Is there really a Santa-Claus Machine?

Yes, Virginia, there really is a Santa-Claus machine. It exists here and now, and represents enough new hacking opportunities to last you a lifetime.

Most science-fiction authors, including Hugo Gernsback, at one time or another introduced a Santa-Claus machine. This was either a mass teleportation device or an elemental atom smasher and rearranger. All you would have to do is feed it the right set of plans, and out would pop a sports car, an oscilloscope, a roast-beef dinner, or, for that matter, a brand new girlfriend.

As many copies as you like,

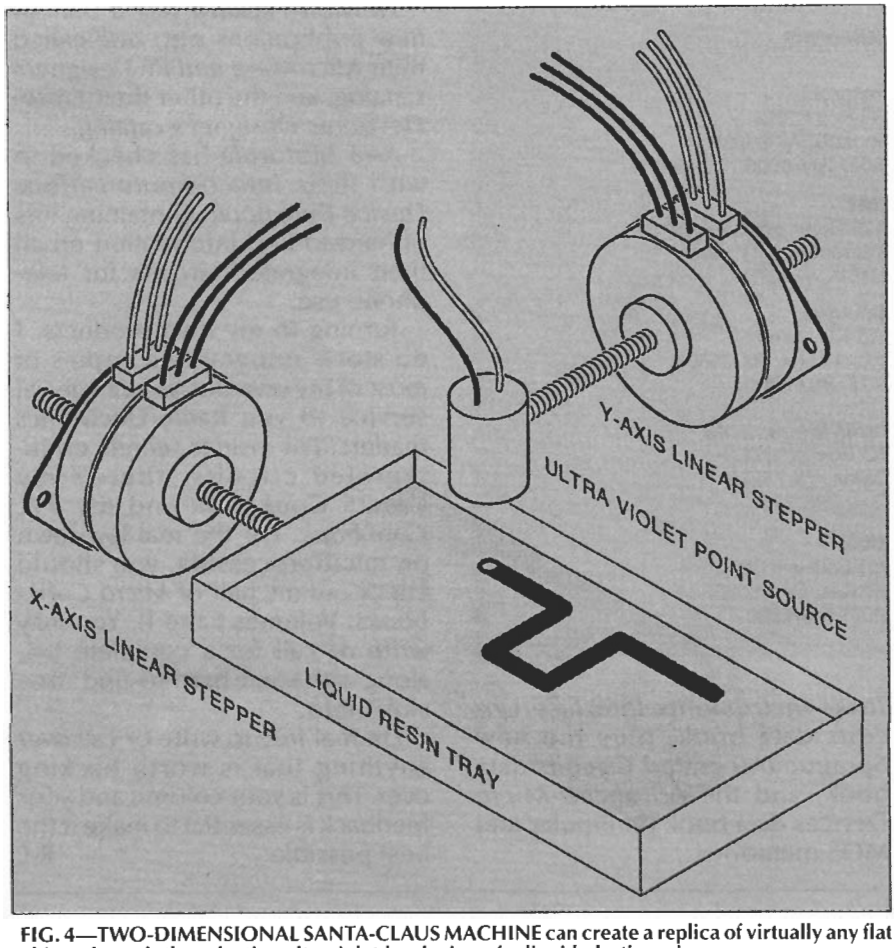

FIG. 4—TWO-DIMENSIONAL SANTA-CLAUS MACHINE can create a replica of virtually any flat object through the selective ultraviolet hardening of a liquid plastic resin.

Second, I would flush the laser and the beam scanning stuff, replacing the laser with a scientific ultraviolet lamp from *EG&G* or whoever, and replacing the beam scanning with two linear steppers such as the *Hurst* type SLS.

And, third, I would not worry about complexity or speed. If it takes a week to machine a simple part, so what? Particularly if you are now three orders of magnitude cheaper than your competition.

There are some very important safety considerations in all that. The resins must be used in a very well ventilated area, and you should avoid breathing any and all fumes. Touching or handling the uncured resin is also probably a very bad idea.

Even worse, intense ultraviolet light can easily cause blindness. That's why all those elaborate interlocks are present on EPROM erasers. Your Santa-Claus machine should be totally enclosed with opaque shields. Experiments on focusing or whatever should be done on a trial and error basis only.

Do **not**, under any circumstances **ever** look at the ultraviolet spot! I would also suggest wearing heavy sunglasses as an additional precaution against an inadvertent powering of the lamp with your shields down.

Needless to say, the editors here at **Radio-Electronics** will pay very well for construction details on the first Santa-Claus machine that can make non-trivial replica models on a hacker's budget.

Santa Claus again

Several times now, we've taken a look at the new Santa Claus machines that create instant desktop prototypes at a tiny fraction of the time and cost of traditional methods. As we have seen, all the stuff out there so far is primitive, klutzy, and horrendously priced. At least so far.

We've also seen some outstanding new hacker opportunities here, that range from low-cost desktop prototyping alternatives to offering your own prototyping service bureaus using the commercial systems.

While the best possible desktop prototyping solution remains "none of the above," let's look at a pair of new alternatives.

Have you ever played around with your glue gun? While not readily available, you can get polyethylene rods to use as glue sticks. That gives you a method for encapsulating compo-

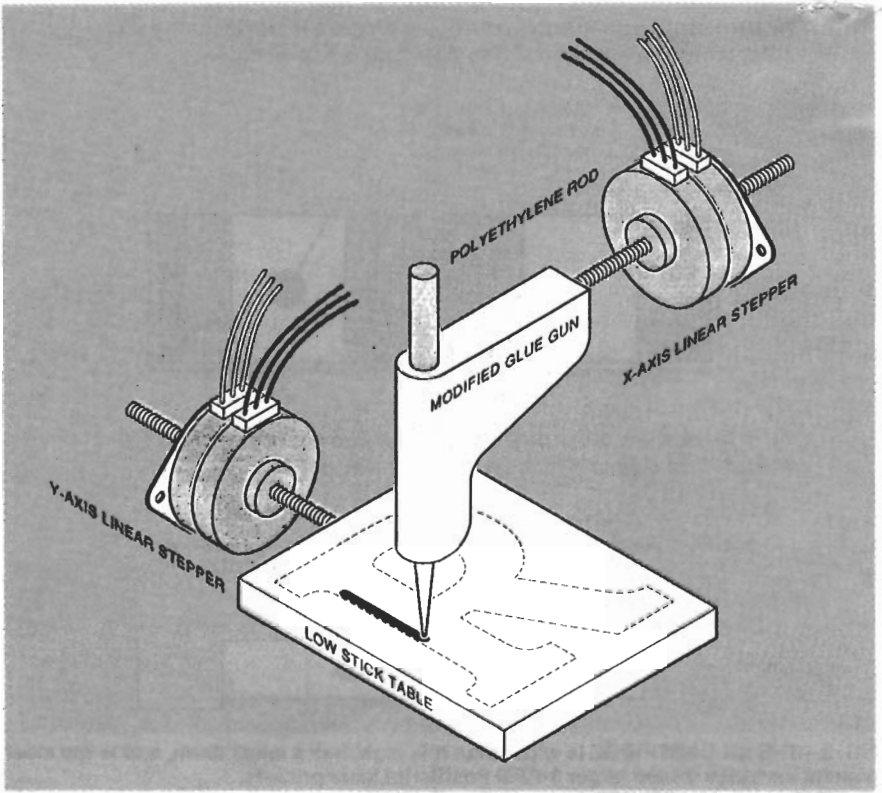

FIG. 5—A "SANTA CLAUS" MACHINE for producing large display letters. The polyethylene bead from the glue gun is programmed to build up the entire letter one strand at a time. While slow, there are no mold charges and the size and style can be instantly changed. Logos and custom characters are a snap.

nents in high-quality plastic or making your own custom connectors. Or of doing plastic casting at a tiny fraction of the usual mold costs.

Let's carry this one step further as shown in the crude system of Fig. 5. Say you wanted to produce some large display letters in various styles and sizes. Just take a modified glue gun on a linear stepper and a no-stick base on a second linear stepper, and you should be able to put a plastic bead down that follows the shape of the letter. Repeat the process until the entire letter is created. The host computer traces out the proper path to build up the letter one bead at a time.

Admittedly, this is a rather crude system which is limited to thin two dimensional objects. And we haven't properly addressed the third dimension at all. But it is a good starting point that could lead to some exciting new developments.

One suitable stepper would be the *Hurst model SLS*. I've been meaning to work up some more details on this and on Hurst's new EPC-015 controller. Maybe in a future column.

There is a commercial variation of the "hot glue gun" desktop prototyping method. This is the brand new *Stratasys 3-D Modeler*. They refer to their process as *Fused Deposition Modeling*, or FDM.

The system starts with a large roll of .020 or .050 diameter plastic or wax filament. The filament is heated just enough to make its outside tacky. The filament is then laid down into an existing pattern in the same way you can do artsy-craftsy stuff with string soaked in glue.

A three dimensional object is then built up, literally one string at a time. While they have an elaborate CAD software system based upon NURBS splines, the *PostScript* language and any old word processor should be able to do a vastly better job far faster and much cheaper.

The FDM method seems especially well-suited for modeling con-

tainers and other hollow packaging products. But sharp edges appear tricky to do, especially gear teeth. Ultimate costs should be low, since no lasers, fumes, high temperatures, costly materials, or exotic chemicals are involved. The typical speeds approach 1000 inches per minute.

One big problem with the system: Some prototypes can end up looking like something that missed hitting the reject bin in the arts and crafts class. Finer filaments can cure this, but build more slowly.

I'm wondering if a better prototyping solution might not involve two steps. Homes are usually built in a "rough" and "finish" stage. And machinists often work with *near net* stock to try and minimize their total production time. And modelers will often build their model first and then *superdetail* it later.

So perhaps the solution is some system that gets the shape pretty near the way you want it quickly and crudely. A second step would then measure and modify what you have to give for your final precision fit and finish. Let's have your thoughts on this.