# **My Schober Theatre Organ**

(1970's Analog Electronic, Built from a <u>Kit!</u>)

By Rick Andersen, January 2007

This page is about my Schober electronic Theatre Organ.

## *NOTE: PAGE STILL UNDER CONSTRUCTION! Article will be expanded over the next few weeks*

### Introduction - Why a page about an obsolete electronic organ?

I am an Electronics Geek who likes to build electronic things from scratch or from kits; see my <u>Simple Homebrew Radios page</u> if you're interested in listening to the world on one transistor and the like. Most of us kit builders are middle-aged or older, part of a generation that shared a fascination with the do-it-yourself kit philosophy which began with the Amateur Radio "hams" who had been building their own equipment since the early days of radio (WWI era). Unfortunately, times have changed, and the hobby has been declining over the years, with great companies like *Heathkit* finally dissolving their kit division altogether and pursuing other types of business. Other companies simply went out of business altogether, either because of sagging sales or because of the death of the owner, as was the case with the **Schober Organ Company** headed by Richard H. Dorf, a well-known technical writer and engineer in the electronic musical instrument [read: Organ] industry of the 1950s-1970s.

The Schober Theatre model was introduced in the late 1960s, competing with other organ kits like the *Thomas* (sold at normal retail outlets *and* in kit form via *Heathkit*) and *Artisan* (still in business, now selling digital organ modules). The Schober Theatre Organ was sold (for around \$1700, pre-inflation \$\$) until the company's demise in the 1970s, when president Richard Dorf passed away. The text from one of their original ads, plus a brochure photo of the Theatre Organ, can be found at <u>The "Schober Orphans" Webpage</u> along with information on the other Schober models.

I'd like to say that I, too, am a Schober "Orphan", but unfortunately I never had the fun of building one myself (too young and penniless at the time). According to *The Schober Orphans* webmaster, Pete Stark, I am what is known as a Schober "Friend" rather than a true "Orphan," because I bought my organ second-hand from the original owner-- which is fine with me. It wasn't until around 1997 that I discovered the Orphans' webpage online, and found out that a gentleman from New Jersey with the same last name as mine (no relation) was selling his Theatre Organ for a price that I could afford (a few hundred bucks). He had built the organ from a kit, played it for a few years, then got busy with life-- and the organ made its way into storage in his garage-- a story we've all heard many times. Well, one man's past-fantasy is another's present, so I wasted no time driving from my home in South Central PA to his in New Jersey to pick it up.

My first impression was "Wow, the horseshoe-shaped stop rail doesn't look as 'deep' as what I had expected" (being used to seeing pictures of the genuine monsters that are still around in some theaters). The Schober's stop rail is mostly straight in the center, as opposed to the deep, round ones that you see on the big *Wurlitzers* and others. Still, it makes a nice-looking piece of furniture, as my daughter remarked (she isn't interested in organs in the least, but she liked its aesthetic appeal) with its "cherry" (sort of an orangey-brown) -stained wood cabinet.

When I got the organ home and plugged it in for the first time, I found that it needed some work; several of the thin wires connecting to the stop tablets had broken off, the expression pedal potentiometer was scratchy-sounding, and the bass pedals didn't work at all. A feature that I did like was the way the organ is illuminated by small light bulbs under the top cover, which bathe the stop rail and keyboards in a warm yellow-white glow. Playing the organ in a darkened room gives one a distant hint of what it must have been like to play in a darkened theater long ago when these instruments were in their heyday, during the silent movie era.

Looking "under the hood" (the top of the cabinet, with the acrylic music rack, opens upward for easy access to the electronics inside) and playing around a bit, I found that some of the old Germanium PNP transistors had died, some of them had partially oxidized in their sockets and made a loud crashing sound when tapped, and I also determined that the original builder/owner had replaced Schober's 12-tone generator/dividers, in the upper (Solo) keyboard, with a *Devtronix* Top-Octave Synthesizer/Divider board. The lower (Accompaniment) keyboard still runs off the old Schober generator/divider system with its direct audio keying (and intermittent audio problems). Having the upper keyboard supplied by the Devtronix keyer is a big improvement over Schober's original design, because

1) the scratchy audio due to oxidized key contacts is practically eliminated,

2) the abrupt on and off keying of the old Schober system is now replaced by a softer "attack" on keydown, which more closely simulates the gradual buildup of tone in a real air-powered organ pipe, and

3) the upper keyboard always stays in tune! And it provides a standard "tuning fork" to use when tuning the lower keyboard master oscillators -which seem to go slightly out of tune with the seasons and extremes of dry and humid weather. When the lower keyboard does drift just slightly out of tune, but not enough to require retuning, the subtle chorus effect produced by the beating of tones between the keyboards (known as *celeste* [seh-LEST] in organspeak) adds to the "largeness" of the sound.

The bass pedals were another story-- they didn't seem to work at all. I ended up building a Schmitt Trigger (squarer) circuit and tapped off the Devtronix board for the pedals, although you cannot play polyphonic pedals because some of the pedals' voice filters have diodes in them and the distortion that results from playing two notes at a time is unbearable. Unfortunately, the pedals are direct-keyed like the lower keyboard, and have the same instant on/off attack/decay characteristic, but I'm living with it for now.

Once I got the basic organ working again, using a cheap Radio Shack 15 Watt amplifier (with its attendant power supply, separate from the organ's), I realized how thin and lifeless the organ sounded without some enhancement to the "straight" sound. I didn't have the money for a real Leslie Speaker, and the Audio Phase Shifters that some people hawked as "Leslie Simulators" just didn't sound good -- more like an offshoot of a Wah-Wah pedal to me -- but I did find that Radio Shack carried (at the time) a "Bucket-Brigade" analog Delay unit for about \$39. I modified it so that it would sweep its delay time up and down, giving a chorus effect that approximated the full, lush slow-Leslie sound much better than a Phaser could. Not too long afterward I inherited a Spring Reverb from an old guitar amp [these reverbs were originally invented by the Hammond Organ Company], and I was in business! The old girl began to sing again, and she really did sound a lot like the old Cinema Organs I used to hear on records by artists like George Wright and others.

Like most people, I am too busy and/or lazy to work very consistently at improving the organ. Right now she needs a new expression pedal pot, a better speaker system, some percussion voices, and better control of the balance between the keyboards and bass pedals. But I thought I would take some time to put up this webpage, seeing that the Internet -- where you can now look up just about *anything* and find a library of information on it - didn't have very much on older Analog Organ technology, aside from a website in Europe or two. The industry itself has long ago moved totally to Digital Synthesis, which makes it possible to build an electronic organ, using what amounts to a small computer and a few extra boards, that sounds infinitely better than the old electronic organs were ever capable of sounding.

Still, I like the idea of keeping some of the 'Retro-Technology,' from our analog past, alive and available to whomever might want to know how to

build an electronic musical instrument out of good old transistors, ICs, resistors, capacitors and inductors. I happen to like the older technology; seems like after all the years it took me to discover it and understand it, it was suddenly obsolete -- and now it's almost vanished. We can still learn something from studying it, and organs built this way can still sound very good, even if they can't hold a candle to their Digital descendants.

I hope this page will be a stimulus for other Schober "Orphans" and "Friends" to put up their own pages to show off their "retro-technology" instruments...

...I'm sure I'm not the only dinosaur still lurking in the shadows.

### Here are some photos of my Schober, with commentary:



As you can see in the picture above, my organ does not have the white pushbutton "pistons" on the wood blocks between or below the keyboards, that the "full-option" model had (Schober allowed you to buy and build only as much organ as you could afford; the push-pistons and their *Reverbatape* were optional). Also notice that there is no speaker grille above the bass pedals, unlike in most electronic organs. Schober's philosophy was that the organ sounds best with a large, external amplifier and speaker system, and so their organs had a blank wood panel where the usual internal speakers would go.

The cheap stereo speakers you see on either side of the console are driven by a small audio power amp from Radio Shack. They project "straight" organ sound, while a separate channel [of my own innovation] splits off and goes, first, into a Radio Shack analog "bucket-brigade"-type Audio Delay unit, then into a "spring reverb" unit from an old guitar amp [which I got for free], then into an amplifier and separate speaker located across the room. This separate speaker box contains a pair of woofers; the box is one of those felt-covered trapezoidal contraptions that teenagers like to install in the back of their cars. A young man, who was a student of mine when I taught at ITT Tech, gave me his trapezoidal speaker box for free, as long as I didn't mind that one of the speakers was blown! (I didn't.) So the speaker box and the reverb were freebies from my students....I guess it pays to talk about your hobbies when addressing a captive audience!

The Analog Delay unit from Radio Shack had [past tense, since they've become a cell-phone store ;-)] a variable delay/echo time, controllable via a slide pot, as well as 'wet/dry mix' and 'regeneration' (feedback) pots. The only problem was, it was not *continuously* variable [a la rotating "Leslie Speaker"], so I built a small op-amp swept triangle-wave generator and found the appropriate spot on the delay unit's circuit board that would allow my triangle-wave to sweep the delay time back and forth at a rate of somewhere between 1/2 and 1 cycle per second, which organists will recognize as the slow *Chorale* speed of a Leslie Speaker. This cheap 'Leslie simulator', together with the spring reverb, made *all the difference in the world* in getting the organ to sound like a real theatre organ. Without these two add-ons, the straight organ sounds rather thin and "too perfect" in tuning, and its phase-shift vibrato sounds rather "pulsy". The multiple reflections within the spring reverb flesh out that pulsy vibrato into a throbbing "tremulant" which is the hallmark of the theatre organ, while the slow sweeping of the Delay unit gives a kind of moving, pipe-organ-like subtle chorusing effect which is essential to getting "The Sound".



Here is a view of the Stop Tablets and control knobs along the left side of the horseshoe-shaped stop rail. Notice the black, multi-position switch knobs at the extreme bottom-left... one of them is a 3-position Balance switch that allows you to set the volume of the upper (solo) and lower (accompaniment) keyboard voices, relative to one another. The other controls the volume for the bass pedals. Frankly, I find these switches annoying (the nuts holding them in the wood panel often become loose and need to be re-tightened with pliers) and will probably replace them with potentiometers when I finally work up the resolve to get around to it.

The pot in the upper left controls the mix of "straight" vs. "reverbed" organ tone.... I have forgotten what that knob USED to do on the original Schober Theatre Organ, but on mine, it's the "Reverb Depth" control.

# The Organ's Stops (Voices)

By today's standards, the voicing on the old Schobers (as well as most other organs of 1960's and '70's vintage) was mediocre to horrible. I both agree, and respectfully disagree, with that statement, in that it's not only a matter of taste, but also a matter of what *expectations* the player has.

Here's what I mean:

As organ/synthesizer/"keyboard" technology progressed over the years, they got better and better at imitating the sound of the real orchestral musical instruments whose names were engraved on their tabs. Nowadays all keyboards use Digital synthesis or sampling of some type, and so it can be said that we have finally "arrived"; the accuracy in voicing that we were striving for in the old days has been achieved, and modern keyboards so much like the instruments they're imitating that it can be difficult to tell "whether it's real or whether it's Memorex," as the old ad used to say.

But along the way, something happened: The organ came to sound so much like strings or brass or a piano, that it didn't sound much like an *organ* anymore! My brother (a Hammond owner) used to point this out during the early 1990's when I was enthralled with the **Wersi** digital kit organs; only in the last several years have I come to appreciate how true his observation was!

When you think about it, the organ has always been an imitative instrument, but also has a repertoire of voices unique unto itself. The obvious example is the **Diapason**, which is the stereotypical bland "Church Organ" sound, and which doesn't sound like any other orchestral instrument known to God or man. To put it another way, nobody ever played a "real" orchestral instrument in such a way as to fool the audience into thinking they were hearing a classical organ! The Diapason sound is unique to the organ, and it is produced by pipes made of a specific material, cut in a specific shape, which emphasizes a particular tone coloration (spectrum) unlike anything else. Nobody plays a "diapason" in your local high school band!

Now, look over the list of voice "stops" on the Schober Theatre Organ and notice how many of them don't really correspond to any known band/orchestral instrument (*Dulciana, Tibia, Diapason, Octave*), but also how some of them bear names that seem to *allude* to real instruments (*Tuba Profunda, Harmonic Flute, Vox Humana* [which is supposed to suggest the sound of a 'human voice', in someone's fondest dream], *Viola D'Amore*).

The original pipe organs, and their electronic imitators, were/are able to imitate the steady-state *tone colors* (audio spectra) of musical instruments very well; but, before the advent of today's digital keyboards, they were unable to reproduce the subtle *transients* that are produced whenever a real instrument is played. It turns out that these transients help to convince us that we are hearing the real thing (even when we're not), whereas the pure "tone" of the instrument, without transients, is really just an abstract, stylized imitation of the instrument.

But it turns out that a lot of very pretty music can be played on an instrument whose voices are abstract, quasi-imitations of the real instruments. Pipe organs and their little electronic brothers from the Analog Electronics Era (1940's - early 1980's) excel in producing *abstractions* of orchestral

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instruments. Add in some chorusing (for a bigger sound), some throbbing Theatre Tremolo or Vibrato, and some decent concert-hall Reverberation, and those retro-technology contraptions can stand on their own, if you're willing to hear them on their own terms, and not impose the demands of the 21st century on them.

It is for reasons like these that I advocate preserving some examples of the sound and the technology of a bygone era-- in a time when these old gems have mostly gone out of style and people can't even give them away. Like the genuine Theatre Pipe Organs before them, these lesser electronic brethren are usually bound for the landfill as their final resting place... I'm hoping to keep my Schober Theatre Organ around a while longer.

#### PEDAL STOPS

Dulciana 16' Tibia 16' Diaphone 16' Tuba Profunda 16' Bass Flute 8' Tuba 8'

#### ACCOMPANIMENT (lower keyboard) STOPS

Tibia 16' Dulciana 8' Vox Humana 8' Tibia 8' Orchestral Strings III Diapason 8' Harmonic Tuba 8' Harmonic Flute 4' Octave 4' Tuba Clarion 4' Solo-to-Solo Accompaniment (coupler)



Here is a view of the Stop Tablets along the center of the rail. Notice the single **Vibrato** tab. Although the Schober does have a switch to select which of the manuals (keyboards) get Vibrato and which do not, there is but one Vibrato for the whole organ, with Depth control, but no Rate control -- that's fixed. A large Theatre Pipe Organ, on the other hand, would likely have several **Tremulants**, perhaps one for each "rank" of pipes. This helps give a fuller, more varied sound.

SOLO (upper keyboard) STOPS Tibia 16' Cello 16' Stentorphone 16' Tuba Mirabilis 16' Viola D'Amore 8' Vox Humana 8' Solo String 8' Clarinet 8' Tibia 8'

Oboe 8'

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Diapason 8' Brass Trumpet 8' Violina 4' Tibia 4' Tromba Clarion 4' Piccolo 2' Fifteenth 2' Flageolet 1' Fife 1' Solo-to-Solo 16' (coupler) Solo-to-Solo 4' (coupler) Solo Unison OFF (coupler)



On the far right of the Theatre Organ's stop rail is a row of green tabs; these are the Schober Percussion voices, whose internal circuitry was also optional and was never installed on my organ. From what I (think) I know about this old technology, the Percussions are one feature I don't miss-in fact, contrary to everything else that this "retro" page stands for, I would eventually like to install what are now the standard MIDI percussion *voices*, available on any PC's sound card, in place of this original analog circuitry. This is because the MIDI percussions are much more realistic-sounding than the originals, which I think is important for such things as Pianos and Orchestral Bells, etc. Unlike the steady-state tonal abstractions I argued for in the preceding paragraphs, percussion voices usually have a hard "strike" transient, then fade away gradually. The "silvery" sound of real bells and the "klang" tones of Chimes and Carillons are hard to imitate the old way. The Piano sounds particularly "lame" when not done as accurately as possible. The 1960's circuitry in this early 1970's organ just couldn't cut it in the Percussion voices' area.

PERCUSSION (upper keyboard) STOPS (Click on MIDI buttons to hear your PC's sound card synthesizer rendition of these voices) **Celesta** [pronounced *che-LES-ta*, and sounds like a "doorbell" in the middle registers, or a "music box" in the upper] **Chrysoglott** [a mellow, tuned-bar-with-short-sustain kind of sound]

Orchestral Bells [10] [also known as a *Glockenspiel*; you may have played one in your high school band] Orchestral Bells (Reiteration or Repeat) [rapidly striking the bells with alternate mallets; often heard on Carousel Band Organs] Piano 🔤 [the current MIDI versions sound pretty realistic; the 1970's organs' imitations were basically just a Diapason-like tone with Decay...] Harpsichord 🔤 ["Lurch" on *The Addams Family* played his in two octaves simultaneously; that's my idea of how a Harpsichord should sound] Xylophone Imm [the MIDI version sounds pretty good; always reminds me of Daffy Duck cartoons]

Mandolin [indispensable for playing *Santa Lucia* and the theme from *The Godfather*]

I would add a Vibraharp ("vibes") 🚾, Chimes 🚾 (MIDI has "Tubular Bells" that sound pretty chime-like), and possibly a Marimba 💌 to these Percussions if I ever do go MIDI.

Finally, notice the 3 black multi-position switches at the far right of the picture above. One controls the Percussion Balance (volume), another the Vibrato Depth, and the last one determines to which keyboard (either, both, or neither) Vibrato is applied.

I haven't said anything about the Coupler tabs mentioned in the stop lists for the upper and lower keyboards. The Couplers are a strange concept to an organist who has been brought up in, say, the Hammond tradition. But they derive from the Pipe Organ, and basically what they do is to allow you to transfer some of the voices from one manual, onto another. Also, to "thicken" and brighten up certain softer voices (such as the upper manual Tibias) by duplicating them in other pitch registers (such as an 8' Tibia becoming a mixture of 8' and 16', or 8' and 4', when the appropriate coupler is depressed). I have found that they effectively add a whole 'nuther set of voices to the organ.... and, in particular, really add to the authentic Theatre Organ sound when the lower keyboard voices are used "straight" -- with no Vibrato -- but when the Solo-to-Accompaniment 8' Coupler is turned on, and the upper keyboard voices have full Vibrato on them. The mixture of straight Accompaniment voices with vibratoed Solo voices

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(coming through the Coupler switch) creates a sort of "warbling notch-filter" effect, like a bubbling audio Phase Shifter sound, that *really* adds to the perception that you're listening to a big Theatre Organ... you really have to hear it for yourself to appreciate what I am trying to say.

# The 4 Families of Organ Tone

As discussed above, Pipe Organs and Electronic Organs really only give us a steady-state tone that *suggests* the "tone-color" or harmonic spectrum of real orchestral instruments. These imitative voices fall into 4 broad categories or "families" of organ tone:

The *white* stop tablets on the Schober and on most Theatre Organs are for voices belonging to the **FLUTE** family -- "Open" pipes sound like the genuine orchestral flute, having a strong fundamental pitch and rapidly tapering harmonics [overtones], both odd and even-numbered. "Stopped" pipes sound similar to the recorder-flute, or to an extremely mellow clarinet, because they are missing the even harmonics, which gives a characteristic "hollow pipe" sort of sound. **Tibias** are stopped flutes; they form the foundational tone of the Theatre Organ, usually in the form of the *Tibia Clausa* stop with full tremulant turned on.

The **DIAPASON**s, also having *white* stop tabs, are the foundational tone of the Classical Organ (heard in traditional church settings, in classical music like that of Bach, etc.). They are somewhat mellow, but with more harmonic structure than the flutes. They are unique to the Organ. In liturgical music, the tremulant/vibrato is not used-- just the straight, sober (or, as some would say, *somber*) tone with a subtle "chorale" [slowly rotating Leslie speaker] to mimic the wandering sound of an organ within a great cathedral.

The *yellow* tabs are assigned to the **STRING** family -- Here is one area where even the old analog electronic organs were capable of imitating orchestral strings (violin, viola, cello) better than pipe organs-- after all, how can we expect a blown *pipe* to sound like a bowed *string*? Well, they really don't, but are narrow-diameter pipes whose steady-state tone has a harmonic spectrum vaguely suggestive of the spectra of real strings... in any case, they add a bright sound to the mellower pipe voices on the organ. And when a pipe or electronic organ adds *celeste* ["chorus," produced when another "rank" of pipes/oscillators, slightly off-tune, is mixed with the originals], the Strings can be very beautiful, even if they don't really sound like an orchestra of violins.

Finally, the *red*-colored **REED**s, which include the orchestral Woodwinds (Clarinet, Saxophone, Oboe, English Horn, Bassoon) and also the Brass (Tuba, Trombone, Trumpet, French Horn, Cornet). The spectra of the reed voices usually includes a resonant peak at some frequency, determined by the physical dimensions of the Tuba, Trumpet, etc. In electronic organs, this translates into the use of Bandpass Filters whose center frequencies match the resonant peak frequencies of the real instrument. In Theatre Organs, the reeds may be used as solo voices (like the mournful Tuba Mirabilis / Tuba Horn) or as the sharp/blaring 'edge' of an ensemble (Trumpet, Post Horn, Kinura).

### **Pitch Registers**

Organs will have some voices from each of the 4 families listed above, but also in several *pitch registers*, meaning that the same tone can be heard at, say, middle C on the keyboard (261.6 Hertz or cycles per second)-- which happens to require a pipe that's 8 feet tall (!), which is why the stop tablet for that voice will have the designation " 8' " on it. But the same voice may also be available at 4', which means that pressing the exact same organ key will now give a tone at an octave higher, or 523.2 Hz, because a pipe organ needs a 4'-tall pipe to produce that pitch. Organs allow you to play several notes, simultaneously, by pressing just one key-- this gives them a large number of possible combinations of voices and pitches.

# Some Sound Files of the Schober Theater Organ

Here are some MP3 sound files I recorded off of a cheap cassette recorder, positioned about 5 feet from the organ's speakers. I apologize for the low fidelity (like weak-sounding bass pedals) and especially for the many mistakes in my playing, but anyone who is "retro" enough to be reading this page in the first place, shouldn't mind too much if the quality of these sound samples isn't exactly top-notch.... the Schober Theatre Organ sounds a lot better, live!

As far as the overall sound quality -- I'm still learning how to optimize it... Anyone who played these sound files when I first uploaded them during the first week of January 2007 will remember the rather high noise level -- tape hiss from the cheap cassette recorder, and low volume on some of the files. Since then I have found a wonderful Audio Editor program online called *Audacity* [Check it out; it's **free**!] which has allowed me to take the raw WAV files, adjust the music volume, remove most of the hissing noise, do a little equalization, and convert them to MP3 files! The only mild objection I have is that on some of the sound files, you can hear a little "tinkling" noise, like pieces of glass being dropped-- that's an artifact of the digital noise removal process and you should disregard it. This is loudest in the Clarinet sound file, because I recorded the original tape at too low a level. If the original samples are recorded loud enough, you don't hear the tinkling glass sound for the most part.

I hope you enjoy the sounds of the Schober Theatre Organ below.

Click on the musical note to the right, to hear a typical "Theatre Organ" sound	7
Here's the same tune, but with the "reeds" turned on, for a "Theatre Brass" sound	/7

The "signature sound' of the Theatre Organ is the Tibia, with full tremulant (vibrato, on the Schober). The Tibia is a mellow, stopped-flute pipe, sounding similar to a "recorder" or even a bit like a "calliope"-- mostly sine wave fundamental with a bit of 3rd and 5th harmonics way down in the mud, but just perceptible enough to give some character to the otherwise 'dull' sound of a pure sine wave.

Here is the 16' Tibia, played high on the keyboard, with 8' and 4' added later...

The Diapason, in 16', 8', 4' makes a classic Church Organ sound...

Schober president Richard Dorf used to refer to the Trumpet and Tuba as "nasty" Reeds...



http://www.tricountyi.net/~randerse/Schober.htm



#### Other Schober and Theatre Organ Links:

Dana's personal "Schober Recital Organ" Page -- Great how-to on cleaning old Schober keyboards, etc. The "Schober Orphans" Webpage American Theatre Organ Society Webpage <u>"What IS a Theatre Organ?"--Very informative article!</u>

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