

Introduction

Compressed air is a great way to achieve short, explosive effects. Air cannons, pneumatic pistons, and even short water spray effects can all be run off of pressurized air. Air can be pressurized and stored in an easy-to-build home-made air tank such as the one shown below in figure 1. The air can then be released at an opportune moment using some sort of valve to achieve the desired effect.

Form and Function

The PVC Air tank shown below is simply a tube which has a bicycle tire-fill valve at one end and a 3/4" threaded female connection at the other. The female connection can be mated with a solenoid actuated valve to allow electronic control over the release of air from the tank. All connections are solvent welded to assure the pressure rating and strength of the tank.

The tank is designed specifically for an All Electronics part SV-2 Valve to be connected at the 3/4" outlet to form the tank's airtight seal. The tank can be pressurized using a conventional bicycle hand pump connected to the tire-fill-valve located at the opposite end of the tank from the 3/4" outlet.



Figure 1: Finished PVC Air Tank Shown without SV-2 Valve

Safety

Any situation where gasses are held at a pressure can be dangerous. Compressed air is no exception. The most important safety precaution is making sure that pressure in the tank never exceeds the weakest-rated component in the system. For instance, if the 2" PVC piping is rated at 280 PSI, the fittings are rated at 300 PSI, the solvent-weld connections are rated at 300 PSI, and the tire-fill valve is rated at 80 PSI, the highest the system can ever safely be pressurized to is 80 PSI. You should always determine what the maximum pressure rating of each component is before pressurizing the system. In general, homemade tanks should not be pressurized above 100 PSI.

Compressed air can not only pose a hazard through explosion, but also through close range exposure to skin. High-pressure air can cut, and in some cases force air bubbles into the bloodstream, which can lead to a fatal heart attack. You should never place a part of yours or someone else's body over the outlet/nozzle of a pressurized air system. Always protect your eyes and body from any incidental dust and debris kicked up by compressed air discharging from a container or tank.

Materials

Most of the materials for this project can be obtained at a local hardware store. Note that there many different combinations of adapters and reducers which can be used. The selection of the actual adapters and fittings depends greatly on the specific application.



PVC Air Tank Parts Cost List						
Vendor	Part No.	Description	Price	Qty	Subtotal	Picture
Lowe's	23902	2" PVC Straight Coupler	\$ 0.62	1	\$ 0.62	
Lowe's	23900	2" PVC Cap (Solvent Weld)	\$ 0.57	1	\$ 0.57	
Lowe's	23862	3/4" Solvent Weld to Threaded Adapter	\$ 0.29	1	\$ 0.29	
Lowe's	23003	2" to 3/4" PVC Pipe Reducer	\$ 0.76	1	\$ 0.76	
Lowe's	23832	2" x 10' SCH-40 PVC Pipe	\$ 8.48	1	\$ 8.48	
Lowe's	23971	3/4" x 10' SCH-40 PVC Pipe	\$ 2.93	1	\$ 2.93	
All Electronics	SV-2**	Solenoid Valve 3/4" Inlet, 1/2" Outlet	\$ 4.50	1	\$ 4.50	
Advance Auto Parts	V4180*	Schrader Valve Stems	\$ 1.98	1	\$ 1.98	
Subtotal					\$ 20.13*	
Overcharge			(For tax, unexpected costs, etc.)	30%	\$ 6.04	
Total Estimate					\$ 26.17*	

*Note – Significant Cost reductions can be achieved if the cost of items 23003 and 23832 (PVC Pipe) is shared among several users as only small amounts of each of these items are required to build the effects. Additionally, Item V4180 can be scrounged from bicycle repair stores which will often give away broken bicycle tubes.

**A Rainbird Solenoid Valve Lowe's Part No. 23026 can be substituted for the all-electronics valve SV-2. This requires that the 3/4" Adapter No. 23862 be substituted with No. 23856 (Solvent-Weld-to-Male-Thread). While the Lowe's solenoid valve is much more expensive than the all electronics valve, it has a larger valve-office making it idea for the faster release of air (offers less resistance to air flow.)



Lowe's	23026	Rainbird In-Line Sprinkler Valve	\$ 14.82	1	\$ 14.82	
Lowe's	23856	3/4" PVC Adapter Solvent-Weld-to-Male-Thread	\$ 0.19	1	\$ 0.19	

Building It

- Start by cutting the 2" PVC pipe. The length is determined by how much air should be stored in the tank. The longer the pipe, the greater the tank's capacity. Also, cut a small piece (about 2" long) of the 3/4" PVC Pipe. Be sure to clean out any PVC filings creating during the cutting process from the ends and inside of the pipe. These small flecks of PVC can cause big problems clogging air lines and nozzles later on if they aren't removed now.
- Drill a hole in the 2" PVC end-cap for the bike tire fill-valve. Drill the hole large enough so that the body of the tire fill valve fits snugly in the hole. Press-fit the assembly before applying any epoxy. Once you are satisfied with the fit, cover the fill-valve connection with tape (to prevent any epoxy or adhesive from accidentally getting inside of it) and then coat the body of the valve with plastic or general purpose epoxy. Slide the valve into the hole in the PVC end-cap and twist 1/4 of a turn. Be sure the epoxy is spread evenly around the inside and outside of the end-cap. Allow the adhesive to cure for the time specified on the package of the product.
- Using PVC primer and cement, assemble the tank as shown in figure 2. See the section on "Solvent Welding" for details on using the PVC primer and cement. Be sure to allow solvent-welds appropriate cure time before attempting to pressurize the tank.

Solvent Welding

Solvent welding, like welding metal, bonds two separate surfaces by essentially melting them into a single surface. Unlike metal welding, PVC solvent welding uses chemicals to create the bond. Be sure to read the directions on the bottle of the solvent weld primer and cement. It helps!

- Be sure that the pipe and fittings are clean and don't have any shavings inside or on the ends from being cut.
- Apply an even coat of purple primer to the pipe and fitting on the surfaces where they will be joined. Be careful about spilling or dripping the primer. It will stain just about any surface.
- Apply an even coat of PVC cement over the primer on both the pipe and fitting.
- Firmly press and twist the pipe into the fitting. Be sure to rotate the fitting about 1/4 of a turn. Allow the cement to set for at least 4 hours before pressurizing.



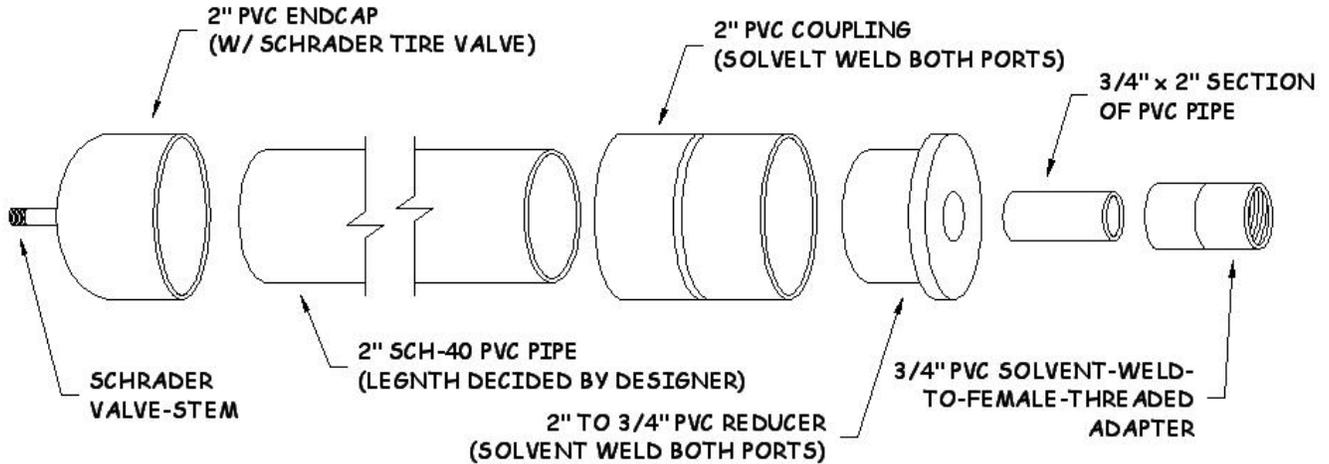


Figure 2: PVC Air Tank Assembly View

Conclusions

There are nearly limitless applications and a small portable compressed air effect in theater. You can connect the outlet of the solenoid valve to a small piston and push an object forward. Another possibility is screw the outlet into an open-ended PVC tube, creating an air-cannon. Regardless of the end application, the PVC air tank is a flexible, useful piece of theater technology.