

# BUILDING AN ELECTRIC ANTIPREDATOR FENCE



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***Oregon State University • Washington State University • University of Idaho***

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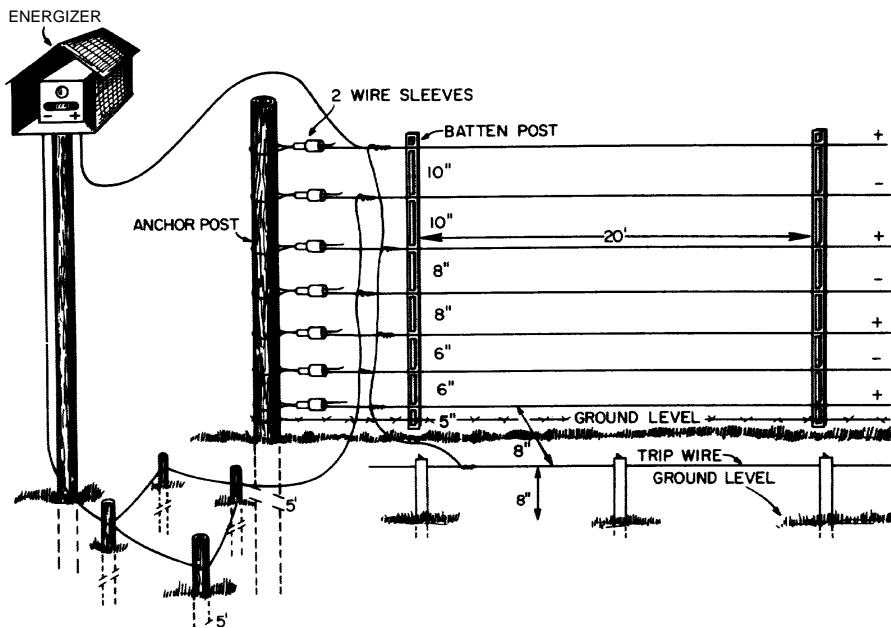


Figure 1a.—Seven-strand electric fence.

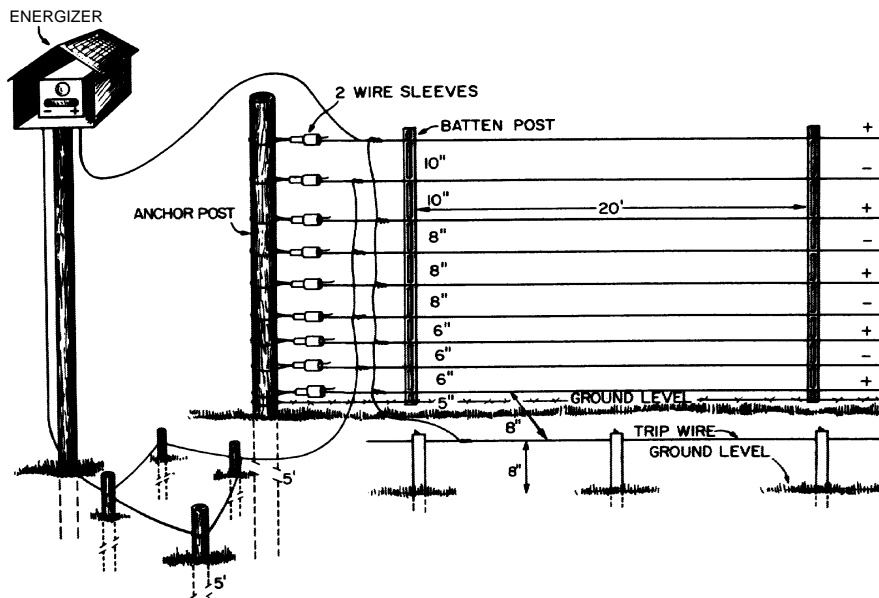


Figure 1b.—Nine-strand electric fence.

Two factors have led to curtailment of some lethal methods of combating sheep predators and limit the use of others: changes in public attitudes and more restrictive state and federal regulations.

Ranchers now use more nonlethal methods for reducing losses of sheep to predator attack. Electric fence tests in Oregon and other western states have shown that fencing can be a useful, nonlethal control tool.

Fences using only electrified wires generally have alternate strands of “hot” and ground wires. Wires are charged by electric fence controllers connected to 115-volt AC or 12-volt batteries. Prototype fences had 12 wires, but most electric fences now use only 7 or 9 wires (Figures 1a and 1b). Best results are obtained with fence controllers that generate 4,000 to 5,000 volts at the fence and have a current flow time of about  $\frac{1}{1000}$  of a second.

Intensive testing in Idaho and North Dakota revealed that fences with 12 strands absolutely prevent access by coyotes. Surveys of ranchers using 4- to 9-strand fences indicate that these fences enjoy similar success in Oregon (Table 1).

Adding two or three electric wires offset from 39-inch livestock fencing is an economical and effective way to renovate existing fences (Figure 2).

Table 1.—Effectiveness of electric fencing to reduce sheep losses to coyotes and dogs.

| Adaptations to mesh fences <sup>a</sup> |                |                           |                |            | All-electric fences <sup>b</sup> |                |                           |                |            |
|---|----------------|---------------------------|----------------|------------|----------------------------------|----------------|---------------------------|----------------|------------|
| Loss before <sup>c</sup>                |                | Loss after                |                |            | Loss before <sup>c</sup>         |                | Loss after                |                |            |
| Percent loss                            | n <sup>c</sup> | Percent loss <sup>d</sup> | n <sup>c</sup> |            | Percent loss                     | n <sup>c</sup> | Percent loss <sup>d</sup> | n <sup>c</sup> |            |
| #1                                      | 6.7            | 120                       | 0.0            | 140        | #1                               | 62.5           | 40                        | 0.0            | 175        |
| #2                                      | 12.5           | 120                       | 0.0            | 160        | #2                               | f              | f                         | 0.0            | 120        |
| #3                                      | 31.9           | 320                       | 0.4            | 1,000      | #3                               | 10.1           | 198                       | 0.3            | 600        |
| #4                                      | 37.9           | 400                       | 0.3            | 400        | #4                               | 32.0           | 125                       | 0.6            | 450        |
| #5                                      | 23.0           | 100                       | 0.2            | 170        | #5                               | f              | f                         | 0.0            | 135        |
| #6                                      | 20.7           | 1,500                     | 0.0            | 2,500      | #6                               | 5.2            | 250                       | 0.0            | 500        |
| #7                                      | —              | —                         | —              | —          | #7                               | f              | f                         | 0.0            | 300        |
| #8                                      | —              | —                         | —              | —          | #8                               | f              | f                         | 0.0            | 60         |
| <b>Avg.</b>                             | <b>22.1</b>    | <b>427</b>                | <b>0.2</b>     | <b>728</b> | <b>Avg.</b>                      | <b>27.5</b>    | <b>153</b>                | <b>0.2</b>     | <b>293</b> |

<sup>a</sup>One to four electric wires offset from existing livestock mesh fences

<sup>b</sup>Three- to nine-wire all-electric fences

<sup>c</sup>Losses incurred the year prior to building the fence

<sup>d</sup>Average of losses in years 2 through 5 after fence is built

<sup>e</sup>n = number of ewes

<sup>f</sup>No sheep in pasture before building fence

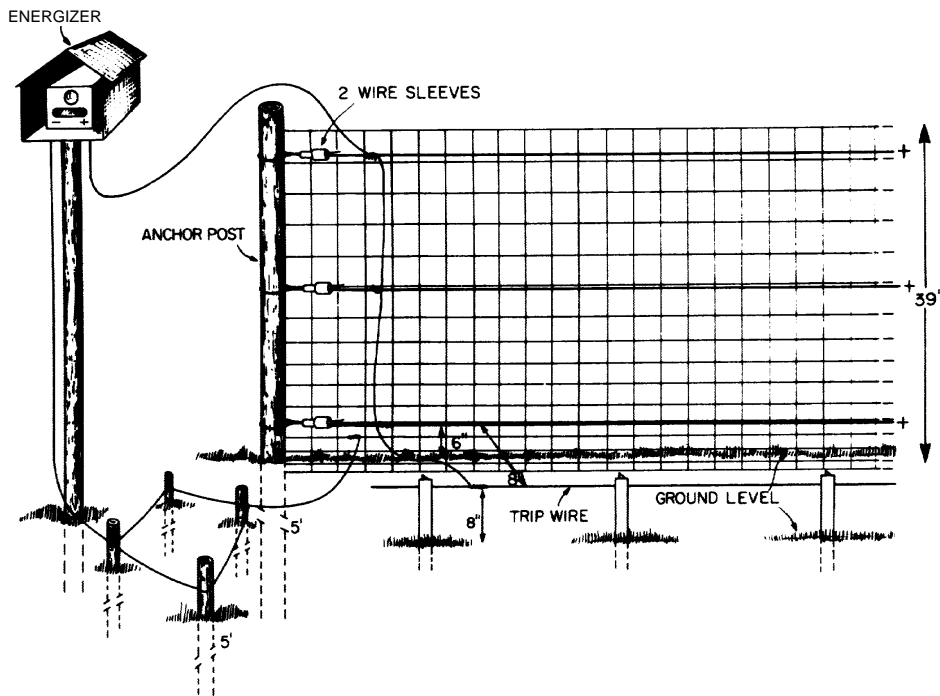


Figure 2.—Three-strand electric fence.

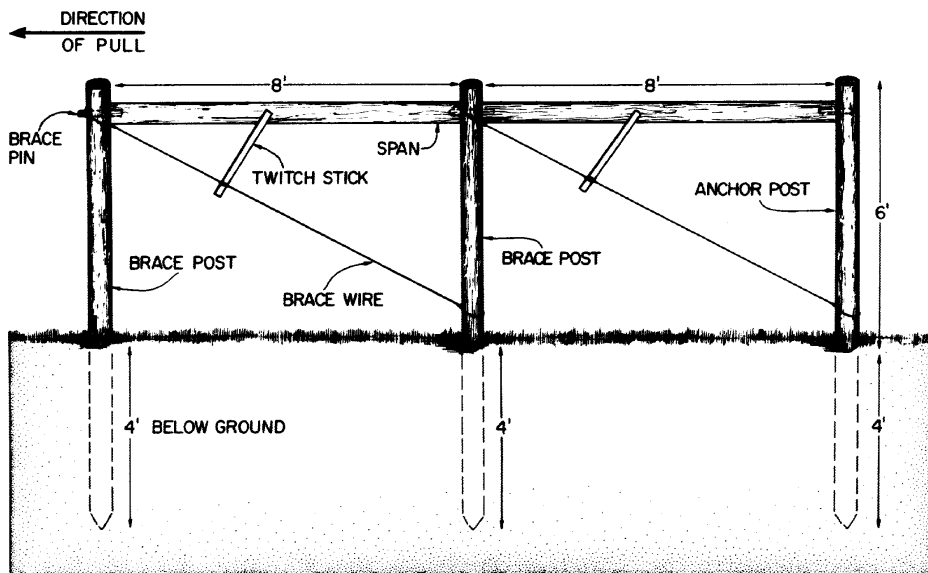


Figure 3.—Double-span strainer assembly.

The offset wires carry a positive charge, and the livestock fencing is grounded to complete the circuit. Sheep growers in Oregon report that losses have been reduced by 80 to 100 percent by this fence.

Another modification, offsetting one hot wire at the top or bottom of an electric fence, is used in a few situations in western Oregon, where coyotes learned to climb over or dig under barrier fences. Once the hot wire was placed at the top or bottom of the fence, and the net portion was grounded, losses stopped.

Electric fence systems are safe. Because the electric current is on for such a short time, little hazard is posed to humans. Normally, there is no danger of starting fires in forested areas. However, as with any electrical device, you must treat these fences with respect and caution.

An electric fence represents a long-term investment. Proper fence construction will reduce future maintenance requirements and fence failures. A survey of western sheep growers using electric fences revealed that many fences were poorly constructed at gates, end posts, and corner posts. Some were failing only a few years after construction.

Electric fences use double-span strainer assemblies (Figure 3) at gates, end points, and at intervals of 1,500 to 2,000 feet on long fences. Strainer assemblies are the source of support for the fence, so the fence will be as strong or weak as these assemblies.

Conventional corners have two double-span assemblies connected at a 90-degree angle (Figure 4). The newer single-span strainer

assemblies, erected in the angle of the corner (Figure 5), use fewer materials but are reputed to be as strong as conventional corners.

The strength of fences depends on how well strainer assemblies are built. Anchor and brace posts should be 9 feet long, at least 6 inches in diameter, and have at least 10 growth rings. Spans should be 8 feet long and at least 5 inches in diameter if round or 4 x 4 inches if square.

Use pressure-treated wood for anchor posts, brace posts, and spans. Posts pressure treated in accordance with Standard C5 (American Wood-Preservers' Association) will provide maximum service life. To avoid the potential problem of corrosion of the high-tensile fence wire, treat posts only with creosote, creosote solutions, or pentachlorophenol.

Place line posts at intervals between strainer assemblies to maintain spacing of wires and to hold the fence line parallel to the ground contour, especially at dips and hill crests. Place line posts at 60- to 100-foot intervals on flat terrain, and at 20- to 40-foot intervals over irregular ground. Line posts (wood or fiberglass) should be 7 feet long. If wood, they should be at least 5 inches in diameter and pressure treated.

Batten or "dancer" posts (Figure 1) are 5-foot lengths of fiberglass posts. Use them to maintain wire spacing between line posts and between line posts and strainer assemblies. Place battens at 30-foot intervals (Figure 6).

### Determine materials list

Make a sketch of the fence line, marking the locations for strainer assemblies, line posts, battens, and gates. This sketch will help in

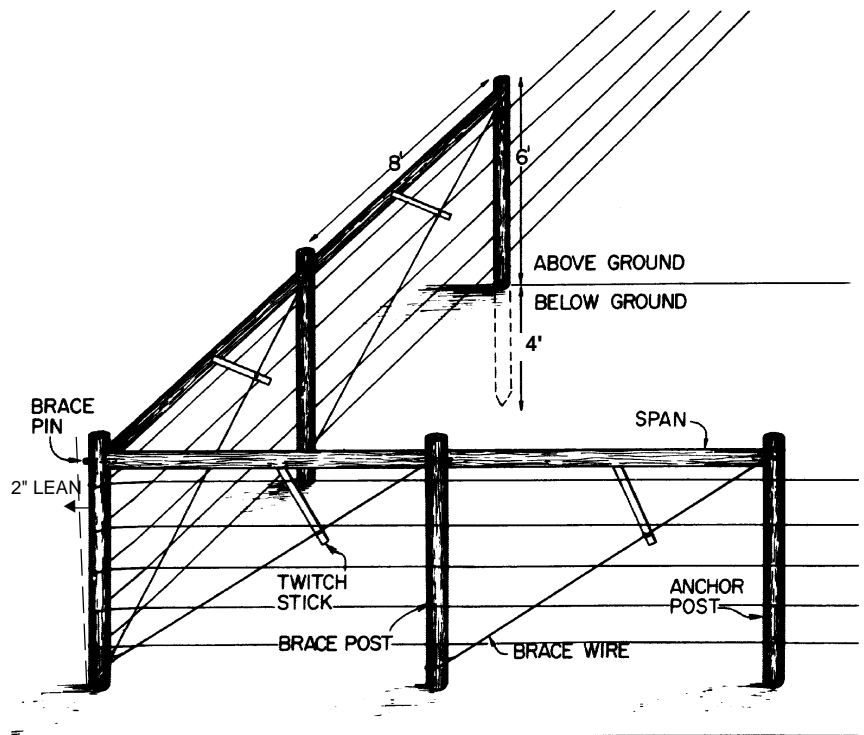


Figure 4.—Conventional corner: two double-span strainer assemblies.

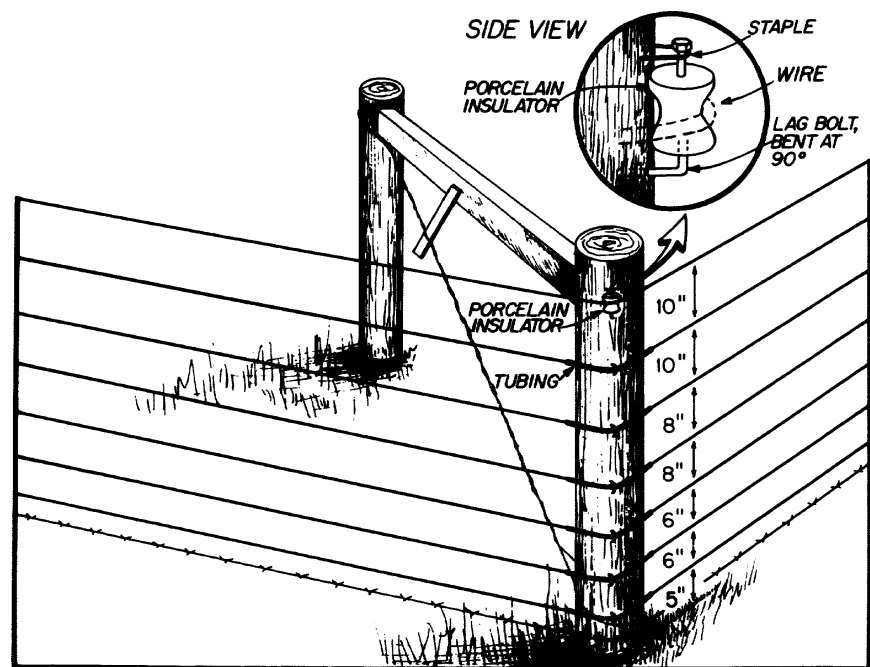


Figure 5.—Single-span strainer assembly at a corner.

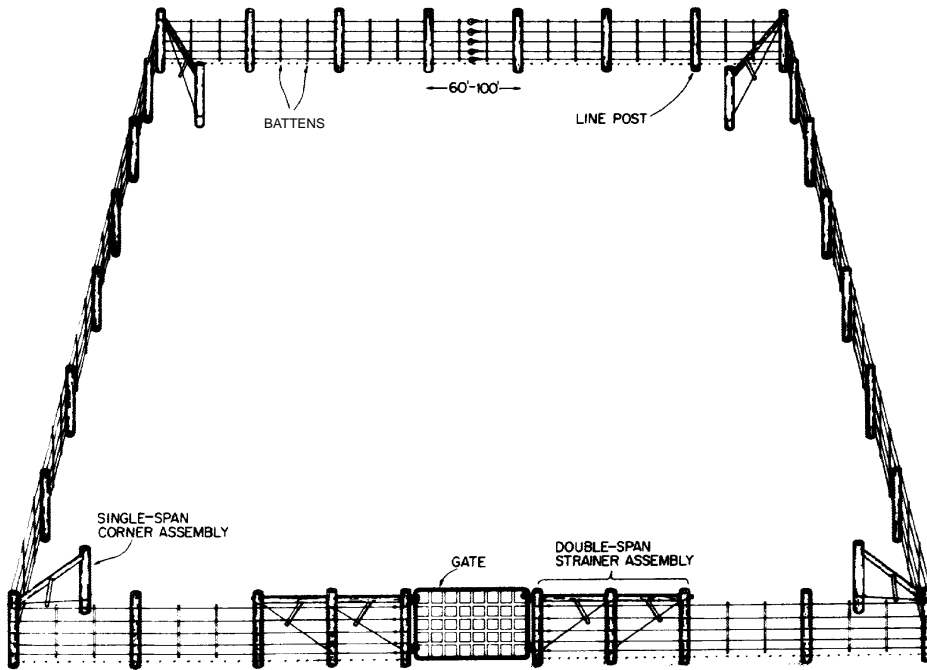


Figure 6.—Typical fence layout, with components.

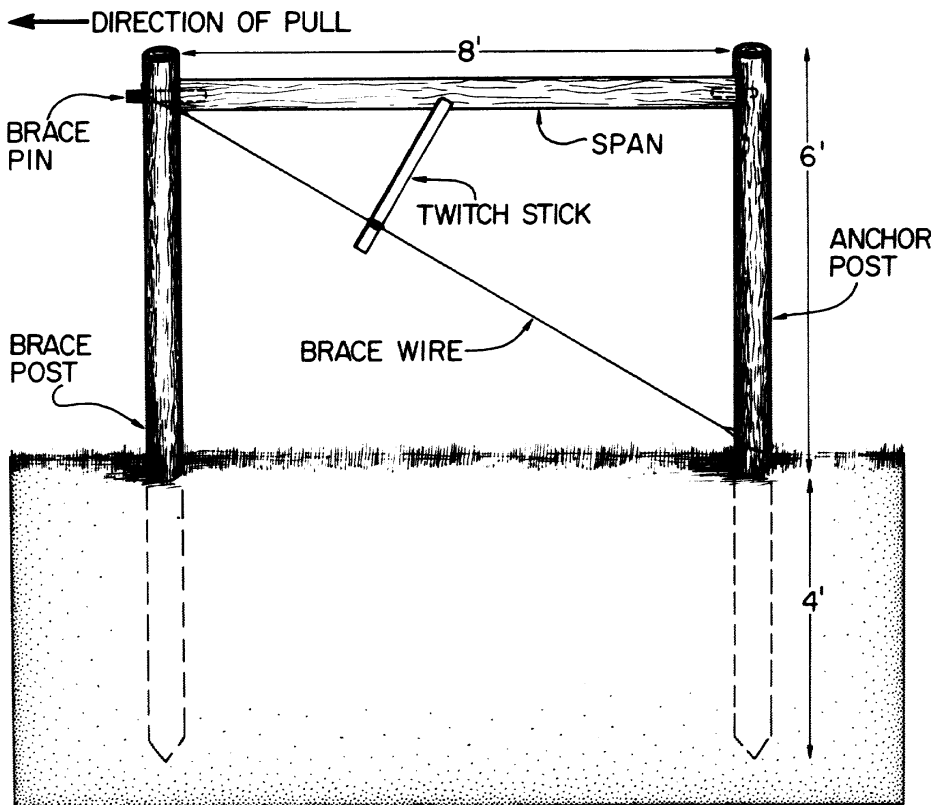


Figure 7.—Diagram of single-span strainer assembly.

determining the materials needed for the fence support system and accessory materials. Examples of a typical fence (Figure 6) and an accompanying list (Table 2) detail the materials needed. Do not buy cheaper materials to save costs; doing so only shortens the life span of the fence. It is especially important to use properly preserved fence posts; triple-galvanized, high-tensile steel wire; and galvanized staples.

### Prepare the fence line

Remove all remnants of old fences, especially corner, end, and gate posts. The fence line should be as straight as possible. Avoid dips, bumps, and gullies—or level them if possible. The best and tightest fences are built where a bulldozer can be used to scrape out a flat, level fence line.

Lay out materials for strainer assemblies at ends, gates, corners, and other fence stress points (dips, hill crests, long stretches between corners). Place them in approximate locations on straight lines.

### Build strainer assemblies

You must bury anchor and brace posts deeply enough to provide maximum resistance to pulling out of the ground. Doubling the hole depth results in four times the resistance of the fence to lifting out. A good guideline is to set anchor and brace posts at a depth equal to 10 times their diameter. For a 6-inch post, the buried depth should be 5 feet.

Dig holes for anchor and brace posts with an auger 1 to 2 inches *smaller* than the post diameter. Drive posts into the holes with tractor-mounted, hydraulic post drivers or with bulldozer blades. Driven posts may be up to 1½ times as resistant to

sagging or lifting out of the ground as tamped posts. In some cases, the hole will be larger than the anchor or brace post (if the auger is too big or no auger is available). You still can set the posts strongly by tamping with gravel.

*Single-span assemblies.* Dig the hole for the anchor post first, angled so that the top of the post will lean 1 to 2 inches *away from* the direction of pull. Drive or tamp the post. Dig the hole for the brace post, with no lean, the length of the span away from the anchor post. Make sure that all brace and anchor posts are directly on line and in line with other strainer assemblies.

Next, pin the span to the brace and anchor posts (Figure 7). Place the span between the anchor and brace posts at the top of these posts. Drill a  $\frac{3}{8}$ -inch hole through the top of the anchor and brace posts and 2 inches into each end of the span. Drive a 4-inch, galvanized,  $\frac{3}{8}$ -inch steel pin halfway into one end of the span. Lift this end of the span and place the protruding pin in the  $\frac{3}{8}$ -inch drilled hole in the anchor post.

Place the other end of the span so that the  $\frac{3}{8}$ -inch hole matches up with the  $\frac{3}{8}$ -inch hole at the top of the brace post. Drive a 10-inch long,  $\frac{3}{8}$ -inch pin through the brace post into the span, leaving 2 inches protruding (Figure 7).

Attach brace wires next. Cut 40 to 50 feet of fencing wire. Nail a staple halfway in at the bottom of the back side of the anchor post (Figure 8, page 8). Bend 3 inches of one end of the wire back on itself to form a flattened loop, and hook it through the staple. Lap the wire twice up over the protruding  $\frac{3}{8}$ -inch pin at the top of the brace post and down through the staple.

Table 2.—Fencing materials and costs per section for typical pastureland (4 miles of fence line).

|  | 3-wire<br>fence | 7-wire<br>fence | 9-wire<br>fence |
|--|-----------------|-----------------|-----------------|
| Gate and corner strainer assemblies (8)            |                 |                 |                 |
| Diagonal-stay assemblies                           |                 |                 |                 |
| 6"x 10' anchor/brace posts (16)                    | —               | 280             | 280             |
| 4"x 8' spans (8)                                   | —               | 40              | 40              |
| <i>or</i>  |                 |                 |                 |
| Double-span assemblies (12)                        |                 |                 |                 |
| 6"x 10' anchor/brace posts (36)                    | —               | 612             | 612             |
| 4"x 8' spans (24)                                  | —               | 120             | 120             |
| Brace wire, 9-gauge                                | —               | 8               | 8               |
| Inline single-span assemblies (8)                  |                 |                 |                 |
| 6"x 10' anchor/brace posts (16)                    | —               | 272             | 272             |
| 4"x 8' span posts (8)                              | —               | 40              | 40              |
| Brace wire, 9-gauge                                | —               | 8               | 8               |
| 8' fiberglass line posts (225)                     | —               | 900             | 900             |
| 4' fiberglass batten posts (475)                   | —               | 475             | 475             |
| Wire clips   | —               | 135             | 175             |
| 12.5 galvanized fence wire                         | 780             | 1,800           | 2,330           |
| Barbed wire  | —               | 700             | 700             |
| Insulators   |                 |                 |                 |
| porcelain  | 16              | 37              | 48              |
| <i>or</i>  |                 |                 |                 |
| insulated tubing                                   | —               | 250             | 330             |
| Wire strainers                                     | 125             | 300             | 380             |
| Electric controller                                | 380             | 380             | 380             |
| Voltmeter  | 60              | 60              | 60              |
| Offset wire brackets                               | 680             | —               | —               |
| Electric fence signs                               | 30              | 30              | 30              |
| Wire sleeves                                       | 30              | 65              | 80              |
| 5-panel aluminum gate (2)                          | —               | 130             | 130             |
| Miscellaneous wires, poultry/livestock fence, etc. | —               | 75              | 75              |
| <b>Total materials cost</b>                        | <b>\$2,101</b>  | <b>\$6,717</b>  | <b>\$7,493</b>  |
| Loan cost  | 400             | 2,250           | 2,650           |
| Bulldozer rental to clear 4 miles of fence line    | —               | 1,200           | 1,200           |
| <b>Total cost</b>                                  | <b>\$2,501</b>  | <b>\$10,167</b> | <b>\$11,343</b> |
| Cost per mile                                      | 625             | 2,542           | 2,836           |
| Average cost over 20 years                         | 31              | 127             | 142             |
| Maintenance per year                               | 10              | 25              | 25              |
| <b>Total cost per year per mile</b>                | <b>\$41</b>     | <b>\$152</b>    | <b>\$167</b>    |

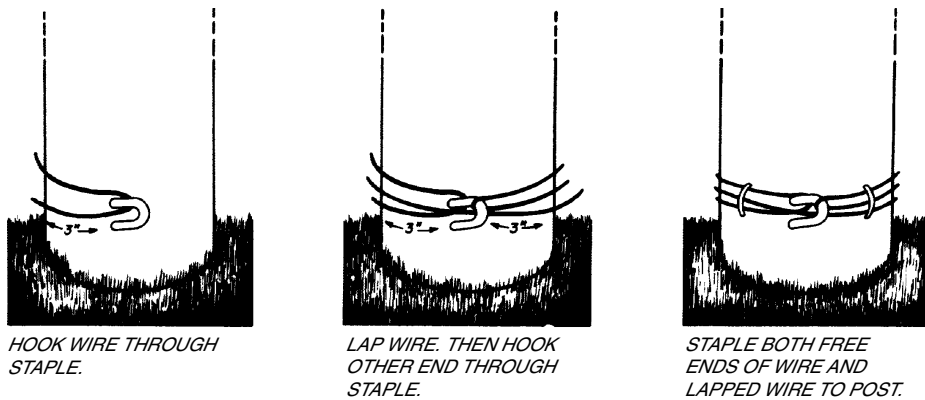


Figure 8.—Attachment of brace wires to anchor post.

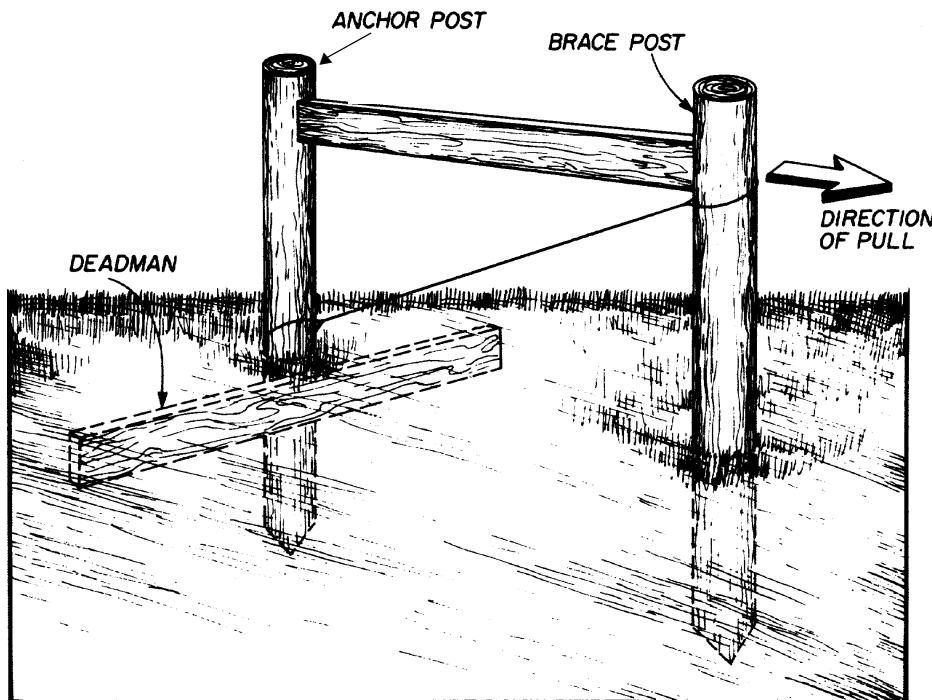


Figure 9.—“Deadman” post installation.

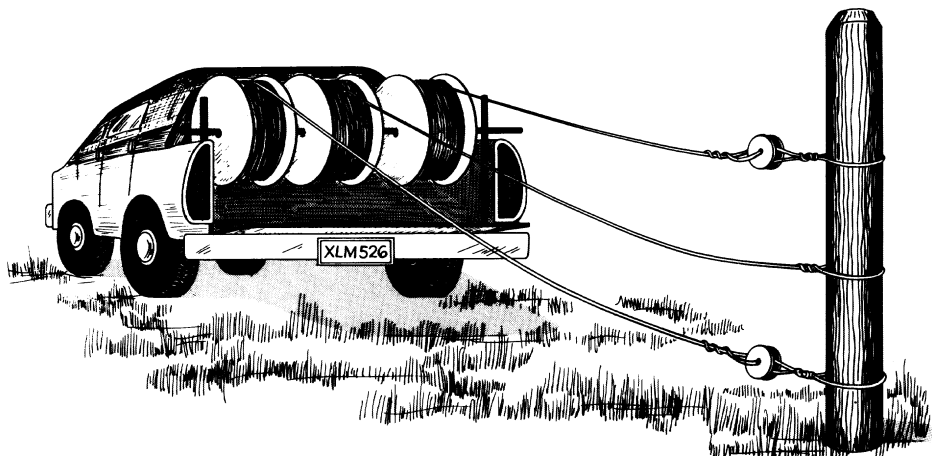


Figure 10.—Paying out high-tensile wire off a reel mounted on the back of a pickup truck

After the second lap, bend the free end of the wire back around through the staple and pull to tighten the brace wiring. Cut off excess wire so that you can bend 3 inches of free end back around the staple. Staple both free ends of the wire to the post (Figure 8).

Next, “twitch” the brace wires. Insert a 2 x 2 x 24-inch creosoted wood twitch stick between the wires, about one-third of the way down from the top (Figure 4). Standing on the *inside* of the fence, rotate the twitch stick toward yourself six to eight times until the brace wires are taut. Place the longer end of the twitch stick against the span. You can hold the stick in place against the span by stapling a short (6- to 8-inch) piece of wire over it.

*Double-span assemblies.* Construct these assemblies exactly like single-span assemblies. They merely add another brace post and span (Figure 7, page 6). Construct a single-span assembly, including brace wire and twitch stick, then place the second brace post (with no lean) in a hole on line with the brace and anchor post of the single-span assembly.

Drill a 2-inch deep,  $\frac{3}{8}$ -inch hole in one end of a second span and fit the span over the protruding pin at the top of the brace post of the single-span assembly. Place the other end of the span against the last brace post, and drill a  $\frac{3}{8}$ -inch hole through the brace post 2 inches into the span.

Drive a 10-inch, galvanized,  $\frac{3}{8}$ -inch steel pin through the brace post into the span. Leave 2 inches of the pin protruding from the brace post. Attach a brace wire and twitch stick to this half of the assembly exactly as you did for the single-span. Brace wire should go from the top of the last brace post to the bottom of the first brace post.

*Corners: conventional assemblies.* Construct two double-span



assemblies at right angles to each other, sharing one common post. Lean this post 2 inches away from the pull of both assemblies (Figure 4, page 5).

*Corners: angle assemblies.* Angle corner assemblies are single-span assemblies placed in the angle of fence corners (Figure 5, page 5). Construct them exactly like single-span assemblies. The post at the corner should lean 2 inches away from the direction of pull.

*Gate location.* Where you plan to insert gates in fence lines, construct double-span strainer assemblies, one at each end of the gate. Anchor posts should lean 2 inches away from the direction of pull.

If you have tamped anchor/brace posts and/or the soil is sandy, a “deadman” will help stabilize strainer assemblies at end, gate, and corner locations. The deadman is a 6- to 8-foot pressure-treated pole, 6 inches in diameter. Bury it against the inside face of the anchor post, just below ground level, at a right angle to the direction of pull (Figure 9).

### Lay out and stretch wire

Use triple-galvanized, high-tensile, 12.5- or 13-gauge steel wire. If the wire comes on reels, you can mount the reels on a rod and pay them out from the back of a pickup truck (Figure 10). Pay out as many reels as there are wires for the fence. If the wire comes in a bundle, place it on a “spinning jenny” (Figure 11). You can buy or rent spinning jennies through fencing suppliers, electric supply companies, or power companies. Never pull wire directly off a bundle—it will kink, ruining it.

When you come to the end of a wire, tie on a new wire, using the figure-8 knot (Figure 12), or splice wires with compression wire sleeves (Figure 13).

Compression sleeves require a special tool, which you usually can

rent from fencing suppliers. Compression sleeves are much faster and easier than tying and don’t weaken the wire like tying. Three wire sleeves are used to crimp wires together.

Wire usually is not stretched over lengths longer than 2,000 feet, nor around corners if the distance from the nearest stress point to the corner is more than 500 to 1,000 feet. Therefore, pay out wire to the corner or other stress point, cut, and lay out the next wire. Leave 3 to 4 feet of excess wire at each end to allow for tying off.

Proper spacing on the wires is essential. The bottom wire usually is 5 inches above ground level and carries a positive charge. Thereafter, wires are alternately positive and ground. (See Figure 1, page 3 for recommended spacing for seven- and nine-wire fences.) An uncharged strand of barbed wire, stretched tight at the ground level of the fence, discourages coyotes from digging under the fence.

You can place a positively charged “tripwire” 6 to 8 inches in front of the fence, 6 to 8 inches above ground (Figure 1) if you need an additional deterrent to keep coyotes from digging under or jumping over the fence.

Tie positively charged wires to anchor posts with porcelain insulators or plastic tubing. Use an anchor-post knot (Figure 14) or a wire sleeve. If you use tubing, thread the wire through about 2 inches of the tubing and tie around the post, again using the anchor-post knot or wire sleeves.

Tie ground wires directly to anchor posts (they don’t need insulators). Make sure wires that will carry positive charge are insulated from anchor, brace, and span posts. Use short (4- to 6-inch) sections of plastic tubing to insulate positive wires from the fence components. Thread the wire through the tubes first before tying it off at anchor posts.

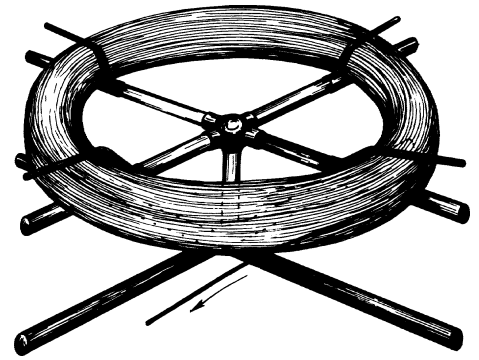


Figure 11.—A “spinning jenny.”

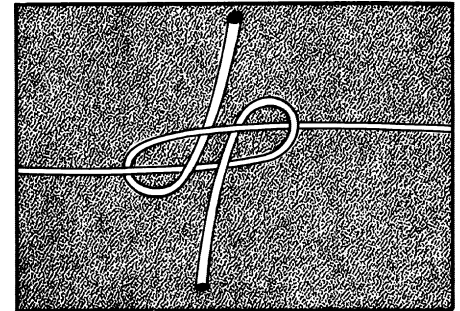


Figure 12.—A figure-8 knot.

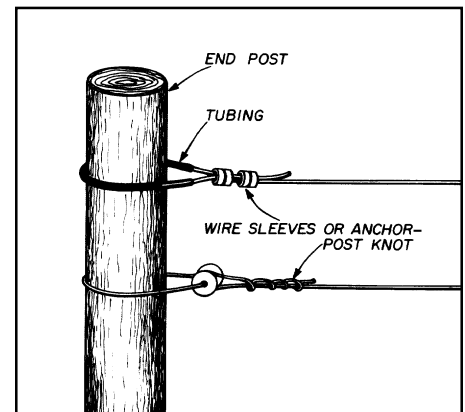


Figure 13.—Tying off wire at posts with wire sleeves or anchor-post knot.

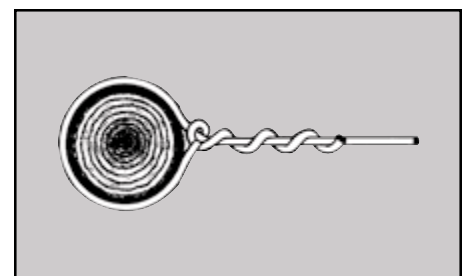


Figure 14.—Anchor-post knot.

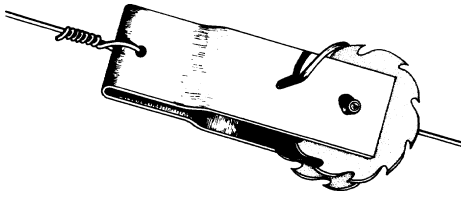
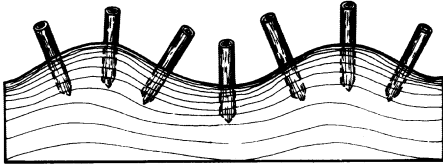


Figure 15.—Wire strainer.

POSTS POSITIONED CORRECTLY



POSTS POSITIONED INCORRECTLY

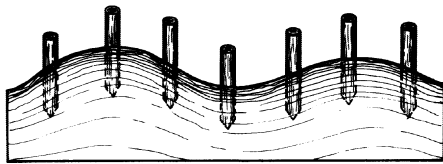


Figure 16.—Correct (top) and incorrect (bottom) placement of line posts on contour lines.

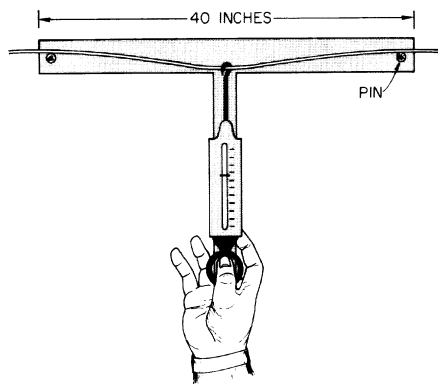


Figure 17.—Tension meter.

If you insulate all (both positive and ground) wires from posts and spans with tubing, you build flexibility into the system—you can make any combination of positive and ground wires. All wires, or lower wires only, may carry positive charge. When the ground is wet, grounded fence wires may not be necessary; all wires can carry positive charge.

Staple positive wires (inside tubing) and ground wires to posts using galvanized staples. Nail the staples diagonally to the grain of the wood, and staple loosely enough to allow the wire to move freely through the staples. Nail them just tightly enough to the tubing to prevent it from moving and exposing the wire to contact with the fence post.

When you stretch wire around a corner instead of tying it off, use tubing (but only on round corner posts; square corner posts will dig into the insulation, eventually causing it to fail) or porcelain insulators attached parallel to the corner (Figure 5, page 5). Maintain proper spacing of wires around corners with staples if tubing is used.

Tie wires to anchor posts, leaving slack in the wire. Leave a 6-inch “tail” at the end of cut wire for attachment of connector wires.

Wire must be stretched to achieve a desired tension (usually 200 to 250 pounds) so that the fence will return to its original configuration if hit by an object. Place wire strainers (Figure 15) in the middle of uninterrupted stretches of wire.

To install a strainer, cut the wire and tie one end to the strainer with an anchor-post knot or a wire sleeve, and thread the other end in the reel of the strainer. When you have connected all wires to strainers, tighten the wire until taut using a special ratchet tool. Lay out and tighten wires for all sections of the fence.

## Place and set line posts

Seven-foot fiberglass line posts generally are used. They do not require insulators. Set line posts at approximately 60- to 100-foot intervals (Figure 6, page 6) and drive them 18 inches into the ground. Seven-foot pressure-treated wood posts may be used, but they will require insulation for positively charged wires. Fiberglass posts are preferred, especially on level ground. If the ground is not level but has contours 3 feet or more below the fence line, use wood line posts (they are less likely to pull out).

Place 5-foot fiberglass batten posts at 30- to 50-foot intervals between line posts. Do not bury batten or “dancer” posts in the ground; use them to maintain spacing of the electric wires.

Make sure line posts are set directly on line between strainer assemblies. When the contour of the fence line is not flat, position line posts perpendicular to the surface of the ground where the post will be placed (Figure 16). Do not place the posts parallel to each other over contoured land; you won’t be able to maintain proper spacing of wires.

Sometimes, line posts go into the ground at an angle, or they later are found to be out of line. They are difficult to take out, but small jack-type tools (available at fencing dealers) will pull out an improperly placed fiberglass post in seconds.

## Place proper tension on wires

You can make a simple meter to measure wire tension (Figure 17). Make it from scrap 1 x 2-inch hardwood, placing two pins (wooden dowels) 40 inches apart at the ends of the meter. Place a mark on the *t* of the meter, ½ inch down perpendicular from a line drawn halfway between the two pegs. To tension the wire, place the meter halfway between the inline strainer and a strainer assembly.

Attach a small spring scale at the midpoint of the wire on the meter and pull the wire down to the half-inch mark. The wire is properly tensioned when the spring scale reads 9 to 10 pounds. Tighten wires at inline strainers until the proper tension is achieved. Recheck for proper tension after a week or two to take up any "give" in the fence. Check again in a month or so.

### Make electrical connections

Strong, positive connections with electrical wires are essential. All positively charged wires need to be connected together, and all ground wires need to be connected together at all breaks in the wire (excluding wire strainers) as shown in Figure 1 (page 3). Such locations are at end and gate posts and at the ends of long stretches of wire at inline strainer assemblies. Make connections with galvanized steel wire. (Copper, aluminum, or other wire causes corrosion and eventual failure of wire.) Make sure positive and ground wire connectors do not cross.

Ground wires must be earth-grounded at the location of the charger and at every 1/2 mile of fence line. Do this by driving four galvanized steel posts 5 to 6 feet into the ground, 6 feet apart and attaching the ground lead from the fence to the posts with pipe clamps (Figure 1, page 3). Wet seeps or other damp areas provide maximum grounding. Never place ground rods inside buildings.

### Attach wires to inline posts

If you use fiberglass posts and battens, simply clip the wires to the posts using the small metal wire clips provided. If you use wooden posts, thread plastic tube insulation on the positively charged wires and staple it firmly to the line posts. Make sure the wire inside the tubing can move freely from side to side. Staple ground wires loosely to wooden

fence posts. Maintain even spacing of the wires on these inline posts and battens.

### Install gates

The easiest type of gate to install is the standard 5-panel aluminum gate. You can wire livestock/poultry fencing to the gate to prevent coyotes from going through it (Figure 18). You can set a concrete sill (4 inches x 6 feet wide, 18 inches deep) under the gate to prevent coyotes from digging under the

fence. Bolt 1/2-inch metal rods to the top of the gate at the ends and bend them out at a 60-degree angle. Bend the livestock/poultry fencing out, away from the top of the gate, and attach it to these rods to prevent coyotes from climbing over the fence.

A cheaper solution consists of stringing positively charged wires between the gate panels and insulating them from the gate with plastic tubing. The aluminum gate can be connected to ground.

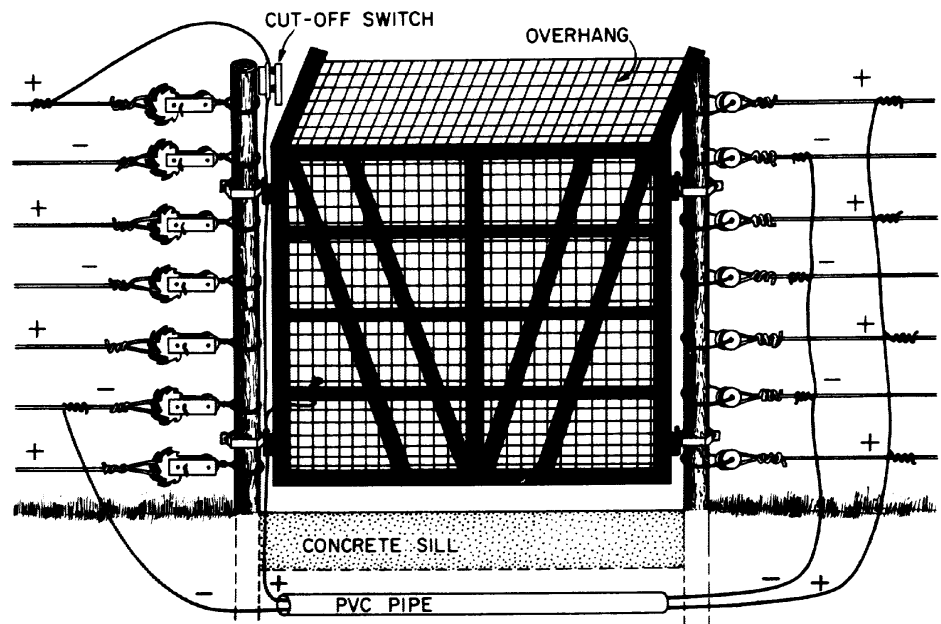


Figure 18.—Five-panel aluminum gate.

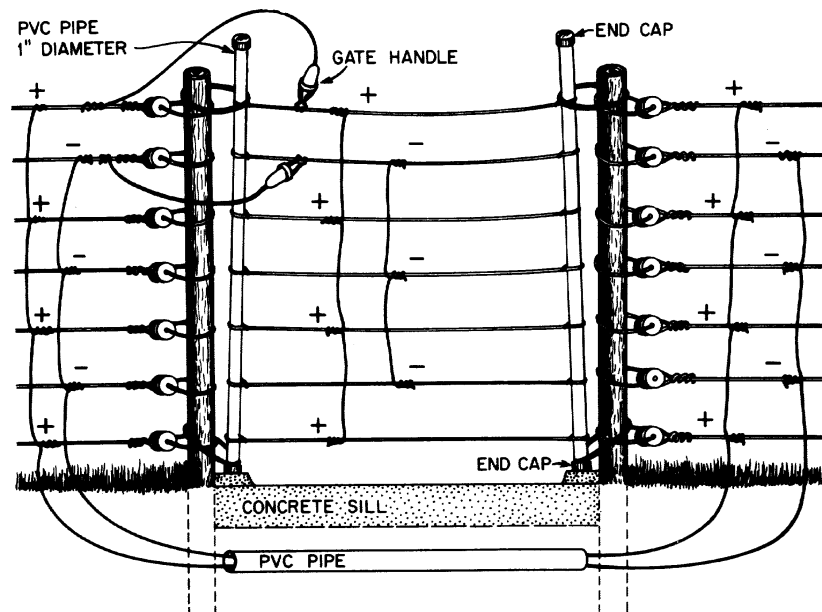


Figure 19.—Electric wire gate.

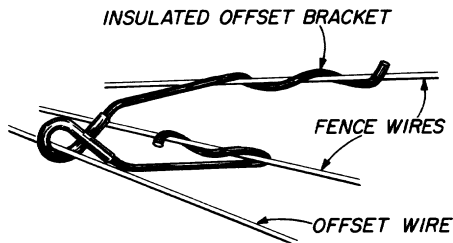


Figure 20.—Commercial offset for keeping live wire off livestock fence.

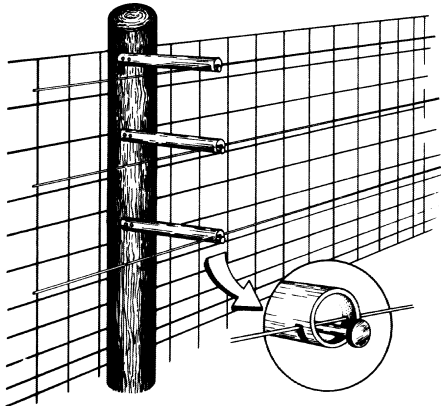


Figure 21.—Homemade offset with PVC pipe.

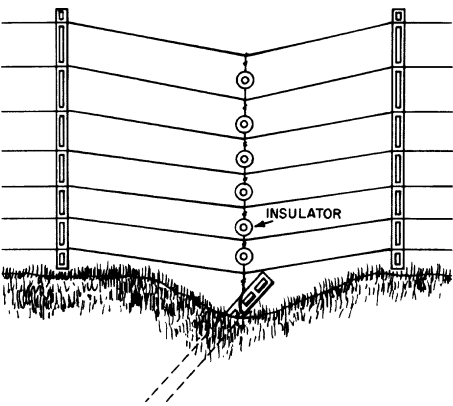


Figure 22.—Method for pulling wires down into a small dip.

Carry current over the gate on a frame with insulated wire or bury the wire under the gate in PVC pipe. If you bury it, be sure to use insulated wire. If you must use insulated tubing to carry bare wire under gates, face the tubing *downward* at the point it connects to the hot wires on the fence to prevent water from pooling in the tubing and shorting out the fence.

You also can construct electric wire gates (Figure 19, page 11), but they are less rigid and take less punishment than panel gates. You also must carry the current across the gate, and this is an additional point where a breakdown in transmission of current can occur.

### Adapting existing livestock fence

Many growers have found that adding two or three strands of hot wire outside existing conventional livestock net fencing stops predation. It certainly is an inexpensive addition.

The wires usually are offset 6 to 8 inches from the top, bottom, and middle of the fence to stop coyotes from climbing over or through or digging under existing fences. You can purchase offsets (Figure 20) that clip on to the net fencing, or you can make your own. Slit an 8-inch section of  $\frac{3}{4}$ -inch PVC pipe parallel to one end to a depth of  $\frac{1}{4}$  inch.

Place the wire in the slit and insert a nail in the pipe between the wire and the slit to hold the wire to the insulator (Figure 21). Secure the pipe to wood fence posts by two 14-penny common nails driven through holes drilled in the PVC. The life span of these homemade offsets is unknown, but they have lasted at least 5 years on some fences in Oregon.

Connect wires to anchor posts in the same manner described for positively charged wires on all-electric wire fences. Strainer span assemblies are not needed. The electric wires on these adapted fences do not need to be protected as much

against loss of configuration, so the tension does not need to be set very high.

Often, ranchers simply attach the wires and tighten them with wire strainers until all slack is taken up from the electric wires. Ground the net portion of the fence to ensure maximum shocking effect. Ground every  $\frac{1}{2}$  mile of net fencing in the same manner described for all-electric wire fences (page 11).

### Selecting and placing electric controllers

The heart of an electric fence system is the controller. Use only high-quality, high-output controllers. Protect the controllers from weather, animals, and curious people as much as possible. The safest and most protected locations are inside barns, sheds, or other utility-type buildings. If you can't use such a structure, build small houses for remote units that blend into the background and are well insulated from wind and precipitation.

The controllers are reputed to hold charge on 50 miles of line. (For a 7-strand fence with 4 hot wires, one controller could charge approximately  $12\frac{1}{2}$  miles of fence line.) For fences where the sum length of all hot wires exceeds 50 miles, install additional controllers. Be sure that sections of fence operated by different controllers are not connected together electrically.

Attach the positive lead from the controller directly to one of the hot wires, which in turn is connected to all other hot wires (Figure 1, page 3). The ground lead from the controller is attached to one of the ground pipes in a typical grounding assembly, which in turn is connected to all ground wires on the fence (Figure 1).

It is essential that you keep proper voltage on the fence at all times. Use small, inexpensive voltmeters to check the voltage daily. A drop in voltage to below 1,000 to 2,000 volts

indicates a short in the system that must be investigated. Some ranchers install the voltmeter alongside the controller and leave it permanently attached to the line for easy inspection.

### Dips, gullies, and streams

Maintain spacing of wires at dips, gullies, and streams. Otherwise, coyotes will cross the fence at these potential weak links. For small dips (usually less than 2 feet deep and 6 inches across), you can connect the wires together (insulated from each other), pull them down, and tie them at a metal stake driven 4 feet into the ground at a 45-degree angle (Figure 22).

Gullies present a larger problem; you won't be able to pull down the wires of an electric fence far enough to seal off the gully. Continue the fence over the gully and fill the gap with a continuation of the electric wire fencing (Figure 23).

Coyotes use stream beds and banks as travel routes; you must maintain fence integrity at these locations. Build the fence line right to the banks of the stream on both sides, using strainer assemblies on each side to anchor the fence line.

To block coyotes from crossing the fence line in the stream, bridge the gap above the water with electric wires or poultry/livestock fence. Attach a top-hinged, self-cleaning floodgate to the bottom of the fence line (Figure 24). Wire tightly strung barbed wire or poultry/livestock fencing to the floodgate. If you use poultry/livestock fencing to span the gap above the stream, carry the current over the stream on a system of stout poles.

### Miscellaneous tips

One of the more common sources of loss of charge on a fence is grounding by wet vegetation. Electric fences require constant weed control

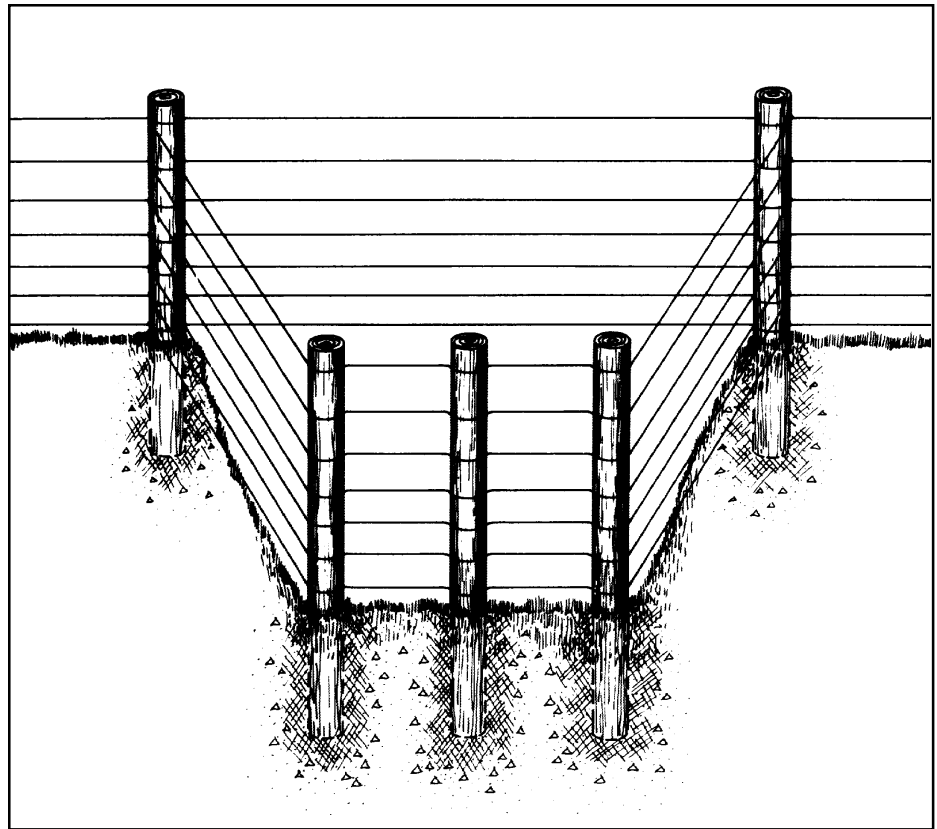


Figure 23.—Extension of electric wire fence down into a gully.

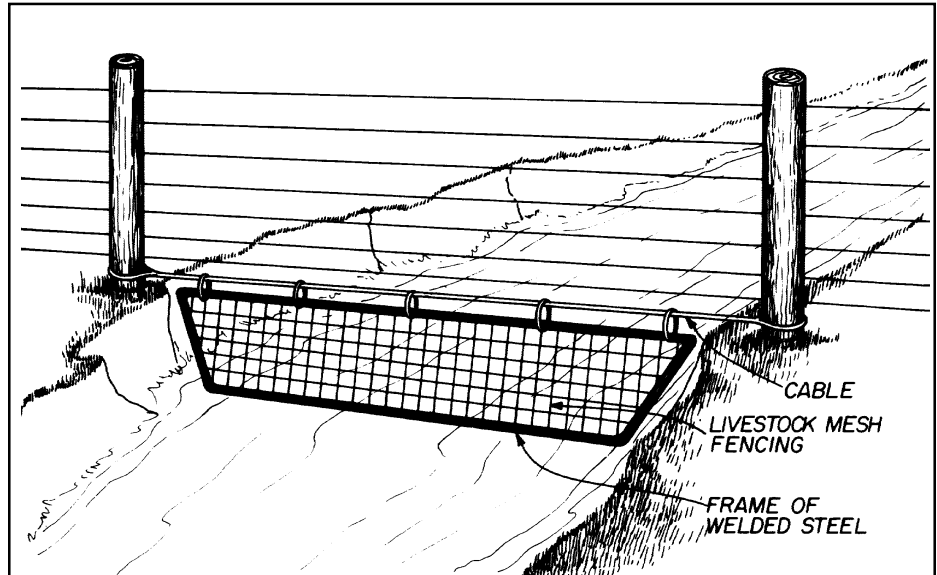


Figure 24.—Top-hinged, self-cleaning floodgate.

and must be checked every few days to ensure the fence is working properly and has not become grounded. As needed, clear the fence line of herbaceous vegetation, either with an herbicide or a hand-held weedcutter.

If you use herbicides, glyphosate works well on emergent vegetation. You also might need to use herbicides such as bromacil or diuron to control preemergent vegetation. If used properly, none of these herbicides should cause corrosion of galvanized, high-tensile fence wire.

Sometimes, it is difficult to locate the source of a short on a fence. You might install cut-off switches at various intervals along the fence, such as at gate locations, to segregate various segments to test for shorts (Figure 18, page 11). Pinpoint shorts by using a transistor radio tuned so only static is heard. As the radio is brought close to a short, it produces audible clicks.

Because of the high voltage generated by the electric controllers, you'll need to nullify the potential for arcing by avoiding metal-to-metal contacts. One place arcing occurs is between steel fence posts and positively charged wires. Elimination of steel fence posts from the fence

line will greatly reduce the already small hazard of a fire.

Another source of grounding is fallen limbs from trees near the fence. Inspect all trees close to fence lines for limbs hanging over the fence line; they could fall and cause the fence to short out. Remove these limbs.

Occasionally, livestock will rub on the fence's brace, anchor, and line posts; this can damage corner angle assemblies. You can eliminate this rubbing by stringing a hot wire along the strainer assembly and insulating it from the frame.

In areas where snowfall is a regular occurrence, maintain your fence's effectiveness simply by removing the charge from the lower positively charged wires as the snow depth builds so that charged wires are always above the level of the snow.

You should place electric fence signs on your fence at intervals of 200 feet, especially in areas where the fence is close to public roads.

Although you can use barbed wire effectively at the bottom of a fence to keep coyotes from digging under, do not use it to replace the high-tensile wire that carries positive or ground charges. Barbed wire usually will not take the tension required for electric fences.

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### **Use herbicides safely!**

- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use.
  - Read the herbicide label—even if you've used the herbicide before. Follow closely the instructions on the label (and any other directions you have).
  - Be cautious when you apply herbicides. Know your legal responsibility as an herbicide applicator. You may be liable for injury or damage resulting from herbicide use.
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## Costs

The cost of materials is difficult to reduce. Quantity buying by several individuals may help. Use of lower quality materials is not recommended; they could increase maintenance costs and shorten the life span of the fence.

Labor has been calculated into the estimated costs below. Labor cost varies depending on the labor force available and the type of terrain to be fenced. Family labor reduces the cash outlay, but the actual cost of family labor varies for each operation and must be assigned a dollar value.

Labor costs may be approximately \$1,400 per mile. Maintenance costs on these fences will approach \$220 per mile annually, based on 20 hours of maintenance at \$8.00 per hour, plus \$20.00 for vehicle and supplies and \$40.00 for herbicides.

### Determining feasibility of fencing

Predator fencing must pay for itself to justify its use. The following calculations will help you decide whether your sheep losses caused by dog and coyote predation are high enough to justify building a fence. Calculations are based on a 20-year life expectancy for the fence and the assumption that predator fencing will nearly eliminate losses to predators.

- Number of sheep that must be saved each year to justify costs

$$= \frac{\text{Ownership cost of fence per year}}{\$ \text{ value of sheep per head}}$$

- Ownership cost per year
  - = Cost of fence per year
  - + Annual interest on investment
  - + Operating costs per year

*Example:* Fence one section, requiring 4 miles of fencing with 9-wire fence, assuming a 15 percent interest rate and an average value of sheep of \$60.00.

|          |                      |              |
|----------|----------------------|--------------|
| a. Fence | Materials, bulldozer | \$ 7,660     |
| costs:   | Labor                | <u>5,600</u> |
|          |                      | \$13,260     |

$$\begin{aligned} \text{Fence cost per year} &= \frac{\$13,260}{20 \text{ years}} \\ &= \$663 \text{ per year} \end{aligned}$$

- b. Annual interest on investment = average investment x interest rate

$$\begin{aligned} \text{Average investment} &= \frac{\text{fence cost}}{2} \\ &= \frac{\$13,260}{2} = \$6,630 \end{aligned}$$

$$\text{Interest rate} = 15\%$$

$$\begin{aligned} \text{Annual interest on investment} \\ &= \$6,630 \times 15\% = \$995 \text{ per year} \end{aligned}$$

- c. Operating costs

$$\begin{aligned} &= \text{maintenance cost/mile} + \text{herbicide cost/mile} \\ &= \$220/\text{mile} \times 4 \text{ miles of fence} = \$880 \text{ per year} \end{aligned}$$

$$\text{Ownership cost per year: } \$663 + \$995 + \$880 = \$2,538$$

Number of sheep that must be saved each year to justify cost of fence

$$= \frac{\$2,538}{\$60} = 42 \text{ sheep}$$

Thus, if you grazed sheep in a 1-section pasture and had losses averaging more than 42 sheep per year, you could justify building the fence.

Assuming the seven- and nine-wire fences both nearly eliminate losses, it is more economical to build the seven-wire fence. However, the nine-wire fence is 20 inches taller and will better eliminate losses by coyotes that jump over fences. Many sheep growers prefer the extra margin of safety afforded by the nine-wire fence for a slightly higher fence cost.

You may wish to enclose a small pasture with an electric fence and use it as a night-holding pasture, a lambing pasture, and/or a pasture for use when predation losses are expected. This arrangement will reduce the amount of land enclosed by the fence, resulting in lower fence costs, but it will not protect your sheep full-time.

Predator fencing is one method for protecting livestock from coyotes, but the potential of fencing must be evaluated for each livestock operation. Fencing is not applicable to all operations, especially trailing sheep on open range, but it has been economically justifiable to farm-flock producers in the Pacific Northwest. Even where electric fencing is used, the need for lethal control methods exists. Occasionally, a coyote will get inside an electric fence line and kill sheep. You can easily control these coyotes with traps and snares or by shooting.

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### Suppliers of fencing materials

This list of suppliers of electric fence components (primarily controllers and wire) does not represent endorsement by the Oregon State University Extension Service, Washington State University Cooperative Extension, or University of Idaho Cooperative Extension System, nor is the list exhaustive.

- The suppliers have local distributors who may be identified by contacting the main supply offices.
- Gallagher Power Fence, Inc.,  
P.O. Box 708900, San Antonio, TX 78270 (1-800-531-5908; 210-494-5211)
- Kiwi Fence Systems, Inc.,  
121 Kiwi Road, Waynesburg, PA 15370 (724-627-5640)
- Live Wire Products,  
1127 E Street, Marysville, CA 95901 (530-743-9045)
- Premier Fence & Supply Company,  
3607 McGhee Road, Maryville, TN 37803 (800-430-8561; 865-379-2348)
- Waterford Corporation,  
P.O. Box 1513, Ft. Collins, CO 80522 (970-482-0911)
- Wilco Farm Stores,  
33685 Hwy 99E, Tangent, OR 97389 (541-926-4404)

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