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1. Introduction

The Christmas display I put up each year is oriented towards a nativity scene, because I prefer to emphasize the true meaning behind Christmas. Very few commercial props fit into this theme. For those that do, I either don't care for the style, or they do not meet my other technical requirements¹. Hence, I build the props from scratch.

The nativity scene I have been using consists of the following figures:

- Mary, Joseph, and baby Jesus in a manger
- Stable
- 3 Kings
- An Angel
- At least one larger animal (camel, donkey, etc)
- At least one smaller animal (sheep, etc)
- At least one shepherd
- Star
- Cross
- Signboard (optional)

When lit, the scene typically looks as follows (I change it around a little some years):



Stable + manger, Mary + Joseph, 3 Kings



Manger scene also with shepherds and angel

¹ low cost, rugged construction, and tolerant of high winds

There are more pictures at <http://gallery.eShepherdsOfLight.com>, or you can see these props in action on YouTube (search for "eShepherds of Light").

The list of props shown above gives a well-rounded, visually "complete" nativity set. This list may be overwhelming at first to anyone wishing to build such a setup. Please note that I built this set of props over a number of years, not all at once. A nice "starter set" might consist of only the following figures:

- Mary, Joseph and baby Jesus in a manger
- Stable

The starter set is very doable as a first-year project. Once you have the starter set built, then you can gradually add other figures, working your way to a more complete set, if desired.

This article describes how I built the basic nativity scene figures (the "people"). Construction of the non-people (animals, cradle/manger, and stable) will be deferred to another article, since those used different techniques from the ones in this article. Electrical hookup and sample Vixen sequences will also not be described here, since there are many possible variations that do not affect the physical construction of the props themselves. If there is interest, I can write up those additional topics in another article, since there are a few tricks that can be used to enhance the display.

This article is a "How-I-did" rather than a "How-to" because it simply describes the steps I used to build these props. I am not an expert and I do not suggest that this is the "best" way to do it - in fact, in some cases it probably is **not** the best way, so this may be more like a "How-not-to" in some regards. As always, reader beware, use your own judgement; I do not accept liability for problems caused by this information, etc, etc.

As far as I know, this construction technique is original. I have not seen or heard of it being used elsewhere. You are free to use this information for non-commercial purposes. For commercial use, please check with the author. I have chosen to share it freely with the DIYC community, in order to encourage more people to also make visually distinctive nativity scenes.

Note to non-U.S. readers: This article assumes U.S. units of measurement and voltages, unless otherwise noted.

2. Materials and Tools

The overall parts list is very simple and inexpensive. The total cost of materials for each figure (as I built them) was under \$10 (including mini-lights). I used the following materials:

- approx 5' of 3' high, stiff fencing, with a 2" x 2.5" grid, dark green, moderately heavy wire
- a few feet of light, bare wire ~ 28 gauge (for lighter duty fastening pieces together) or zip ties
- a few feet of heavier, bare wire ~ 18 gauge (for high-wind reinforcement, and to join parts)
- 2 – 3 strings of 100 ct. mini-light strings (colors optional), or twice as many strings of 50 ct.
- a few feet of duct tape; ¼" - ½" wide is ideal (other widths can be sliced into strips)

(some of the figures used more than 3 - 100 ct. strings)

The size of the figures I built was 3½' - 4' H x 1½' W x 1' D. I chose this size according to how much display (and storage) space I had, and how far away I wanted them to be visible. I found that 4' high figures were a good compromise. The instructions in the remainder of this article will assume 4' figures – you can adjust the measurements appropriately to suite your needs.

The fencing provides the primary structure for the figures, so it needs to be reasonably rigid to hold the shape and withstand handling, but flexible enough to be shaped and bent. I found that ~ 16 gauge wire, with a 2" x 2.5" grid worked very well. I was able to make Mary, Joseph, manger, angel, 3 wise men, a donkey, 4 shepherds, 6 sheep, and a few other small misc. items from one roll (I think it was a ~ 50' roll from Home Depot).



The lighter wire is useful for fastening together parts where strength is not critical.

The heavier wire is used to fasten together parts where strength is important, such as fastening body parts together. The figures should be rigid when carried, with no dangling parts ready to fall off. The heavy wire can also be used to anchor the figures to the ground for high wind conditions (40+ mph), or to reduce the chance of theft.



A roll of ½" wide duct tape is ideal for wrapping around the mini-light sockets. However, I could only find 2" wide duct tape, so I used a carpet knife to slice it length-wise into ½" wide strips. Good quality duct tape is advisable - my oldest props have lasted over 10 years without re-stringing their mini-lights, but the duct tape is falling apart.

Colored mini-lights are optional – I found that a little color nicely accents the figures. In particular, red, green or blue for the wise men bodies, and yellow/orange for their crowns and gifts, and maybe a little red or blue on Mary and Joseph seem to look nice. You can use colored bulbs or use clear bulbs and then paint them later. LED strings can also be used.

Tools I used during the construction were:

- Tin snips or wire cutters (to cut the wire and fencing)
- Pliers
- Carpet knife and scissors (if you need to slice the duct tape)

3. Construction

The construction technique is similar for each type of figure, although the shapes and structural aspects of each type vary slightly. I will also briefly describe variations for the various types of figures.

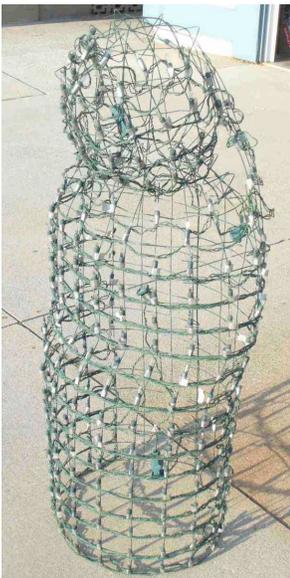
The overall construction process I used was as follows:

1. cut and bend 2 sections of fencing into shape (1 for body, 1 for head)
2. assemble the shapes to form the figure
3. attach mini-lights to the figure

These 3 steps are described in more detail below. They describe construction of the basic figure, which can then be enhanced in various ways. I will not cover SSR wiring or final prop setup, since those can vary widely depending on your setup. A future article will cover those topics if they would be of interest - I could also describe SSR multiplexing, adding RGB color, or accessories such as canes or musical instruments (see the photo gallery or the YouTube videos for examples).

3.1. Cut and bend sections of fencing

The people figures consist of 2 basic pieces: the body and the head. Each piece was formed separately, and then fastened together. The actual body shape will vary depending on whether it's Mary, Joseph, angel, shepherd or king. Shown below are some pictures of Mary:



View at an angle



Front view



Side view



Top view



The Body

The body is basically a squashed, upright cylinder. It was formed by cutting ~ 4' length of fencing, and then joining the edges together to form a cylinder. I used the edges of the fencing itself to join

it together – just fold them over each other as hooks. Then the cylinder was “squashed” by pressing in the front and back. These steps are shown in the photos below:



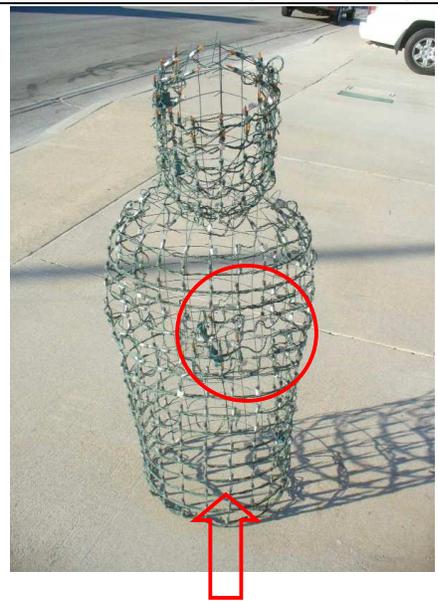
Cut a section of fencing. Hook the edges ... to form a cylinder. Then squash the cylinder

After the squashed, cylindrical body is formed, I rounded off the shoulders by pinching the fencing, bending it in and out, on the top few rows to gradually reduce its diameter:



There is a short video demonstrating this step on YouTube at <http://www.youtube.com/watch?v=oYuubbxDZko>.

I also tried to make some of the figures appear to be kneeling (Mary, Joseph, wise men), so I pushed in the top half of the cylinder more than the bottom half:

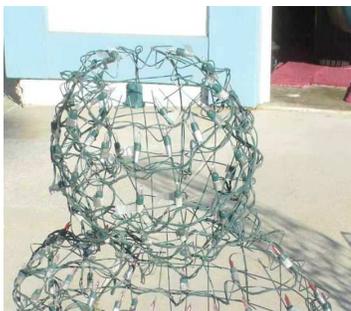


On the wise men, I also fastened a small scrap of fencing to the middle to try to make it look like they were holding gifts. In addition, I used mini-lights that were a different color from the body to help show this detail.

I customized the shapes as I built them, so I did not have a precise pattern to work from. You can vary the shapes as desired to create the effect you want.

The Head

The head is basically a spherical shape, formed from a smaller piece of fencing (about 18" – 24" square). For figures such as Mary, Joseph, and the angel, I formed a small cylinder first, and then gathered in the top and bottom edges using the "shoulder technique" described earlier, ending up with a spherical shape (more or less). For the wise men, I only did this on the bottom of the head, and left the top of the head open to make it look like he was wearing a hat or crown. I also put a little pointed piece on top of one of the wise men. In addition, I used yellow/orange bulbs on the upper rows of the head to make the crown/hat more visible. For Mary, I attached a couple of pieces of scrap fencing to the back of her head, to try to look like either long hair or a head covering.



Joseph's head



Wise man's head



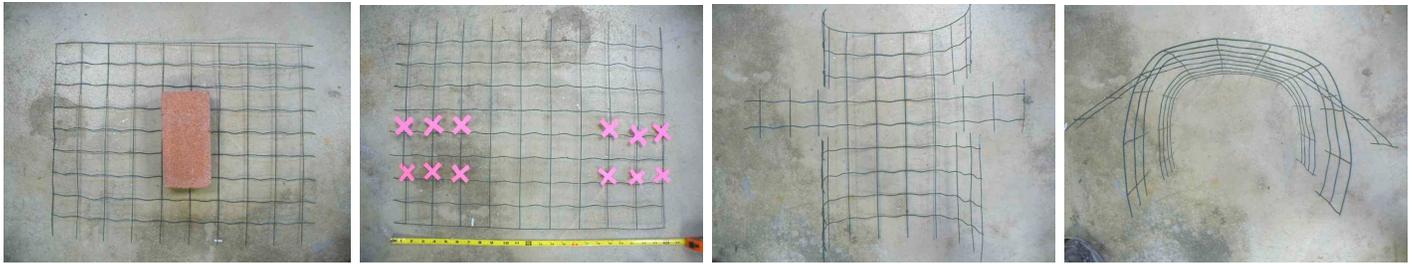
Mary's head



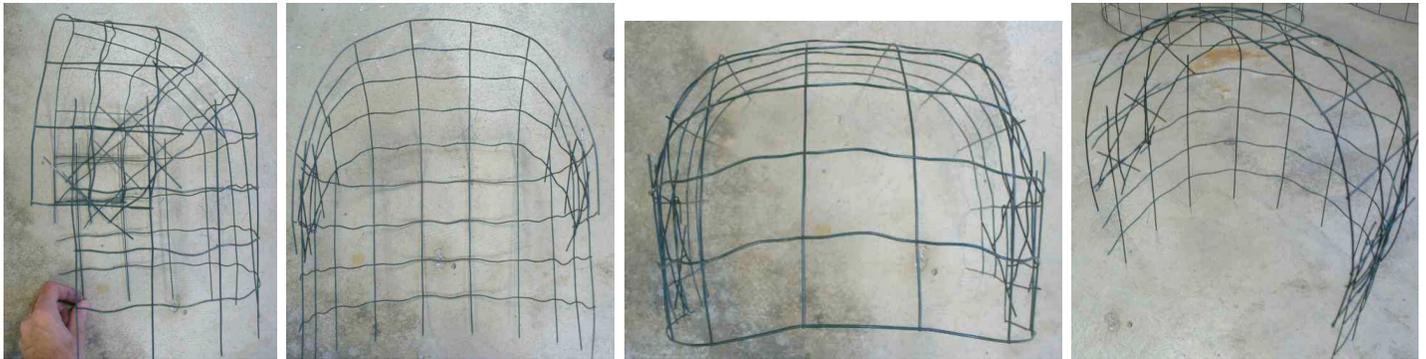
Mary again

Shepherds heads

For the shepherds' heads, I used a different approach. I started with a square piece of fencing, but then cut into it from the sides (shown by the X's below). I also only formed a partial cylinder, leaving one edge open and the cutout sections open also:



Then I bent the top down to make it look like a hood, and bent in the side "flaps" close to the head:



side view

front view

top view

angle view

Angel

The angel had additional parts for the wings and arms/trumpet. The wings were cut out of another piece of fencing (~ 4'), and then fastened to the back of the figure using wire. I inserted a piece of ceiling hanger wire near the top of the wings to stiffen them. The arms and trumpet were strips of fencing, with the trumpet being a narrow cylinder with the end flared out (sorry about the shadows in the photos):



front view of wings

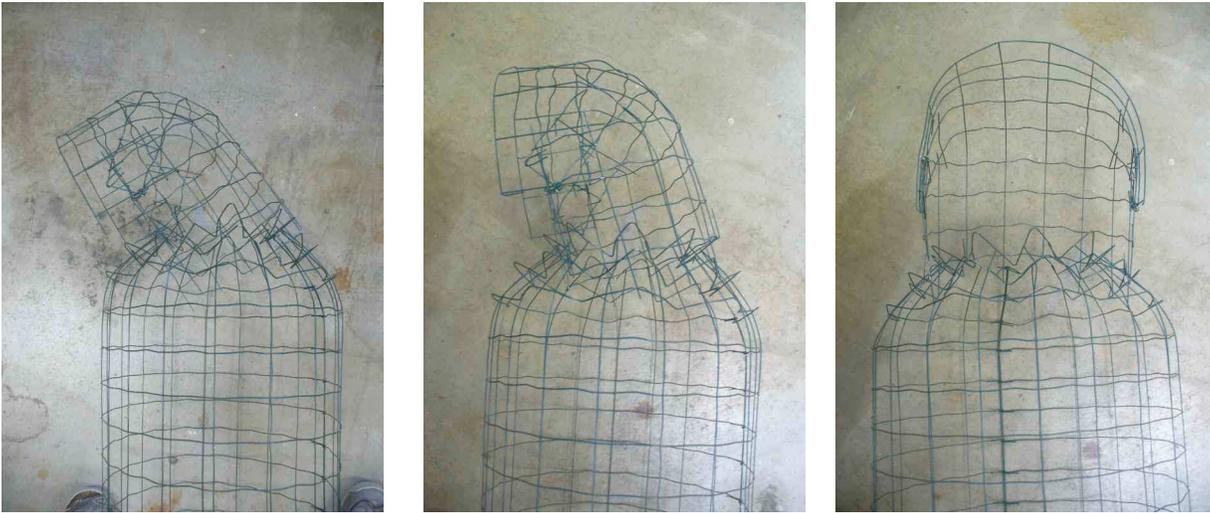
side view - trumpet/arms

top view showing wings + arms/trumpet

3.2. Assembling the figures

Assembly is simply a matter of firmly attaching the head and any additional parts (wise men's gifts, Mary's head cover, angel wings and arms/trumpet) to the body. The heads can be bowed a little, turned at an angle, etc to give some variety to the figures if desired.

I set the head on top of the body, and then either folded over pieces of fencing from loose ends that were sticking out, or used a piece of stiff wire to "tie" the head to the body at points where the fencing touched. Shown below are a couple of examples of shepherds with their heads at different angles, as well as a view from the front:



3.3. Attaching the Mini-lights

Mini-light strings can be rapidly wound or wrapped around the figures many times, and then fastened in a few places to secure them, as is commonly done with mini-trees. However, this approach is not my preferred style. I prefer props that are "barely there" – that is, high winds just blow right through them, they are practically invisible when not lit, and nearly transparent (so that props behind them can be seen). To achieve these goals, I try to minimize the amount of wire and clutter attached to the props, which means that I cannot just wrap mini-light strings around the props several times. This, in turn, means that I need to pay attention to bulb placement (since I use just enough to light the prop, and no more).

These factors make this step the most tedious part for me. However, I am pleased with the end results, and feel that the extra effort is worth it. Shown below is a photo of how I attach the mini-lights to the figures, how nicely spaced the bulbs are, and how "open" the props appear when done:



LED strings could be used instead of mini-lights. I suppose rope light could also be used, although I think that the continuous illuminated rope strands would somewhat compromise my other objectives as listed above.

I first decide whether to use white lights or colored lights to help "paint" the figure. I ended up using white for the angel and shepherds, mostly white for Mary and Joseph (with a band of red or blue to look like cloaks), and various colors for the wise men.

Next, I established a bulb "budget" for the figure – that is, I planned out how many bulbs each part of the figure would take, and then adjusted the numbers so the total was a multiple of 50 (or at least a combination of 20, 35, and 50), so that the figure would be evenly and completely covered when done, without the need to cut any mini-light strings.

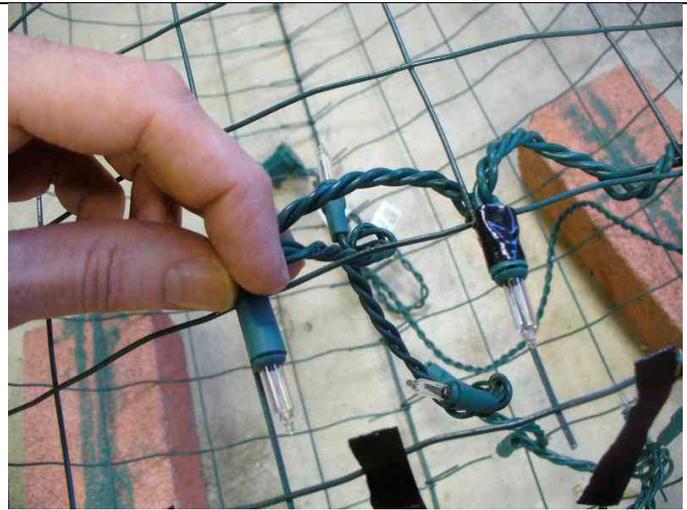
For Mary and Joseph, I used $17\frac{1}{2}$ rows (last row was half populated) \times 15 bulbs/row = 263, plus \sim 36 for the head, for a total of 3 - 100 ct. mini-light strings for each figure.

For the wise men, I used about $18\frac{1}{2}$ rows \times 15 bulbs/row = 278, plus $5\frac{1}{2} \times 12$ bulbs/row = 66 for the head, plus a few for the gift, for a total of 3 - 100 ct. and 1 50 ct. mini-light string per wise man.

For the angel, I used 3 - 100 ct. mini-light strings for the body (18 rows \times 15 bulbs/row = 270, leaving 30 for the head). In addition, I used a 100 ct. yellow/orange string for each wing, and a 50 ct. for the arms + trumpet, for a total of 5 - 100 ct. and 1 - 50 ct. mini-light strings for the angel. I actually put these on separate circuits so the prop can be used as a non-angel (for example, in the Hippo song I turned off the wings, or the arms and trumpet were animated in other songs), but that is optional.

I originally budgeted 12 rows \times 12 bulbs/row = 144 bulbs for each shepherd body, which would require 2 - 100 ct. mini-light strings, leaving $200 - 144 = 56$ for the head. However, this arrangement left the body a little too short, so I also added a 20 ct. string to the mix. This gave 14 rows \times 12 bulbs = 168 for the body, with $220 - 168 = 52$ left for the head, which was good coverage.

To attach the bulbs to the props, I cut a bunch of strips of duct tape (about $1\frac{1}{4}$ " - $1\frac{1}{2}$ " long, $\frac{1}{2}$ " wide) and temporarily stick them onto the frame, lay the figure on its side, then start taping the bulb sockets to the frame by wrapping a piece of tape around the socket and wire frame, one at a time. It's a little tedious, but actually goes quite quickly once you get going. I have found the 2" \times 2.5" grid on the fencing to be just right for all of the mini-light strings I have used, which usually have something like $2\frac{3}{4}$ " bulb spacing.



I go back and forth across the prop horizontally one row at a time, so I am using a 2½" bulb spacing (if you go vertically or have the fencing oriented the other way, you would end up with 2" bulb spacing instead of 2½").

I do not go all the way around the props when stringing the lights – I found that going about 2/3 to ¾ of the way around the prop is sufficient to make it look fully illuminated even when viewed from an angle, and also reduces the total number of bulbs needed for the prop. Some mini-light strings have uneven bulb spacing, so in some cases I needed to unwind the mini-light wires a few turns in order to be able to reach the next frame wire in the grid. Conversely, sometimes there is too much slack, so I make a few extra turns to "tighten up" the wire, or just leave it sticking out (as long as it does not hide a bulb filament).

I also found that inserting the bulbs from inside the prop and "hooking" them out over the wire in the fencing keeps the mini-light wires inside the cylindrical form, and helps to hold them back so they do not hide the bulb filaments.

I generally start at the bottom of the prop, so that the male plug is closer to the ground, and then work my way up the figure. Most of the figures need more than one 100 ct. string, so I plug these together end-to-end and continue all the way up to the top of the prop (if the entire prop will be on the same channel). For the heads of Mary, Joseph, and the angel, I think I did go all the way around since there are fewer redundant bulbs on the back of the head, and because the viewing angle typically needs more of the spherical shape populated with bulbs. For the shepherds and wise men, I left it open at the back (I actually went all the way around on one of the wise men, because I had a few extra bulbs "left over").

Even though this method is more time consuming, I am pleased with the final look:



3 wise men/kings, showing colored bodies and crowns



Angel with arms/trumpet lit



Mary + Joseph + cradle



Shepherds and sheep

Note – if you want to be able to light your figures in multiple colors, switching back and forth, you could repeat the process described above for each color. However, that will result in a lot of wires and bulbs on the figure. For multi-color props that can be switched back and forth, I use the above technique only for the prop's "primary" color (for example, white on the shepherds), and then I use a different technique to add the other colors. I'll defer that discussion to a separate article, since this one is so long already.

4. More Information

If you have any questions or comments for improvement of this article or the construction technique in general, please send an email to techguy@eShepherdsOfLight.com.

5. Revision History

Version	Description	Date
0.5	Started first draft	9/23/07
1.0	Finished first draft for DIYC	12/29/08
1.0a	Fixed typos, minor text corrections	1/11/09
1.0b	Add "freely distribute" clarification	7/19/09

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