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

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

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 1¼ inch PVC pipe with a 1¼ 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 1¼ 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.

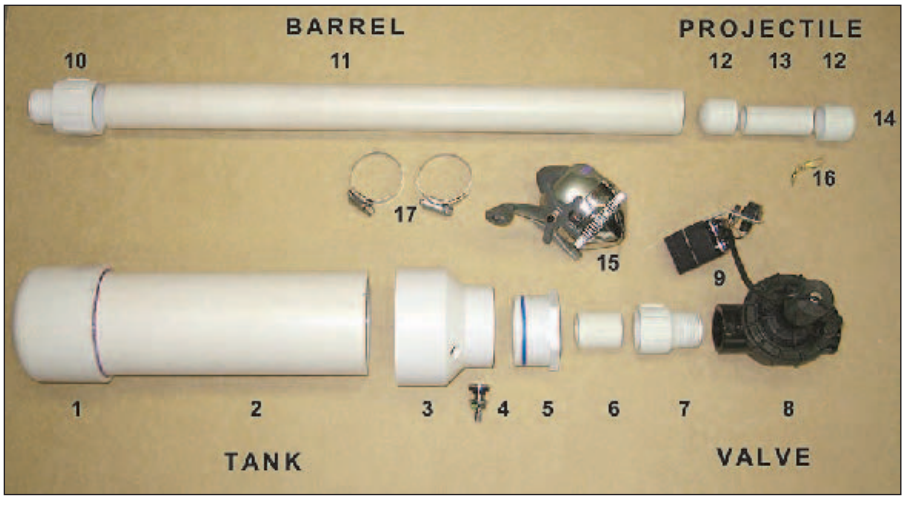

Figure 5 — Key parts of the spudgun.

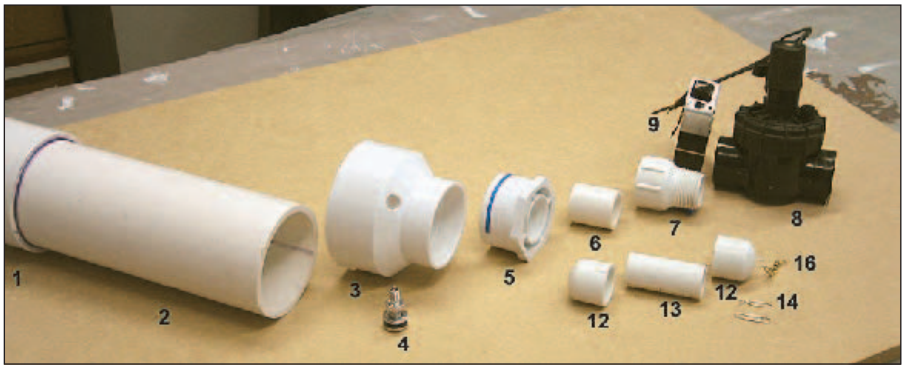

Figure 6 — More assembly details.

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 ($)*[1]	*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.		
9A	Batteries, 9 V (2 required)	4.00	Many
9B	Battery clips	3.00	RadioShack
9C	Safety switch	1.75	RadioShack
9D	Push button	2.50	RadioShack
9E	Aluminum plate, 1 × 4"	1.00 (24"/$5)	Lowes
10	Male adaptor 1" to 1¼"	1.50	Lowes, Home Depot
11	Pipe, 24" long 1¼"	1.50 (10'/$6)	Lowes, Home Depot
12	End cap, ¾"	0.75	Lowes, Home Depot
13	Pipe, 2½" long ¾"	0.25 (10'/$2.50)	Lowes, Home Depot
14	Paper clips		
15	Fishing reel, Zebco 202	8.00	Walmart
16	Fishing swivel	0.20 (6/$1)	Walmart
17	Hose clamps	2.00	Home Depot
	PVC cleaner and cement	6.00	Lowes, Home Depot
	Tire pressure gauge	4.00	Advance Auto Parts

[1]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.

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

6 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 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**.

in any legislation addressing communications issues related to emergencies, disasters, or homeland security.

■ Objective #5: The ARRL supports the complementary legislative objectives of other radiocommunication services, particularly the public safety and scientific services that require spectrum access and protection from interference for noncommercial purposes that benefit the public.

Call Sign Allocation Study: The Board voted to instruct the Executive Committee, with advice and input from the Programs and Services Committee, to study the FCC sequential, vanity and special call sign programs.

Amateur Radio and Driving: The Board noted that local municipalities, as well as state legislatures, have made laws or are considering laws that apply to drivers who use cellular telephones while driving. Recognizing that this sort of legislation often inadvertently prohibits — or can be construed to prohibit — Amateur Radio mobile communications, the Board instructed the Executive Committee to develop a policy statement and recommend language that protects the ability of licensed radio amateurs to prudently conduct mobile amateur communications.

Upon the resignation of West Gulf Director Coy Day, N5OK, after the Board meeting, Vice Director Dr David Woolweaver, K5RAV, moved up to become West Gulf Director. Oklahoma Section Manager John Thomason, WB5SYT, was appointed to fill the Vice Director vacancy.

Other Items

Committee Elections and Appointments

Executive Committee: The Board elected the following Directors to the ARRL Executive Committee: Bill Edgar, N3LLR, Atlantic Division; Dick Isely, W9GIG, Central Division; Jay Bellows, KØQB, Dakota Division; Tom Frenaye, K1KI, New England Division, and Bob Vallio, W6RGG, Pacific Division. Members of this committee serve one year terms.

President Harrison appointed the following Board members to committees:

Administration and Finance Committee: Jim Fenstermaker, K9JF, Chairman, Northwestern; Jim Weaver, K8JE, Great Lakes; Dennis Bodson, W4PWF, Roanoke; Brian Mileshosky, N5ZGT, Rocky Mountain; Dick Norton, N6AA, Southwestern; Vice Director Cliff Ahrens, KØCA, Midwest, and Treasurer Jim McCobb, K1LU.

Programs and Services Committee: Bruce Frahm, KØBJ, Chairman, Midwest; Greg Sarratt, W4OZK, Southeastern; Coy Day, N5OK, West Gulf; Mickey Cox, K5MC, Delta; Frank Fallon, N2FF, Hudson, and Vice Director Greg Widin, KØGW, Dakota.

Ethics and Elections Committee: Greg Sarratt, W4OZK, Chairman; Brian Mileshosky, N5ZGT, and Jay Bellows, KØQB.

Ad Hoc Scouting Committee: Brian Mileshosky, N5ZGT, Chairman; Bill Edgar, N3LLR; Jim Fenstermaker, K9JF, and Staff Liaison Larry Wolfgang, WR1B.

Ad Hoc Committee on the ARRL Foundation: Vice President Rick Roderick, K5UR, Chairman; Tom Frenaye, K1KI; Jim Fenstermaker, K9JF; Chief Executive Officer David Sumner, K1ZZ, and Chief Development Officer Mary Hobart, K1MMH.

Chairman and Liaison Appointments

Public Relations Committee: Bill Morine, N2COP, Chairman; Mike Raisbeck, K1TWF, Liaison, New England Vice Director.

Historical Committee: Vice Director Gary Johnston, KI4LA, Chairman, Great Lakes.

Legal Defense and Action Committee: Jay Bellows, KØQB, Chairman.

Electromagnetic Compatibility Committee: Dennis Bodson, W4PWF, Chairman.

Band Planning Committee: Vice President Rick Roderick, K5UR, Chairman.

Microwave Band Planning Committee: Tom Clark, K3IO, Chairman.

RF Safety Committee: Greg Lapin, N9GL, Chairman.

VHF/UHF Advisory Committee: Kermit Carlson, W9XA, Chairman.

DX Advisory Committee: Bob Allphin, K4UEE (announced after the meeting).

Contest Advisory Committee: Dick Green, WC1M, Chairman.

Amateur Radio Direction Finding Coordinator: Joe Moell, KØOV.

The complete Minutes of the 2009 Annual Meeting of the ARRL Board of Directors are available at **www.arrl.org/announce/board-0901**. The next meeting of the ARRL Board of Directors is scheduled for July 17-18, 2009. QST

Feedback

◊ In "The W4SSY Spudgun" [Mar 2009. pp 67-69], Byron Black, W4SSY, reports that he has been informed that OSHA recommends against use of PVC for above ground compressed air. The problem, per James R Divine, PhD, PE, WB7DJX, is not so much that the PVC can fail as that if it does fail, it shatters, resulting in a hazard to everyone around. Further, as the temperature drops, it becomes more and more brittle, and thus should not be used in cold weather. In any case, the area should be kept well clear. Wrapping the air chamber with reinforced duct tape may help, but it is not a proven technique. The author has supplied supplemental information that can be found on the *QST* binaries Web site at **www.arrl.org/files/qst-binaries/**.

◊ In "Announcement — Second ARRL Homebrew Challenge" [Feb 2009, p 75], the caution about a "beryllium substrate…" should have said "beryllium **oxide** substrate…." Check the new Homebrew Challenge Web site at **www.arrl.org/qst/hbc/** for rules clarifications and reader questions and answers.

◊ In "Product Review — TelePost LP-PAN Software Defined IQ Panadapter" [Feb 2009, pp 44-50], it was stated that mono to stereo adapters for the output connectors were not available from RadioShack. Brian Torr, N6IIY, noticed that RadioShack sells what they call an "Aircraft 2" adapter that converts a ⅛" stereo jack to two ⅛" mono plugs. It is RadioShack part number 42-2495. They also sell a Y adapter to convert an ⅛" stereo jack, such as on the laptop's sound card, to two ⅛" mono jacks, part number 274-375.

◊ In "The World Above 50 MHz" [Jan 2009, pp 87-89] the Internet address for the Summitek Instruments company document on "Passive Intermodulation Measurement Techniques" was incorrect. The correct Web address is **www.summitekinstruments.com/passive/docs/pimprimer.pdf**.

◊ In "Designing and Building Transistor Power Amplifiers" [Mar 2009, pp 40-43], the 2SC5739 power transistors are correctly identified in Figure 2, but are referenced errouneously in the text.

◊ In "World Above 50 MHz" [Mar 2009, pp 89-91] the MDS values in Table 2 for the SDR-5000 and the K3 were transposed. The K3 should show an MDS of –138 dBm, while the SDR-5000 should be shown as –132 dBm.

◊ The author's footnote references were inadvertently left out of "A Lost Dit of Vibroplex History" [Feb 2009, pp 58-59]. The footnotes and the text that they reference are as follows:

Horace G. Martin invented the Autoplex and the Vibroplex in New York City in the early years of the 20th Century, but the first Vibroplex manufacturing plant was located in, of all places, the little town of Norcross, Georgia. [J. Ceccherelli, "Vibroplex — The Company and its Classic Key," *QST*, Jan 2003, p 48]

William R. Holly, K1GH, adds some detail on the Norcross connection in his definitive history of the Vibroplex Corporation. [W. R. Holly, *The Vibroplex Co., Inc. 1890 to 1990*, The Vibroplex Co, Inc, 1990]

According to published reports, young Buck Buchanan learned telegraphy from a depot operator by the name of Dave Wall. ["Edward F. Buchanan," *The Atlanta Georgian and News*, Dec 6, 1910]

As is well-known, Martin became highly proficient, a world-class operator. [J. Casale, Ed., "Horace G. Martin, Part One: The Telegrapher," *The Old Timer's Bulletin*, Nov 2002]

It would be tempting to conjecture that Martin and Buchanan became acquainted when both worked as telegraphers in 1904 in New York City. [Holly, p 5]

The partners of the firm, including Edward F. Buchanan, whom *The New York Times* described as "the young Napoleon whose strategy had failed to connect" even spent some time under arrest. [*The New York Times*, Aug 26, 1908]

The Horatio Alger kid found himself back at the Atlanta Western Union office where he applied for a job saying, "Just make me a plain old op." ["Edward F. Buchanan," *The Atlanta Georgian and News*, Dec 6, 1910]