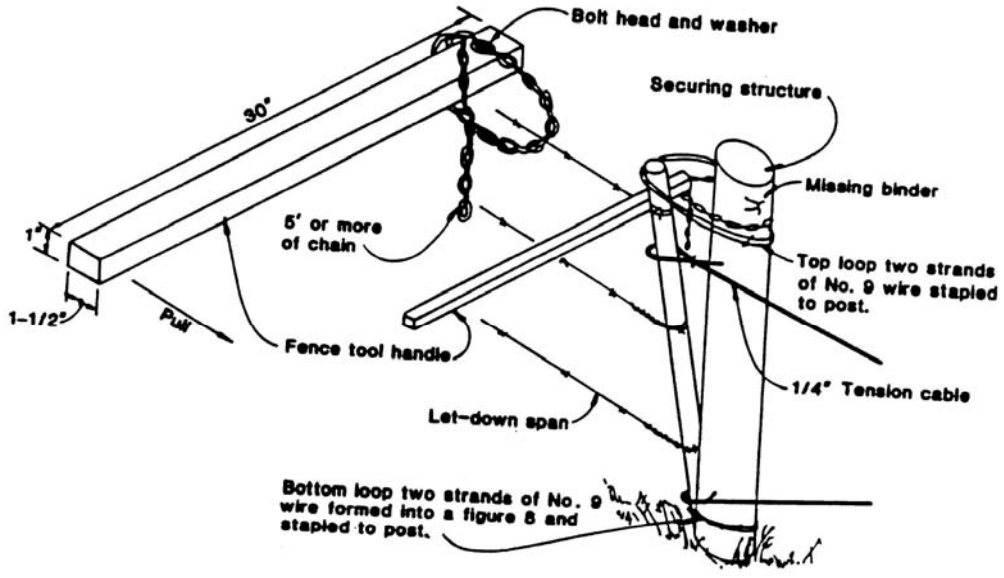
Exhibit 12

LET-DOWN FENCE





Sanderson et al (1990)

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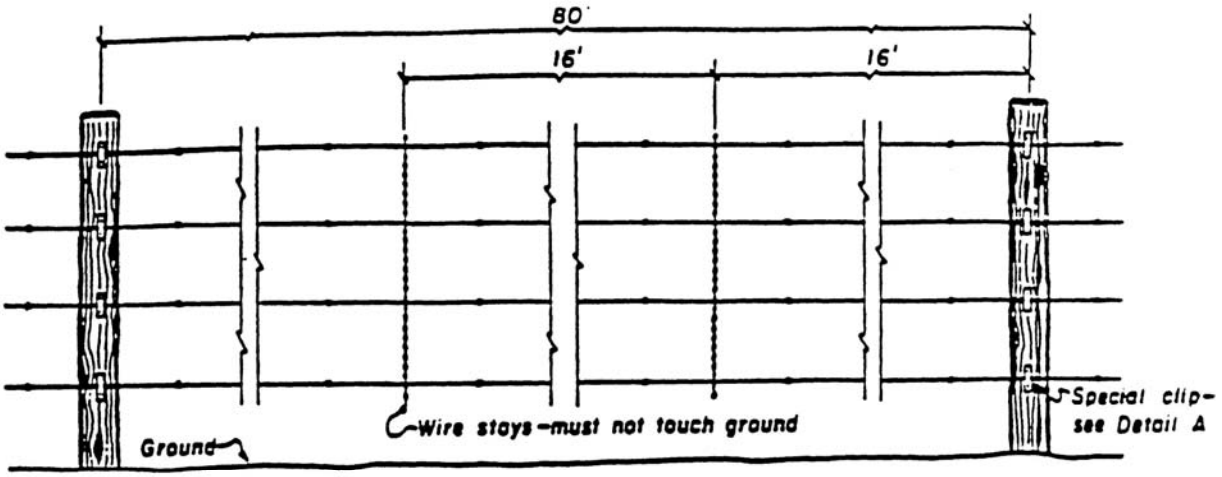
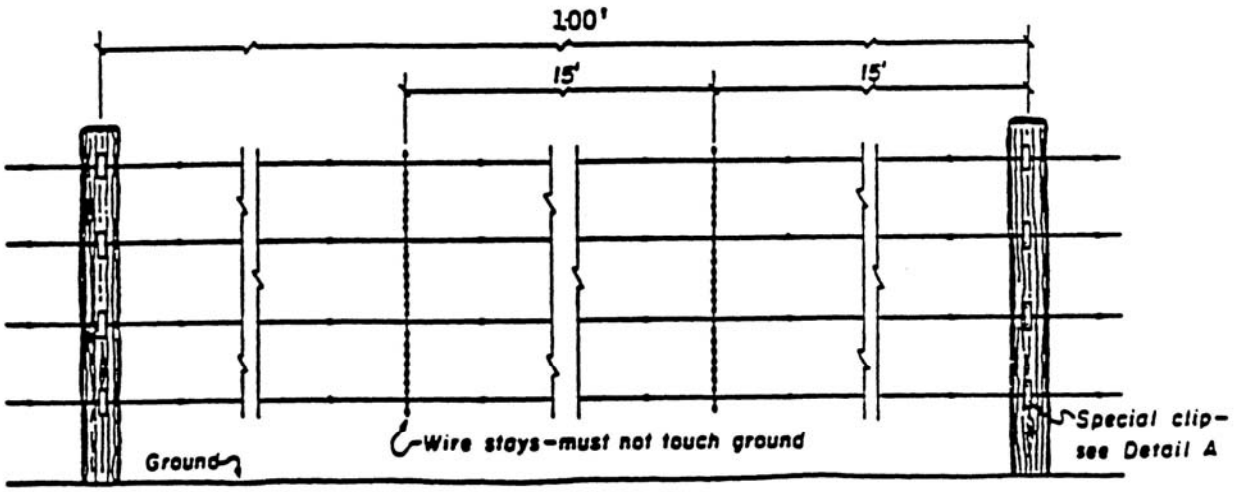
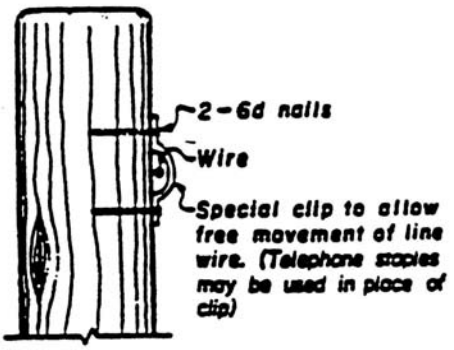
Exhibit 13



ELEVATION
(POSTS 80' APART)



ELEVATION
(POSTS 100' APART)



DETAIL A

SUSPENSION FENCE

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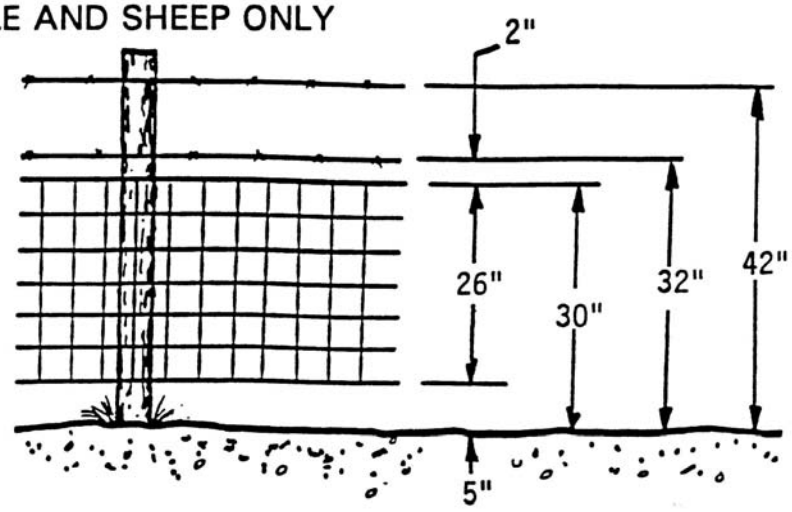
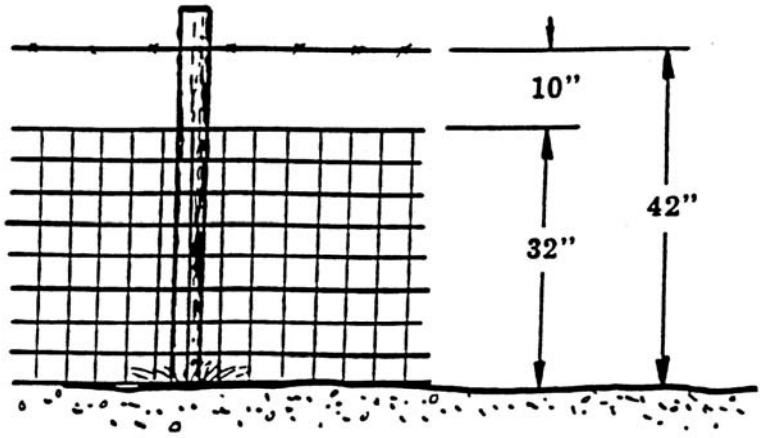
Exhibit 14

CATTLE AND SHEEP ONLY



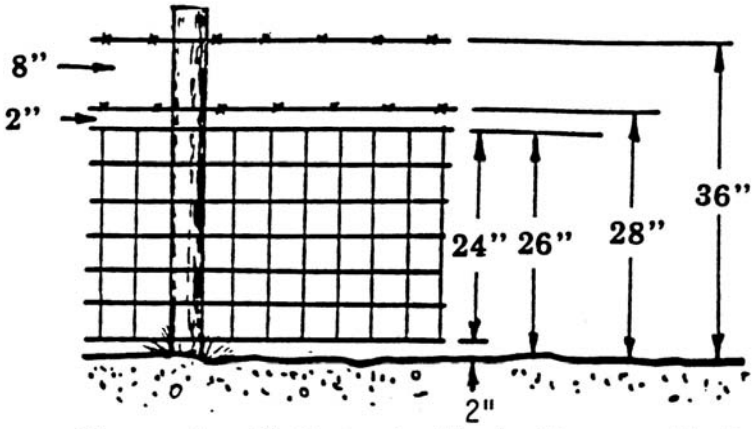
Woven wire with 2 strands barbed wire

CATTLE AND SHEEP ONLY



Woven wire with 1 strand of barbed wire.

SHEEP ONLY



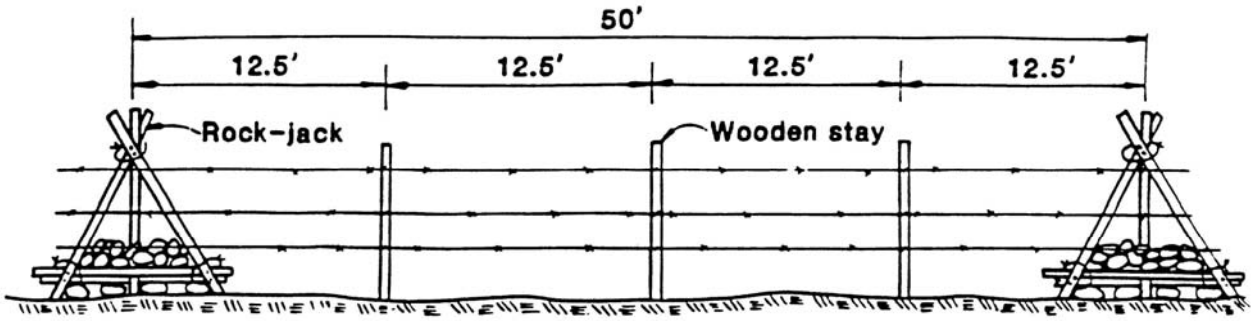
Woven wire with 2 strands of barbed (or smooth) wire

WOVEN WIRE FENCE

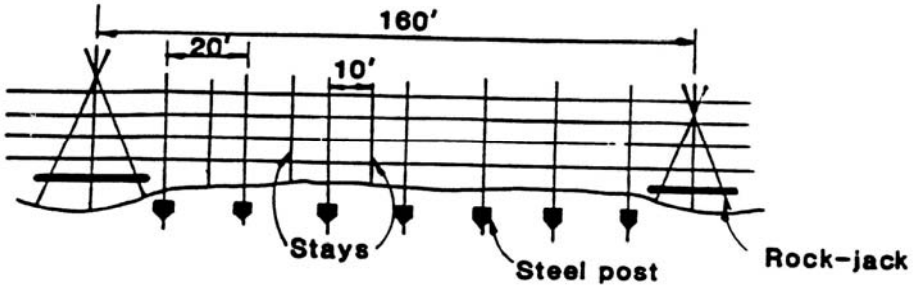
USDI/USFS 2400-Range 8824 2803 (1988)

NRCS, NV
February 1996

Exhibit 15

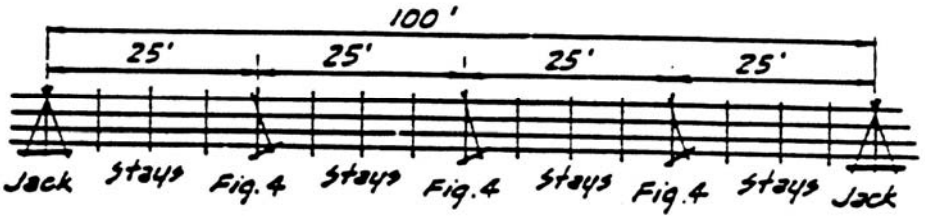


Standard rock-jack

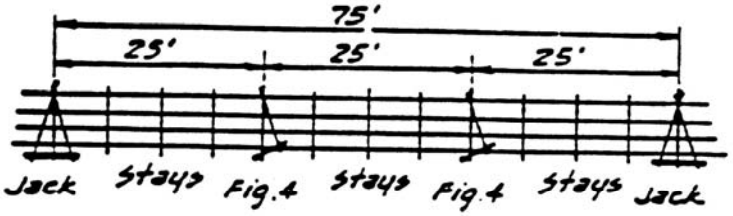


Steel post and rock-jack

For level topography, light snowfall.

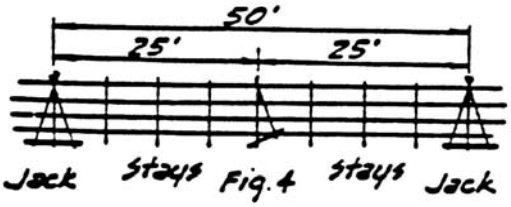


For moderately steep topography, moderate snowfall.



NOTE:
Place additional jacks at all abrupt breaks in topography.

For steep topography, heavy snowfall.



SPACING DIAGRAMS

ROCK-JACK AND FIGURE "4" FENCE

Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)

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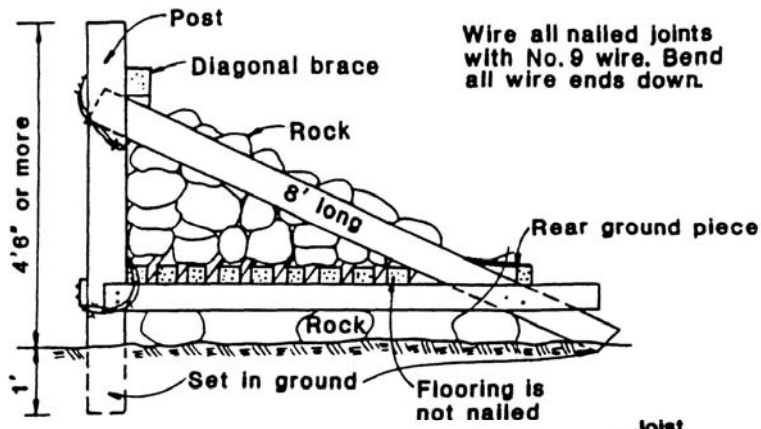
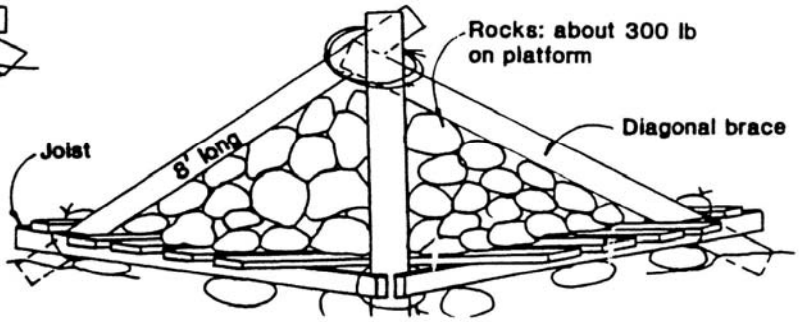
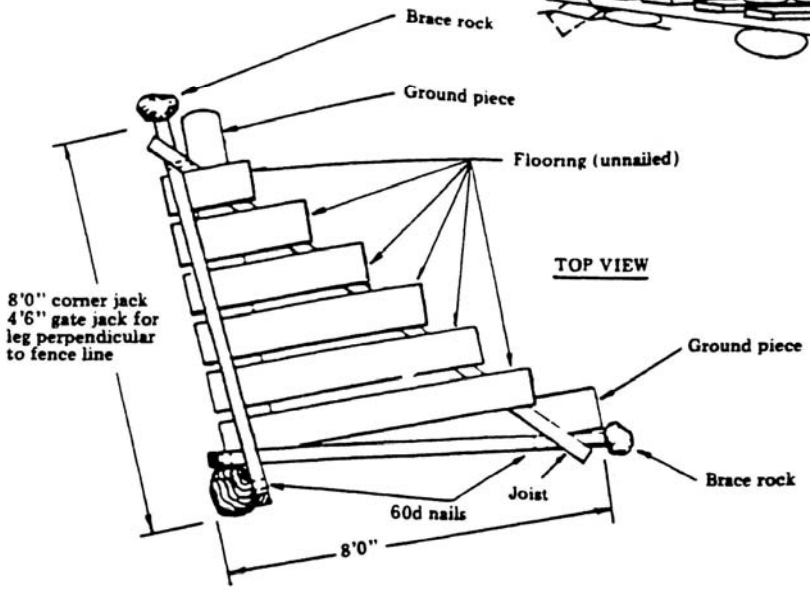
February 1996

Exhibit 16

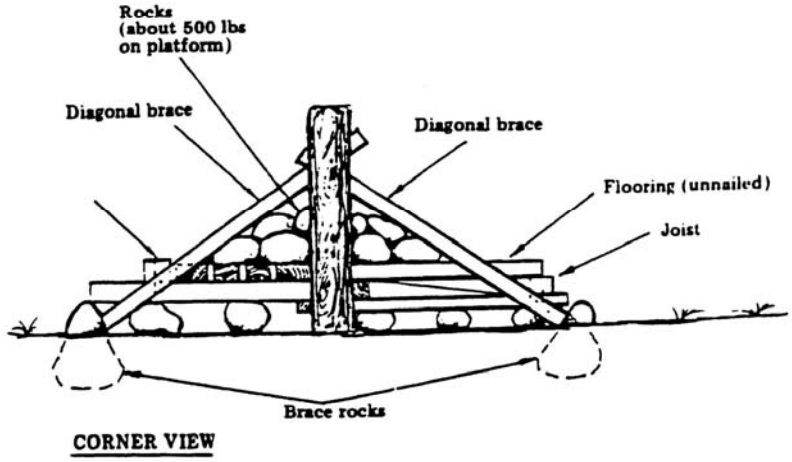


Side view





ROCK-JACK



CORNER VIEW

Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)

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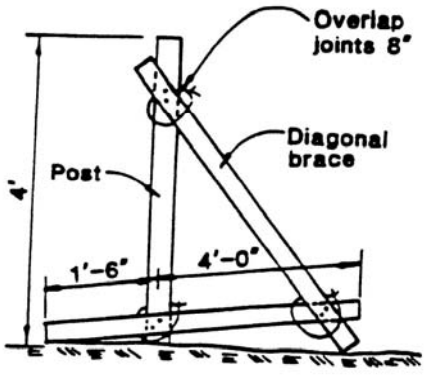
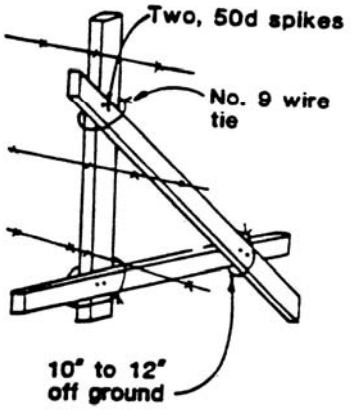
February 1996

Exhibit 17

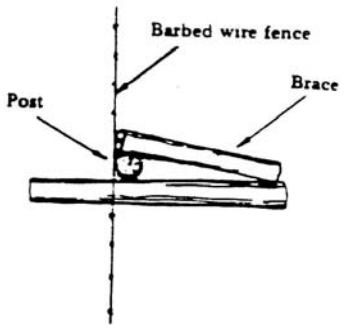
Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)



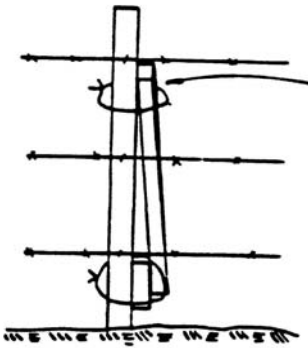
Side view



Diagonal view



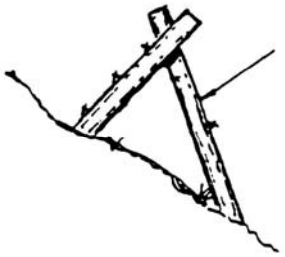
TOP VIEW



Use two 50d nails at each joint.
Drive nails at a binding angle.
No. 9 wire each joint.

Ground piece
Diagonal brace } 3"x6"x5-1/2'
Post 3"x6"x4'

Front view



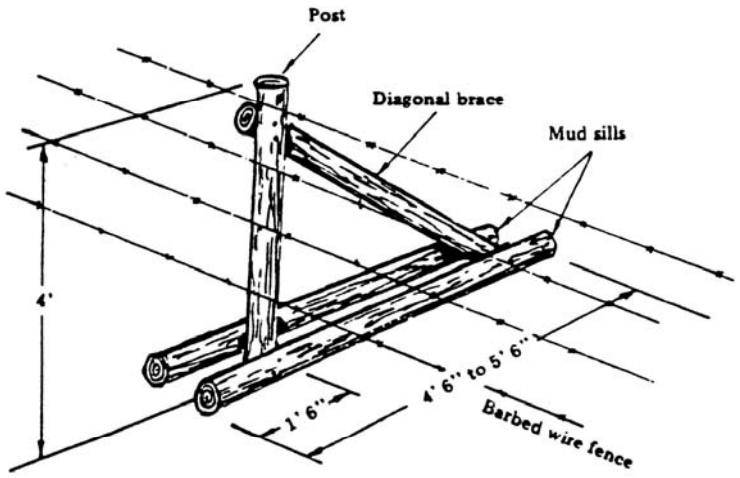
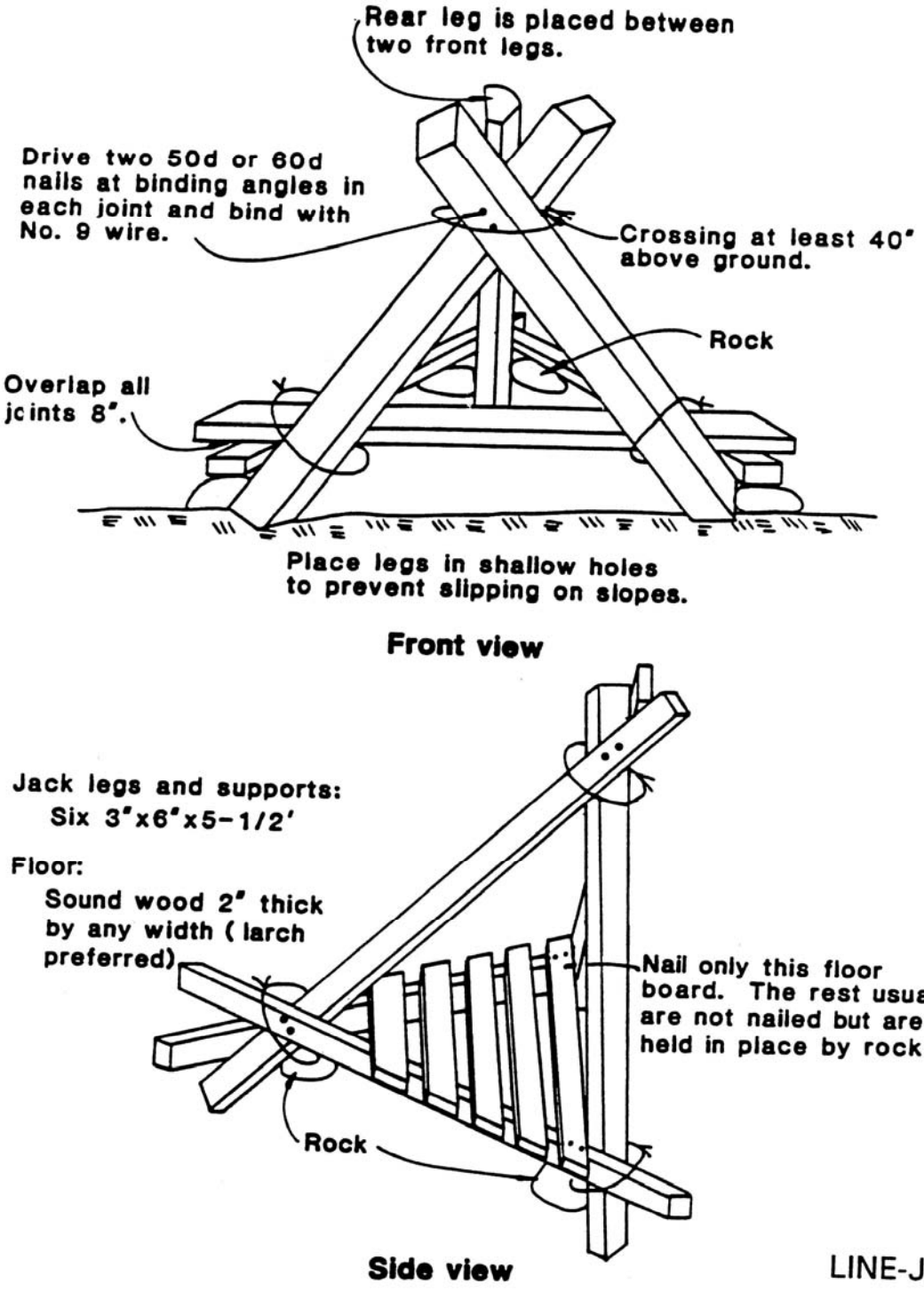


FIGURE "4"

NRCS, NV
February 1996

Exhibit 18



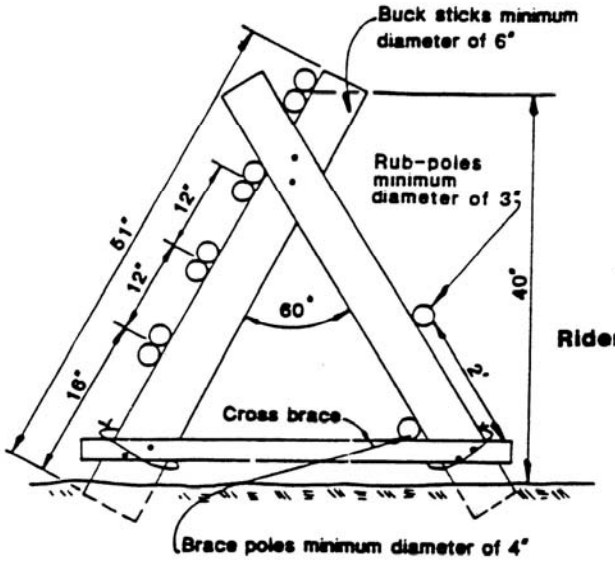
LINE-JACK

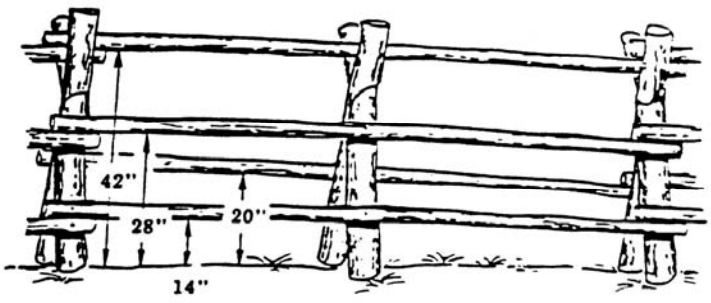
Sanderson et al (1990)

NRCS, NV
February 1996

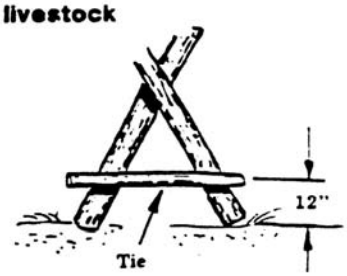
Exhibit 19

BUCK-AND-POLE FENCE

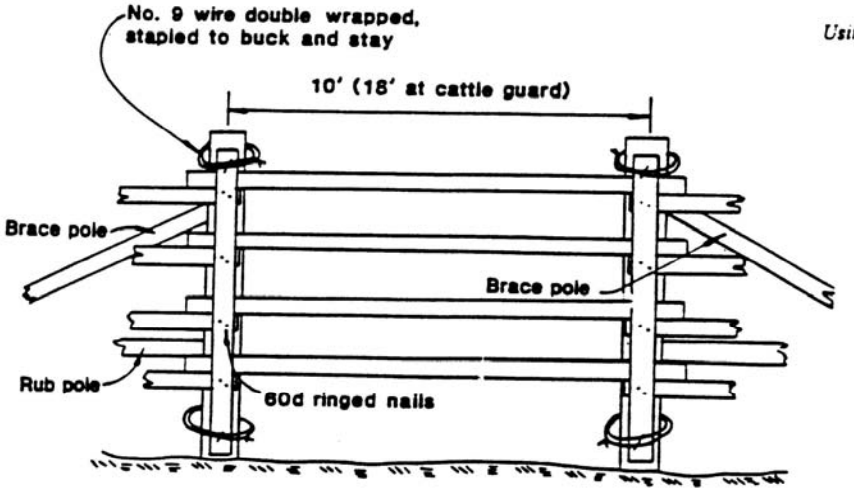




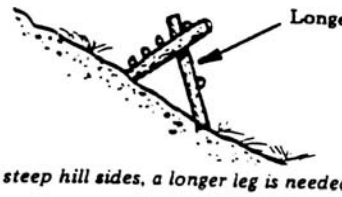
Rider-pole spacing for livestock



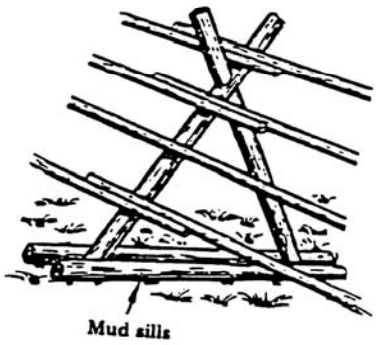
Using a reinforcing tie to prevent legs from spreading.

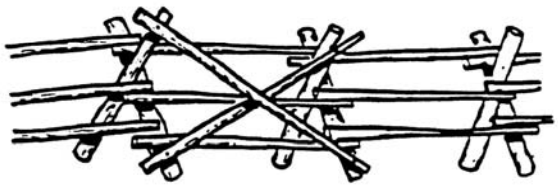


Gate poles are slightly smaller in diameter than fence poles to allow gate poles to slide freely.

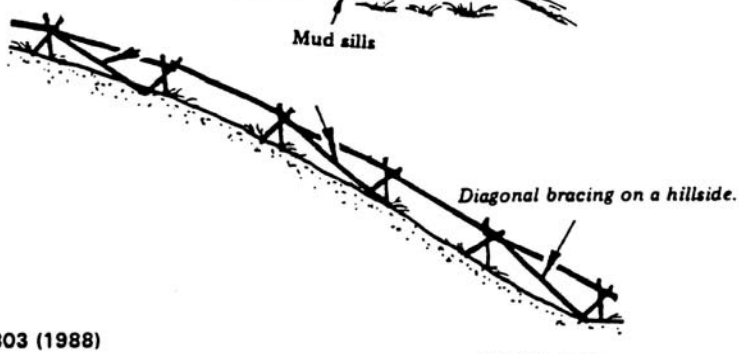


On steep hill sides, a longer leg is needed on low side.





After fence has been completed, a double pole "X" brace may be attached for reinforcement.

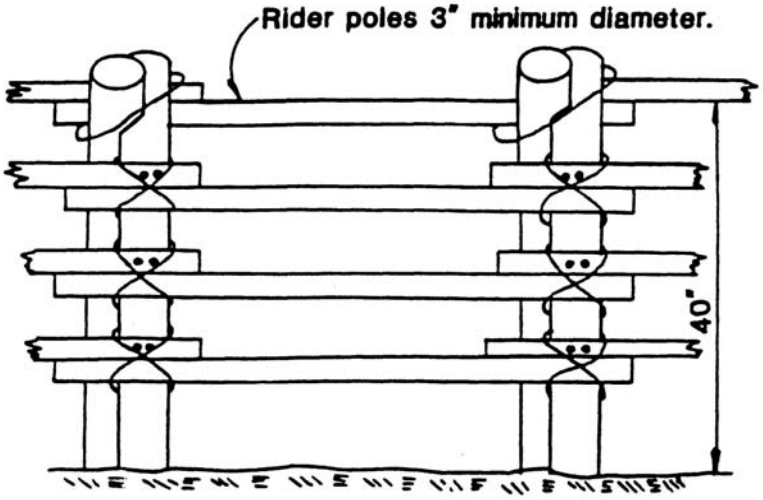


Diagonal bracing on a hillside.

Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)

NRCS, NV
February 1996

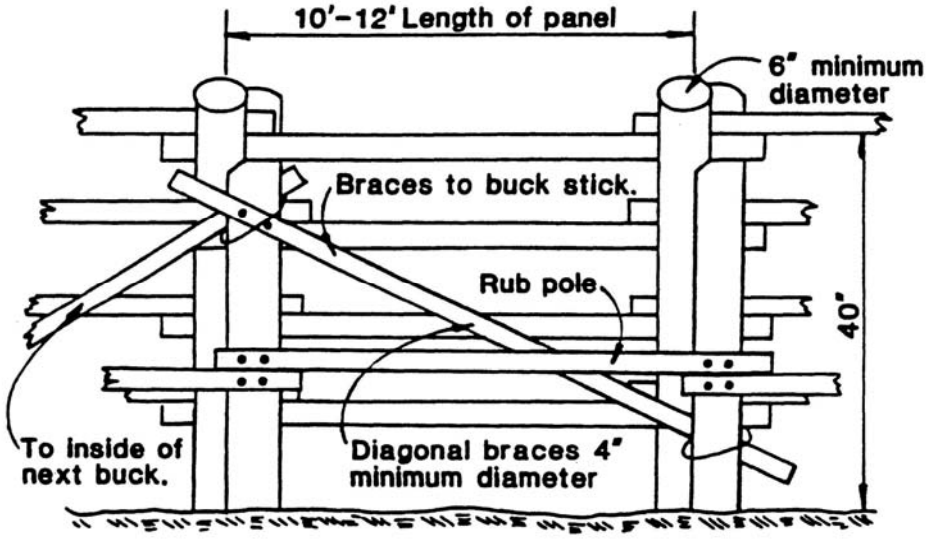
Exhibit 20



Notch and flatten poles to fit bucks with half of nail length in each.

Rider pole detail

BUCK-AND-POLE FENCE



Drive two 60d nails at each joint and bind with No. 9 wire.

Brace and rub pole detail

Sanderson et al (1990)

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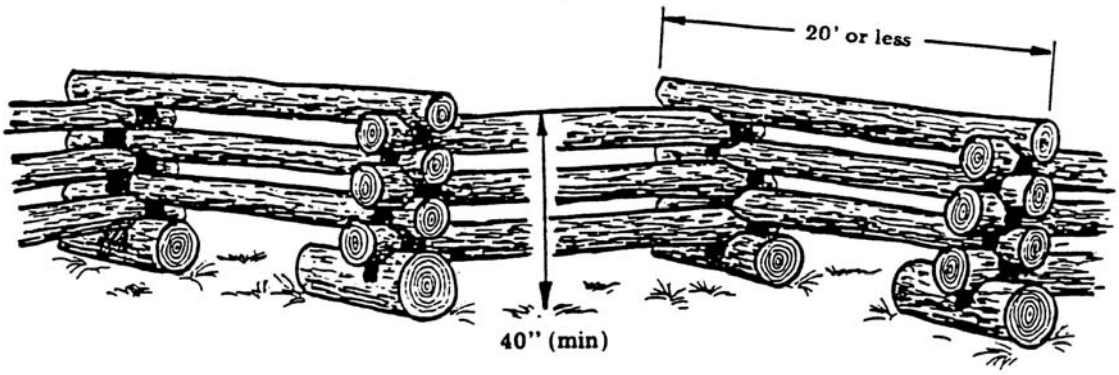
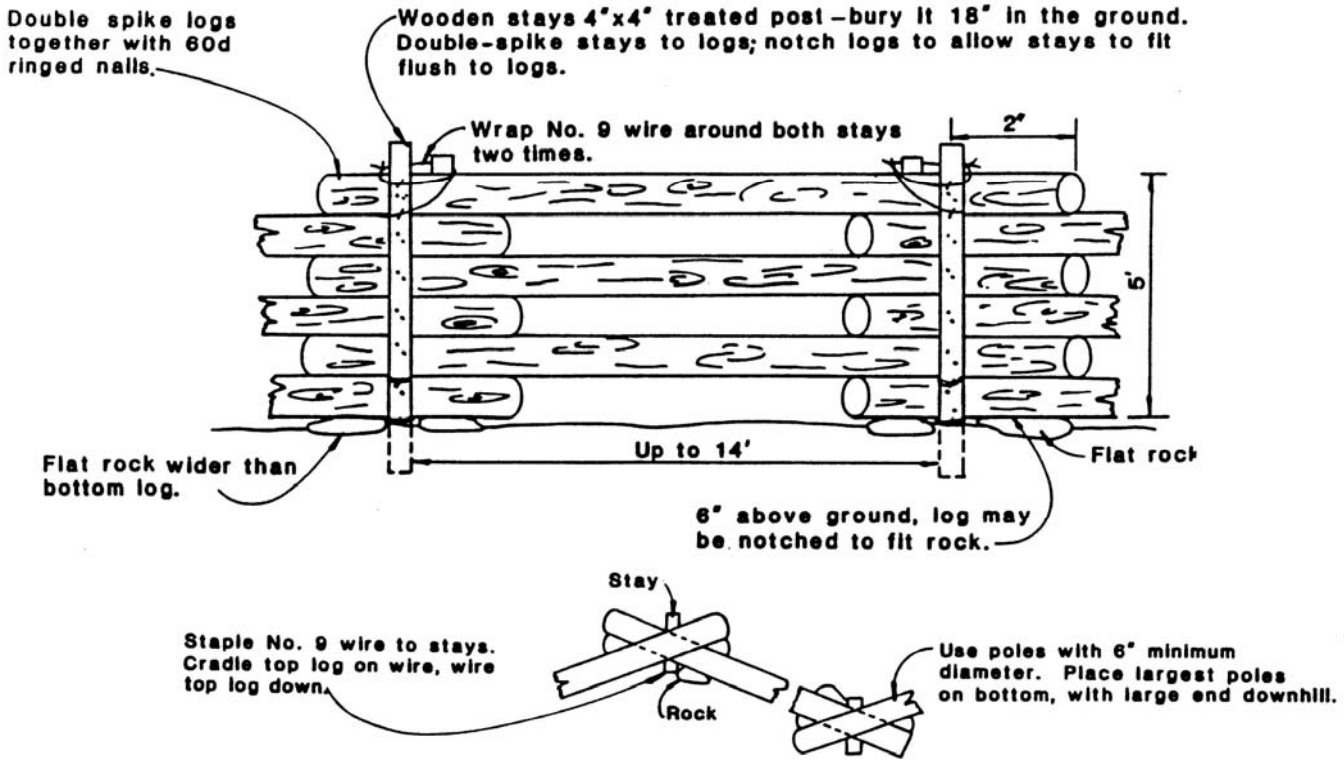
February 1996

Exhibit 21

Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)



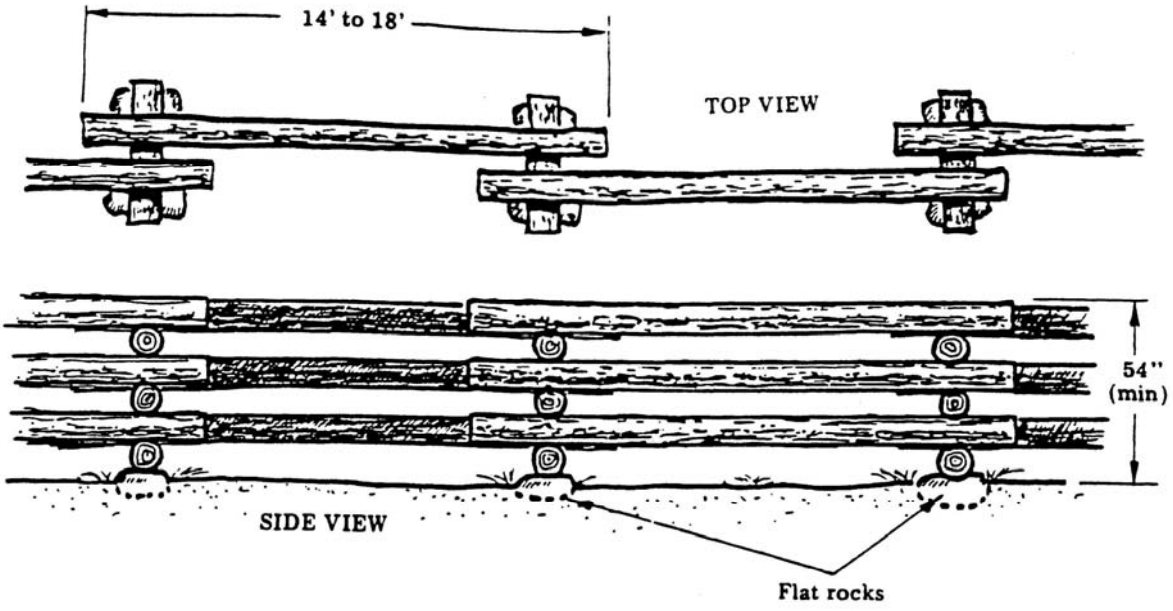


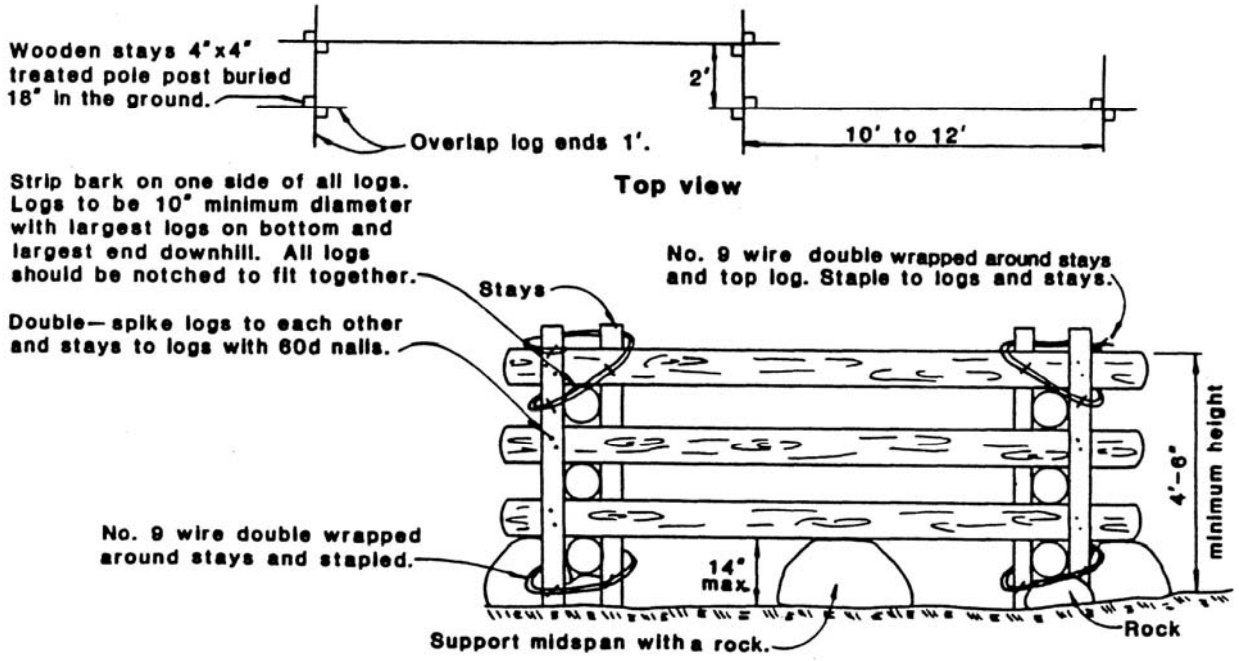
LOG-WORM FENCE

NRCS, NV
February 1996

Exhibit 22

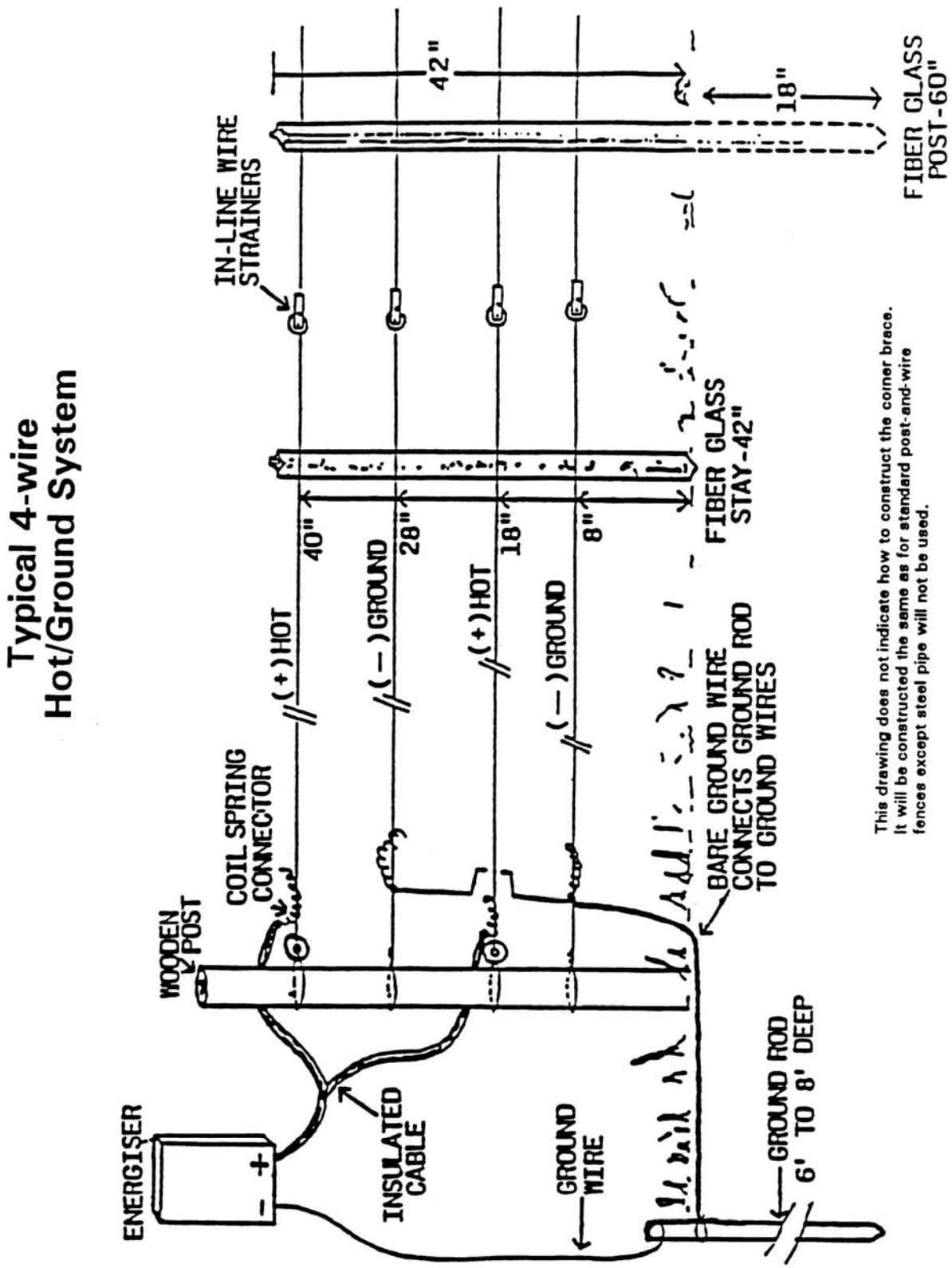
Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)





BLOCK-AND-POLE FENCE

Exhibit 23

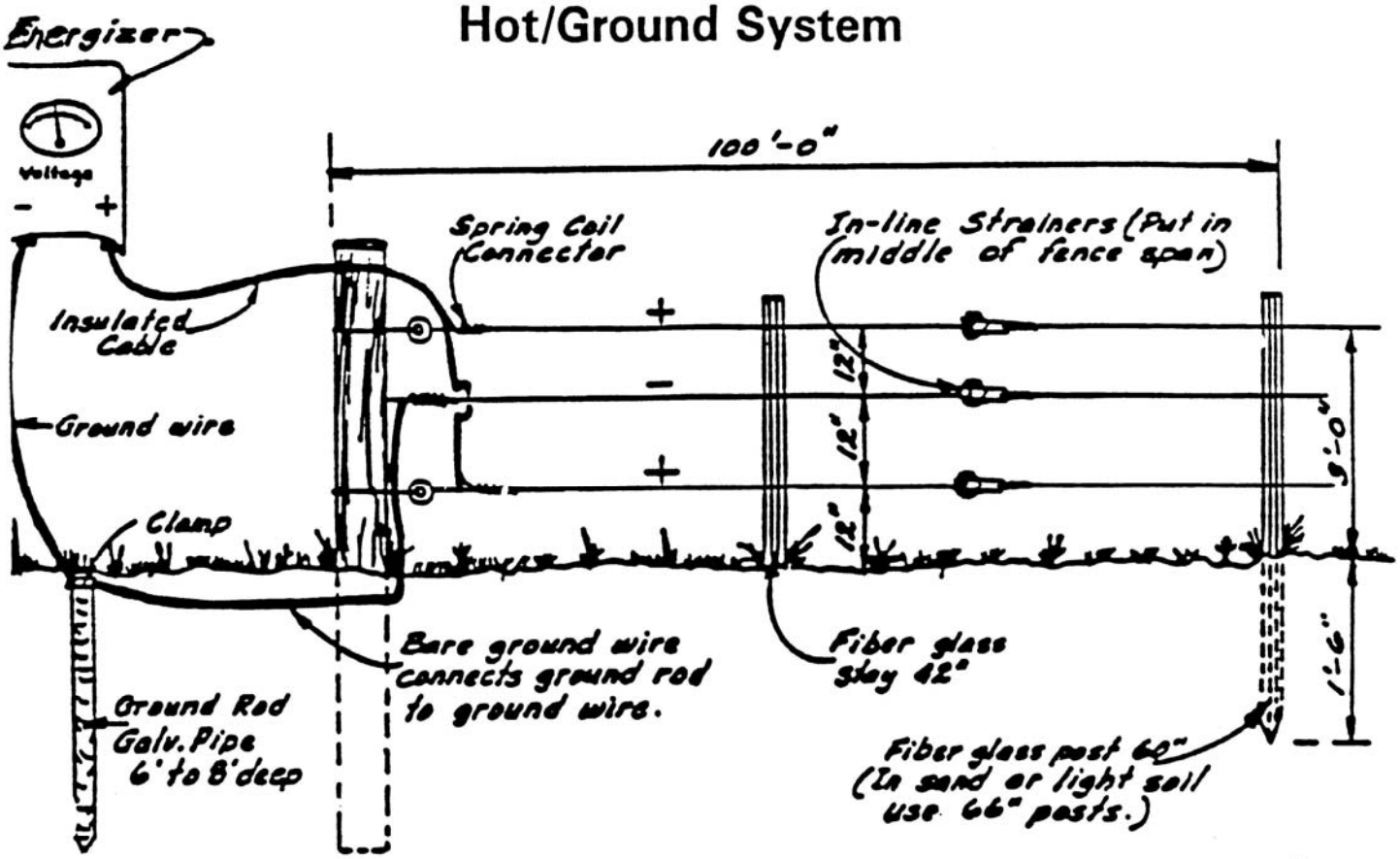


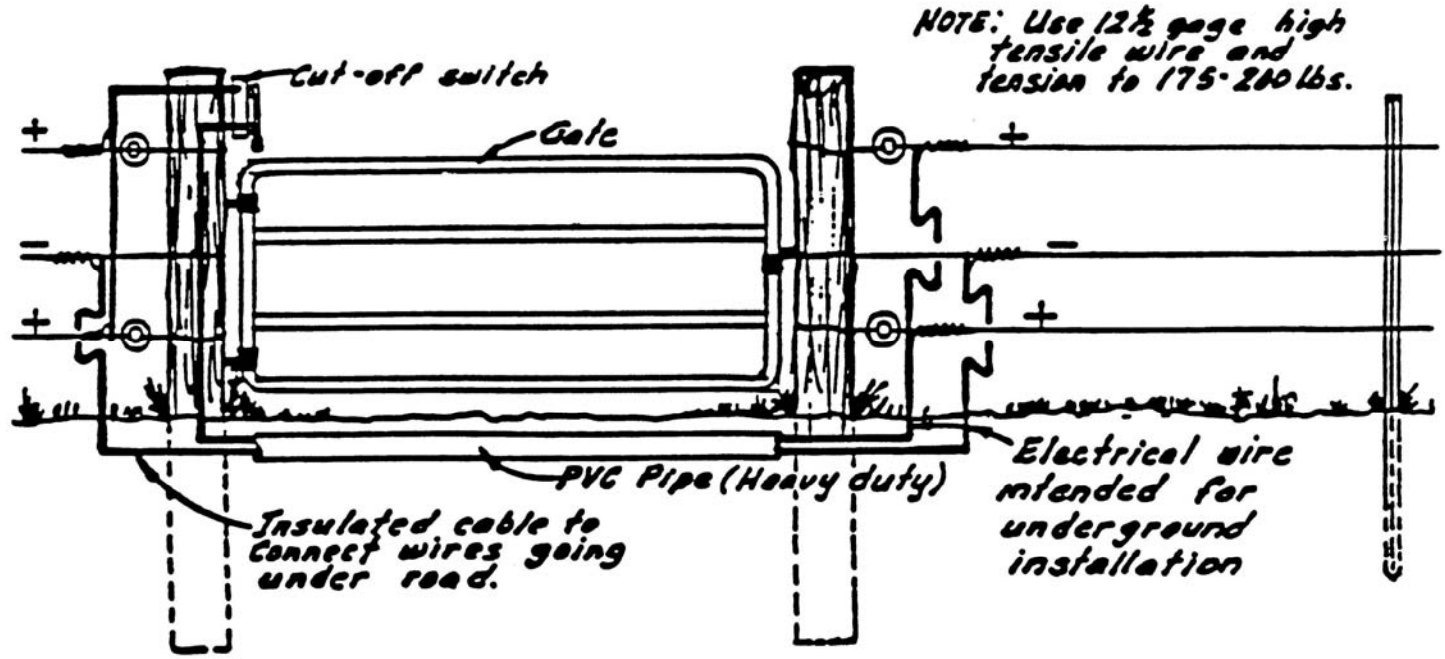
PERMANENT POWER FENCE

NRCS, NV
February 1996

Exhibit 24

Typical 3-wire Hot/Ground System





PERMANENT POWER FENCE

NRCS, NV
February 1996

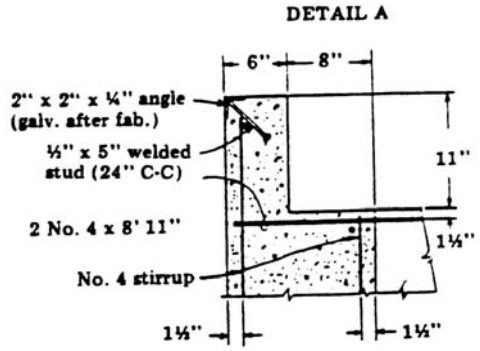
Exhibit 25

LIFT OR AUSTRALIAN GATE
FOR USE WITH PERMANENT POWER FENCE

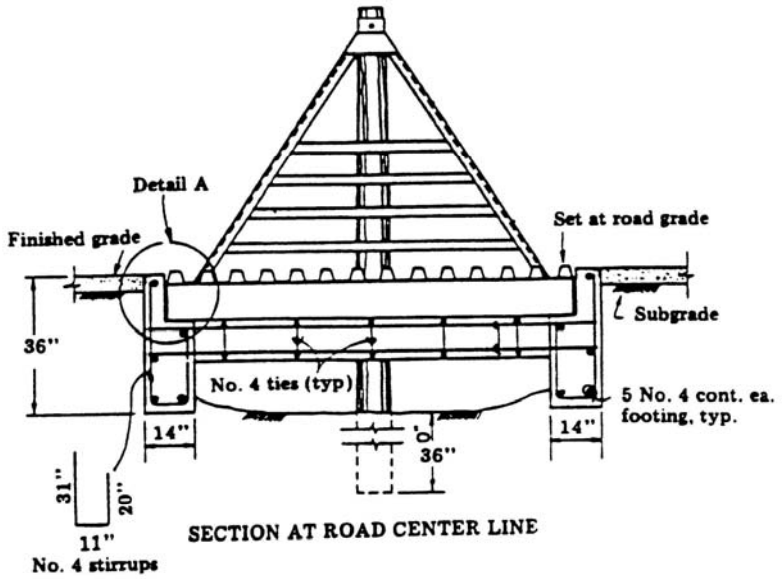
NRCS, NV
February 1996

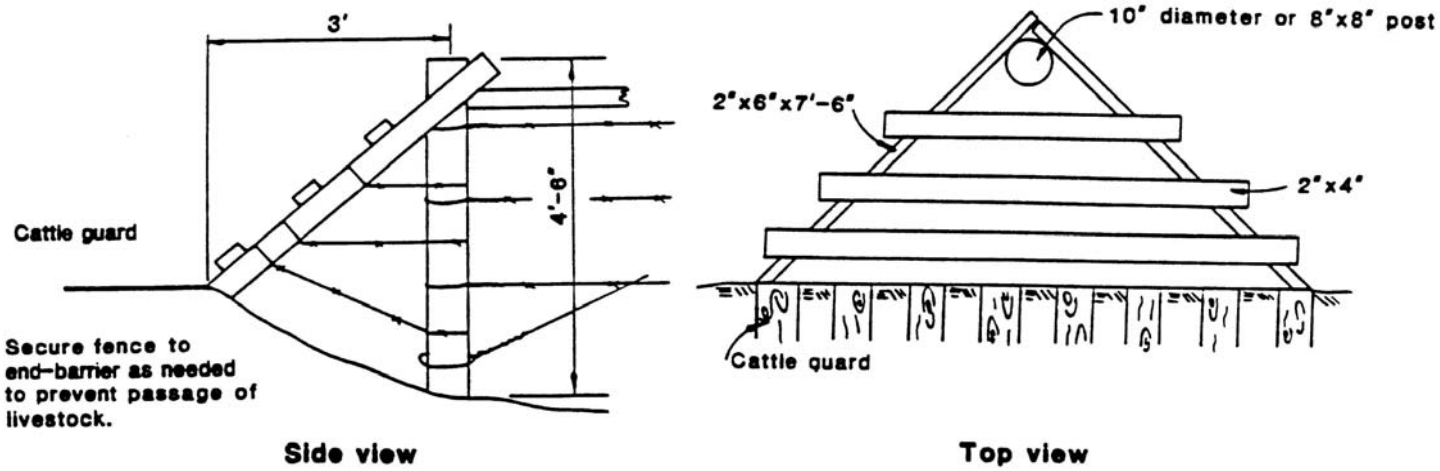
Exhibit 26

CONCRETE FOUNDATION



CATTLE GUARD

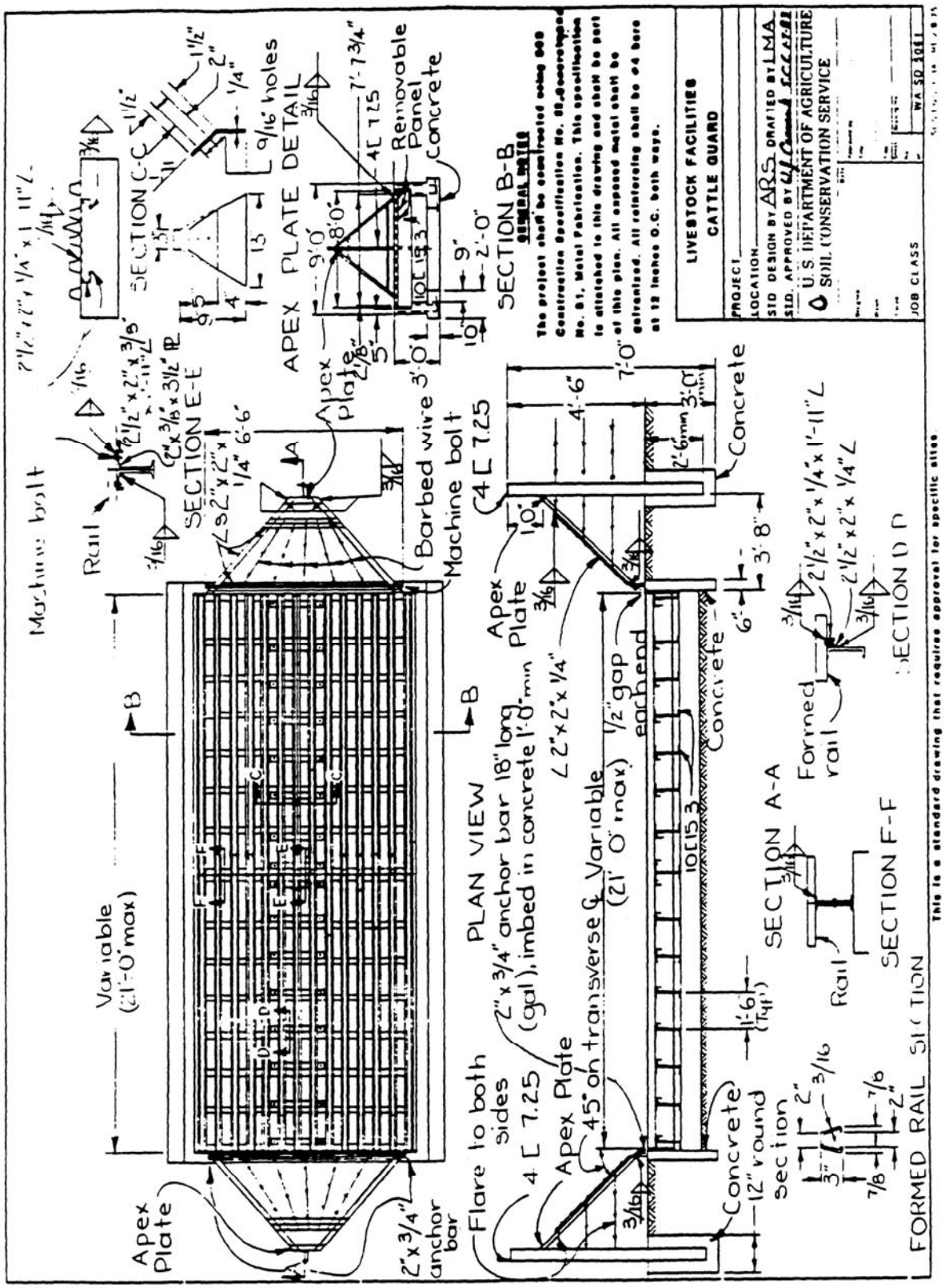




Details for wooden end-barriers used to connect a cattle guard with a fence.

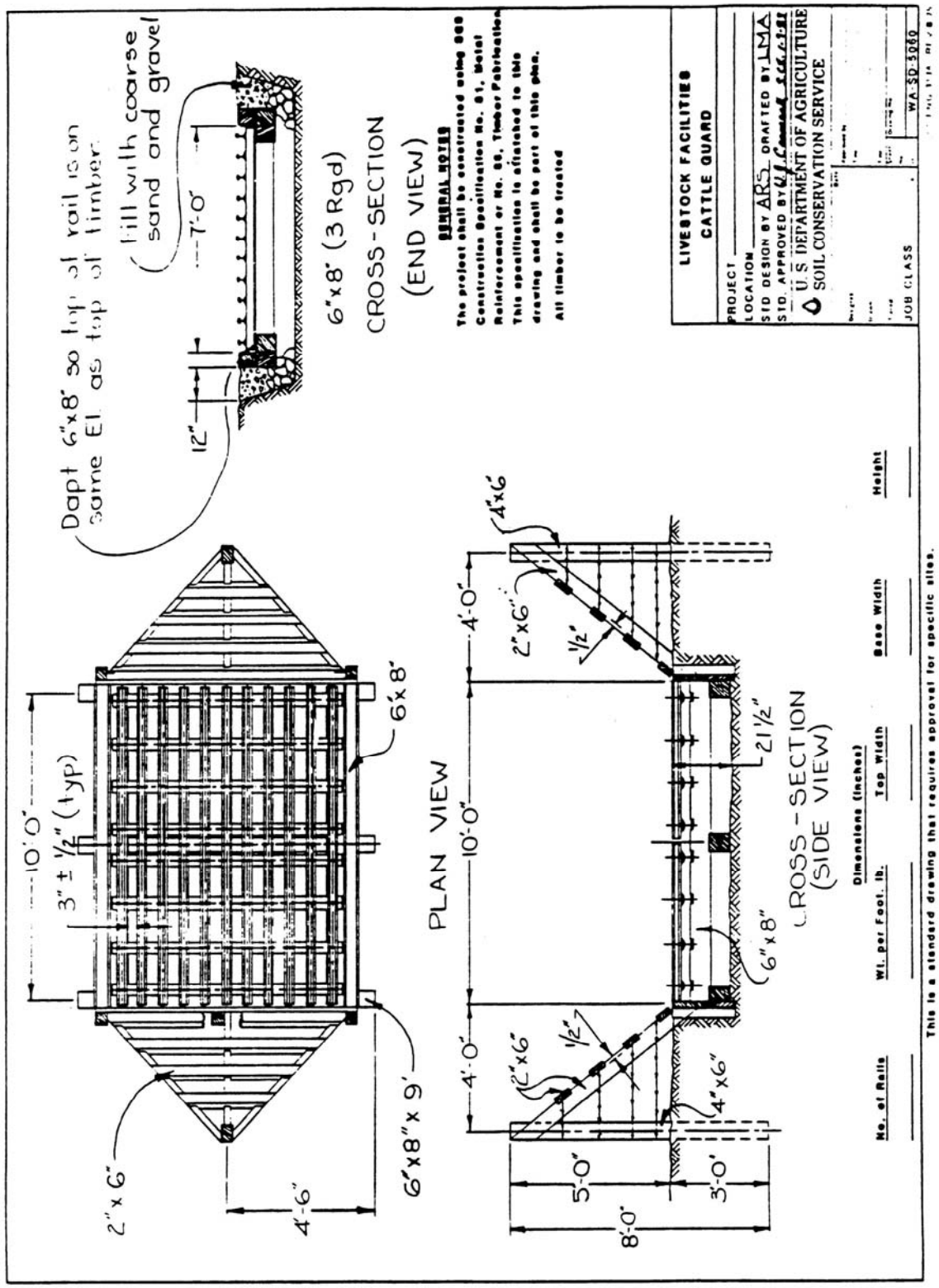
Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)

Exhibit 27



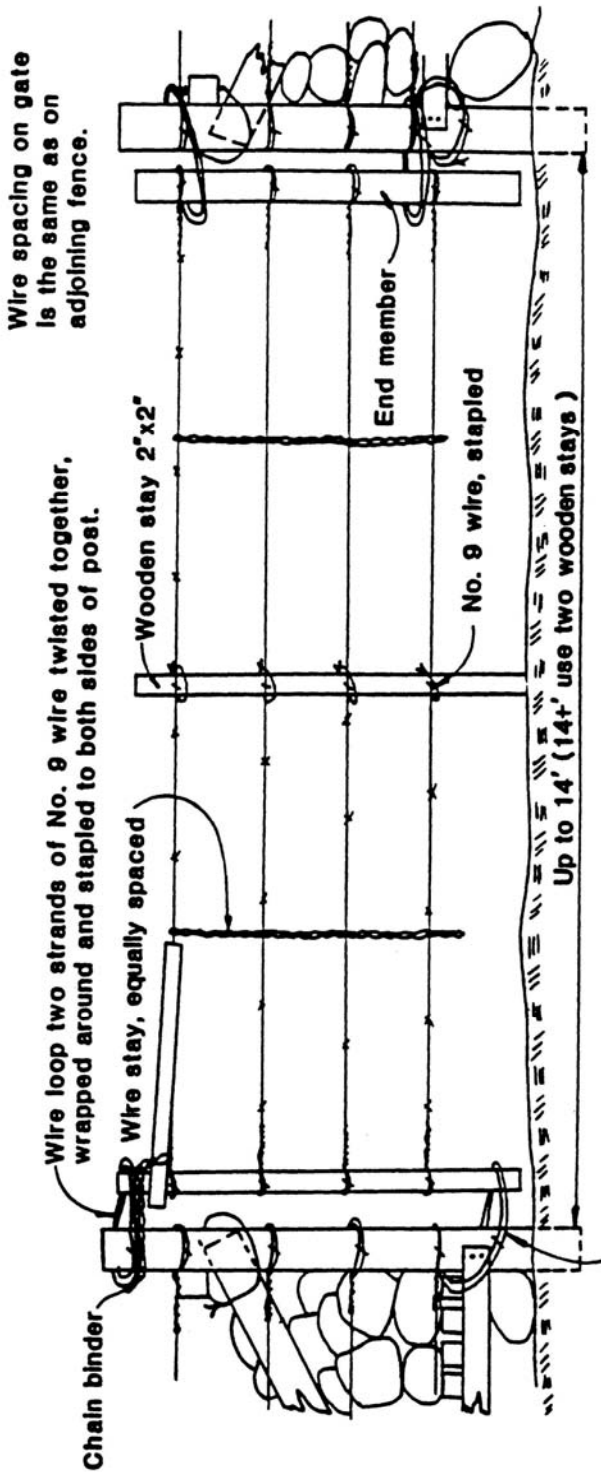
CATTLE GUARD

Exhibit 28



CATTLE GUARD

Exhibit 29



Specifications for standard wire gates:
Recommended gate width - 12 to 16 feet in fenceline,
18 to 22 feet at roads and cattle guards;
Gate Closer (Chain Binder)
Handle - 3 feet by 3 inches in diameter;
Welded Chain - 12 to 18 inches long by 1/4-inch in diameter;
Fasten chain to handle with No. 9 gauge smooth wire; nail to post.

Sanderson et al (1990)

STANDARD WIRE GATE

Exhibit 30

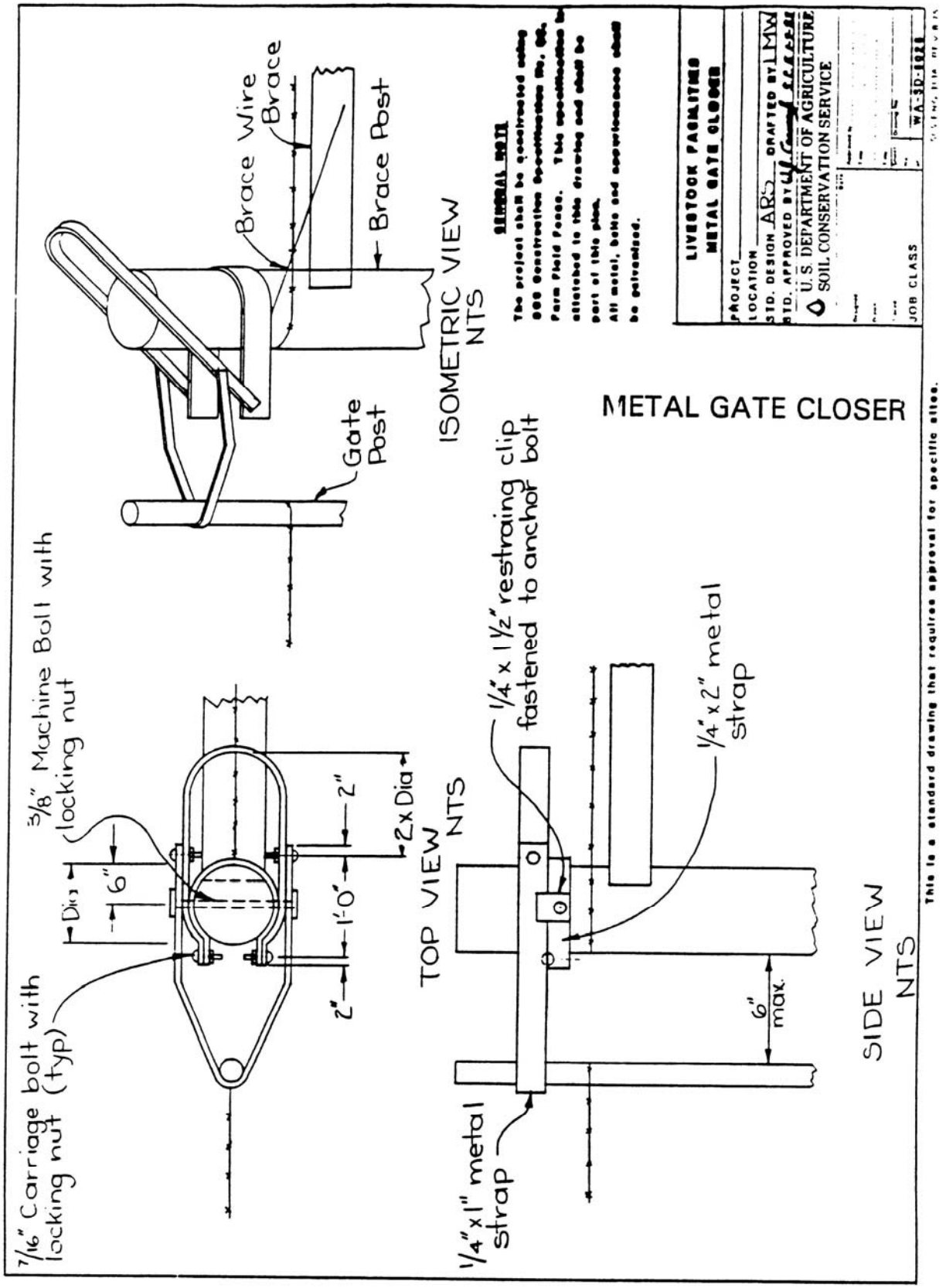
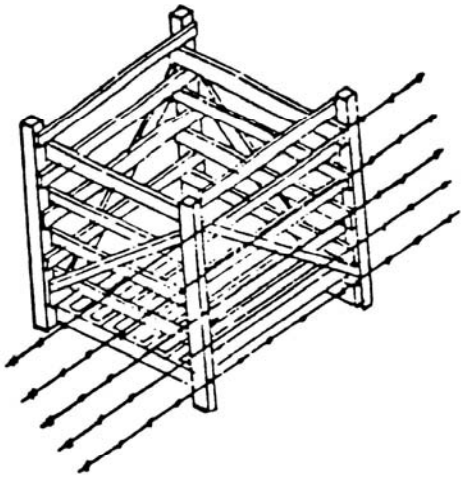
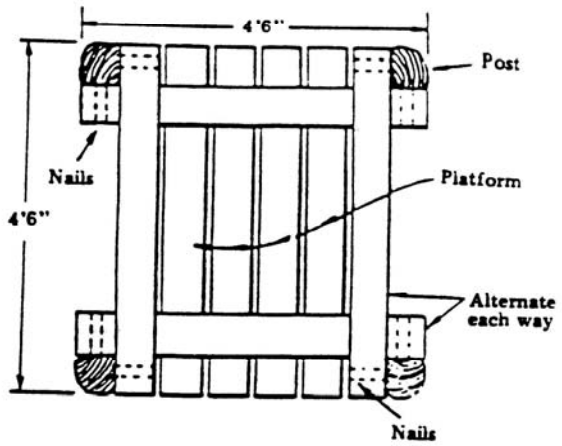

Brace Wire
Brace
Brace Post
Gate Post
ISOMETRIC VIEW
NTS
METAL GATE CLOSER
GENERAL NOTE
The project shall be constructed using 590 Construction Specification No. 66, Farm Field Fence. This specification is attached to this drawing and shall be part of this plan.
All metal, bolts and appurtenances shall be galvanized.
LIVESTOCK FACILITIES
METAL GATE CLOSER
PROJECT
LOCATION
STD. DESIGN ARS
STD. APPROVED BY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JOB CLASS
WA-3D-1021
7/16" Carriage bolt with locking nut (typ)
3/8" Machine Bolt with locking nut
Dia
6"
2"
1'-0"
2"
2x Dia
TOP VIEW
NTS
1/4" x 1 1/2" restraing clip fastened to anchor bolt
1/4" x 2" metal strap
1/4" x 1" metal strap
6" max.
SIDE VIEW
NTS
This is a standard drawing that requires approval for specific sites.

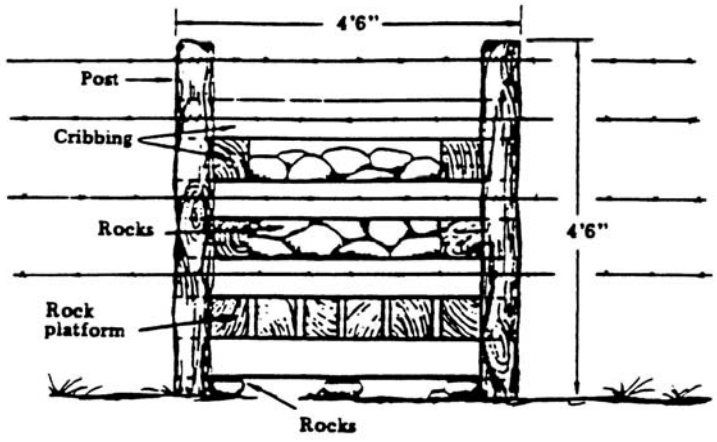
Exhibit 31

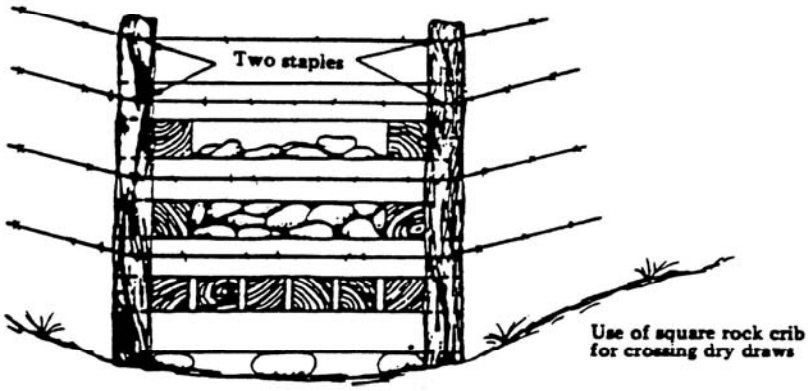
SQUARE ROCK CRIBS





TOP VIEW

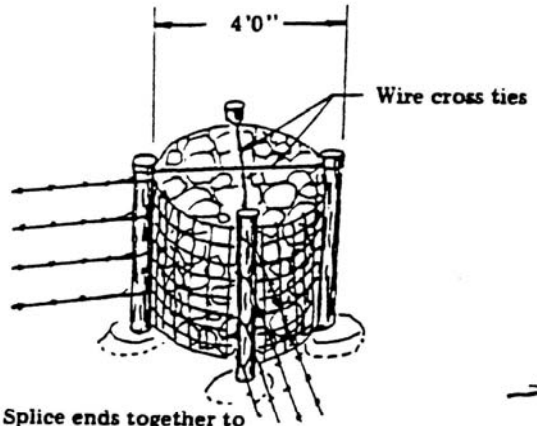




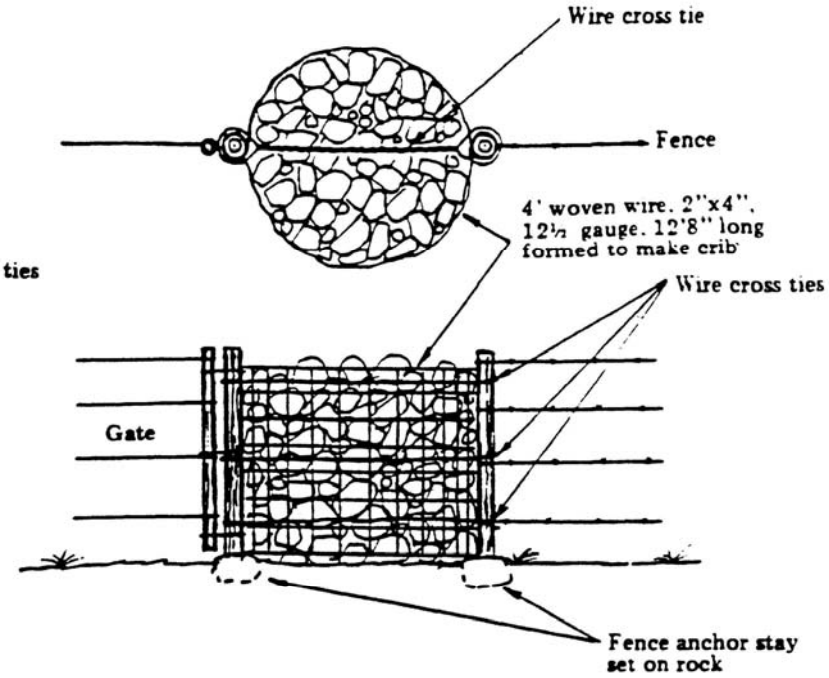
Use of square rock crib for crossing dry draws

Exhibit 32

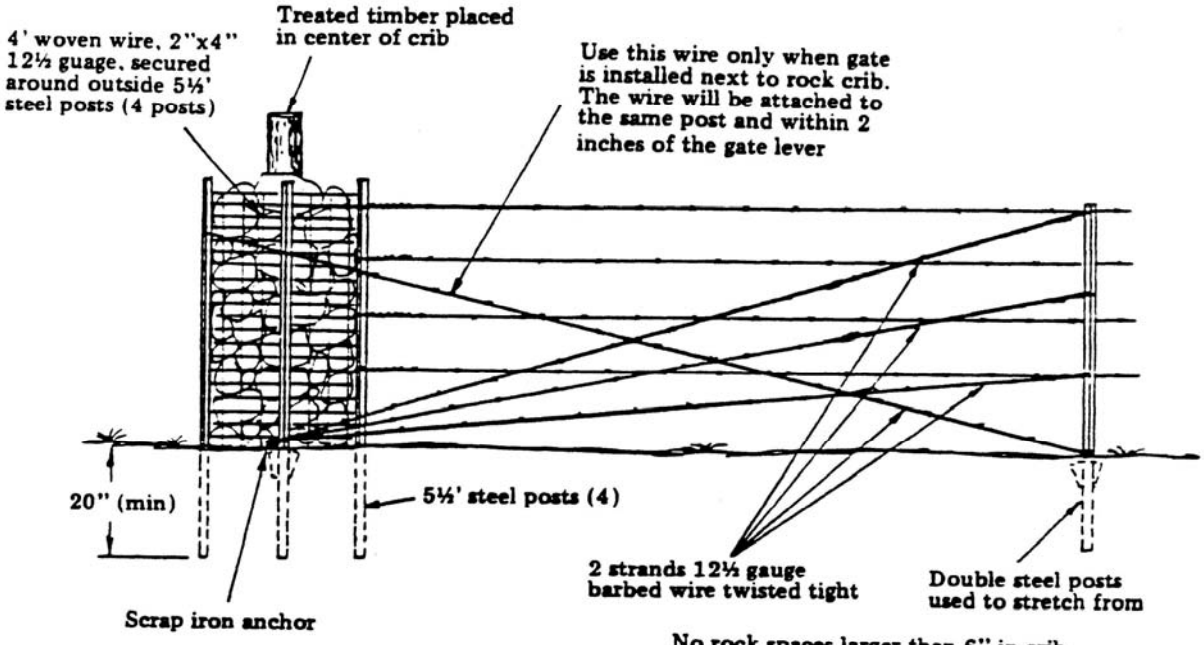
WIRE FENCE CRIBS



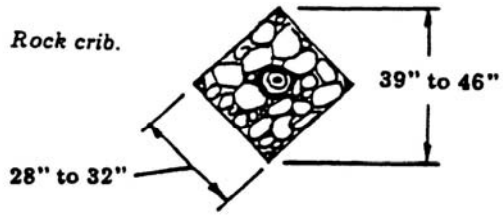
Rock crib corner post



Rock crib gate post



Rock crib.

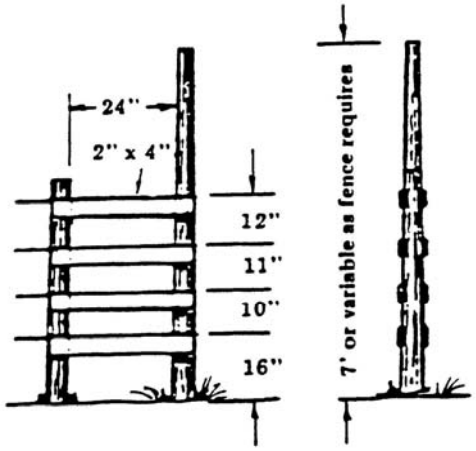


No rock spaces larger than 6" in crib.

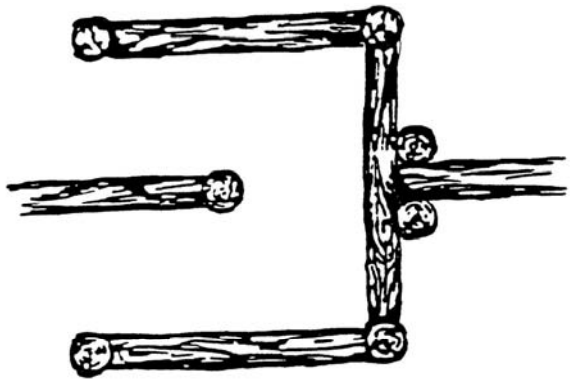
The woven wire ends will have 12" overlap and be wired to itself, using the ends of each longitudinal wire to make a splice with at least 4 turns. The wire shall be attached to each post in the crib at the top and bottom wires and at a minimum of 2 intermediate horizontal wires.

Exhibit 33

PEOPLE ACCESS

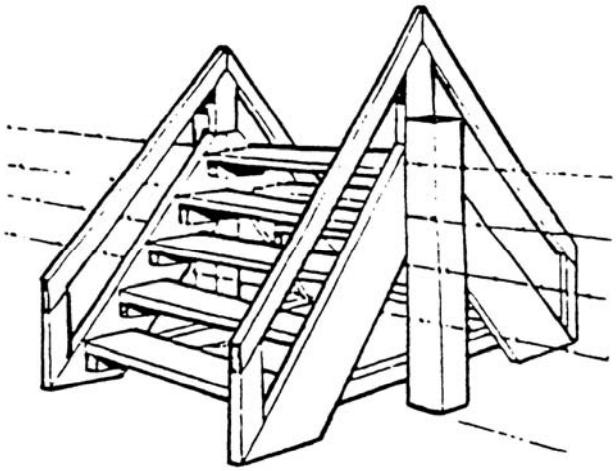


Standard fence post

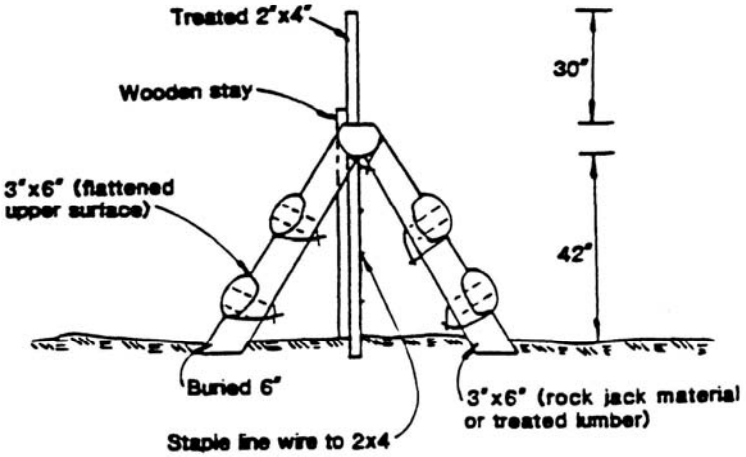


TOP VIEW

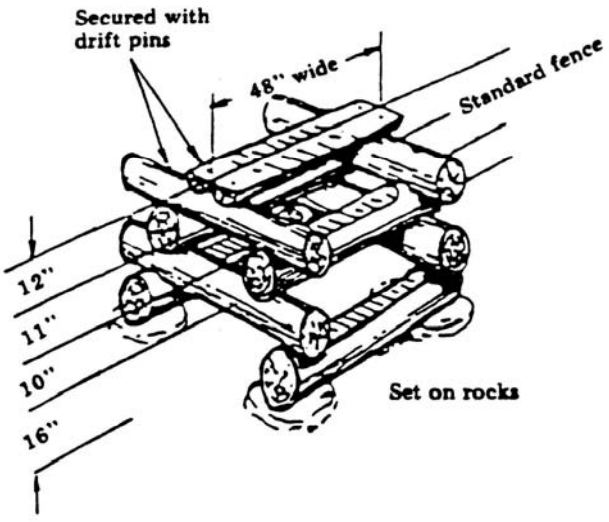
Walk-through gate.
(Excludes livestock & wildlife.)



Fence stile.



Fence stile.

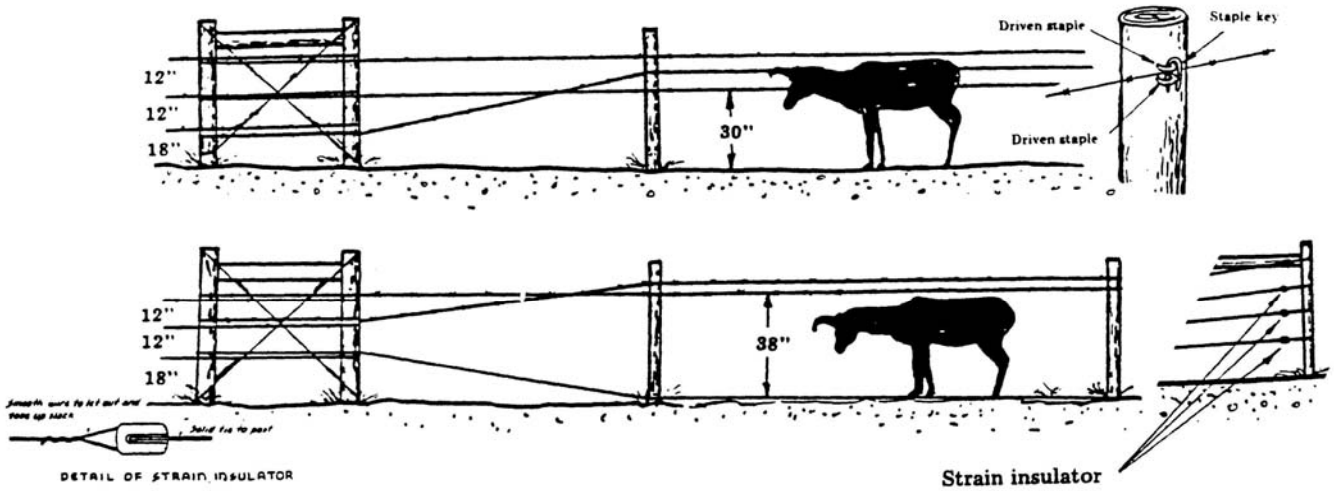


Sanderson et al (1990) *and* USDI/USFS 2400-Range 8824 2803 (1988)

Exhibit 34

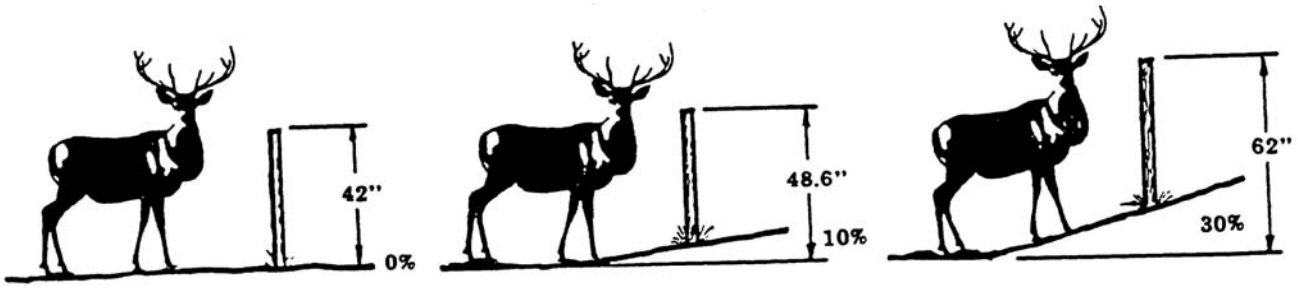
FENCE MODIFICATIONS FOR BIG GAME

Adjustable wire fences are suitable for use in areas subject to seasonal movements of big game animals when livestock are not present. A staple let-down fence allows all fencing wire to be either raised or lowered to permit unrestricted passage. Adjustable wire fences can also be used for stream crossings where conventional fencing could be subject to damage during high flow periods. This type of fence can be adjusted very quickly.



In areas of heavy seasonal movement by deer or elk, the preferred fence types are the post-pole-and-wire fence or any wood fence design. These fence designs offer a visual barrier height that these animals can negotiate without causing damage to the fence or themselves. Deer normally jump with their hind legs forward. If the top pole and the line wire are too close together, deer can entangle their hind legs. Elk drag their hind legs over the top of a barrier and seldom become entangled.

Fence barrier height presented to deer and elk is increased with an increase in ground slope.

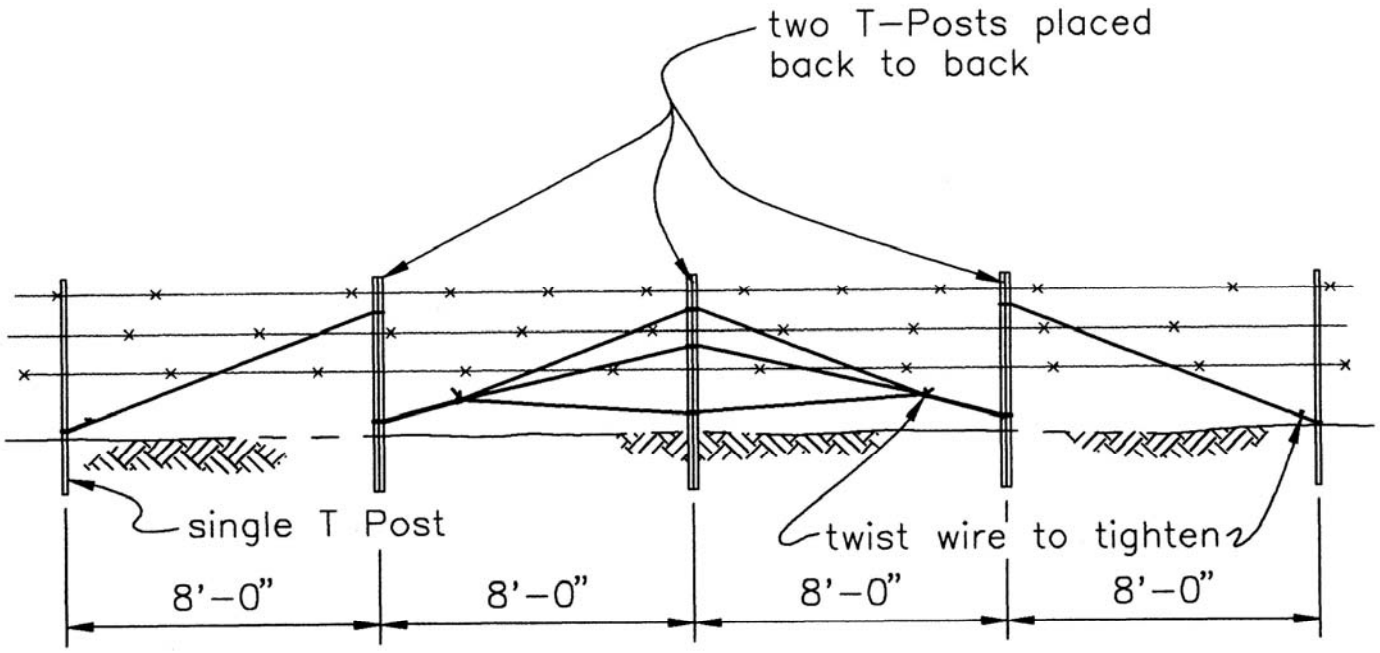


USDI/USFS 2400-Range 8824 2803 (1988)

NRCS, NV
February 1996

EXHIBIT 35

In–line stress panel–to be used only where fence is straight.

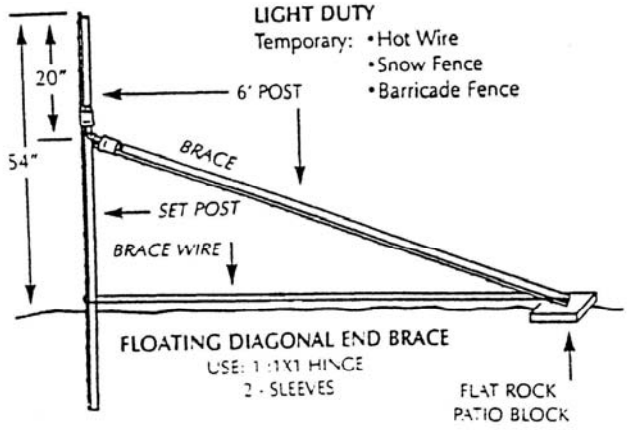


Note: When stretching wire, stretch wire from center post in panel.

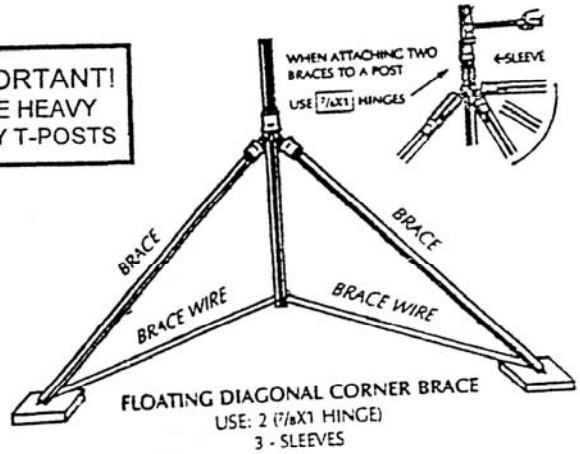
Portland, Ore
July 1996

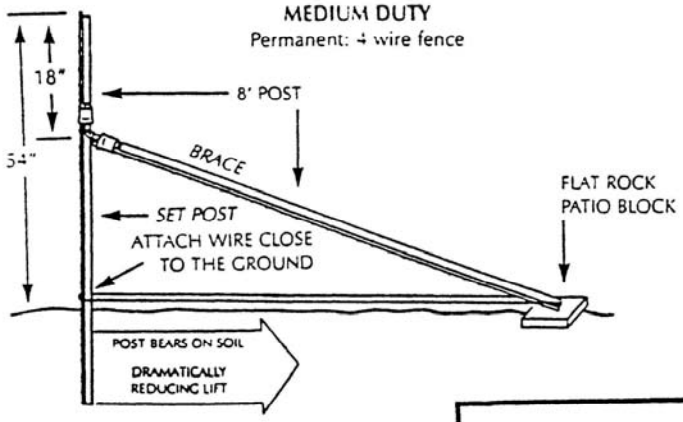
FLOATING DIAGONAL BRACES INSTALL IN JUST MINUTES!!

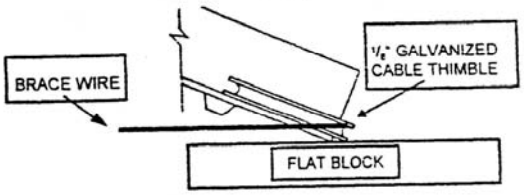
(1) Hold a hinge at the desired height on the set post .. two hinges in a corner application. Slip a compression sleeve, bell end down, over the set post and on top of the hinge, then seat the compression sleeve over the hinge by driving it home with a hammer. (2) Install one end of the diagonal brace (buttons down) to the free end of the same hinge ... butting the end of brace to set post at the desired angle ... with another compression sleeve. (3) Drive a 1/8" cable thimble on the free end of the diagonal brace that is setting on the ground. (4) Install the brace wire by tying off one end of the brace wire near the bottom of the set post. Loop the wire around the thimble on the free end of the diagonal brace. (5) Complete the wire loop and secure appropriately at the base set post ... or secure the brace wire in a single full loop with a wire strainer, gripple or wire compression sleeves. **NOTE:** 10-12.5 gauge class 3 galvanized wire is recommended for brace wire. (6) The **brace wire need only be snug.** Set final wire tension, if needed, with a hammer driving compression sleeve and hinge lower on the set post. **NOTE:** The diagonal brace "floats" on the flat block in direct response to the pull of the fence wires on the set post. The tension automatically and equitably distributes throughout the three brace members ... the set post, the brace and the brace wire. The brace wire pulls the set post horizontally and firmly against the soil, dramatically reducing set post lift!

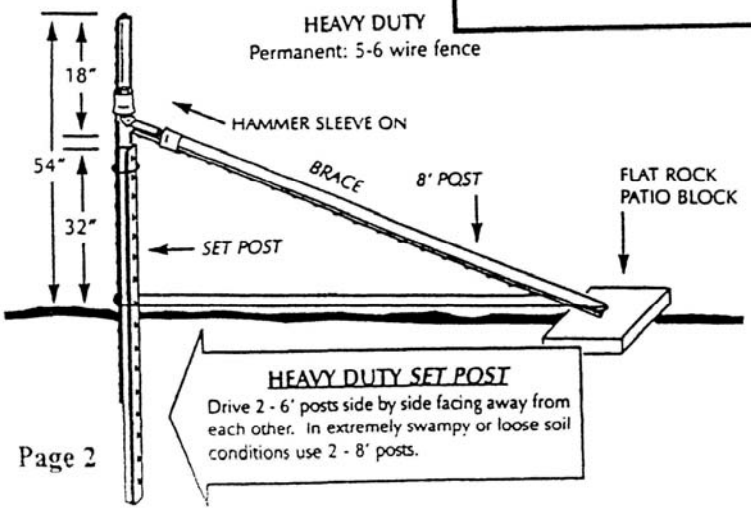


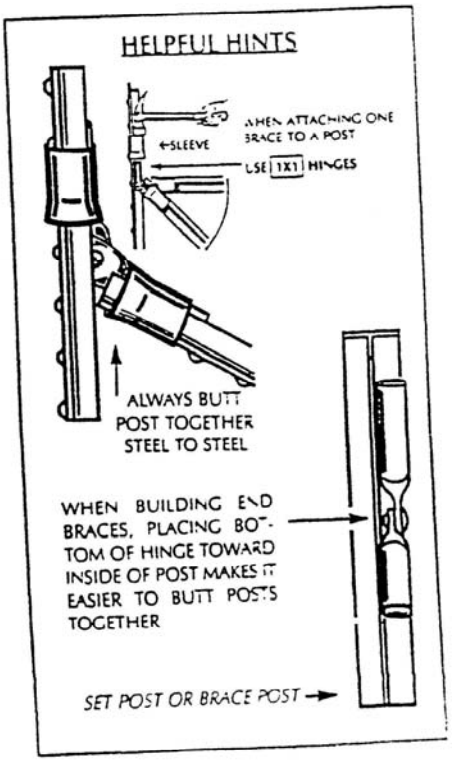
IMPORTANT! USE HEAVY DUTY T-POSTS



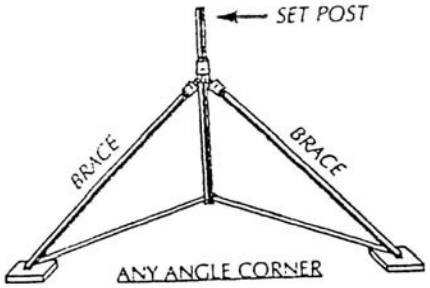




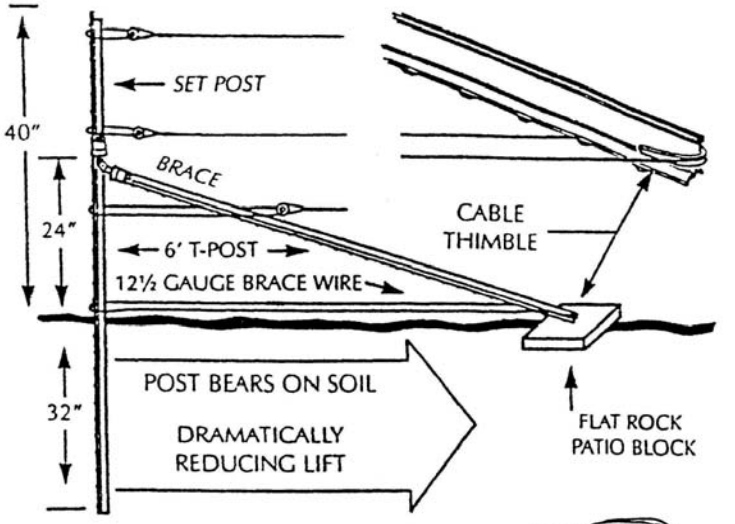


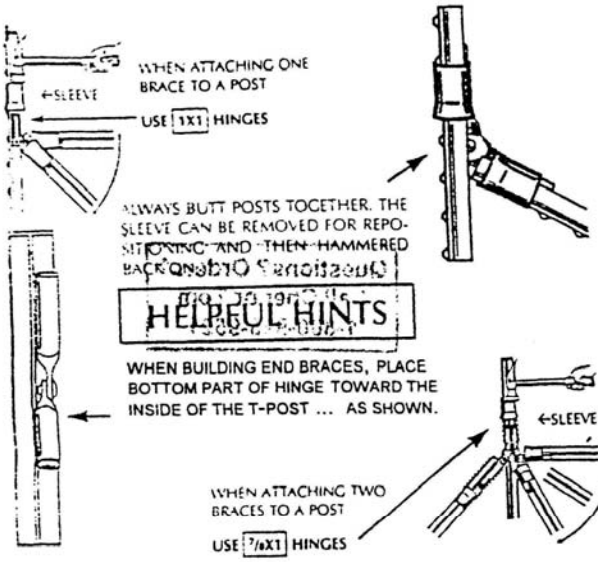


GRAZIERS • ROTATIONAL / INTENSIVE / CONTROLLED • 1-3 WIRE ELECTRIC FENCE BRACES
SPECIAL FLOATING DIAGONAL • PERMANENT OR TEMPORARY



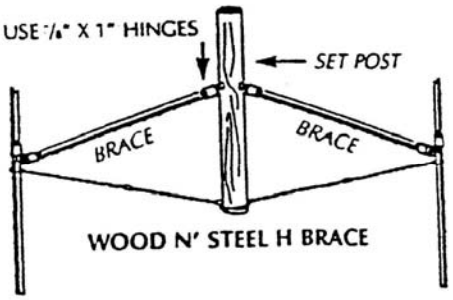
FLOATING DIAGONAL CORNER BRACE





WOOD N' STEEL T-POST CORNER END BRACING

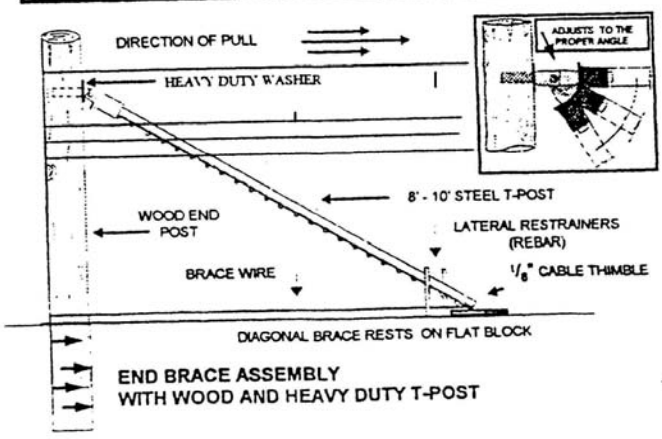
6-7 WIRE AND FIELD FENCE



WOOD N' STEEL H BRACE

IMPORTANT: ALWAYS USE 133 HEAVY DUTY T-POSTS

VINEYARD END BRACE ASSEMBLIES FIT ENTIRELY WITHIN THE VINE ROW !!!



END BRACE ASSEMBLY
WITH WOOD AND HEAVY DUTY T-POST