

The W4SSY Spudgun

Use this clever launcher to get antennas and halyards over high supports.



Byron Black, W4SSY

My first order of business as I returned to Amateur Radio after almost 30 years was to get an antenna in the tallest tree I could find. I thought of a bow and arrow or a slingshot as appropriate candidates for a launcher. At the age of 75, with two damaged rotator cuffs, however, the chance of success seemed slim. I had heard of *spudguns*, but thought of them as something that youngsters play with. I was also concerned about possible noise.

The Spudgun Moves to the Front

Following some research, I learned that a spudgun can work quietly with compressed air so I started to experiment. I came up with the antenna launcher shown in Figure 1 after trying a dozen variations. This will launch a projectile over any tree in my area (to 150 feet), and has the additional advantage of being non-threatening. It does not look like a weapon.

This last factor is important since my club, the Vienna Wireless Society of Vienna Virginia, normally has our field events in public parks with many people around. This launcher attracts a friendly curiosity such as “what is that thing?” and usually generates a few “wows” and “cools” when it launches. How can you be afraid of something you pump up with a regular tire pump (see Figure 2)? Everything, including the pump and a few accessories can easily be carried in a medium size sports bag as shown



Figure 1 — The assembled antenna launcher ready to be pumped up and used.

in Figure 3. Not including the pump, the total cost is less than \$70.

Making it Happen

The launcher consists of only four basic parts: tank, valve, barrel and projectile and is simple to fabricate (see Figure 4). All parts are off the shelf, and only common tools are needed. All materials were purchased from local retail home stores, auto supply houses and RadioShack.

The tank (items 1 through 7 in Figures 5 and 6) consists of a 12 inch long piece of 3 inch diameter schedule 40 PVC pipe (2), with an end cap (1) at one end, and at the other end a 3 inch to 1½ inch coupling (3), a 1½ inch to 1 inch bushing (5), a short piece of 1 inch pipe (6) and a 1 inch male adaptor (7). A tire valve (4), just like the ones on your car, goes into a hole in the coupling for filling the tank.

The valve (8) is a standard lawn sprinkler valve — Toro part 53708 (EZF-06-04 in the Toro commercial line is exactly the same valve), 1 inch size with female threads at both ends. I have tried several other makes and models, many of which will work as well.

The firing trigger consists of two 9 V batteries, a safety switch and the firing button. All are wired in series and mounted to a 1 × 4 inch aluminum plate. The entire assembly (9) is then taped to the sprinkler valve. Although not shown in the figures, I would recommend that the aluminum plate be about 6 inches long and bent back above the fir-



Figure 2 (left) — How can bystanders be afraid of something you pump up with a regular tire pump?



Figure 3 — All the pieces can conveniently fit in a medium size sports bag.

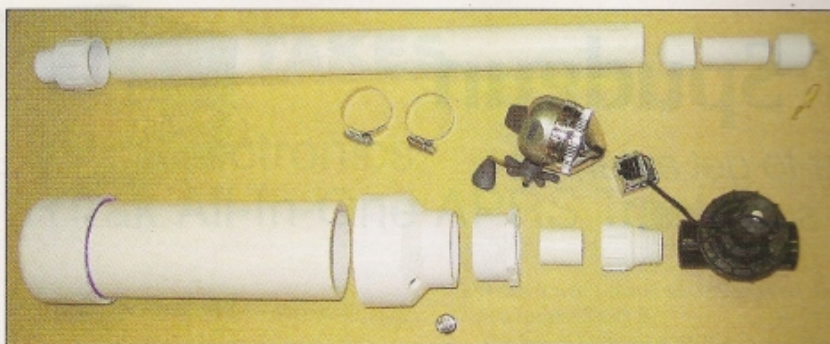


Figure 4 — The spudgun is easy to fabricate from the pieces shown.

ing button to reduce the chance of accidental firing.

The barrel (11) is a 24 inch long piece of 1½ inch PVC pipe with a 1½ inch to 1 inch male adaptor (10) that screws into the sprinkler valve. Near the end, a fishing reel (15) is clamped to the barrel with two clamps (17). A swivel (16) on the fishing line hooks to the projectile. The fishing reel is a Zebco 202.

The projectile is made up of a 2½ inch piece of ¾ inch PVC pipe (13) with two ¾ inch end caps (12). One of the caps has two small holes with a paperclip twisted inside to form a loop (14). It is a good idea to make sure that the pipe for the barrel and the end caps for

the projectile fit well together as you select the pieces. There is no industry standard for the inside of pipes, nor for the outside of fittings, and some combinations will not work. Do not worry if the cap seems too loose; it will work fine. Some end caps may have a little plastic ridge that needs to be filed down.

There is nothing sacred about this design. I have tried many combinations with tanks as small as 2 inch pipe, 8 inches long and with barrels from 12 to 36 inches long. The tank should have at least twice the volume of the barrel, however. There are several other combinations of parts that will let you go from the tank to the valve and from the valve

back up to the 1½ inch barrel.

I have also experimented with other types of valves and firing systems (see Figure 7). Firing the sprinkler valve pneumatically, as shown in the right on Figure 7, is more efficient but is more difficult to build. A PVC globe valve, shown in the center of Figure 7, has a lot to recommend it. It will work almost as well as the sprinkler valve, will be much easier to find, will save about \$25 and may be less likely to be fired accidentally.

To select a PVC valve, find one that turns easily (they vary quite a bit) since the valve must snap open quickly for best results. Try to get a 1 inch valve with threaded fittings and you can build the launcher, except for the valve, exactly as described. Later on, if you want to try the sprinkler valve, it is easy to substitute.

I would strongly recommend that you stick with the barrel and projectiles described here. I spent as much time trying to find a good combination of barrel and projectile as I did for the rest of the design. These projectiles are inexpensive (\$0.75), take only minutes to make, are easy to see and slide nicely through dense tree foliage.

For filling the tank I tried all sorts of pumps before ending up with the cheapest, easiest and lightest — a \$15 hand pump complete with pressure gauge. About 10 to 15 strokes is all it takes.

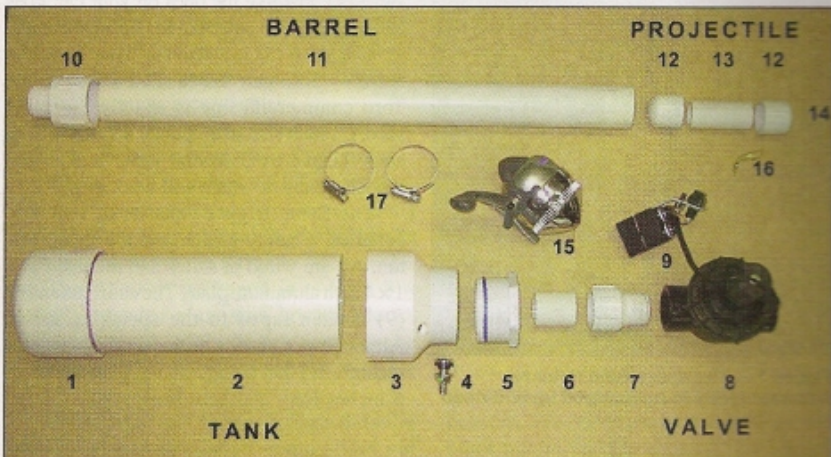


Figure 5 — Key parts of the spudgun.



Figure 6 — More assembly details.

Required Tools and PVC Fittings

The only tools needed are a hacksaw, a utility knife, a drill with a ½ inch bit, a few smaller size bits, a few small files and a soldering iron. You also will need PVC cleaner (get the purple kind), PVC cement, Teflon tape, plastic tape and masking tape.

Before joining the PVC fittings, run your fingers over the surfaces to see that they are smooth and clean inside and out. Be very careful about trying to dry fit the parts together; they can get stuck and be difficult to separate.

Apply a light coat of purple cleaner on the surfaces to be joined. For the sake of appearances, mask the surfaces you do not want to end up purple. When you are ready, put cement on both surfaces and *work very fast*. You only have about 30 seconds before it hardens. On larger parts that require lots of cement, make sure that the excess does not drip inside onto the tire valve or sprinkler valve. The cement acts as both a solvent and a lubricant. If lined up properly, the parts will slide together easily. Slightly rotate the pieces as you press them together. If you have not worked with PVC before, I recommend that you practice on a projectile first. The really nice thing about PVC is that if you make a mistake, it is inexpensive to replace the ruined parts.

All Together Now

Here is the recommended sequence in assembling the tank and valve. Wrap at least

Table 1

Parts List for the W4SSY Spudgun

Key	Part Description	Estimated Price (\$) [†]	Suggested Source
1	End cap, 3"	3.00	Lowes, Home Depot
2	Pipe, 12" long 3" pipe	3.00 (24"/\$6)	Lowes, Home Depot
3	Coupling, 3" to 1½"	3.00	Lowes, Home Depot
4	Tire valve	2.50 (2/\$5)	Advance Auto Parts
5	Bushing, 1½" to 1"	1.25	Lowes, Home Depot
6	Pipe, 1½" long 1"	0.25 (10'/\$3)	Lowes, Home Depot
7	Adaptor, 1" male	0.75	Lowes, Home Depot
8	Sprinkler valve, 1"	17.00	Lowes, Home Depot
9	Firing assembly, see 9A-9E.		
10	Batteries, 9 V (2 required)	4.00	Many
11	Battery clips	3.00	RadioShack
12	Safety switch	1.75	RadioShack
13	Push button	2.50	RadioShack
14	Aluminum plate, 1 x 4"	1.00 (24"/\$5)	Lowes
15	Male adaptor 1" to 1½"	1.50	Lowes, Home Depot
16	Pipe, 24" long 1½"	1.50 (10'/\$6)	Lowes, Home Depot
17	End cap, ¾"	0.75	Lowes, Home Depot
18	Pipe, 2½" long ¾"	0.25 (10'/\$2.50)	Lowes, Home Depot
19	Paper clips		
20	Fishing reel, Zebco 202	8.00	Walmart
21	Fishing swivel	0.20 (6/\$1)	Walmart
22	Hose clamps	2.00	Home Depot
23	PVC cleaner and cement	6.00	Lowes, Home Depot
24	Tire pressure gauge	4.00	Advance Auto Parts

[†]You can save on parts if you build more than one. The Vienna Wireless Society had a workshop and built 12 launchers for a cost of slightly more than \$51.00 each, not including the pump.

5 layers of Teflon tape on the threads of the 1 inch male adaptor and screw it into the input end of the valve as hard as you can by hand. The arrows on the sprinkler valve must point toward the barrel end of the valve. The outside of the male adaptor looks like a big plastic nut. Line it up so that there is a flat side on top of the valve, providing the trigger assembly with a flat place to sit. Now set this assembly aside.

Drill a hole in the coupling to receive the tire valve. With the rubber washer on the inside, tighten the valve so that it is fully secure. An optional aesthetic step for the bushing is to cut a little bit from the back end (shown by the thin blue tape) so that it will fit more flush into the coupling. Cement the coupling, bushing and a short piece of 1 inch pipe together. Cement this assembly into the 1 inch male adaptor, making sure that the tire valve is on the top side of the valve. When cementing multiple parts, allow several minutes between steps. Cement the 3 inch pipe to the coupling, and cement the end cap at the far end. This completes the assembly of the tank.

The barrel is made up of only two PVC parts. After you tighten the hose clamps on the reel, make sure the projectiles still slide easily through the barrel.

Bubbles in the Sink

After the tank and valve are assembled, and the cement has set for several hours (but before the switch and batteries are taped to the valve), put about 15 psi maximum of pressure in the tank. Immerse everything but the switch and batteries in a sink full of water, and check for bubbles. If the bubbles are in the joints of the PVC fittings, clean the area

around the leak and try forcing cement in the joint. If it still leaks, clean the joint and cover with epoxy. For a leak in the center of the tire valve, clean the valve core and retighten it. If a leak occurs between the tank and the sprinkler valve, take it apart, clean the parts, add a few more layers of Teflon tape and retighten the parts. For leaks at the barrel end of the valve, make sure the solenoid valve and the little bleeder valve are screwed in tight.

Be Very Safe

Although schedule 40 PVC pipe is rated at about 170 psi, all of the manufacturers of PVC pipe say that their product should not be used with compressed gases. You should never put more than 60 psi in the tank. If you need more than that, you should not be using this launcher. I suggest that you start with 30 psi and go up from there. I have found that 45 psi will work for even the tallest trees in my area. Never put the projectile into the barrel until you are ready to shoot. Do not walk around with air in the tank and a projectile in the barrel. The force from this is about the same as from a well hit baseball and will easily break a window, put a nice dent in your neighbor's car or put a hole in drywall. Although the launcher is fun to use, it is not a toy and must be used with care.

Ready, Set

Do not screw the barrel tightly into the valve; it is not necessary, nor is Teflon tape required. When you are in position and ready to fire, push the release on the fishing reel and only then drop the projectile into the barrel. Turn the safety switch to ON and fire. I find that after a shot it is easier to reel in the line or

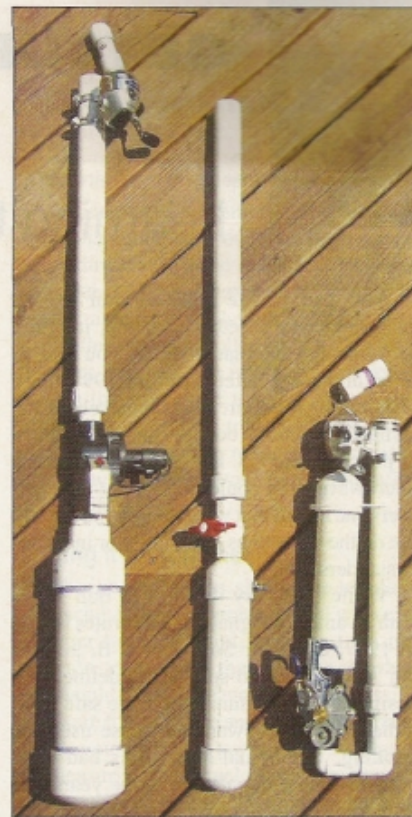



Figure 7 — Other types of valves and firing systems can be used. Right: Firing the sprinkler valve pneumatically. Center: a PVC globe valve.

go through brush with the barrel unscrewed from the tank.

Always have someone "downrange" to help pull the lines through and to make sure that no one is nearby and there are no overhead wires. Keep safety in mind and wear protective head, hand and eye gear.

Use the fishing line to pull a small nylon cord first and use that to pull larger lines. Cover the knots at tied junctions with plastic tape and smooth them down to slip through the branches more easily. Happy launching.

Byron Black, W4SSY, retired in 2004 after practicing architecture for almost 50 years as principal in a large Washington, DC firm. He holds BS and MS degrees from Virginia Tech and since retirement has continued taking college courses, mostly in science subjects. He was first licensed in 1951 as W4SSY and now holds an Amateur Extra class license. He is a member of the Vienna Wireless Society, Chapter 91 of QCWA, the ARRL and the Virginia Gun Collectors Association. You can reach Byron at 10608 Vickers Dr, Vienna, VA 22181 or at w4ssy@arrl.net. 

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W4SSY Spud Gun Parts List

01	3" End Cap	3.77	(Home Depot)
02	3" Pipe, 12" Long	5.05	(Home Depot)
03	3" to 1½" Coupling	3.77	(Home Depot)
04A	Tire Valve (for 2)	3.19	(Advance Auto Parts) Standard size is 0.453" (29/64")
04B	Valve Wrench	1.99	(Advance Auto Parts)
05	1½" to 1" Bushing	.98	(Home Depot)
06	1" Pipe, 1½" Long	1.67	(Home Depot)
07	1" Adapter, Male	0.53	(Home Depot)
08	1" Sprinkler Valve	14.37	(Home Depot, Lowes) (Toro Part # 53708)
09A	3 - 9V Batteries	12.94	(Home Depot) You can beat this price
09AA	3 - 9V Battery Snap Connectors	2.99	(Radio Shack - Catalog #: 270-0324)
09B	3 - Battery Clips (for 4)	1.98	(Radio Shack - Catalog #: 270-0326)
09C	1 - Safety Switch	2.99	(Radio Shack - Catalog #: 275-0634)
09D	1 - Push Button (for 4)	3.69	(Radio Shack - Catalog #: 275-1547)
09E	1"x4" Aluminum Plate	4.63	(Home Depot)
09F	10Ω 1W (for 2)	1.49	(Radio Shack - Catalog #: 271-0151) for current limiting
10	1" to 1¼" Adaptor	1.70	(Home Depot)
11	1¼" Pipe, 24" Long	2.34	(Home Depot)
12	¾" Caps (18) (Makes 9) @ 0.32	5.76	(Home Depot)
13	¾" Pipe, 2' Long (Makes 9)	1.15	(Home Depot)
14	Paper Clips	0.00	Steal Them
15	Fishing Reel, Zebco 202	4.76	(Walmart)
16	Fishing Swivel (for 12)	0.96	(Walmart)
17	2 - Hose Clamps @ 1.15	2.30	(Home Depot)
18	PVC Cleaner	5.10	(Home Depot)
18	PVC Cement	5.10	(Home Depot)
19	Tire Pressure Gauge	???	(Advance Auto Parts)
20	Air Pump	9.99	(Advance Auto Parts)
21	Plumber's Teflon Tape	1.18	(Home Depot)

The 10Ω resistor is to limit the current through the sprinkler valve. I'm using 3 nominally 9V batteries in series, which actually supply a measured 28.1V. The valve specs call for a momentary inflow of 400 ma at 24V. The internal resistance of the valve solenoid is 60Ω, so the additional 10Ω in series with the batteries holds the current within a hopefully safe range. That's probably overkill, but heck, why not?