Building a 43-note Calliope

Dave Kerr

What on earth is a "Calliope" (pronounced "cal-eye-o-pea" although some American aficionados pronounce it "calleyopey" or just plain "calleyope")? *Calliope* was the Greek Muse of eloquence and heroic poetry. How she got mixed up with a brash musical instrument is anybody's guess. In the pipe organ world Calliope was originally a steam driven organ comprising thin walled tubular brass steam whistles in a musical chromatic scale and played from a keyboard or a or a piano type roll. It was invented by Joshua C. Stoddard and first displayed in 1856. The first instrument had 15 whistles, of graduated sizes, attached in a row to the top of a small steam boiler, originally played by a cylinder with protruding pins like a barrel organ. Later, Stoddard replaced the cylinder with a keyboard, the pipe valves were operated by wires attached to the keys—in this form it was first played by his daughter (perhaps her name was Calliope?). Because of the high pressures used, it was very loud and brash and meant to attract attention. It was usually employed by showmen running carousels or other amusements, or by circus folk during the early part of last century and in the late 1800s.

Figure 1. The Tangley Calliope.

The air calliope uses air and not steam and it too usually was on high pressure from a blower powered by either a petrol or electric motor. The one described here operates on lower pressure (about three inches water gauge) but it can be run on higher pressure (up to about eight inches, some commercial ones used up to 28 inches or between 3/4 and 1 1/2 PSI) but more of this later.

This project started through discussion between three friends who have an interest in organs, and theatre organs in particular. An article written by A.K. Brill (see inset on the right) describing the construction of a 43-note air calliope and two commercial calliopes, the American Tangley (**Figure 1**) and National Calliope, was used as the basis for ideas on construction. This was further extended with the conception of automatic operation using modern electronic control with the music recorded on E-prom (**E**rasable **P**rogrammable **R**ead **O**nly **M**emory). Since two of the group were electronic whiz kids, this was seen as an easy option.

Originally we were going to construct the pipes of brass and some were made of brass and copper pipe from the scrap metal yard. However, the scrap metal yard is an unreliable source, so commercially available material was investigated. Thin walled brass tube of the required dimensions is no longer available and commercially available brass proved to be prohibitively expensive, so alternative material was investigated. Plastic drainage and water pipe was considered the best alternative since all material could be obtained for about $50. Other material was sourced from garbage recycling depots and included vacuum cleaner motors (for the blower) at $3 and electronic organ keyboards for about $5. Solenoid valves to operate the pipes are a bit more problematical, luckily, one of the members has been collecting pipe organ components and had several pipe chests containing solenoids. Similar solenoids to mine can be obtained from the Perterson Organ Co. in Illinois for about $5.00 each. If you can't get the solenoids described later, you could try plumbing and garden irrigation suppliers or search the internet for solenoids. You might find something you can modify to suit your needs.

A. K. Brill

A. K. Brill was a Jewish newspaper reporter who established several Illinois papers along with an interesting career. Among his "accomplishments" were the fact that he became a lion tamer's assistant; was in trouble with the 'mob' after publishing a story about a local politician who placed boxes in front of slot machines so that children could gamble; and the fact that he got fired from one paper after exposing a mayor who turned out to be a stockholder of the paper he worked for.

He was interested in circus, carnival and illusionist equipment and for many years went about examining, measuring and drafting plans for what he had seen. He then cataloged this material and sold individual plans of various items. He did this for many years and his plans were widely used. Pertinent to this article is the fact that he wrote up plans for a 28-pipe calliope run by a vacuum cleaner motor.

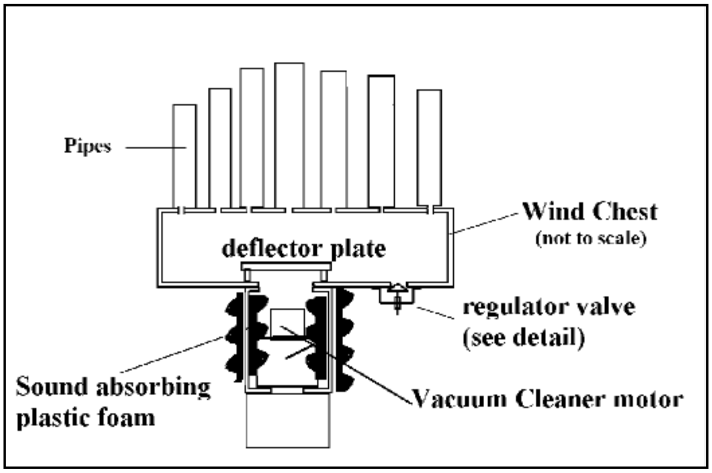

Figure 2. The wind chest.

Construction of the pipes is the most difficult part of the project and details of construction of both metal and plastic pipe will be given here. It is a distinct advantage if you have a lathe for this part of the project. A metal lathe fitted with both compound and cross slide makes the construction much easier. However, construction can be done using a wood lathe, but you will need to rig up some extra attachments, particularly for constructing plastic pipes. A little Aussie ingenuity would probably enable you to construct plastic pipes without a lathe. You need some sort of a spindle to hold the pipe while you cut the slots. Metal pipes (that is , brass or copper) are simpler since the pipe consists of two parts connected by soldered bridges.

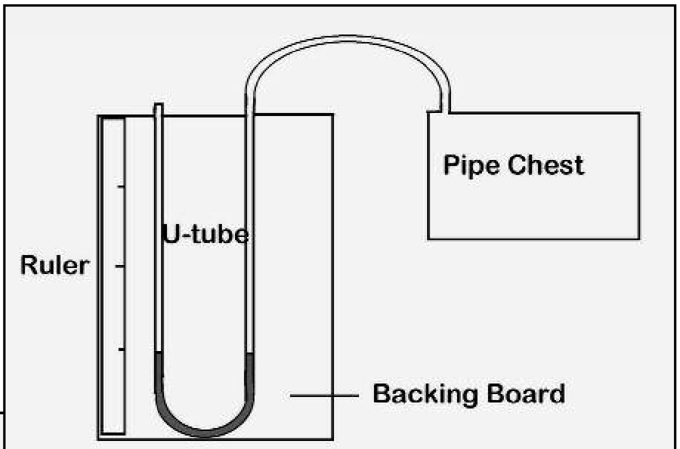

Figure 5. Home made manometer.

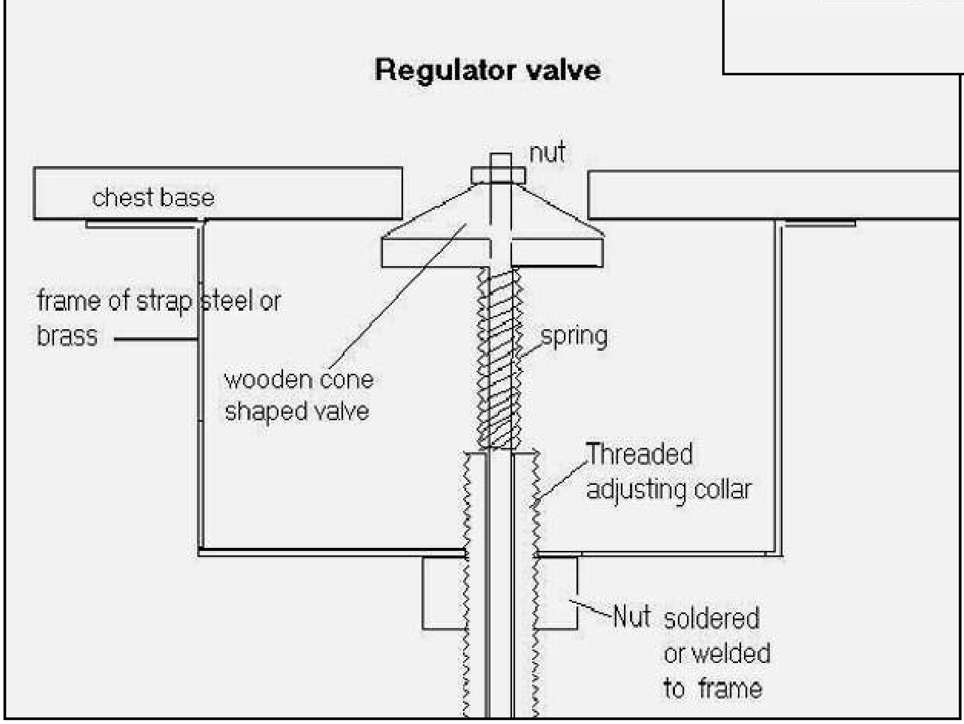

Figure 3. Regulator valve in base of wind chest.

The Wind Chest

You will probably need to build the wind chest (**Figure 2**) before you make the pipes since you will need a source of air for setting the gap and for voicing and tuning. The chest top (**Figure 4**) and bottom are constructed from 12mm (1/2") fiberboard (MDF). The sides were made from 20mm (3/4 inch) solid timber, in my case 150mm x 19mm (6" x 3/4")DAR pine. Dimensions to the top were 900mm x 375mm (approx. 3 ft by 1 ft 3 ins.). If you are constructing a 48-note calliope such as the one I finally built, you will need a larger top, about 3' 6" x 1' 6". A regulator valve (**Figure 3**) is fitted on the base to spill excess air and is adjustable to set the required pressure. The cone shaped design was found to be better than a trap-door type because the high air volume tended to draw it closed due to the Bernoulli effect.

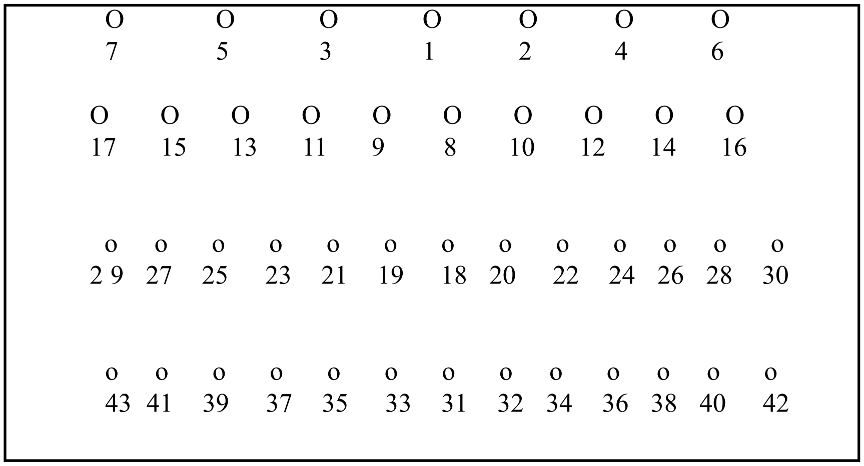

Figure 4. Pipe layout on wind chest top (not to scale)

The air supply was from an old vacuum cleaner motor but any blower which delivers approx.. 20 cubic ft per minute will do. The vacuum cleaner motor is very noisy and requires extensive covering with sound-proofing plastic foam. The box covering the motor will vary in size according to the dimensions of the motor. I used a 1200 watt motor but a smaller one (say 800 watt) would be adequate. Better still would be a blower powered by an induction

> ***Calliope*** was the Greek Muse of eloquence and heroic poetry. How she got mixed up with a brash musical instrument is anybody's guess.

motor since this would be almost silent. However, once the calliope is playing, it will drown out the noise of the motor!

In order to measure the wind pressure, you will need a manometer which is a piece of clear plastic tube bent into a u-shape and partially filled with water, and with a ruler at one side to measure the water column displacement (**Figure 5.**)

The Solenoids

These are likely to the most difficult item to acquire. I used pipe organ solenoids as illustrated in **Figure 6** but suitable solenoids would be ones which have a shaft movement of about 8 mm and to which a circular disk can be attached to act as a valve (see alternative design below). They should operate on approx.. 12 to 24 volts DC depending on the power supply you use. The solenoids are wired with one end of the coil soldered to an earthing rail of thick copper wire fixed to the underside of the chest top. The other end is soldered to individual wires to form a cable which is connected to the keyboard switches . Here I used computer ribbon cable of 50 wires (numbers 1 to 43 for the solenoids and number 44 and 45 for the earthing rail, leaving the remaining five as spares) which exits the chest laying flat on the edge between the top and sides of the chest. A gasket of leather or suitable material around the top edge ensures that there is very little if any air leakage.

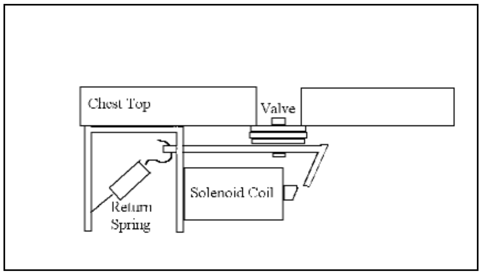

Figure 6. Solenoid for each playing hole.

> *. . . a manometer which is a piece of clear plastic tube bent into a u-shape and partially filled with water, and with a ruler at one side to measure the water column displacement.*

Pipe Construction

Thin walled brass tubing is no longer available or, if available, is very expensive. Drainage and water pipe in brass or copper is much thicker and the sizes available do not follow closely the ideal sizes listed in **Table 1** (right, in imperial measurements). You will need to select the most appropriate sizes available and make substitutions for sizes either side. The list in **Table 2** shows the relationship between the length and diameter of pipe, musical note and frequency in metric units, together with the substitution sizes for plastic pipes.

Metal pipes consist of six (6) parts: base tube, base plug, inlet pipe, saddles (or stand-offs), main pipe (which is the resonator) and tuning plug and is illustrated in **Figure 8** (next page). Plastic pipes have a one piece tube in which slots are cut and consist only of the tube, base or inlet plug, inlet pipe and tuning plug and is illustrated in **Figure 7** (below).

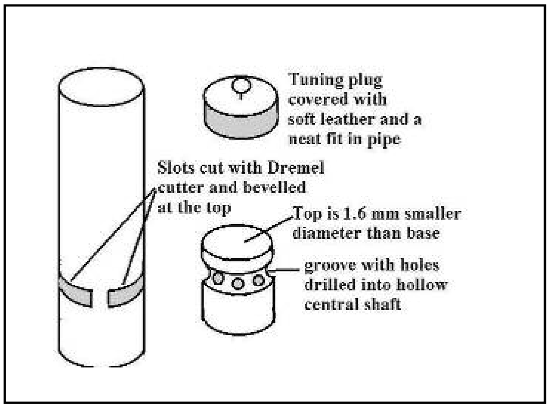

Figure 7. Construction details of a plastic pipe.

In making either metal or plastic pipes you will need to make the base plugs and tuning plugs. I used fine grained Australian hardwood (Jarrah) but any dense timber which is fine grained and

Table 1
Pipe Measurements*

Tube No	Qty	Tube ID	Tube Length	Base Length	Gap	Inlet	Top Plate
1	1	3-7/16	20	2	1	11/16	3-7/16
2 & 3	2	3-7/16	18 1/2	2	1	5/8	3-3/16
4 & 5	2	2 -15/16	17	2	7/8	9/16	2-15/16
6 & 7	2	2 -11/16	15	2	7/8	9/16	2-11/16
8 & 9	2	2-15/32	13-1/2	2	7/8	1/2	2-15/32
10 & 11	2	2-3/16	11-7/8	2	13/16	1/2	2-3/16
12 & 13	2	1-15/16	10-3/4	2	5/8	7/16	1-15/16
14 & 15	2	1-11/16	9-5/8	1-1/2	9/16	3/8	1-11/16
16&17	2	1-11/16	8-5/8	1-1/2	9/16	3/8	1-11/16
18 & 19	2	1-11/16	7-5/8	1-1/2	9/16	3/8	1-11/16
20 & 21	2	1-7/16	6-7/8	1-1/2	1/2	3/8	1-7/16
22 & 23	2	1-7/16	6-1/8	1-1/2	7/16	3/8	1-7/16
24 & 25	2	1-3/16	5-5/8	1-1/2	5/16	5/16	1-3/16
26 & 27	2	1-3/16	5-1/16	1-1/2	5/16	5/16	1-3/16
28 & 29	2	1-1/16	4-5/8	1-1/2	5/16	5/16	1-1/16
30 & 31	2	1-1/16	4-1/8	1-1/2	5/16	5/16	1-1/16
32 & 33	2	15/16	4	1-1/4	3/16	1/4	15/16
34 & 35	2	15/16	3-3/4	1-1/4	3/16	1/4	15/16
36 & 37	2	13/16	3-7/16	1-1/4	3/16	1/4	13/16
38 & 39	2	13/16	3-1/4	1-1/4	3/16	1/4	13/16
40 & 41	2	11/16	3-15/16	1-1/4	3/16	1/4	11/16
42 & 43	2	11/16	3-11/16	1-1/4	3/16	1/4	11/16

*measurements in inches

stable should do. Avoid softer woods as these will dehydrate and fall out of the pipe. The base plug should be a driving fit in the base of the pipe. It consists of the base, a semicircular section groove about 3/4 of the way up into which holes are drilled towards the centre, meeting a vertical hole from the base. This is the air way (or languid of organ pipes). The top of the plug is 1.6 mm (1/16th inch) smaller in diameter than the base to allow a circular stream of air to be directed against the beveled lip of the main tube (**Figure 7**). This 1.6 mm difference is consistent throughout the range of pipes. This results in 0.8 mm gap respectively all the way around. This is very small and requires a measure of precision in manufacture, and in reality, requires a lathe. An alternative plug could be made from three flat disks separated by spacers, either metal or perspex or somesuch, the top disk being 1.6 mm smaller diameter than the other two.(**Figure 9**)

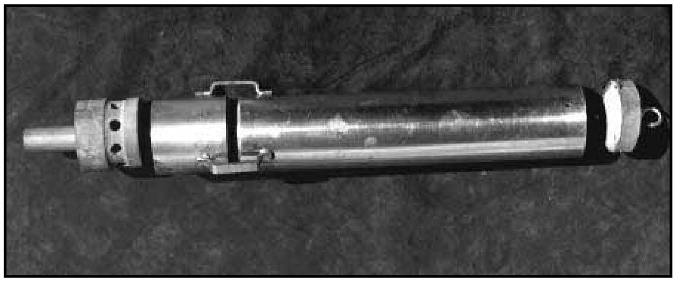
Figure 8. An example of a metal pipe (exploded view).

Table 2
More Pipe Measurements

Tube No.	Musical Note	Frequency (Hz)	Tube I.D. (mm)	Substitute Dia.*	Tube Length (mm)	Base Length (mm)	Gap for High Pressure	Gap for 3-4" Pressure	Total Pipe Length	Hi Pres. Pipe Height	Lo Pres. Pipe Height
1	F	174.614	87	3 1/2	508.00	51	26	21	558.80	584.20	580.19
2	F#	184.997	87	3 1/2	508.00	51	25	21	558.80	584.20	579.47
3	G	195.998	87	3 1/2	469.90	51	25	20	520.70	546.10	540.66
4	G#	207.652	76	2 1/2	469.90	51	22	19	520.70	542.93	540.10
5	A	220	76	2 1/2	431.80	52	22	19	483.60	505.83	502.10
6	A#	230.082	76	2 1/2	431.80	51	22	18	482.60	504.83	500.20
7	B	246.942	76	2 1/2	381.00	52	22	17	432.80	455.03	449.90
8	C	261.626	76	2 1/2	381.00	51	22	16	431.80	454.03	448.20
9	C#	277.183	76	2 1/2	335.28	52	22	16	387.08	409.31	402.78
10	D	293.665	56	2 1/2	335.28	51	21	15	386.08	406.72	401.08
11	D#	311.127	56	2	301.63	52	21	14	353.43	374.06	367.83
12	E	329.628	49	2	301.63	51	16	14	352.43	368.30	366.23
13	F	359.228	49	2	273.05	52	16	13	324.85	340.73	338.15
14	F#	369.994	41	2	273.05	38	14	13	311.15	325.44	323.75
15	G	391.995	41	2	244.47	38	14	12	282.57	296.86	294.57
16	G#	415.305	41	2	244.47	38	14	12	282.57	296.86	294.07
17	A	440	41	2	219.08	38	14	11	257.18	271.46	268.18
18	A#	466.164	41	2	219.08	38	14	11	257.18	271.46	267.78
19	B	493.882	41	1 1/2	193.68	38	14	10	231.78	246.06	241.88
20	C	523.21	37	1 1/2	193.68	38	13	10	231.78	244.48	241.48
21	C#	554.365	37	1 1/2	174.63	38	13	9	212.73	225.43	222.03
22	D	587.33	37	1 1/2	174.63	38	11	9	212.73	223.84	221.53
23	D#	622.254	37	1 1/2	155.58	38	11	9	193.68	204.79	202.18
24	E	659.255	30	1 1/2	155.58	38	8	8	193.68	201.61	201.88
25	F	698.456	30	1 1/2	142.87	38	8	8	180.97	188.91	188.77
26	F#	739.989	30	1 1/4	142.87	38	8	8	180.97	188.91	188.47
27	G	783.991	30	1 1/4	128.59	38	8	7	166.69	174.63	173.89
28	G#	830.609	27	1 1/4	128.59	38	8	7	166.69	174.63	173.59
29	A	880	27	1 1/4	117.48	38	8	7	155.58	163.51	162.18
30	A#	932.328	27	1 1/4	117.48	38	8	6	155.58	163.51	161.88
31	B	987.767	27	3/4	104.78	38	8	6	142.88	150.82	148.88
32	C	1046.302	24	3/4	104.78	38	5	6	142.88	147.64	148.68
33	C#	1108.731	24	3/4	101.60	38	5	6	139.70	144.46	145.30
34	D	1174.659	24	3/4	101.60	32	5	5	133.35	138.11	138.65
35	D#	1244.508	24	3/4	95.25	32	5	5	127.00	131.76	132.10
36	E	1318.51	21	3/4	95.25	32	5	5	127.00	131.76	131.90
37	F	1396.913	21	5/8	87.31	32	5	5	119.06	123.82	123.76
38	F#	1497.978	21	5/8	87.31	32	5	5	119.06	123.82	123.56
39	G	1567.982	21	5/8	82.55	32	5	4	114.30	119.06	118.56
40	G#	1661.219	17	5/8	82.55	32	5	4	114.30	119.06	118.34
41	A	1760	17	5/8	100.01	32	5	4	131.76	136.52	135.58
42	A#	1864.655	17	5/8	100.01	32	5	4	131.76	136.52	135.36
43	B	1975.533	17	5/8	93.66	32	5	3	125.41	130.17	128.80

(pipes 37 to 43 were made from electrician's plastic conduit)

* based on available plastic drainage and water pipe, these figures in inches because of varying I.D. in commercial pipes.

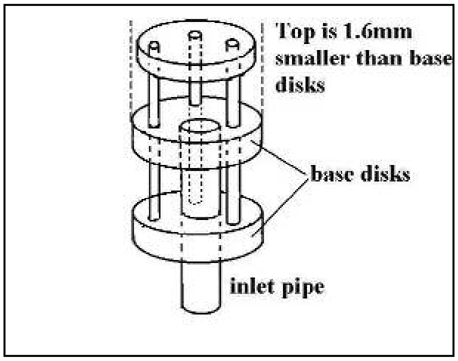

Figure 9. An alternative base plug made from three flat disks.

Tip: *to fit the base plug so that the gap is even all around the inside of the pipe, use a bearing or gear puller. Fit the claws in the slots (***Figure 10***) or over the top part of the base pipe and fit a small piece of metal over the base hole for the tip of the advance screw and then simply screw it up until the top of the plug contacts the claws.*

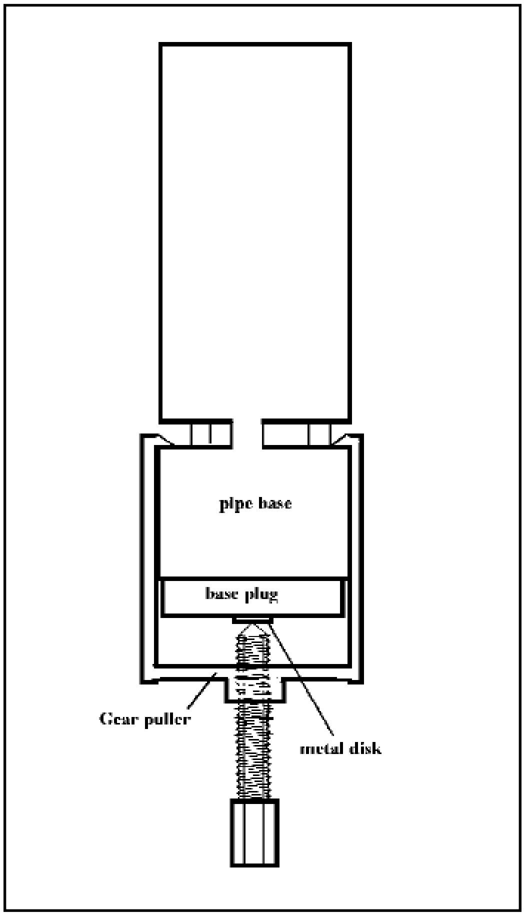

Figure 10. Using a gear puller to fit the base plug into the pipe.

The tuning plug is straightforward. It is a disk about 12mm thick (thicker for the larger pipes) which is covered in soft leather and a firm to tight fit in the top of the pipe. For leather you could try a leather clothing maker for scraps and offcuts. The thinner the better, like the leather in kid gloves. You will need to overlap the leather over the lower edge of the plug to stop it jamming and wrinkling up. Screwed into the top of the plug is a screw eye of appropriate size to allow the plug to be pulled up the pipe for tuning. You may need to braze or silver solder the join of the screw eye to stop it opening when pulling the plug up.

Voicing metal pipes

With metal pipes, make the base first and attach the bridges which should be bent inwards slightly to firmly clasp the base of the main tube or resonator. This will allow you to slide the tube up and down to find the best position of the gap (called the mouth in organ pipes) for the pipe to sound best. The tuning plug should be in place and when the pipe sounds best, try to get the tuning plug at about the right position for the note being tested. This will ensure the best gap for that note. The gaps given in the tables above are approximate and will vary slightly according to other factors e.g. the size of the languid and the air pressure used. The bridges are made from brass or copper strips about 5 to 10mm wide and about 25mm long, depending on the size of the pipe. You will need 6 bridges for the larger pipes, reducing to 3 for the small pipes (less than 25mm diameter). I made a former from steel bar for making the bridges (**Figure 11**). The center piece is hinged and to make the bridge simply lift the center flap, insert a strip of brass or copper, let the flap down and size it with a large hammer.

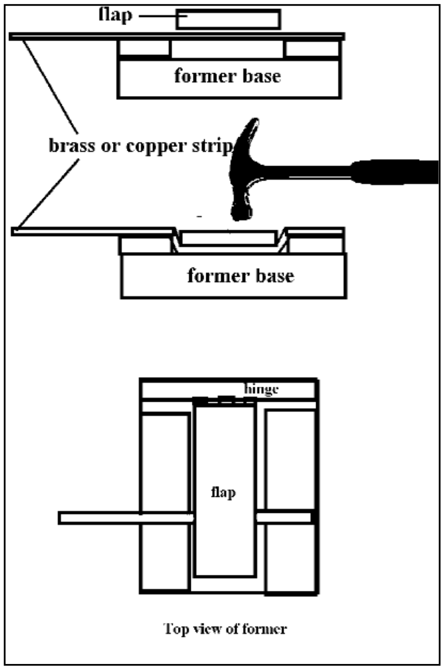

Figure 11. The bridge former made from steel bar.

Part II of "Building a 43-note Calliope" will be printed in the October, 2000 issue of the *Carousel Organ.*

Dave Kerr and his wife, Myra, live in Stirling, Australia (Australian Capital Territory). Before retirement Dave was managing National Parks including the Tidbinbilla Nature Reserve (with lots of kangaroos). Now he "tinkers" in his workshop and maintains the Compton Theatre pipe organ and is helping restore the Gebruder Apollo carousel organ.

Building a 43-note Calliope — Part II

Dave Kerr

The first portion of "Building a 43-note Calliope" appeared in Issue No. 8 of the Carousel Organ. This installment finishes out this informative article on construction of a calliope—ed.

Making your own calliope continues with the finishing touches of the pipes and cabinet. Although this was a huge project it seems somewhat less intimidating after I have spelled out these instructions.

Voicing Plastic Pipes

Plastic pipes need to have slots cut in the side to form the mouth. Before cutting the slots you will need to determine the width of the slot (mouth) which can be done by making a collar as in **Figure 12**. This piece of pipe, about two inches long with openings cut in it and with a vertical cut to allow it to be slipped over a base, again about two inches long into which a base plug is fitted. The collar should be glued to the base—this will then allow you to slide the main tube up and down to find the best gap for voicing as with the metal pipes. The bottom of the top tube should be beveled at an acute angle (less than 45 degrees). Once the best gap is found for that note it should be carefully measured with vernier calipers (one of the most useful measuring tools you can have) for this will be the width of the slot. For the larger pipes, six slots will need to be cut around the tube, reducing to three for the smaller pipes. The length of the slot is determined by measuring the outside diameter of the pipe and multiplying this by Pi (22/7 or 3.14285), and then dividing the result by the number of slots required. Leave 10mm between the slots for the supports, that is, the slot is 10mm shorter than the figure derived above.

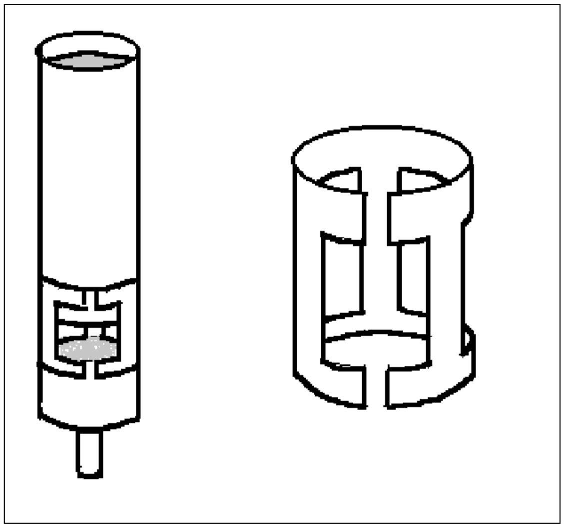

Figure 12. An example of a plastic pipe collar.

Cutting the slots

This is a delicate operation—I used a Dremel tool with a 3mm cutter to make the slots for the smaller pipes and a 6mm cutter for the larger pipes (**Figures 13 & 14**). First, mark the position of the slots on the pipe with pencil and then mount the pipe on the lathe spindle. The Dremel tool was mounted on the lathe tool post, first at 90° to the pipe, advanced, cutting into the pipe with the cross slide advance at the lower end of the position of the slot. The pipe is then rotated by hand to cut the bottom part of the slot. As the Dremel is withdrawn, the pipe rotated to the next slot position and the process repeated for each slot. On the last slot the Dremel is moved to cut the top of the slot with the saddle advance and the process repeated as for the bottom of the slot (make sure you cut the slots slightly narrower than the required width because the final cut is done with the angled cutter). The Dremel is withdrawn and angled to cut the bevel at the top of the slot. First, position the cutter at one corner of the slot and rotate the pipe by hand to cut the bevel, withdraw the cutter using the compound slide, check the width of the slot with the vernier calipers, rotate the pipe to the next slot and advance the cutter with the angled compound slide. Repeat this process for all slots. I know this sounds complicated but once the process has been established, it only takes a couple of minutes to cut the slots in a pipe.

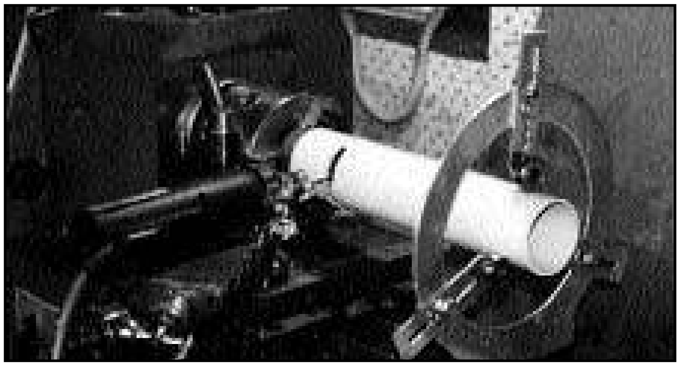

Figure 13. Cutting the slots in the plastic pipe.

Now, those of you who have been paying attention will ask "why bother with cutting slots in the pipe ? Wouldn't it be much simpler to make collars for each pipe as in Figure 12?" Construction would be similar to the metal pipes. Voicing would be simple, just glue the collar to the pipe at the point

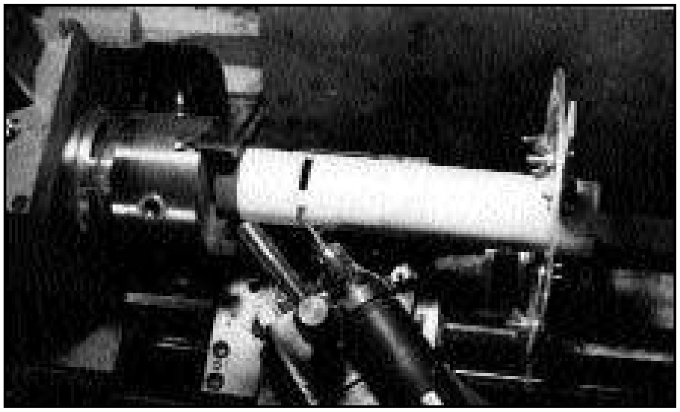

Figure 14. Cutting the bevel.

where it sounds best. No need to bother with the hassle of Dremel tool and lathe The base plugs and tuning plugs could be made on a wood lathe by exercising sufficient care. Well of course you could, but you will need a glue which is shock resistant and I haven't been able to find one. The tuning slide needs to be tapped down in the pipe and if quite tight it sometimes requires quite a thump which is enough to break the bond between the collar and pipe. The second reason is one of aesthetics—a slotted pipe looks much neater and professional than one with a collar, but it's really a matter of taste.

Mounting the Pipes

The inlet pipes on most of the whistles are ½ inch (12 mm) copper pipe except for the largest whistles which are ¾ inch pipe (20 mm). This means that the smaller pipes will sound much louder than the larger ones so you will need to fit chokers which are simply pieces of dowel with small holes drilled through the centre fitted inside the inlet pipe to reduce the inlet size. Some experimentation might be needed here but holes of ¼ inch (6.5 mm) or smaller will probably do the job. Once the whistles are complete they are fitted on the wind chest as in the layout diagram given in the wind chest section (**Figure 4**, pp 18, issue No. 8, *Carousel Organ)*. This layout is not the only one, The Tangley calliope had the larger pipes arranged around the outside with the smaller pipes in the center (see **Figure 1**, pp 17, issue No. 8) . This was to allow the larger pipes room to speak. If too crowded, they will not speak or speak poorly and need about one inch separation between pipe surfaces. The National calliope had a layout similar to the one given above but had the rows arranged in steps or tiers to overcome the same problem. You should have no problem with the above layout because of the lower operating pressure provided you have sufficient separation between the bass pipes. The inlet pipes should not protrude more than the thickness of the chest top below the base of the whistle. Tangley calliopes had threaded inlet pipes which screwed into the base plate. This firmly fixed them in place during transport in street parades etc. You could run a rough thread on the inlet pipes and screw them into the holes in the chest top.

Solenoid Power Supply

I made my power supply from a transformer from an old TV set, using a secondary winding tap to give approximately 10 volts AC. This was rectified by a solid state bridge rectifier with a large electrolytic capacitor connected across the output and gave about 12 volts DC. However, you should be able to get a power supply commercially which has an output current of about 3 amps. Each solenoid will pull up to 500 milliamps so you need enough current to drive about 6 solenoids since it is unlikely that any more than six notes will be sounded at a time. Alternatively, use a 12-volt car battery and a charger.

Figure 15. The temporary frame (with keyboard) allows for final adjustments and tuning.

Mounting the Wind Chest and Keyboard

Figure 15 shows the chest and keyboard mounted on a temporary frame to enable final adjustments and tuning to be undertaken. Traditional calliopes had an angle iron frame covered with sheet metal and when the brass pipes were mounted the whole unit weighed about 200 kilos or more, and took four men to lift. By using timber and plastic you should get a calliope which weighs much less than 220 pounds. A cabinet can be made from MDF to enclose all the works.(**Figure 17 - 20**). This also assists in muffling the noise of the blower. The way I have mounted the pipes and blower on the wind chest allows the whole unit to be slid in from the back, allowing easy removal for repair or maintenance. You will notice that in **Figure 20** there are actually 48 pipes and a pedal board. These were added as an afterthought to allow the instrument to be played like a spinet organ.

Tuning the Whistles

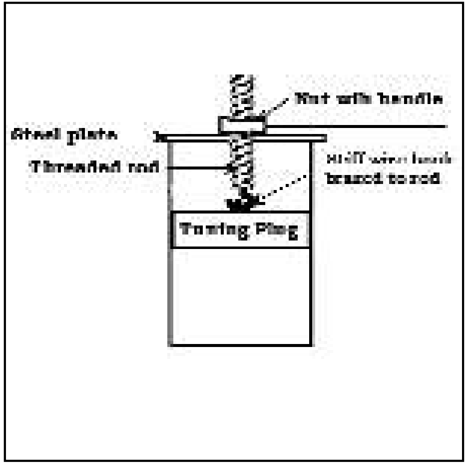

Figure 16. The pipe tuner mechanism.

Tuning can be done using a portable keyboard to sound the notes for comparison. First, position the tuning slide so that the note sounds similar to the reference note on the portable keyboard. Then, sound both together. If out of tune the notes will beat against one another, the faster the beat the more out of tune. Try to get the notes sounding the same without any beats. There are alternative methods, the most accurate is an electronic instrument used by piano tuners but if hard pressed you could use a mouth organ or harmonica! If the tuning plug is very tight, you can use a lifting arrangement such as in **Figure 16** to lift the plug so the note is flat. It can then be tapped down to the right position with a piece of dowel or piece of pipe.

Painting the pipes

The whistles can be painted any color you like. I used paint spray cans (in Australia, "Taubman's Fiddly Bits") in gold to simulate brass pipes and I found it superior to cheaper varieties. Painting should be done after the whistles have been completed, tested and tuned because you will need to spray the inside of the top of the whistle to complete the illusion. Pulling the tuning plug up over a layer of paint is quite difficult so they need to be tuned first.

Making The Cabinet

The cabinet was made from Medium Density Fiberboard (MDF). I used 6 mm (¼") thick board but you might need to use heavier (e.g. 12 mm or ½") if the instrument is to be lugged around to fairs etc. The length and width depend on the size of the wind chest. The cabinet I constructed has an internal frame so that the wind chest can be slid in from the back. In addition the top of the wind chest is hinged at the front with a cupboard hinge (like a short piano hinge).and has a folding strut attached to the side. This makes it easy to service the solenoids and wiring without having to remove the pipes (**Figure 17**). The top is fastened to the chest with screws along the back and sides. The keyboard (i.e. the top of the white keys) should be from 32 to 34-1/2 inches from the ground depending on whether you have installed a pedal board or not. The rear of the cabinet is closed off by double doors, and casters are fixed to the base, underneath at the corners.

Figure 17. The nearly-finished cabinet revealing the cupboard hinge allowing for easy servicing of the solenoids.

Automatic Operation

I mentioned earlier that it was planned to convert the instrument to automatic operation using electronics. There are several ways of doing this but the current thinking is that MIDI might be the way to go since second hand computers with an appropriate sound card (e.g. an old 486 with a Soundblaster card) are quite cheap—all you need is a decoder and drivers for the solenoids.

There are several manufacturers of decoders. JW Electronics in the United Kingdom have 32 and 64-note MIDI decoders for about $142.00. You will find them on the internet at http://www.j-omega.co.uk/index.html. I think Devtronics also market MIDI decoders but I understand they are quite expensive. MIDIlator Systems also produce MIDI decoders and their web site is http://www.midiator.com/. I have had no experience with any of these systems but, on the surface, the English one seems to suit my Calliope best.

> . . . it was planned to convert the instrument to automatic operation using electronics . . . MIDI might be the way to go!

Modifying the Calliope for 48-note operation

Additional Pipes:
For 48-note operation you will need an additional five bass pipes from C to E. These are constructed in the same way as the other pipes with the dimensions as follows:

Note	Total Pipe Length	Pipe Diameter	Gap (mouth)
C	28 3/4"(730 mm)	3 1/2"(89 mm)	24 mm
C#	26 3/4"(680 mm)	3 1/2"(89 mm)	24 mm
D	26"(660 mm)	3 1/2"(89 mm)	23 mm
D#	24 1/4"(616 mm)	3 1/2"(89 mm)	23 mm
E	24"(610 mm)	3 1/2"(89 mm)	22 mm

If you are pressed for space, you may find that the bass pipes will not speak properly because of crowding problems (see “Mounting the Pipes,” page 5) in which case you could employ an alternative pipe design which reflects traditional organ pipes with a single mouth. This may look odd, particularly if you are trying to present the instrument as a calliope with the traditional circular mouth of calliope pipes.

Alternative Pipes
Construction details for these pipes differ very little from the calliope pipes above. The greatest differences are (1) a single mouth which is a third of the circumference of the pipe and much higher (that is the gap or mouth is almost half as much again) and (2) The base plug has the air gap going only a third of the circumference (**Figure 18**).

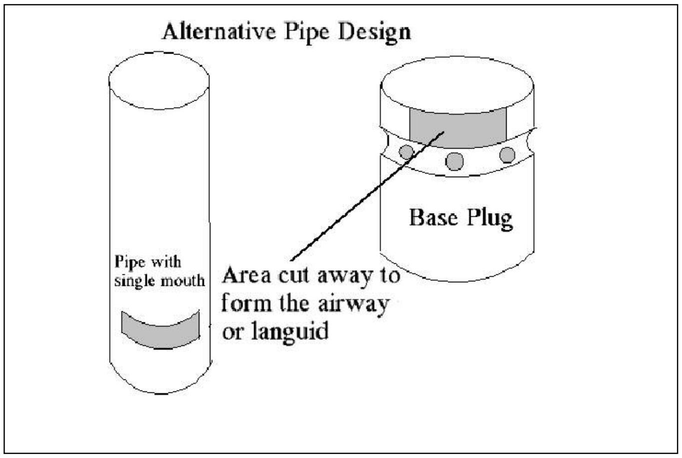

Figure 18. The alternative pipe design used for the pipes needed to make a 48-note calliope.

The base plug is turned in the same way as other base plugs except that it is the same diameter all around, except for the groove. The air gap or languid is cut with the Dremel tool in much the same way as the slot in the pipe except that the material is cut away with the front of the cutter. This air way must line up with the slot in the pipe when fitted together. If the pipe squeals when blown, it is overblowing and needs to have the mouth cut higher. The dimensions given are a guide only and will depend on the pressure used. You will probably find that the length of these pipes (i.e. from the languid to the tuning plug) is much shorter than the traditional calliope pipes.

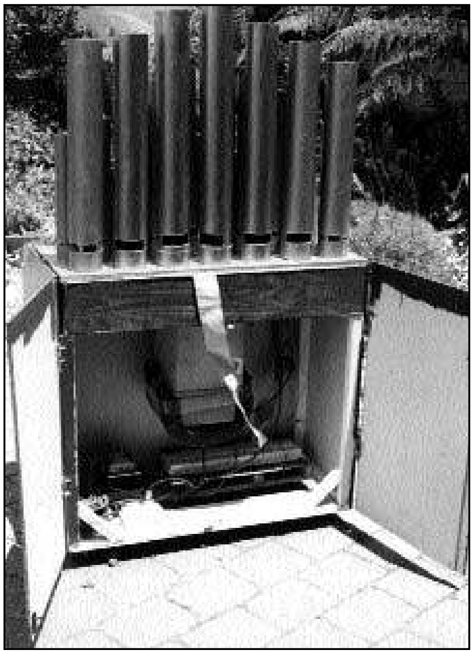

Figure 19. On the lower left is the transformer for the power supply; on the lower right is the pedal board key-switch assembly and in the center is the box housing the blower. All can be seen more clearly in figure 17.

Enjoy Your Calliope!

Figure 20. The finished 48-note calliope.

Dave Kerr, an Australian native, helps maintain the Compton Theatre pipe organ and currently is helping restore a Gebruder Apollo carousel organ.