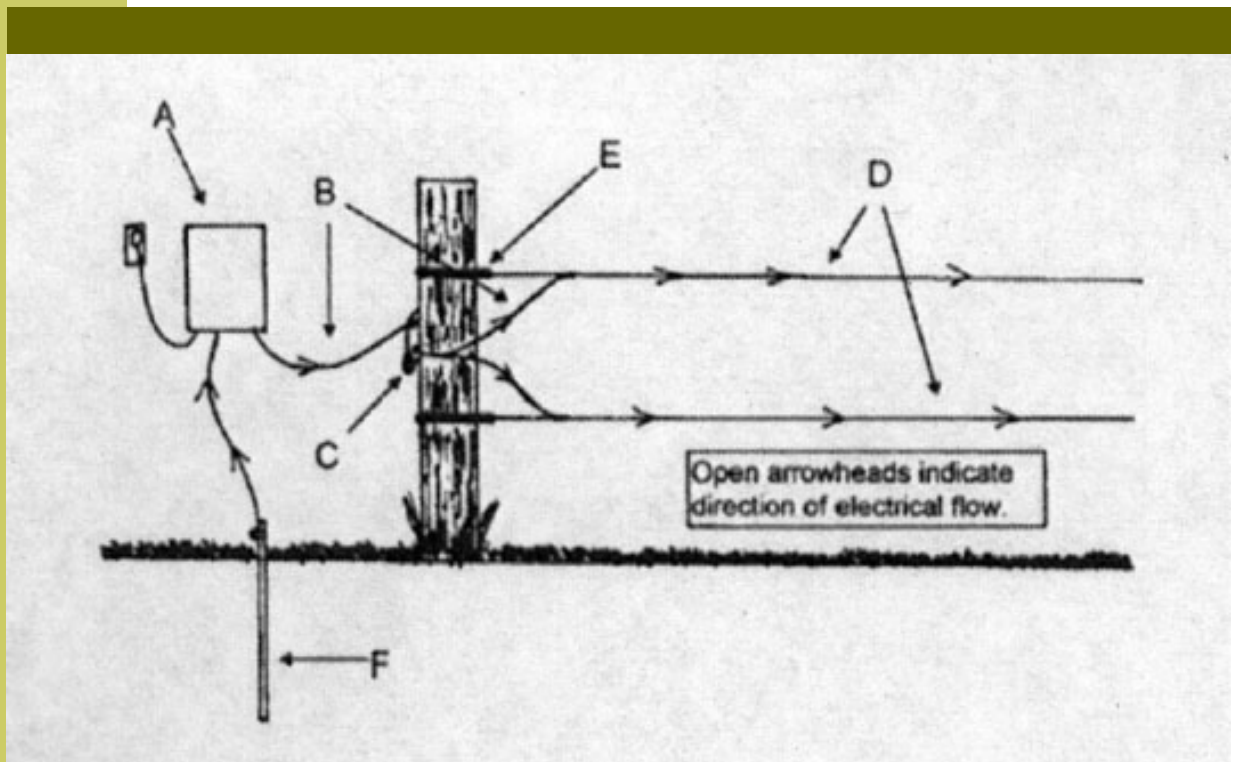


# Fencing Systems for Rotational Grazing



## Keeping the Current Flowing

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# "KEEPING THE CURRENT FLOWING ON AN ELECTRIC FENCE"

Modern electric fencing systems have made managed grazing possible by providing livestock owners with animal management tools that are flexible, effective and relatively inexpensive. What makes a "modern" electric fence effective is its ability to deliver a powerful enough jolt of electricity to whatever critter happens to touch it so they won't want to do it again. An electric fence is a "pain barrier" and if the amount of electricity flowing through the fence is too low, animals won't respect it. The amount of electricity, or pain, that is needed to get an animal to respect depends on what animal we're talking about. It's going to take a lot more of a jolt to keep a bull or ram separated from a breeding herd than to keep the herd or flock in a fresh paddock of grass. On the other hand, if the amount of electricity is too high there can be all sorts of problems that can be expected with electricity, such as stray voltage, electrocution, and barn and grass fires.

Keeping an electric fence system charged means understanding how it works, which also means knowing a little bit about how electricity flows. When an electric fence doesn't work properly it usually means that somewhere in the system electricity isn't flowing the way it should in order to do the job it is asked to do.

## Electricity has to Flow to do Work

We can't start discussing how to properly hook-up an electric fence, and add all sorts of gizmos and gadgets, until we get the basics of electrical circuits out of the way. Let's start with the most basic of circuits, a battery and light bulb.

A battery contains stored electricity. Sitting all by itself a battery has the potential to provide stored electrical energy to some kind of device that can turn that energy into work, heat or light. In this particular example we'll be turning it into heat and light. When the light is hooked up to the battery (Figure 1) the filament in the bulb gets bright and heats up as the electricity flows through it. Whatever electricity isn't used by the light bulb flows back to the battery. This is a very simple circuit.

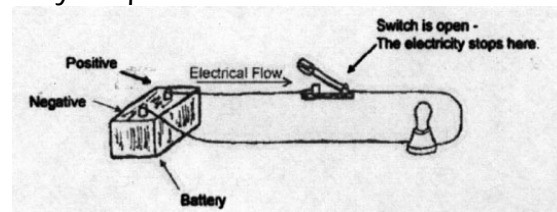


Figure 1. A simple electrical circuit

Now let's shut off the light by breaking the circuit. One way to do it would be to put in a switch to stop the electricity from reaching the bulb (Figure 2). Another way would be to put in a switch after the bulb (Figure 3). This switch will work just as well on either side of the light because it stops the electricity from flowing.

The circuit can be broken either coming from or returning to the source of power. This return loop back to the power source becomes very important when we working with electric fences.

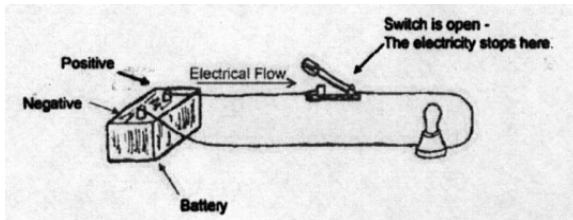


Figure 2. Simple circuit with a switch on the positive side

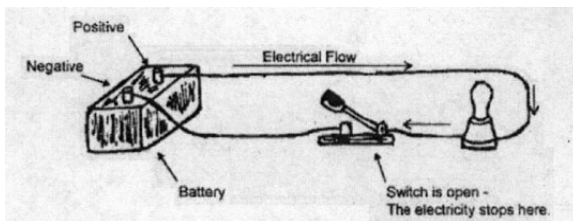


Figure 3. Simple circuit with a switch on the negative side

Next we'll take the regular on/off switch out and put in a dimmer switch. A dimmer switch is a switch that can be turned up and down to control how much electricity flows through the circuit. Turning the switch down lets less electricity flow and the light gets dimmer. And, just like the on/off switches (Figures 2 and 3), the dimmer switch can work just as well on either side of the light bulb. It can also reduce the amount of electricity going out and unused electricity flowing back to the battery.

Next, on to electric fences themselves.

## Keeping the Current Flowing on an Electric Fence

Let's start by building a very simple single wire fence. Probably very similar to what has been built for years on farms around the world (Figure 4). First comes the source of power for the fence, the energizer (Item A). The energizer is the heart and soul of the fence and is probably the single most important purchase that needs to be made in setting up a so-called -"modem" electric fencing system. Energizer technology has changed dramatically over the years and what are often referred to as \*New Zealand" style energizers are in fact low resistance, or low impedance, energizers. They convert low voltage electrical currents into high voltage, high amperage, short pulse electrical charges that can keep fences electrified through conditions that would have made fences thirty years ago totally useless.

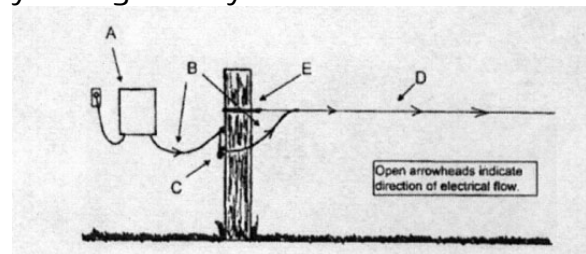


Figure 4. Single wire fence

Now that we've purchased a "low impedance" energizer we've got to get the electricity to the fence. If the distance to the energizer isn't very far we can use a piece of electric fence wire, but, if we've got to go underground or through a building it might be smarter to use an electric fence lead-out wire. An electric fence lead-out wire is insulated with materials that can keep in high voltage charges. Low impedance electric fence energizers will often produce high voltage charges

greater than 5000 volts. Wires that are used for standard home and farm wiring are only insulated to a rating of 600 -volts and can not be guaranteed to hold in the high voltage-high amperage charges put out by a low impedance energizer.

Before we actually get to the fence it's not a bad idea to put in some kind of a cut-off switch. For many this may be an option they decide to bypass but it is generally better to shut off the electricity leading to the fence with a cut-off switch than by unplugging the energizer all of the time. The cut-off switch can usually be put closer to the fence for convenience since the energizer is many times outside the fence perimeter near a building. From the cut-off switch another lead-out wire finally heads to the fence. In the particular example our fence is a 12.5 gauge, Type III galvanized, high tensile wire connected to the post using a plastic wrap-around insulator.

O.K., you're all set. You quickly take a look around the fence to make sure the wire isn't touching anything, plug in the energizer, open the gate, let the animals in the field, pile the kids in the truck and head to town. On your return you turn off the highway and head down your lane only to see the critters in the garden munching on what used to be the pea patch. What happened?

Let's stop and take a look at the fence. You've got the energizer plugged in and it's clicking. You've used an insulated lead-out wire and it's hooked up to the cut-off switch, and the switch is on. The lead-out

wire is hooked nice and tight to the energizer, the switch and the fence. You use a fence tester to see how much voltage is on the fence and find there is less than 1000 volts.

So what happened? Quite simply the electricity was not able to flow in a circuit. Just like in our description of an electrical circuit if the electricity is not able to freely flow back to the power source the amount of electricity that can flow through the system, and do some kind of work, including shocking an animal, will be reduced. What needs to be added to the energizer is an earth return rod. By adding an earth return rod we give the electricity a path to return to the energizer. If the earth-return-rod is missing or too small, it will have an effect similar to an on/off switch, or actually more like a dimmer switch. The term that is used here, "earth return", is very important. An earth return rod is not the same as a "ground rod". A ground rod takes excess electricity and sends it to the ground, or earth, and an earth return rod is like an antenna that brings the electricity from the ground, or earth, back to the energizer. Most energizer manufacturers realize that this return loop to the energizer is extremely important and will make recommendations on how to construct a system that will work best for a particular energizer.

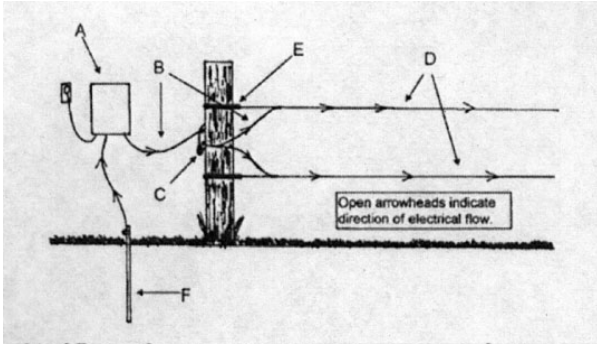


Figure 5. Two-wire fence—all wires hot

## Multiple Wire Fences

Many dairy farmers have absolutely no trouble at all keeping their cows in with a single wire fence, especially if the cows are always on fresh grass. However, other types and sizes of animals aren't always as accommodating and multiple wire fences need to be built. The next step up from a single wire fence is a two wire fence with both wires hot (Figure 5). And, with additional bracing we can expand the fence to 3, 4, 5 or more wires depending on what you're trying to keep in or out.

In any part of the world where there is adequate soil moisture, fences that have all the wires hot can work just fine. The important point here is the moist soil. When an animal touches the fence the electricity flows from the spot on their body where the fence makes contact, through their body by the shortest path to the earth, through the earth and then back to the energizer by way of the earth return system. If the earth is extremely dry, the earth part of the circuit would act like a dimmer switch. One way of getting around this problem is something called a continuous ground.

## A Continuous Ground Fence

For simplicity sake we'll look at a two-wire continuous ground fence (Figure 6). We've done two different things to this type of fence compared to 2 hot-wire fence (Figure 5). First we've disconnected the bottom wire (Figure 6, Item G) from the main cut-off switch (Item Q). Next we've put in a ground rod (Item H) to carry any current that might be flowing along the bottom wire directly to the earth. By putting in the ground rod we can hopefully get the electricity deeper into the earth where it might be able to find some damp soil that is a better conductor, and also increase the surface area that the rod comes into contact with the earth. The fence ground rod can also be put closer to the earth return rod so the distance between the two is reduced and the electricity doesn't have to travel as far through the earth.

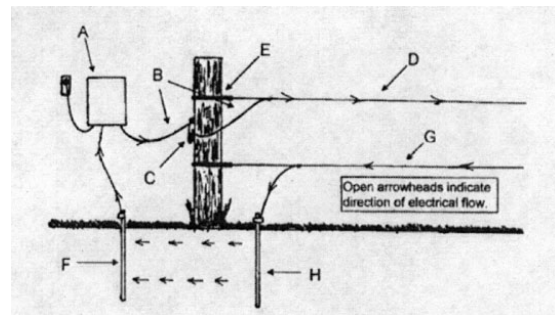


Figure 6. Two-wire continuous ground fence

The idea behind a continuous ground on the fence is to make sure that if an animal makes a connection between the hot and ground wires of the fence with some part of their body they will have a memorable



experience, regardless of weather or soil conditions. Even though I've pictured a two wire continuous ground, the same idea holds for any multiple wire fence. I've seen all sorts of arrangements but the most common is having every other wire hot.

There are a few cautions with continuous ground fences. First, never hook the continuous ground wire on the fence directly to the earth return pole on the energizer. There will be so little resistance to electrical flow that there will be problems with electricity flowing through fence posts themselves, especially some of the cheaper fiberglass and rubber posts. Second, if an animal touches the ground wire by itself they won't get a shock. If there are only two wires on the fence and if the bottom wire isn't hot the critters will usually figure out how to get under it. And last if for some reason the hot and ground wires are brought in contact with each other, like a branch falling on the fence or a deep snow bank holding down the wires, it can cause a direct short that will tremendously reduce the power on the fence, especially on the other side of the short.

## Currents are Everything on an Electric Fence

A majority of problems that people have with electric fences are because they forgot about the basic principles of electricity. When electricity is sent out on an electric fence by an energizer it just doesn't mysteriously disappear into nothing. What goes

out must come back. But unlike electricity that is kept in nice clean insulated wires, the electricity that is cycling through the environment can end up going places it was never intended to go if some thought isn't put into setting up both a well insulated conducting system, and an adequate earth return system.