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Haunt Air Manager (HAM)

The Haunt Air Manager is a standard component used for [pneumatic](#) effects in our haunt. In one package, it provides electrical triggering, pressure regulation, exhaust regulation, and air storage.



So, let's talk about "managing" a pneumatic effect...

- [Why bother?](#)  
- [Two-Way Valve Method](#)  
- [Three-Way Valve Method](#)  
- [A little slice of HAM](#)  
- [Green Eggs and HAM](#)  
- [Bits and pieces](#)  
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Why bother?

In order to activate a [pneumatic](#) prop, you need a way to feed it a supply of compressed air. Assuming that you already have a [compressor](#) and a bit of hose, the problem is reduced to a valve that can be used to turn on the air flow.

But there is one additional problem. Let's consider a little thought experiment...

Think of a toy balloon as your air-activated prop. Just imagine the balloon painted with a monster face, and inflating it causes the monster to suddenly appear in front of the trick-or-treaters.

You connect the balloon to a compressor and a valve that can be used to send air into the balloon on command. Kids come up the walkway; you open the valve; air flows into the balloon, making it expand; kids run away in terror.

Now what?

I mean, now, how do you prepare for the next batch of kids? You have to *let the air out of the balloon*. This allows the balloon to deflate, *resetting* the scare for the next batch of kids.

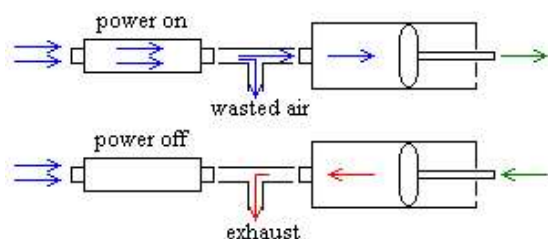
But we didn't plan for that! All we have is a way to get air into the balloon. If we open the valve again, even more air will go into the balloon. We need a way to exhaust the air. There are numerous ways to do this.

Two-Way Valve Method

The cheapest method is to insert a tee into the air line between the valve and pneumatic effect.

- The side branch of the tee goes to a cheap "bleeder" valve, or even a piece of tubing, crimped or crushed to slow the escape of air.
- When the valve is triggered, air rushes into the prop *and* out the escape hole. But flow through the escape hole is slow enough so that there is sufficient air to activate the prop.
- When the valve is turned off, air from the prop flows back and out the bleeder.

- This approach is often used with a two-way valve, which has only two ports, in and out, and works like a simple on/off switch.



When power is applied, compressed air goes into the pneumatic cylinder, and escapes through the bleeder valve.

When power is removed, exhaust air exits through the bleeder.

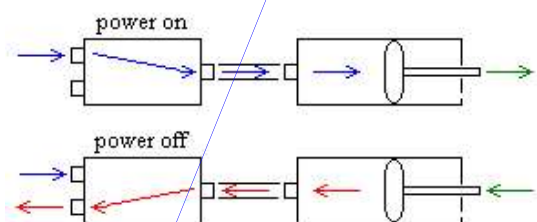
When using a two-way valve, the faster you want the prop to reset, the wider you must open the bleeder, and the more air that is wasted when you activate the prop. This will also cause your compressor to cycle more frequently.

Three-Way Valve Method

I prefer the use of a *three-way valve*.

- A three-way valve has three connections: a "normally open", "normally closed", and common. The valve has two pathways through the valve: it can connect the common to the normally open port, or the common to the normally closed port.
- When the valve is activated, air flows from the normally closed port, through to the common, and into the prop.
- When the valve is deactivated, air flow from the normally closed port stops, but the other port opens.
- The air from the prop flows back, through the normally open port, and is exhausted.
- By placing a flow control on the exhaust port of the two-way valve, you can control the speed with which the air escapes, and how fast the prop resets.

HAM is built around a three-way valve.



When power is applied, compressed air goes into the pneumatic cylinder, and only into the cylinder. No wasted air.

When power is removed, exhaust air exits through the other port. HAM puts a flow restrictor there to let you set how fast the prop resets. This does not cause any extra air loss, since the restrictor is used only for exhaust.

Note that just providing a way for the air from the prop to escape isn't always enough for the prop to reset fully, or in a timely fashion. If you open the stem on an air mattress, some of the air will indeed escape, but not all of it, and not rapidly.

That's one reason why some people like to use [screen door closers](#) as pneumatic cylinders - they contain a heavy spring that will automatically reset the prop, if you allow the air to escape.

A little slice of HAM



- quick snap-on air connectors on both ends
- pressure regulator turns the incoming high-pressure feed into precisely controlled pressure that this particular effect needs
- electrically-activated air valve dispenses air on command



• flow regulator on the valve's exhaust port controls the rate at which the effect returns to the quiescent state

It's really quite simple.

Here's a list of parts for the little slice of HAM. Prices and part numbers are from my local [Harbor Freight Tools](#), circa September 2001.

quantity	part	part number	unit price
1	1/4" brass industrial-style quick-connect male		
1	1/4" brass industrial-style quick-connect female		
1	3-way solenoid valve, with 1/4" NPT ports		
1	diaphragm pressure regulator, with 1/4" NPT ports	#32872	\$9.99
1	flow regulator, 1/4" NPT	#32905	\$2.99
1	AC line cord set		
1	fuse holder, inline		
1	fuse		
~2	1/4" connectors (close nipples)		

Green Eggs and HAM



This is the upscale Haunt Air Manager unit. It features:

- quick snap-on air connectors on both ends
- provides local storage of compressed air: as you add effects, you add air storage
- pressure regulator turns the incoming high-pressure feed into precisely controlled pressure that this particular effect needs
- electrically-activated air valve dispenses air on command
- flow regulator on the valve's exhaust port controls the rate at which the effect returns to the quiescent state

Here's a list of parts for the Green Eggs and HAM. Prices and part numbers are from my local [Harbor Freight Tools](#), circa September 2001.

<u>quantity</u>	<u>part</u>	<u>part number</u>	<u>unit price</u>
1	1/4" brass industrial-style quick-connect male		
1	1/4" brass industrial-style quick-connect female		
1	3-way solenoid valve, with 1/4" NPT ports		
1	diaphragm pressure regulator, with 1/4" NPT ports	#32872	\$9.99
1	flow regulator, 1/4" NPT	#32905	\$2.99
1	AC line cord set		
1	fuse holder, inline		
1	fuse		
~3	1/4" connectors (close nipples)		
1	converted propane tank (cleaned, drilled, and tapped)		
1	tee, 1/4" NPT		
1	pipe nipple, 1/4" NPT		
1	street elbow, 1/4" NPT		

[This particular sample used, instead of a street elbow, a regular elbow and yet another connector. Use what you have, can scrounge, or buy for cheap.]

Bits and pieces

Here are close-ups of some of the pieces that go into the various HAM variations.

Improvised air tank



With a full order of HAM, you get Green Egg, the air storage tank made from a recycled propane tank. The compressor makes all the pressurized air that we need, but might be tempted to run its motor all night long. In order to keep the motor from running, we provide air storage tanks. The motor runs only until the storage tanks are filled, then shuts off until the storage tanks run low again. Larger compressors have storage tanks of their own, and you can easily add more air storage with additional external tanks.

We have elected to give each air-powered haunt effect a little air storage of its own; as you add props, you add air storage to operate them.

Construction is simple: get empty propane tank; make sure it's empty; unscrew and remove the two valves; wash out with soap and water; drill and tap for 1/4-inch NPT; clean; paint; replace the pressure-relief valve. ([detailed instructions](#))

Quick connectors



We like to give our components a common, standard connection. This allows us to move them around as required and replace tired units with spares. The snap-on air connectors are a key to this. Our compressor and all of our hoses and manifolds use these same quick connectors. Any time we want, we can add 50 feet of hose, a manifold, or another



HAM - just by snapping it into place.

Note - This comes at a slight cost in system operational efficiency, because hard connections leak a bit less than the quick connectors.

Solenoid valve



Each HAM has an electrically-controlled (solenoid) valve. It permits us to remotely cause air to flow from the storage tank to the prop. When we turn the valve back off, the air in the prop is expelled through the exhaust port.

Solenoid valves come in all brands, sizes, and ratings. This one is an ASCO Red Hat model. The complete HAM unit shown at the top of this page uses a Mac valve.

Other pieces

Other pieces of HAM, not shown in brutal close-up:

- manifold - This is a T-shaped connector that allows us to take the air coming in from the compressor and route it to both the local storage tank and the solenoid valve.
- pressure regulator - This allows us to run the compressor at high pressure, and each prop at a lower pressure that is no more or less than the prop needs.
- flow regulator - This controls the speed at which air escapes from the prop after you turn off the solenoid valve. This lets you control the speed at which the prop "resets" for the next scare.
- assorted 1/4-inch NPT fittings

With the exception of the solenoid air valve, these parts can be easily and inexpensively found at [Harbor Freight Tools](#).

Then, just put it all together with Teflon plumbing tape.

Valves

A lot of home haunters use solenoid valves from scrapped washing machines and dishwashers. Buying these items as new replacement parts might be pricey, but when you can get them free, the price is right.

But these are [two-way valves](#), with no provisions for the exhaust that allows your prop to reset. You will have to install a bleeder valve, and live with the wasted air that results.

I don't know of any commonly scrapped consumer item that will yield [three-way valves](#) for free. Your choices are to buy them new, or find used ones from dealers in surplus stuff.

One good point is that you need not be constrained by any particular make and model number. Good, usable valves from a variety of manufacturers pop up surplus all the time. Just make sure they:

- are three-way valves, with three connection "ports"
- have input and output ports that you can attach to
We like 1/4" NPT, but you might like something else.
- take a power supply that you can deal with
We like 110 VAC because it is easily driven by [X-10](#).
- can take the pressures that you will be dealing with
- have an orifice capable of handling sufficient air flow

This is seldom a problem unless you have a prop that needs a lot of air, fast. 1/8" seems adequate for most applicaions.


Here are some valves that we have used:



MAC 113B-111BAAA



ASCO "Red-Hat" EF8003G1
(only rated for 50 PSI)

We have more info on [solenoid valves](#). 



Thank you for visiting. Your comments are welcome.



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Improvised pneumatic cylinder from a screen door closer

[Compressed air](#) can provide your animated Halloween gear with forceful, rapid linear action by activating a [pneumatic cylinder](#).

Pneumatic cylinders can be purchased new, found used, and improvised from a variety of materials. There is occasional debate on the safest, best, and cheapest form of pneumatic cylinder.










This page shows how to build an improvised pneumatic cylinder from a screen door closer, a technique that we have used effectively on:

- [popup skeleton](#) 
- [giant spider](#) 



Here are three converted door closers, ready to scare!












So, let's talk about screen door closers...

- [History and Resources](#) 
- [Safety](#) 
- [How a door closer works](#) 
- [How the modification works](#) 
- [What is the result?](#) 
- [What kind of closer do I need?](#) 
- [Conversion process](#) 
- [One way to finish](#) 
- [Another way to finish](#) 

History and Resources

I haven't researched this extensively, but the first mention that I recall of improvising a pneumatic cylinder from a screen door closer was in Carl Chetta's Trash Can Trauma. There have been many descriptions of this hack since then.







Here are some projects, like grave jumpers and body slingers, using pneumatic cylinders:

- <http://hauntedresources.8m.com/howto/casket/Casket.html> 
- <http://www.hauntedresources.8m.com/howto/Casket.html> 
- <http://www.scaryguys.com/slinger.htm> 
- <http://www.sonic.net/~trueoak/hank.htm> 
- <http://members.aol.com/halloween179/leapingloafer.htm> 
- <http://www.scaryguys.com/slinger.htm> 
- <http://www.ghoulsville.com/Construction/c1/Coffin/coffin.html> 
- <http://www.citilink.com/~blorsung/halloween/Projects/coffin.html> 
- www.deviousconcoctions.iwarp.com 
- http://www.serytech.com/~rao/Projects/coffin_jumper.htm 
- <http://www.startle.com/start/slinger.htm> 

air cylinders

- [P V C PNEUMATIC CYLINDER](#) 

other helpful stuff:

- <http://www.phantasmechanics.com/air.html> 
- <http://earthsands.com/holiday/halloween/hallpropsindustrial.html> 
- <http://earthsands.com/holiday/halloween/hallPropsPneumatic.html> 
- www.deviousconcoctions.iwarp.com/pneumatics.html 
- [\[manesmann rexroth\]](#) 
- <http://marks-mos.8m.com/cyl.htm> 

Safety

This project is an improvisation. It takes a commonplace item and reuses it in an unconventional way, for a task it was never designed to do.

There have been long, passionate debates on the [e-mailing lists](#) concerning the safety, cost, efficiency, and other tradeoffs of such improvisations.

You will have to make up your own mind as to whether or not this is a good thing to do.

We have used these effectively on:

- [popup skeleton](#) 
- [giant spider](#) 

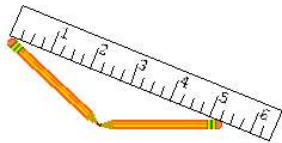
CAUTION:

- Always use a pressure regulator when using an improvised pneumatic cylinder.
- Do not use excessive pressure - it can blast the end off the screen door closer.
 - Many people who use this technology warn against going over 40 PSI.
 - How much pressure you can use depends on the make, model, and condition of the closer that you use.
 - Use the minimum pressure that produces an acceptable effect.
- Make sure that the ends of the cylinder do not point at people or where people might be. If the end does blow off, gods forbid, you just lose a prop instead of an eye.
- Perform comprehensive testing of the cylinder and prop before deploying them.

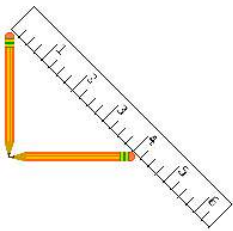
How a door closer works

Before you attempt to convert a door closer, you should know how one works.

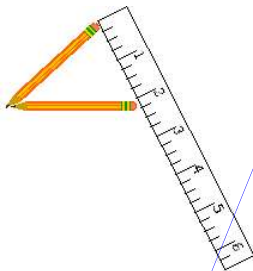
Let's start with the concept of a triangle, made from two pencils and a ruler. Depending on the angle between the pencils, we'll need a different length of ruler.



A large angle requires a large third side on the triangle.



Medium angle.



A small angle requires a small third side on the triangle.

The point is simply that, when two sides of the triangle stay the same size, the third side changes in size as the angle changes.

Now, think of one pencil as your screen door, and the other as the door frame. The place where the pencils come together is the door hinge.

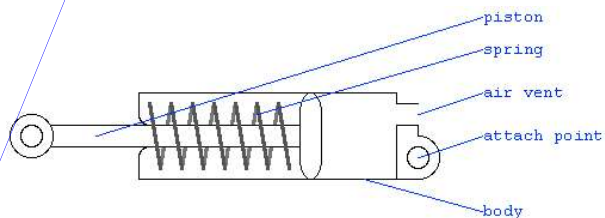
The angle measures how far the door is open. If you replaced the ruler with a gadget capable of changing its length, it would be able to automatically change the size of the third side of the triangle, thereby changing the angle between the door and frame, opening and closing the door.

The screen door closer is exactly such a gadget. You can pull open the door, stretching the closer to its full length. *When you let go of the door, the closer slowly shrinks in length.* This pulls the door closed, firmly, but without slamming.



Here's a closer, mounted on a screen door.

Now, let's take a look at how the closer works inside.



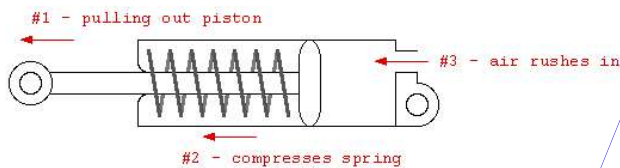
Cutaway view of a door closer.

Let's forget about the air vent for a minute.

- If the body of the closer is attached to something, you can pull out the piston.

- You are pulling against the internal spring, which is quite strong.
- As soon as you let up, the spring pulls the piston back into the cylinder.

Now, let's consider the air...



- Think of the air vent on the right of the closer as being a manually operated valve.
- Open the valve and pull on the piston.
- You are pulling against the internal spring.
- As the piston moves to the left, air enters through the valve to fill the space vacated by the moving piston.
- As soon as you let up, the spring pulls the piston back into the cylinder, and the air is driven back out.

But what would happen if you pulled out the piston and *closed* the valve?

- The spring attempts to push the piston back into position.
- As the piston returns, it encounters the air that was allowed into the cylinder when the valve was open.
- With the valve closed, the air has no place to go - it can't get out of the way of the spring-driven piston.
- The air will compress a little, but eventually equal the force of the spring.
- The piston will move a little and stop. It can't continue moving back until the air pressure is released.

If you open the air valve just a tiny bit, the air will leak out, and the spring will be able to slowly push the piston back into the resting position.

That's the intended use of the screen door closer right there: you can stretch it out to its full length, and it slowly collapses back to resting length as air leaks out.

How the modification works

So, why do we care how the door closer works?

Well, what if, instead of the valve, you hooked up a hose and pumped air in and out of the cylinder? The piston would move in and out. Hook it up to something and you have animation.

And, to make it even simpler, most of these cylinders have an air valve in the form of a screw threaded into the body of the cylinder. If you unscrew that, you have a port into the cylinder, that can be used to pump air in and out.

What is the result?

After the conversion, you should have something that:

- operates on 30-40 PSI
- has a reach of 6 inches
- automatically retracts when air pressure is removed

What kind of closer do I need?

We are dealing with the cylindrical air-operated door closer, not the oil-filled beasts that tend to be rectangular and chunky.

Read through all of these directions and study all the pictures, and you'll be able to easily recognize a suitable door closer.

Conversion process



Door closer before modification.

These are available in black, white, gold anodized, aluminum, and other colors.

The one on the top of the picture is a tad longer.

Keep the assorted hardware that comes with it. You might find it useful in mounting the converted cylinder.



Pull the piston out a couple of inches and use the wedge to hold it out.

We do this so that there is no chance of harming the bottom end of the piston during conversion.



Find the air adjustment valve. It should be on the end of the cylinder body. It just looks like a screw. If you're lucky, it will be indicated by markings for "+" and "-" or "faster" and "slower". Most are unmarked.

Here are two slightly different

models of screen door closer. The one on the left has a bit more metal surrounding the screw.

Unscrew the screw!



The hole for the valve screw is in two parts. The outer part is wide enough for the head of the screw to go in. The inner part is narrow, and threaded to accept the screw.

By locating and removing the screw, you have actually done the hard part!

All you now need is a way to blow air into that hole, and let it escape later, and you're done!

We want to be able to make a clean, strong air connection to the closer. Just about anything that you can screw in, epoxy in, or solder in will work ... if it will take a little pressure.

We'll show just two of the numerous workable methods to finish this project.

One way to finish

This method uses a hose barb and a length of clear vinyl hose. Like all our pneumatic assemblies, it terminates in a snap-on quick connector that we use as our standard.

I came up with this approach for use on closers that have very little metal around the air valve screw. In such cases, there might not be enough material to drill and tap.

As side benefits, it's a little cheaper, and has a built-in flexible air connection.



This is a barbed hose splicer, intended for use in splicing together two pieces of hose. They come in various sizes, as shown here.

The one on the bottom has been cut down on the left side, so that one end is only long enough to go clear through the bottom of the closer.



The simplest way to cut down the hose barb is with a pipe and tubing cutter. Failing that, use a hacksaw.

In either case, clean up the cut with a file or sandpaper.



The trimmed barb is only long enough to go clear through the bottom of the closer.



The inner threads in the hole are too small for the hose barb. The outer part of the hole is too large.

We'll drill out the inner part just enough to make a *very tight* fit with the cut-down hose barb.

Use caution in drilling. It's best to firmly clamp the closer while working on it.



If your epoxy is runny, or slow to set, make the hole a tight fit, jam in the barb, and then pour the epoxy between the barb and the inner wall of the hole.



If your epoxy is thick, or sets fast, roll the barb in the epoxy until it has built up a thick collar of glue, and shove that into the hole, while giving it a twist.

Or make up your own technique!

Don't use so much epoxy as to cause drips inside the cylinder. It's probably a good idea to hold the cylinder upright, with the barb at the bottom, until the epoxy sets.

I like to run a bead of epoxy around the junction, too. Don't be cheap! This is the part that gives strength to the connection!



Finish up with a length of clear vinyl tubing and a hose clamp. I told you this was easy!

Finish the other end with whatever suits you. In my case, that's a quick connector and little bits of hardware to hook it up to the vinyl tubing.

This vinyl tubing is rated up to 55 PSI. You weren't planning to go that high with a door closer, were you?

Another way to finish

This method uses an elbow and some little rigid fittings. The goal here was to get to our standard snap-on quick connector as fast as possible.



I rather like standard pipe fittings, so I'll be attaching this 90-degree elbow to the cylinder. The threaded part that will be going into the door closer is 1/8-inch NPT (National Pipe Thread).

You can find these at the hardware store. Just ask for a

90-degree street elbow
1/8-inch NPT

Yes, I know that 1/8" sounds mighty small. But that's not the real size. It's just what they call it.

The "street" part means one side is male, the other female. (A regular elbow is female on both sides and will require an additional nipple to hook up.)

Other parts: 1/8" close nipple, 1/8" to 1/4" reducer, and male quick connector.



The threads in the inner hole are too small for the 1/8" NPT elbow. And the outer part of the hole isn't threaded at all, and makes a tight fit with the elbow.

At this step, some folks just force the elbow into the outer hole. Others drill the hole much larger and epoxy it in. You have to be careful that you don't drill away too much metal; there isn't much there to begin with.

We like to drill the inner hole out a *little*, without damaging the outer hole, then tap the hole all the way through.

This requires a closer with a decent amount of metal around the screw hole.

Use caution in drilling. It's best to firmly clamp the closer while working on it.



Tap the hole all the way through (inner and outer) with a 1/8" NPT tap.

I take it slow and easy, and don't use cutting oil.

Then turn the closer upside down and shake it a lot. You want no trace of metal filings left in the cylinder!

Now, dry-fit the elbow to the tapped hole in the cylinder. If they don't screw together, run the tap through the hole again, and chase the threads on the elbow with a 1/8" NPT die. [I have seen elbows that claimed to be NPT, but didn't taper properly.]



Now screw the elbow fitting into the cylinder.

I like to mix up some epoxy and lubricate the threads with that before assembly, and run a bead around the junction.

With a properly drilled and tapped hole, matching threads on the elbow, and epoxy, the result is quite strong.



Put the rest of the parts together, using teflon tape on the joints.



We're done!

Now all you have to do is [mount it](#).

Thank you for visiting. Your comments are welcome.



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