How To Repair a Hammond Solovox

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The author has taken the "works" out of the tone cabinet for service. Keyboard is at right.

WHEN a bulky box and a piano-like keyboard is brought into your radio repair shop, you may wonder what it is and how you will ever be able to service it. But don't let a Solovox stump you. It is not hard to service. Last year I repaired 15 of them, and I am now going on my eighth for this year.

While some parts of the circuit more or less resemble standard amplifiers, most parts are peculiar to the Solovox. Since all the components are ordinary ones, however, with which the technician comes in contact every day, repairing the instrument is not a difficult problem. The troubles I have found in actually working with Solovoxes and the repairs made should help other technicians with their own Solovox repair.

Vibrato

The vibrato effect is caused by a metal reed with a magnetic drive. On one end of the reed is an iron core which moves in and out of an auxiliary coil connected (when the VIBRATO switch is on) across a portion of the oscillator tuning coil. The moving core varies the inductance of the coil and the frequency of the oscillator.

Sometimes the vibrato does not work because the reed is not vibrating. The magnetic drive is not self-starting; the on-off volume-control lever gives the reed a push to get it started. If the lever is moved to the operating position too gently, the push may not be hard enough. The trouble can usually be remedied by turning the instrument off and then pushing the lever to the right more quickly.

Remember, if the keyboard is placed on the workbench for service, that the reed won't vibrate unless the keyboard is in the playing position, as in the photos, not on its back or up-ended.

Silent octaves

There is only one oscillator in the Solovox. It oscillates at 2,093 to 3,951 cycles, equivalent to the C to B at the top of the piano keyboard. The five lower octaves which can be sounded are generated by five 6SN7-GT frequency dividers and two 6SN7-GT drivers. Therefore, when the top octaves sound normal but all notes below a given C are silent, one or more of the 6SN7-GT's may be bad. The easiest way to find out is to replace them, one by one, beginning with the fifth tube from the left in the upper row (see photo of rear of tone cabinet).

If no sound is heard or if only the top octave is working, the 6SJ7 (tube at extreme left) or the 6J5 first driver (second tube from left) may be bad. Try substitution.

The mute circuit

One of the factors affecting the tone quality of the instrument is the mute circuit, operated by a switch on the front of the keyboard. The MUTE switch cuts in a diode following each frequency divider. The diode, when in the circuit (MUTE switch *off*), gives the tones both odd and even harmonics. When the switch is *on*, the diodes are out of the circuit and the only overtones heard are the odd harmonics, giving the tones a "muted" or softened effect.

If operating the MUTE switch has no effect on the tone—if it remains muted—a 6H6 may be bad. Three 6H6's are used, one of the six diode sections being in the output circuit of the oscillator and each divider. Usually, therefore, only a certain range of tones will not be muted correctly (assuming that only a single 6H6 goes out at a time). If all tones are affected, the contacts on the MUTE switch may be bent or dirty.

Clicks and thumps

One of the two contacts on each key selects one of 12 tuning capacitors for the oscillator. However, when no keys are pressed, the oscillator generates the note B. The amplifier, therefore, must be shut off when no keys are being pressed.

A pair of 6SK7 control tubes (V14, V15) is used in a gating circuit. Normally they are biased to cutoff by a high positive cathode voltage. When a key is pressed, relay coils, obtaining their voltage from the same voltage divider that supplies the cutoff bias, are energized. The current drawn by the coils reduces the voltage at the 6SK7 cathodes so that the tubes operate. The audio fed to them is amplified and passed on to the 6K6 push-pull output stage.

Unless the 6SK7's are well balanced, you may hear a click or thump each time a key is pressed. The unbalance may be due to age, or balanced tubes may not have been installed during a previous service job. As replacements, use two tubes of the same make. If the noises are still heard, experiment with tubes selected at random until a good balance is indicated by the absence of noise.

Relays

Though the keyboard covers only three octaves, six octaves of tones are

available from the oscillator and frequency dividers. The keyboard is "moved" up and down through this range by the registration controls, which select the three octaves to be played. In addition, the upper, middle, and lower octaves of the keyboard are connected to the correct divider by three relays, one for each octave. If these relays do not operate, no tone will be heard.

To determine whether the relays are working, put your ear close to the relay unit and push one note on each of the three octaves successively. You will be able to hear the relay go on. If the relay is heard but the notes are not, the contacts may be pitted or dirty. Before going into the relays, however, check everything else, as the relays are hard to get at. If necessary, apply the usual remedies to the contacts—clean with carbon tetrachloride and burnish them.

Switch and key contacts

Dirty, pitted, or bent contacts are sometimes found on the switches and keys. The BASS, TENOR, CONTRALTO, and SOPRANO registration controls may be removed for inspection and cleaning. Remove the small screws from the bottom of the Bakelite end piece at the left of the keyboard. After removing the end piece, pull out the long rod on which the register controls pivot. Pull off the control or controls that seem to be causing trouble. Clean the contacts with carbon tetrachloride. Bend them into place if necessary; but unless you are sure your bending is correct, don't do it.

When replacing the controls, be sure the small lip fits inside the copper spring to give correct tension. When the rod is pushed in, the controls will sometimes not line up. Jiggle them a little to put them in place. Check all keys, octaves, and controls. Do not leave a Solovox repair job until you have done so, and you will have few callbacks.

If one or more of the notes chirp or don't appear to go on and off cleanly, the key contacts may be dirty. Dirty contacts may also cause complete failure of one key or may make a key play the note B instead of its correct note.

Each key has two sets of contacts, one for tuning and one for relay control. These contacts hit bus bars. Each bar may be moved slightly to expose a new, clean contact area by loosening one screw in each end of the keyboard. Move the bars about 1/32 inch.

Volume troubles

Low volume or too much volume may be caused by misadjustment of the maximum and minimum volume controls. These are located under the keyboard at the left of the volume-control lever and may sometimes be shifted accidentally by the player.

Complete loss of volume control may be caused by bad 6SK7 control tubes. The volume control itself is not a continuously variable unit, but a multipoint switch. It rarely causes trouble.

Components

As with all electronic equipment, trouble can always be caused by failure of components—resistors, capacitors, and so on. To find these, the usual signal tracing is effective. A good beginning is to trace through the frequency-divider stages, beginning with the oscillator. A signal should appear at the plate of each 6SN7-GT. Trouble will be located between the oscillator and the first tube at the plate of which no signal can be heard.

If all is well here, check the 6J5 pramplifier. The various tone controls are in the plate circuit of this stage. The signal then goes to the control tubes and the power output stage, which may be checked like any push-pull amplifier.

The voltage chart is useful for furnishing a clue to the source of trouble. The readings shown there were taken with a 1,000-ohm-per-volt meter having 50-, 250-, and 1,000-volt scales. Deviations of as much as 20% in readings may be caused by variations in line voltage. All controls were off during the measurements, the volume control in its softest position, and no key pressed unless noted. All voltages are *positive* with respect to chassis.

Summary

The most common troubles in the Solovox are as follows (in order):

1. Bad contacts (or keys, register relay controls, or relay contacts.)
2. Gassy and microphonic 6SN7-GT.
3. Bad control tubes.

Here is a list of practical troubles and their remedy:

Sputtering and cracking: Dirty key; remove the end piece and shift the bus bar.

Chirping: Dirty key on relay contacts; as above and clean.

Thumping and checking: Bad 6SK7 control tube; replace both.

Cracking and microphonic sound: Microphonic 6SN7-GT or 6V6-GT; replace.

SOLOVOX VOLTAGE CHART

Tube	Pin	Volts	Tube	Pin	Volts
5Y3-GT	2	320	V16, V17	3	310
V1	8	195	V16, V17	4	280
V3	3	45	V16, V17	8	25
V3, V5, V6, V8, V9	2, 5	140	Arm of min. vol. contr.		0–30
V2	3	220	(vol. contr. in softest position)		
V4, V7	2, 5	220	arm of min.		
V13	3	85	Vol. contr.		20–50
V13	3	2.5	(vol. contr. in loudest position)		
V14, V15	8	320	Spkr. field		–60
V14, V15	6	120	black wire (pos. meter lead grounded)		
V14, V15 (no keys pressed)	5	175			
V14, V15 (any key pressed)	5	55			

Unit fails to light up: Large male receptacle plug has been pulled out of its socket.

One key fails to play: Dirty key or contact; shift bus bar about 1/32 inch.

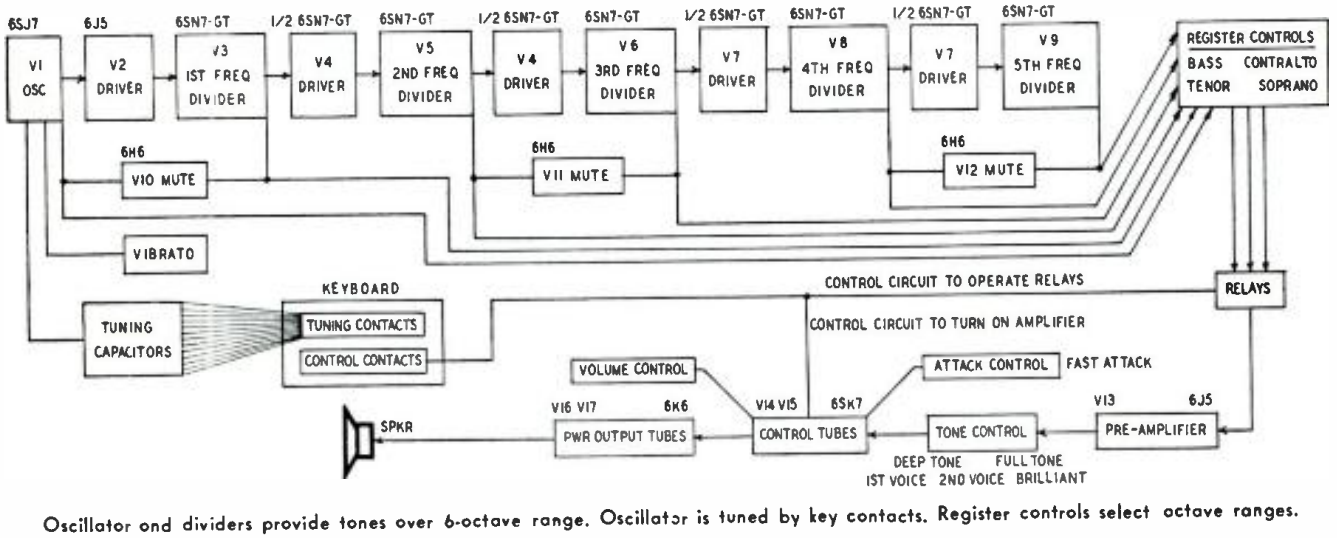
One single octave fails to play: Generally register control tablet; remove end and wipe or brush contacts with carbon tet.

Low volume: First check min and max volume controls as they can easily be turned during operation; then check power output stages.

No vibrato tone: Dirty contact or vibrator; first switch vibrator on vigorously with switch lever; then check contacts.

Can't control volume: Bad 6SK7 control tubes; replace.

Excessive a.c. hum: Bad filters.



Oscillator and dividers provide tones over 6-octave range. Oscillator is tuned by key contacts. Register controls select octave ranges.