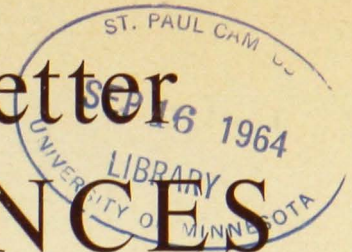
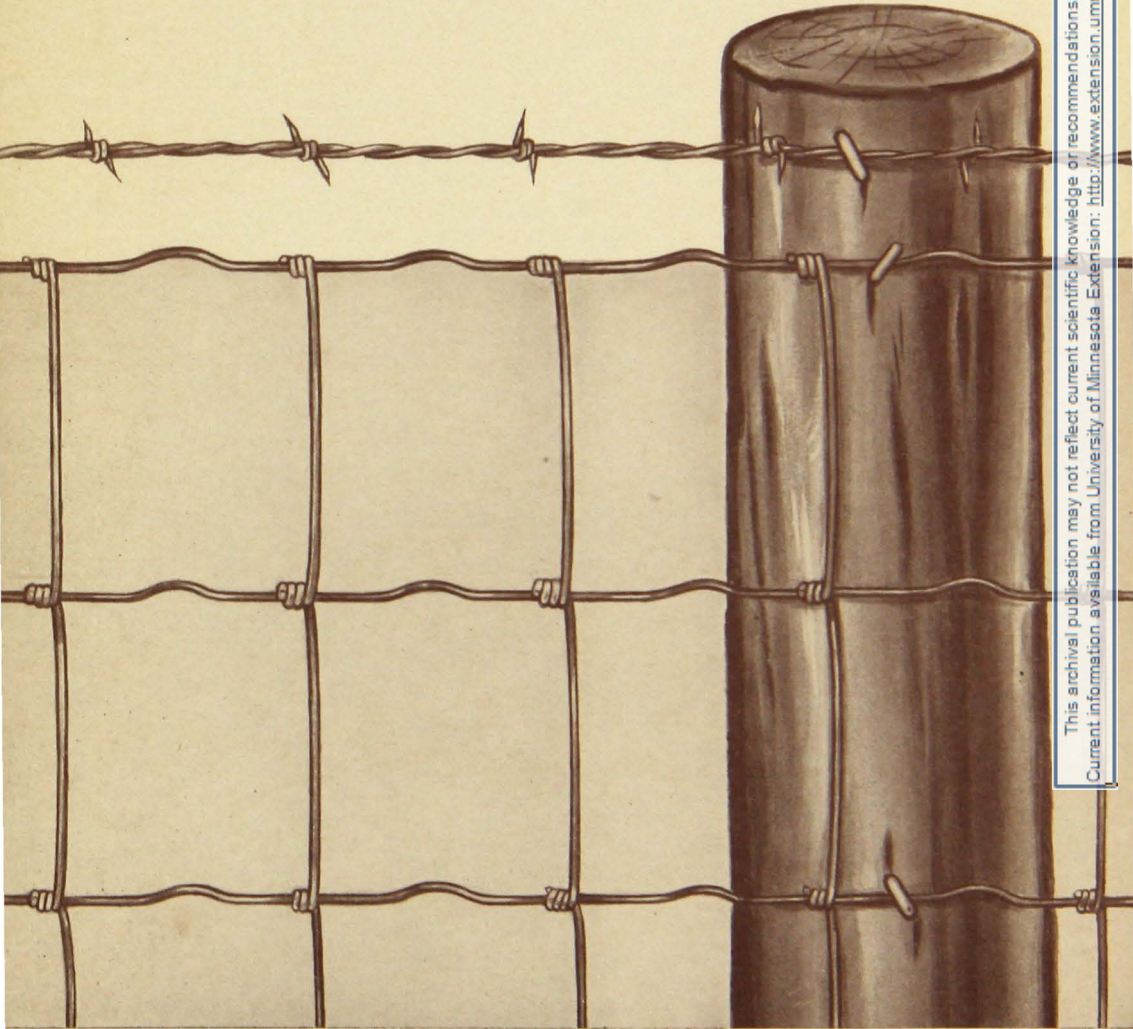


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# Building Better FARM FENCES



John R. Neetzel



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AGRICULTURAL EXTENSION SERVICE

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## Well-Built Fences Remain Maintenance- and Repair-Free for Many Years



This fence was built in June 1952 using pointed 3-inch-top treated wood posts. The line posts and corners were all set with a power post driver.



The same fence in March 1964—after nearly 12 years of service. The pasture on the right has been used each summer by beef cattle. The fence has received no maintenance or repair since it was built.

# Building Better FARM FENCES

John R. Neetzel<sup>1</sup>

Much has been done during the last half century to improve the quality and increase the service life of fencing materials. Fence wire and fasteners have been greatly improved. Treated wood posts which will last 25 to 30 years or longer are now extensively used.<sup>2</sup>

In contrast, little improvement has been made in fence construction methods. Improvements in construction can be just as important as better materials in reducing fence construction costs and in assuring long service life with a minimum of maintenance.

Several important steps in fence construction are described in this publication. Steps are discussed in the order usually followed when building a fence. Most recommendations also apply to fence maintenance.

Only wood corner and line posts are considered here because studies and experience have shown they are long-lived and superior in strength and overturn resistance. Also the wire can be attached easily to wood posts. By power driving, wood posts can be set easily and rapidly.

Not all details of fence construction are included, and no attempt is made to discuss all the good ways to build a satisfactory fence. However, if these suggestions based on research and observations are followed, a well-

constructed, economical fence can be built.

## Use Posts With Long Service Life

Durable posts are an essential part of the economical farm fence. Posts used in early fences were cut from the heartwood of naturally durable woods such as eastern redcedar, white and bur oaks, walnut, and northern white cedar. These posts gave 15 to 20 or more years of service. When available, posts cut from the heartwood of these durable species can still be used without treatment.

As the supply of durable woods decreased and the need for farm fences increased, less durable woods such as red oak, tamarack, birch, aspen, and pine were often used for posts. These posts, when used untreated, usually rotted off within a few years.

Service tests begun many years ago demonstrated that treated wood posts give a service life of 20 or more years. As a result, increasing use has been made of wood posts treated with either pentachlorophenol or creosote.

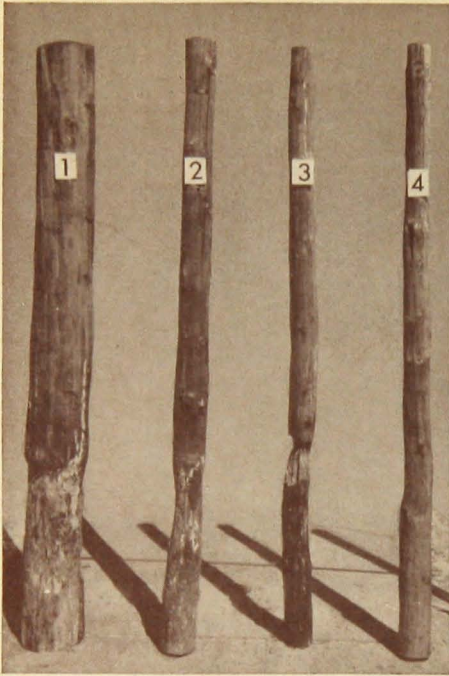
Most commercially treated posts are made from young pine trees cut as thinnings from dense stands of second growth timber and plantations. These pine posts readily absorb the preservative and give many years

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<sup>1</sup>The author is a forester, employed cooperatively by the University of Minnesota School of Forestry, and the Lake States Forest Experiment Station, U.S. Forest Service.

<sup>2</sup>Much of the research which forms the background of this publication was done at the Cloquet Forest Research Center and the Agricultural Experiment Station, Rosemount.





*Treated posts last longer.* Posts 1 (8-inch top), 2 (5-inch top), and 3 (3-inch top) were not treated and post 4 was treated with an effective preservative. Ground line diameter was reduced by decay after 3 or 4 years in untreated posts; post 4 was in perfect condition after 7 years of service.

of service in the fence when adequately treated.

Posts 4 to 5 inches in diameter were commonly used in early fences. As second-growth trees were used for posts there was a trend toward larger diameters which had a greater volume of the more durable heartwood. The untreated wood post, unless cut entirely from heartwood, begins to decay almost as soon as it is set. Both ground line diameter and strength decrease rapidly until the post eventually fails.

The use of preservative-treated wood posts again makes it possible and economically desirable to use

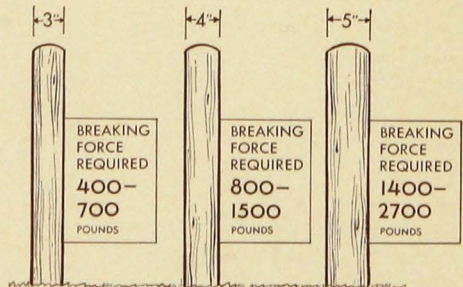
those of small diameter. Initial size and strength of such posts are retained throughout most of the service life, and 3- to 4-inch posts are adequate for line construction.

When fencing on sandy or very wet soils or on side hills, use 4- to 5-inch posts for greater overturn resistance. These larger posts are also recommended for contour fencing. Line posts should be 6½ to 7 feet in length. When fencing through ravines, along lakes or streams, and around barnyards, use 8-foot posts with a 4- to 5-inch top diameter.

## Set the Corner Posts

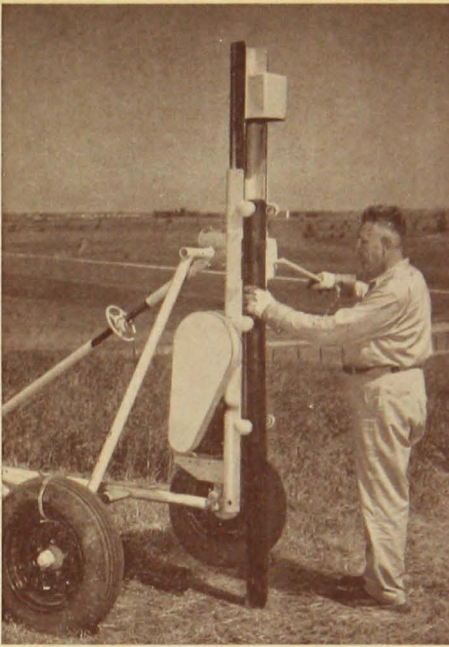
Locating corners, ends, and gates is the first step in building a fence. Set permanent corner and gate posts at these points and develop the fence between them.

In the past, the large corner, end, and gate posts have been set by hand methods. Setting a single post often took several hours. Anchors of various types were sometimes attached to the bottom; frequently these large posts were set in concrete.



*Approximate strength of wood posts.* The small values for each size are for northern white cedar while the larger values are for white oak. Jack pine, tamarack, and most other species fall between these extremes. Strength is computed for a force exerted 4 feet above the ground line on green posts.





Power driving corner post with trailer model driver.

Corner posts can now be power driven in a few minutes. Actual driving time is less than 5 minutes for an 8-inch, 8-foot post set  $3\frac{1}{2}$  feet deep in dry soil. Not only can the posts be driven rapidly, but they are set firmly in the ground with all displaced soil packed tightly around them.

## Keep Fence Lines Straight

A barbed wire stretched tight and straight between ends or corners is an excellent guide for preparing the holes or setting line posts. A straighter line usually results from this than from the older practice of sighting each post. Marking the line with a barbed wire also saves time.

Keep holes and posts a uniform short distance (a few inches) from the wire to avoid disturbing the straight line. Set a few temporary

short stakes or pins along the wire to secure it against movement by tractor wheels or wind. This guide wire can later be used as one of the fence wires.

## Building the Fence Corner

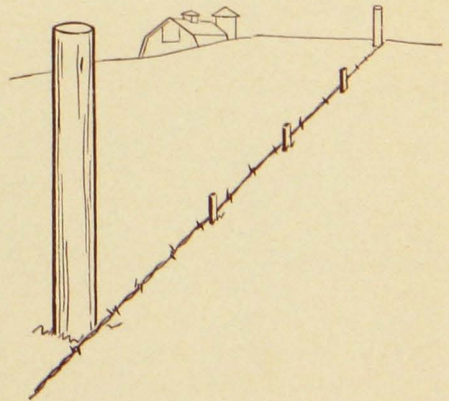
The corner is the foundation of any fence. You can easily build the Rosemount corner illustrated (page 6) with inexpensive small-diameter treated wood posts.

Cut shallow notches in the ends of the braces. No cutting or notching of the posts is necessary.

Place the braces *parallel* with the ground and near the top of the posts. When placed at the top level of the woven wire or the top barbed wire they help protect the wire if people climb over the fence.

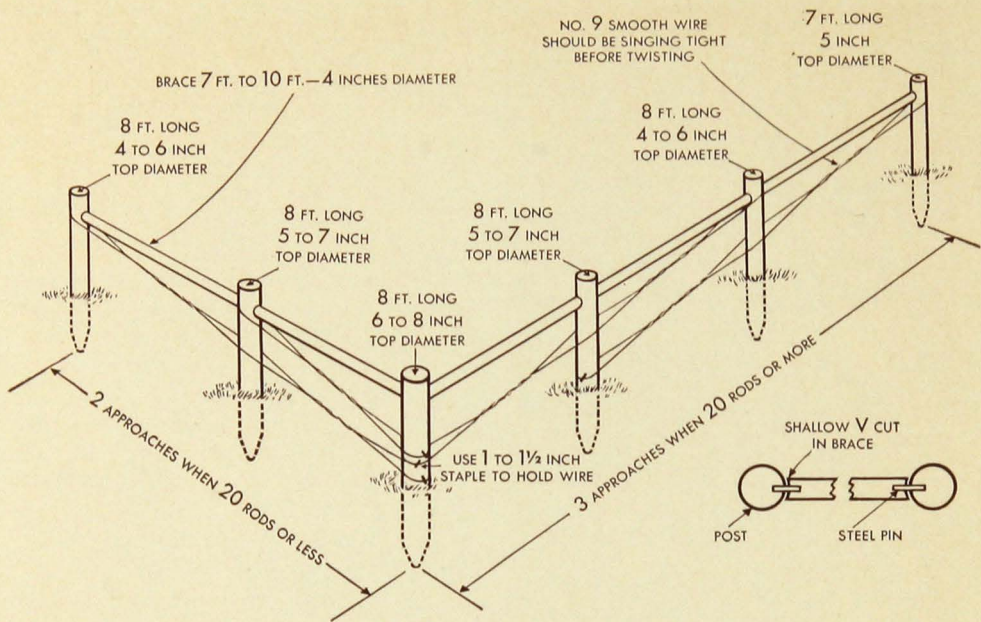
Attach braces to the posts with pins made from small iron rods or large spikes with the heads removed. Set these pins in holes drilled in the posts and in the ends of the braces.

Splice the brace wire and staple it to the bottom of the corner post. Use a hammer and hardwood block to drive the wire upward on the approach post until it tightens the corner. One or two twists may be added to keep the brace wire close to the



Wire used as guide for setting posts.





*The Rosemount corner.*

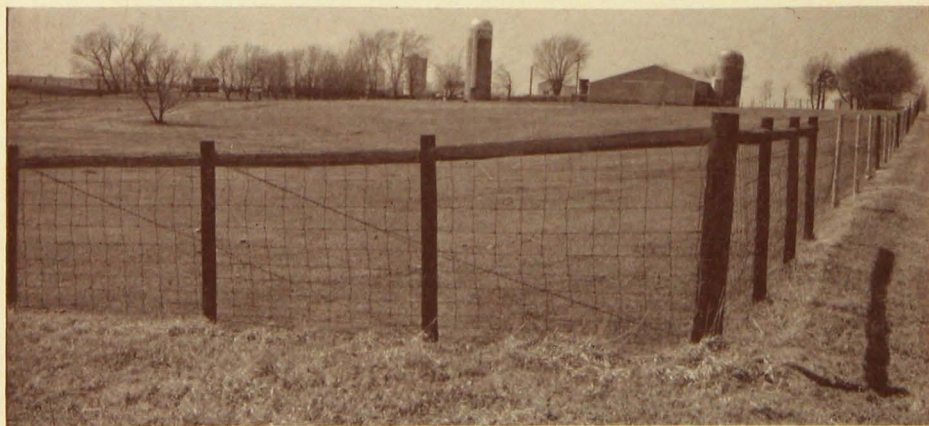
fence wire and out of the way of the feet of cattle and horses.

Diameter of posts and whether you use three or four posts in the corner depend upon length of the fence to be supported, type and firmness of the soil, and how tightly the wire is to be stretched. Use small diameter posts in heavy compact soils, larger posts in sandy or wet soils.

All posts for the Rosemount corner

can be power driven, greatly reducing construction costs. From several years' observation, power driven posts appear to be superior to those set by hand methods for corner use.

Corners built on this pattern have successfully withstood 14 winters of heavy snow damage to the fences they supported. Neither wind damage to the fence nor breakage of wires by farm machinery disturbed corners.



*Rosemount corner after 8 years' service*



## Setting the Line Posts

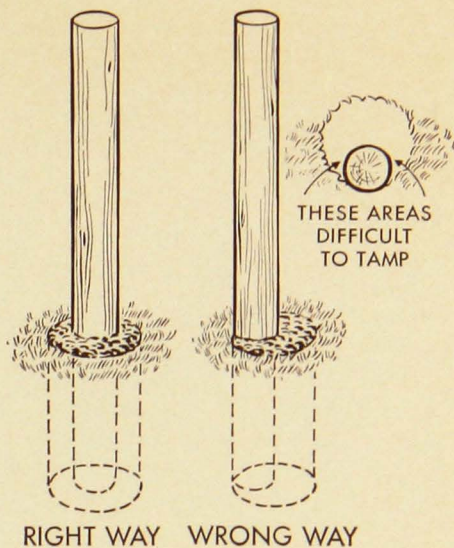
In early fences the holes were dug with a shovel or hand digger and soil was tamped around the post. Many posts are still set by this method. When the post is set in the center of the hole, soil can be tamped securely on all sides. These posts are firm. Posts set against the side of the hole are always loose since the soil cannot be properly tamped.

With mechanization of agricultural practices, power post-hole diggers were introduced to reduce the cost of making the holes, but the big job of tamping the post remained.

The power post driver completely mechanizes post setting and does a better job than hand methods. Not only can posts be driven rapidly but they are set firmly in the soil.

Posts to be power driven should be relatively straight. Crook or sweep should not exceed the diameter of the post.

Driving tests show that power driven posts should have a *blunt point*, preferably on the *large end*. This point makes it easier to drive



posts in any soil, and especially aids when driving in rocky or root-filled soil by helping to by-pass obstructions.

Posts may be pointed with a lathe-type sharpener. Or four sloping cuts can be made with a common circular wood saw to provide a satisfactory point. Pointing with an axe is satisfactory but slow.



Power digging saves much hard work.



Power driving line posts.

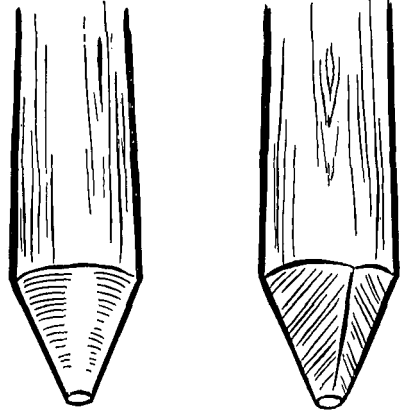
The *large end* of the post should be pointed to place the maximum diameter at the ground line. Slight rounding of the top end of the post adds to the appearance of the fence but is not necessary.

Set the posts at least 2 feet deep—preferably deeper.

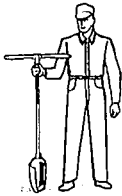
A spacing of *14 feet or less* is recommended for line posts for snow conditions like those in Minnesota. Closer spacing gives greater protection to wire and staples.

To space line posts evenly, tie a piece of rope around the tire on the power driver or tractor and count the revolutions while moving between posts.

Cost studies show that a man with hand tools can set about four posts, on the average, per hour of labor.



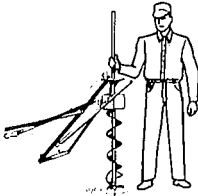
*Lathe sharpened. Power saw sharpened*



WITH HAND TOOLS



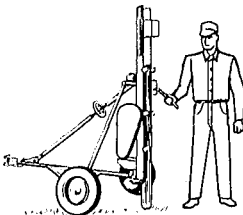
ONE HOUR



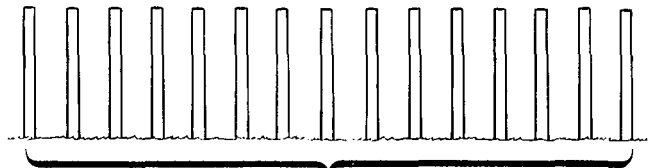
WITH POWER DIGGER AND HAND TAMPING



ONE HOUR



WITH POWER DRIVER



ONE HOUR

*Hand methods versus power post setting.*



When the holes are dug with a power post hole digger and posts tamped by hand, six posts can be set per man hour. Power digging is much easier than hand digging, but tamping is still hard work.

The power post driver makes it possible to set 15 posts per man hour. Operating the power post driver is physically easy when compared to hand digging and tamping.

Power driving of wood posts is feasible in any soil where holes can be dug.

## Splicing the Wire

The wrap or *telephone-type splice* is strong, will not cause damage or breakage of the wire, and is easy to make either by hand or with a simple splicing tool.

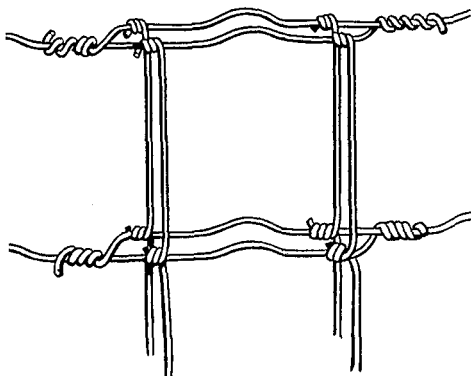
When splicing woven wire, *overlap one section* to provide a good hand hold while wrapping the splice.

Do not pull wire around a corner. Cut and tie it with a wrap similar to the wrap splice.

## Stretching the Wire

Wire is seldom damaged by hand stretching. But when tractors are used for stretching, both barbed and woven wire are frequently damaged by pulling the wire *too tight*.

Between the warmest days of summer and the coldest days of winter a fence wire 40 rods long will contract several inches. When woven wire is properly stretched the "hump" between the stays will absorb this contraction and will retain the tension as the wire expands again during the following summer.



*Wrap splice woven wire.*

When the hump is lost through stretching too tightly, the wire will be permanently stretched, leaving a loose fence as the wire expands the following summer. When the wire is stretched too tightly, it often breaks. Unless well built, the corners may be damaged. Posts in contour fences, draws, and ravines are often pulled out of line or lifted by wire stretched too tightly.

Unfortunately, barbed wire does not have a built-in gauge like the hump in woven wire to tell when it is tight. *When barbed wire is stretched with a hand stretcher, it usually will not be too tight.* Power stretching of barbed wire is not recommended.

There is a tendency to stretch wire too tight in hilly country. You can partially avoid this by stretching short sections of the fence at a time.

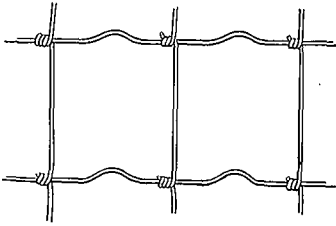
## Choosing the Staples

Most treated wood posts are made from pine or other softwoods. To reduce pulling, use staples  $1\frac{1}{2}$  to 2 inches long. Staples should not be

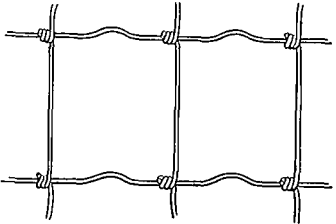


*Wrap splice barbed wire.*

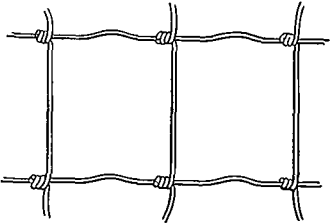
How the hump in woven wire looks:



Before stretching.



After proper stretching.



Stretched too tight.

driven their full length, so it is necessary to recommend longer staples than were used formerly.






Galvanized staples are preferred. Not only do they resist rusting, but they also retard rusting of the attached wire. Furthermore, there is evidence that galvanized staples remain imbedded in the wood more firmly than ordinary staples.

### Attaching Wire to Posts

Attaching wire to the wood post is one of the most important steps in building a fence.

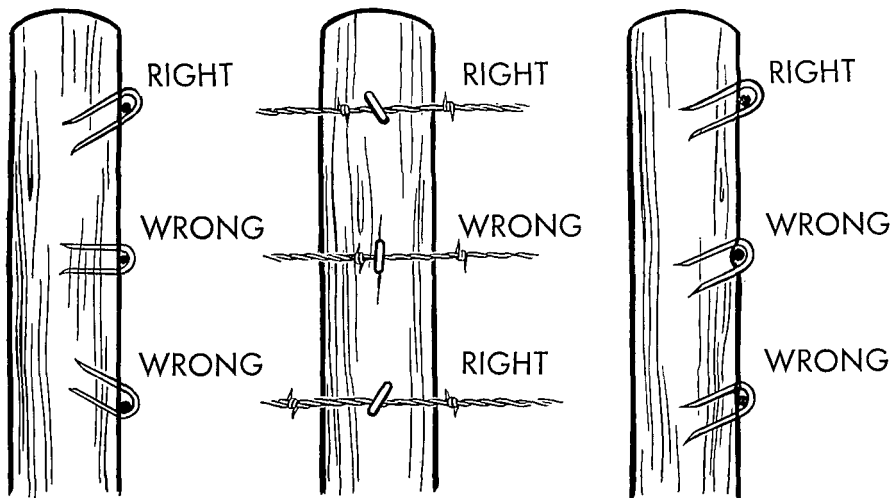
Slope the staple against the pull of the wire in the v-notch against the post. For level ground and over knolls, slope staples downward. In draws where the wire tends to lift, slope staples upward.

Make staples more secure by angling them slightly from parallel to the

				
<b>1</b> IN.	<b>1<sup>1</sup>/<sub>4</sub></b> IN.	<b>1<sup>1</sup>/<sub>2</sub></b> IN.	<b>1<sup>3</sup>/<sub>4</sub></b> IN.	<b>2</b> IN.
WHITE OAK BUR OAK RED OAK	TAMARACK	JACK PINE RED PINE (NORWAY)	COTTONWOOD ASPEN (POPPLE) EASTERN RED CEDAR	NORTHERN WHITE CEDAR

*Suggested staple sizes for common woods used in posts.*





**DRIVE STAPLES  
AT ANGLE**

**DO NOT DRIVE  
STAPLES PARALLEL  
TO SIDE OF POST**

**LEAVE WIRE  
LOOSE  
IN STAPLE**

side of the post. This reduces splitting, especially in small treated posts.

Staples should not be driven tight. The wire should always be free to move through the staple. Tight stapling not only damages wire at the point of contact but also limits seasonal expansion and contraction of the wire between posts.

Tight stapling also increases damage when the wire is bumped by farm machinery and livestock. On corner construction, however, drive the staples even with the wire to distribute the pull against the entire corner.

Except on corners, never place staples over or adjacent to barbs on barbed wire or the stay wires or ties on woven wire, since this restricts free horizontal movement of the fence wire.

When stapling woven wire, staple the top and bottom wires at each post. Also staple every other wire be-

tween, alternating on successive posts so each wire is stapled at least once on any two consecutive posts.

When stapling the fence it is best to start about midway between the corners or ends and staple toward each end. This gives uniformly tight fence wire.

A heavy canvas carpenter's apron is a safe and convenient container for staples when fencing. One pocket can be used to accumulate old staples and short ends of wire.

Always place wire on the inside of the pasture fence.

When fences are near driveways or lanes where snow is plowed, place the wire on the side of the posts away from the road and use short staples. The staple may be pulled by the snow and must be replaced in the spring, but the wire usually will not be damaged. When restapling, move the wire slightly from its previous position to avoid old staple holes.

Rusting can be retarded and the service life of woven wire greatly increased by keeping the bottom strand several inches above the ground. If additional protection is needed to prevent small animals from crawling under the fence, use one or more strands of barbed wire, which can be easily and inexpensively replaced, below the woven wire.

## Gates

Locate gates away from stock-watering tanks, waterways, and other wet areas, because excessive soil moisture makes it difficult to keep the post set firmly. It is best to keep gates away from fence corners.

Posts on either side of the gate should be parallel to each other and firmly set so the gate opening will not be enlarged by the pull of the fence. To maintain the size and shape of the gate opening, regular-end construction, using two or more approach posts and a like number of horizontal braces on either side of the gate posts, is usually used.

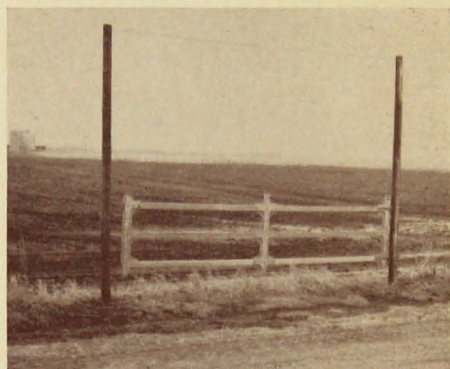
All bracing on both sides of the gate can be eliminated by using *two tall gate poles tied together at the top* by a chain, wire, or board. For regular drive-through gates, 16-foot poles with 5-inch tops are adequate. Twelve-foot poles with 4-inch tops are large enough for foot gates.



*Conventional gate bracing (in service 12 years).*

Cost of two long treated poles is considerably less than that of a complete gate assembly. The two long poles are also less expensive to install.

Tall poles help define the gate location from a distance.



*Tall poles on either side eliminate gate bracing (in service 6 years).*

## Fencing Adjoining Pastures

Animals exert considerable pressure on pasture fences. To avoid staple pulling, place the wire on the animals' side of the posts. When fences separate pastures, place the posts on alternate sides of the wire. Pressure from livestock against either side of the fence will then be largely against the



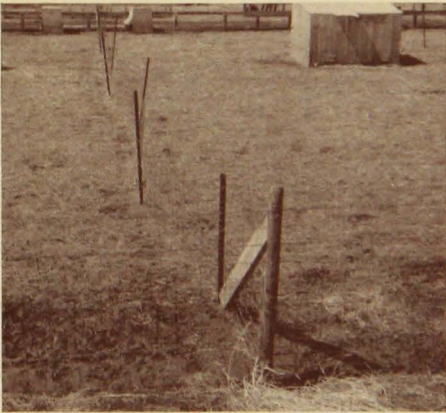
*Posts on alternate sides of the wire (in service 8 years).*



posts, and staple pulling will not be a problem. This does not add greatly to the cost of fence building. Every other post is set and the wire stretched and attached; then posts on the alternate side are set.

## Zig-Zag Fences

A *temporary* woven-wire fence, strong enough to hold swine, sheep, calves, and poultry, can be most economically built on a zig-zag pattern. Wood corners or end posts must be securely set. Sections of wire a few feet longer than the openings are then attached. The wire is tightened by driving T-steel posts so each leans sideways in a direction opposite to the preceding one. The wire catches on the post knobs and requires no tie wires. Fence tension is distributed along the fence and the end posts require little bracing.



*Zig-zag fence for hogs.*

## Fence Row Burning Damages Fences

*Fence row grass fires will damage or even destroy partly decayed wood posts. Similar fires only char the outside of sound wood posts. There is no evidence that sound wood posts*

are seriously damaged by grass fires.

But grass fires should be prevented, because the heat is usually sufficient to damage the wire's zinc coating, permitting rust to develop and shorten the service life.

## Fence Maintenance

No matter how well constructed and how good the materials, a fence will require some maintenance. A few staples may be pulled and wires kinked or broken by the weight of a settling snowbank or bumps from farm animals or machinery. Older fences require more frequent and extensive maintenance, including post replacement.

*When old posts reach the point of failure, replace them. If permitted to rot off, their weight adds to the tension on other posts and the entire fence may fail prematurely.*

When a post is replaced, be sure to remove the old post from the fence. Don't make the wire and other posts support them.

Removal of the upper section of old posts is not enough. Remove the section below the ground also. This section will remain for many years, and if the fence is removed, may catch machinery and cause serious damage and accidents.

When replacing posts on fence lines between pastures, place new posts on the opposite side of the wire to relieve pressure on staples.

*Staples on older posts often loosen and pull out. If they are set in the old holes, they quickly pull again, or damage the wire if they are driven tightly.*

Restaple at least  $\frac{1}{8}$  inch away from old staple holes.

Do not try to tighten loose wire by adding extra staples to the side of the post. These staples undergo terrific

pressure and soon pull. Such stapling also kinks the line wire and shortens its service life.

*Wire:* Leaning posts, boards, or other items on the fence pulls staples, bends wire, and causes unnecessary maintenance. Many people who are

careful about heavy items will hang short ends of wire, sections of iron, and even cloth over posts and wire. It is only a short time before the wire's protective coating is broken and rust develops, shortening its service life.

## Steps in Building Good Fences

1. Locate corners, ends, and gates.
2. Choose durable posts—such as treated wood posts—for long service life.
3. Use 3- to 5-inch, 6½- to 7-foot posts for line construction. Use 4- to 6-inch, 8-foot posts for corner and end construction.
4. Use 12- to 16-foot posts on either side of gates.
5. Set permanent posts at corners, ends, and gates.
6. Use a tightly stretched barbed wire between the ends, corners, and gates to build a straight fence.
7. Provide a good foundation for the fence with properly constructed corner and end sections using small treated wood posts.
8. Use a power post driver to set fence posts easily and economically.
9. Use pointed wood posts for easier driving and a better fence.
10. Use the wrap splice for connecting the wire.
11. Don't stretch wire too tightly. Stretch woven wire so as not to remove more than one-fourth of the hump from the horizontal wire. Do not use machinery to stretch barbed wire.
12. Use 1½-inch (or longer) galvanized staples for treated pine posts.
13. Slope staples into the wood against the pull of the wire.
14. Drive staples at a slight angle (not parallel with side of post).
15. Do not drive staples tightly against the wire. The wire should be free to move through them.
16. *Remember:* fencing is hazardous work. Wear heavy leather gloves to avoid cuts or torn flesh.

## Safety in Fencing

Protection of both man and animals is an important part of any fencing operation. It saves dollars and makes good fences.

### Protect Man

Building and repairing fences often results in serious cuts and tears of skin and flesh. These injuries usually are ragged, difficult to heal, and fre-

quently result in serious infections.

Most injuries resulting from fencing can be prevented by a few simple precautions:

1. Use close-fitting tough clothing when fencing—loose, ragged clothing catches easily on the wire.
2. Use extra heavy gauntlet-type leather gloves.



3. Wear high-top boots for maximum protection to legs and ankles.
4. Use proper tools.
5. Keep equipment in good condition. Be especially careful that chains and clamps used to stretch wire are in good condition and properly attached.
6. Stand on the side of the posts opposite the wire when stretching it. The wire may break or the clamps or chains slip, and it is dangerous to be caught in the twisting, rolling wire.
7. Don't carry staples in pants pockets. The sharp points puncture the pocket and the skin beneath.
8. Be sure shields are on power shafts when using power diggers. And keep feet away from rotating auger.
9. Keep children away from all fence building operations.
10. Don't rub your face, hands, or other exposed skin with gloves which have handled treated posts. Some people are allergic to the preservatives used in treating wood. The face, neck, and other exposed skin may be irritated, especially on hot, windy, sunny days. A good skin lotion usually gives adequate protection.
11. If you get chemicals on unprotected skin, wash and cleanse the area quickly and thoroughly.

## Protect Animals

1. Pick up every loose piece of wire and every staple that falls to the ground. Pieces of wire may catch in the mower or other machinery and cause equipment trouble.

Smaller pieces of wire and staples left on the ground may be picked up by cattle when grazing, especially dairy cattle. Many veterinary calls are for *hardware disease*, which could have been prevented.

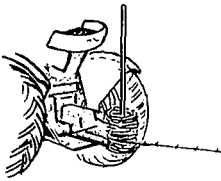
Staples, nails, and short sections of wire also make puncture wounds in horses' hooves.

2. During hard thunderstorms, animals frequently crowd against fences, especially near corners. If lightning strikes the fence, animals may be injured or killed. Protection can be obtained against lightning by periodic grounding of the fence with galvanized wire attached the length of the post under the fence wire or with steel posts. Grounding the first post on either side of corners, gates, or other openings, on high knolls, and once every 10 rods on long stretches of fence is usually sufficient.



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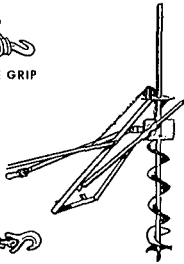
# Tools Used in Fencing



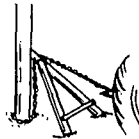
WIRE WINDER



WIRE GRIP



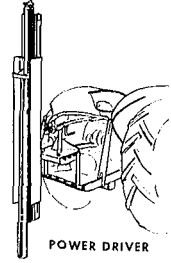
POWER DIGGER



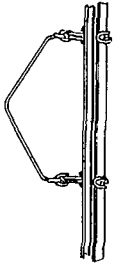
TRACTOR POST PULLER



HAND BARBED WIRE STRETCHER



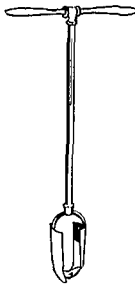
POWER DRIVER



WIRE NETTING CLAMP



HAND DRIVER



HAND AUGER



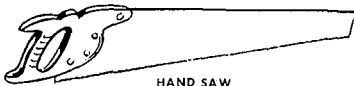
HAND DIGGER



TAMPING STICK



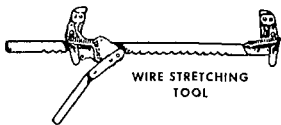
CROWBAR



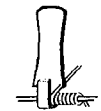
HAND SAW



BRACE AND BIT



WIRE STRETCHING TOOL



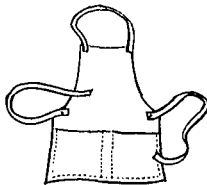
WIRE SPLICING TOOL



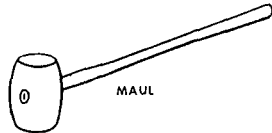
WRECKING BAR



WRENCH



CARPENTER'S APRON



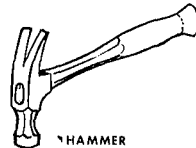
MAUL



FENCING PLIERS



PINCERS



HAMMER