Schober Organ Notes No. 88

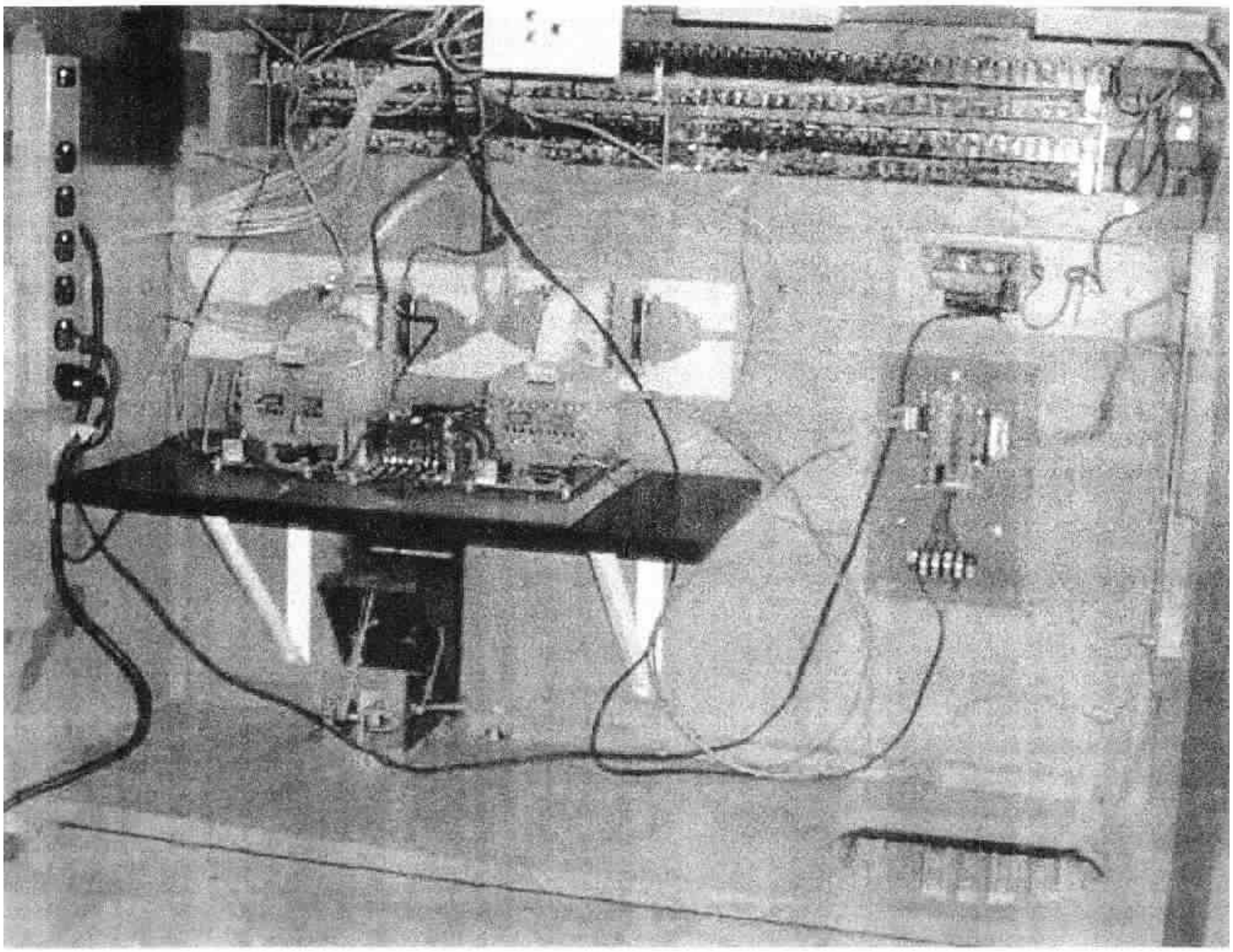
Disclaimer: We accept no responsibility for any unfavorable consequences resulting from following our advice

OVERTURE

Happy Holidays to all! This issue is almost on time and I hope to be back on schedule with the next issue.

RICHARD McBETH'S CONSOLETTE

Richard has written several articles on his Consolette project and they are full of great information. Since it has been a while since his last article appeared, I am reprinting the first three parts of this series along with the latest. For e-mail subscribers who want to see the diagrams and photos, please send me a SASE with $.60 postage attached and one loose $.37 stamp.



CONSOLETTE II PROJECT

by Richard McBeth

Ok, so I am crazy. Who would take a perfectly good Schober Organ, strip the guts out of it and rebuild it with new circuits? My problem was that I was never really happy with the operation of the keyboard, but I enjoyed the quality sound produced by the Schober. There always seemed to be a chirp at the start of some notes when depressing a key. I believe that this was caused by one bus making contact before another bus due to the switching design. Also there was the ongoing contact cleaning problem, the tone generator tuning and the hiss, pops and hum that developed over the last 30 years.

When I found the Schober Orphan WEB page and read the Organ Notes article that related to the Devtronix circuits, I knew I had the answer to my problems. The beauty of the Devtronix circuit is that not only do they eliminate the tuning problem, but also the attack and decay of the notes are switched and controlled electronically. Having a technical background, I decided to rebuild the tone generator section. But, of course, a DIY (do it yourself) person can't just stop there. This project mushroomed into several different phases. Like it had a mind of its own!

Phase 1 - Design of the tone generation system.

Phase 2 - Remove, clean, rebuild and modify the keyboards.

Phase 3 - Remove old tone generator boards, mount new tone generators and modified keyboards. Here the signals may be connected to the old audio system and tested.

Phase 4 - Replace old audio system with new audio system designed with operational amplifiers and electronic echo.

Phase 5 - Replace old power amplifiers and speaker system with new design. This will keep the Swell, Great and Pedal in separate amplified channels.

At this point I should have a clean switching crisp sounding Schober Organ free of chirps, pops, hiss and hum and I will never have to tune it again.

Where am I in this process - well phase 1 is done and I am 1/2 way through phase 2. I plan on describing my progress, problems encountered along the way, solutions found and results obtained. I would like to thank fellow Orphan David Casteel for the inspiration to write this. And for the record, I don't plan on deviating much from the basic Schober design philosophy, it has withstood the test of time.

CONSOLETTE II PROJECT

by Richard McBeth

PHASE 1

Phase 1 of the Consolette project is to develop the tone generator circuit. The basis of this design was the same as used by Devtronix. The circuit is designed around two integrated circuit chips.

Unfortunately both chips are obsolete now but may still be purchased (see Note 1). The first chip is the MO-83, a top octave synthesizer (TOS) signal generator. The second is the TDA1008, a gating/frequency divider for electronic musical instruments. A combination of these chips will generate and switch all the notes in an organ. In essence they replace the Schober tone generators and the keyboard-switching matrix. At the same time they may be designed to generate the same saw-tooth signals that the Schober stop filters require. It should be noted that this approach is technology from the late 1970s early 80s. Today's technology would do the complete organ electronics (tone generation, switching, filters, etc.) using a Digital Signal Processor (DSP) and a microprocessor all on a 4" by 6" PCB for the cost of a few hundred dollars.

Figure 1 illustrates the basic block diagram of the complete tone generation system.

The TOS chip is crystal controlled at 4 mega hertz (MHz) for long term stability. It has internal frequency dividers that create the top (highest) frequencies used by an organ. This starts at the high C of the 1-foot pitch and goes down (for all notes) 1 octave. Figure 2 shows the internal block diagram of the TOS chip.

Figure 3 is the block diagram of a TDA1008 chip. One chip is required for each note (C, C#, D...) and generates the tones for 5 octaves. Each keyboard has its own set of 13 TDA chips. A 13th chip is required to control the low C on the keyboard. Remember there are 6 C notes on the Schober 61 key keyboard. Referring to Figure 3, each key of a 5 octave spread of a given note is connected to input K1 to K5. Outputs are taken from Q1 to Q5.

Q1 = 1 ft, Q2 = 2 ft, Q3 = 4 ft, Q4 = 8 ft, Q5 = 16 ft.

Pin P is connected to the appropriate TOS signal and pin S is connected to a potentiometer and controls the decay (sustain) of the output. (More about this later.) The dividers at the left generate the correct frequency for a given note. For instance, middle A key will produce 440 +/- ½ Hz on the 8 ft output (Q4). The matrix switches the correct frequencies to the output as a function of which key is depressed. Figure 4 shows the input key switch circuit to the TDA1008 chip. One of the advantages of this chip is that it controls attack and decay of the tone when a key is depressed. The key switch S1 switches +6V to the TDA1008 input circuit. Resistor R1 and capacitor C1 control the attack time. I have set this up at about 20 milliseconds. R1 and C1 also provided de-bounce for the key switch. Any contact bounces when it is first made. This creates noise. The action of R1 and C1 will filter out this noise. The maximum decay (sustain) of the tone, when a key is released, is controlled by R2 and C1. I have set this up for about 1 second. Sustain is further controlled at pin S by a potentiometer and may be controlled from maximum (1 sec.) to almost 0 time. The attack, hold and decay of a note are known as its envelope. See Figure 5. (Future plans call for an electronic echo chip. See Note 2.)

All tones generated in the above discussion are square waves because these are easy to generate and divide. The keyed tone needs to be converted into a saw-tooth waveform because that's what is required by the Schober stop filters. This was accomplished the same way Schober did, by using a ladder resistor network. See Figure 6. Finally, the saw-tooth signals from each TDA1008 chip are bussed together and buffered by an operational amplifier (op-amp). The output of the op amp is sent to the organ bus amplifier and then to the stop filters.

The TDA1008 chip requires three different voltages, +12, +9 and +6 volts. I purchased a +/- 5V and +/ 12V power supply on the WEB for about $20 and use 7806 and 7809 voltage regulator chips to develop +9 and +6 on the PCB. +12 volts is used for the 4 MHz oscillator and the TOS chip. +/- 12 volts will provide the power required to operate operational amplifiers and the +5 volts provides any logic chip power that may be required.

The physical construction of the circuit evolved into a base motherboard that holds the common circuits (+9, +6 regulators, 4 MHz oscillator, TOS chip and the saw tooth buffers). On this board were sockets to plug in 7 baby boards.

Each baby board has two TDA1008 chips and the saw-tooth resistor network. Power and S sustain voltage is bussed to each baby board. The saw-tooth signals were bussed from the baby board to the op-amp on the motherboard. Finally, the key switches were connected to the baby boards as required. From Figure 4 see that the keyboard switch switches +6 volts to the TDA1008 chip. This required modification of the keyboards and is the subject of the Phase 2 report.

Note 1: MO-83 TOS chip from Organ Supply Corp. TDA1008 chip from Classical Organ Inc.

Note 2: HT8955A and 21256 DRAM from Radio Shack WEB site

CONSOLETTE II PROJECT - PHASE 2

Phase 2 of the Consolette II project involved the restoration and modification of the swell and great keyboards. I should say that working on the keyboards is not for the faint of heart. It requires time and a lot of patience. These keyboards were manufactured by Pratt & Read Co. and of course are they are no longer in business. Spare parts may still be ordered from Organ Service Corp. (note 1). The folks at Organ Service were very helpful. I started by reading the articles in Organ Notes (ON) # 56 concerning the keyboard and obtaining the Schober technical notes from A.K. This proved to be a very good starting place.

The article in ON #56 discussed, in detail, the method for solving the 'sticky key' problem and provided a detail drawing of the key action. An additional problem I found in the keyboard was that the rubber Key Guide Bushings, located on the inside of each key, dry out over time and become very hard. I believe this is what can cause the 'clackity' noise refereed to in ON #56. Their purpose is to cushion the press and release movement of the key. If you disassemble the keys to clean and replace the grease, I highly recommend that you replace the Key Guides at the same time. They are easily replaced after removing the old ones, which may fall apart when you look at them. (See note 1)

When you remove the keys, the lady at Organ Service recommended that you keep track of where each key came from and reassemble in the same order. I did this by giving each key a number on a piece of masking tape. I also numbered the metal key bodies. You also need to remove the Key Return Spring located on the rear of each key. These springs are color-coded. There are different springs for each type of key (natural or sharp key). It's a good idea to keep them separate as you remove them. Also have a few extra on hand incase some fly off and are gone forever. (See note 1)

As you remove the various parts be extremely careful not to disturb the Bell-Crank Return springs. (not the same as the Key Return springs) These springs are very delicate and not held in place very well. Have some replacement springs on hand. (see note 1) They can be replaced, but be very careful. Before reassembling the keys check to insure all the bell-crank return springs are in place correctly and working properly.

Unless there is an electrical switching problem there is no need to remove the circuit board from the bottom. The contacts and busses may be cleaned without the removable of the PCB.

Because my project required modification to the circuit board I was required to remove the PCB. The Consolette II only has 3 buses, 4', 8', and 16'. The method of contact is the same as the bigger organs. The contact springs and bus bars will probably need cleaning. Follow the cleaning instructions provided in ON #56. I purchased Pro Gold spray cleaning agent from the Radio Shack WEB site. (www.radioshack.com not available in the stores)

Removal of the printed circuit board (PCB) is described in the Schober technical notes #BM-043 & BM-043A. (available from A.K.) The PCB mounting grommets are destroyed when removing the PCB and a replacement is required. A PCB mounting replacement from Organ Service was purchased, unfortunately they were not suitable and I returned them for a 15% restocking charge. A suitable low cost board remounting method was developed and has been described in ON.

Basically the modifications required by the new Tone Generator circuit (see Phase 1 article in ON) required that the keyboard be changed from switching the audio signals to switching +6 volts to the Tone Generator circuit. This was accomplished by installing a wire jumper around the resistor on the rear contact and removing the resistor from the front contact and installing a wire jumper from that contact point on the PCB to the note pin. In making the circuit this way I created a parallel contact for each 6 volts to the Tone Generator. This is called a bifurcated contact and improves the reliability significantly. In essence I reversed the keyboard action. It originally switched an audio note from the note pin to the buss. It was changed to switch +6 volts from two busses to the note pin to the Tone Generator which in turn generates the audio note and puts it on the appropriate bus to the stop filters.

To sum up - working with the keyboard can be frustrating and time consuming, but they certainly work better when completed.

Note 1, www.organservice.com Tel.: (800) 457-4408

72320 - 214 Key Return Spring ($0.40 ea.)

72320 - 215 Key Return Spring ($0.40 ea.)

72320 - 224 Bell Crank Return Spring ($0.20 ea.)

72320 - 236 Key Guide Bushing ($0.38 ea.)

72320 - 264 Bell Crank Cap ($0.20 ea.)

CONSOLETTE II PROJECT - Update Report

By Richard McBeth

Well it's finally been put back together and actually sounds like a Schober Organ again. The original goal was accomplished as the keying action of the keyboards is now very, very smooth. My last project report was in ON #72/73 back in 2002. Alex was kind enough to reprint those articles here for your convenience. Since then the disassembled organ sat in one corner of my basement. Fellow Orphan Tom Lavin inspired me to 'get the job done'. My excuse was that I was caught in the Telecommunication Industry melt down. The company I worked for had over 8000 employees, today it has just 3000. So I took an unexpected retirement. It's just great!

But I digress, back to the Schober project. I have included pictures of the completed conversion to the Devtronix keying system. In Photo #1, note a shelf installed in the organ to support the keying system circuit assemblies. There are two circuit assemblies separated by the main power supply. The assembly on the left is connected to the Swell keyboard and the right assembly is connected to the Great keyboard. You can see the cables coming from the keyboards are connected to a small board that makes the transition wiring to the Key Gating board on the circuit assemblies via flat cables. The output (2', 4', 8' and 16' saw-tooth signals) are fed from each motherboard by the small connector on the right front of each assembly. These signals go the Schober Bus Amplifier (BCA-4) where S4, S4W, S8, S8W, S16, G4, G8 and G16 are mixed and fed to the Schober Stop Filter (SCF-2) board.

In order to save money, I did not use another complete Devtronix circuit assembly for the pedal signals. Instead I designed a simple gating system using TTL logic to control the pedal signals. This board gets its input from (1) the top octave frequencies available from one of the Devtronix gating assemblies and (2) +5 V switched from the appropriate pedal. Its output (the pedal note) is connected to the Schober Pedal Generator (PCG-4). You can see this board to the right of the shelf. Above this board is a -15V power supply that provides power to the final Schober Preamplifier-Vibrato (PCR-6) board. Fifteen volts (-15 V) was used for this board to provide more current for the opto-resistors. All the rest of the Schober boards are powered by -12V from the main power supply. I found that all the Schober boards operate just fine down to -10.5 Volts. My hat is off to the original designer of these boards for a quality design job. Photo #3 is a close up view of the Pedal switching board. I will provide technical details of the pedal note gating board in a future article.

Each of the audio channels (Swell, Great and Pedals) has been kept separate. Each has its own preamplifier, power amplifier and speaker system. To support the pedal channel a powered amplifier (100 W) sub-woofer speaker system was built which easily handles the base notes down to 32 Hz. See photo #4. I purchased the amplifier for $29 and the rest of the parts required from partsexpress.com which sells speakers and speaker building parts for the DIY fan.

In general I am very pleased with the operation of the Devtronix key switching action. It makes the keying action very smooth and responsive. Now I need to learn how to play. Future projects will include designing an electronic replacement for the Reverbatape using an echo chip and then replacing the Schober discrete transistor circuit assemblies with Operational Amplifier circuits. Hopefully it won't take another 2 years.

ADS

Disclaimer:
Any deals, making of payments, receipt of payments or verifications are strictly your responsibility.

RECITAL Schober is available for free in New Providence, NJ, around 25 miles west of New York City. It worked fine until it was last moved. Contact: John Puttress, Phone: 908-464-5082 Email:

RECITAL Schober is available for free in Brevard, NC. It is not working at present; Includes a Chimeatron. Contact: Gordon Boynton, Phone 828-884-6761

CONSOLETTE Schober PARTS available. Richard Thompson has placed several ads giving away his Consolette. There were no takers, so now he will give away parts for the shipping costs. Write: 403 E Smith, Bay City, MI 48706 Phone: 989 684-1076

CONSOLETTE Schober is available in Aberdeen, South Dakota. See ON 63 for a photo of his organ. Contact Mrs. McFarlane at phone # 605 225-2410. (This ad is appearing in the E-mail version of ON88 only as it was placed after the hard copy version was already printed.)

HELP: Our member Mark Gordon read somewhere in Schober literature that Schober made a bridge kit for connecting two TR-2 Amplifiers together. Has anyone heard of this? If you have any information please email him at: CBOLGER@cinci.rr.com

I would also appreciate any information (your Head Honcho, A. Kruedener)

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Editor/Publisher: Alexander Kruedener, 161 East 89 Street, Apt. 4E, New York, NY 10128, (212) 831-0662.
Kruedener@juno. com

ORGAN NOTES FOR SCHOBER ORPHANS AND FRIENDS Issue 88
Fred Henn Founder & Headmaster Emeritus
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EDITOR Alex Kruedener kruedener@juno. com
EMAIL Jack D. Gildar JDgildar@juno. com
Schober Organ Orphans' Web Page: http://www. users. cloud9. net/~pastark/schober.html