posure he has been giving to both. He obviously has a "soft spot" for treasures of the past — theatres, theatre organs, live radio and that of superb storyteller. It is a fine broadcast melding folk music, country and western, classical, even an occasional ragtime band. Information on the time of the broadcast (which begins at Minnesota Public Radio) probably can be obtained from the local Public Radio station.

Sincerely,
Tom DeLay
Fresno, California

Dear Sir:

The excellent article ("The Theatre Organ . . . Wherein Lies Its Future?" by John Ledwon, THEATRE ORGAN, January/February 1986) sums up what I have been thinking for a decade and says it eloquently. I think that the day of the sobbing Tibias and fixed-position tremolos has long passed. I leave most theatre organ concerts finding that I was moved by only one or two of the selections played. I shall take a walk outside the auditorium the next time the "artist" perpetrates "Diane" or some other '20s hearts-and-flowers warhorse on me.

We need the younger generation and whatever of its music is properly adaptable to theatre organ. Light, color, movement and some innovative theatricality is now needed.

Ledwon's thoughts are like fresh air in a long-sealed tomb. His approach is even more impressive coming from an educator, professional musician and theatre organist who knows of the glory days.

Sincerely,
Irvin R. Glazer
Springfield, Pennsylvania

Dear Sir:

The highly commendable review of the Australian recording, "Five Alive," made in TOSA South Australia's Capri Theatre, incorrectly described Ray Thornley as "a relative newcomer to theatre pipes." In fact, Ray's introduction to organ playing was on a theatre pipe organ in his early teens, before he had touched an electronic. This was more than 20 years ago, when what is now the Capri organ was installed in the Sydney, NSW, home of the late Jack Penn Hughes.

At 16 he was appointed resident organist, on pipes, at the Victory (now Mecca) Theatre, Kogarah, leaving at the end of 1975 to become national concert artist for Lowrey organs. In January and February 1974 Ray visited the U.S.A. and played many organs, including some of the pizza restaurant installations.

Ray has been a regular concert artist on the Australian theatre pipe organ circuit for the past ten years or so. It will be seen Ray Thornley cannot be described realistically as "a relative newcomer" to theatre pipes.

Incidentally, buying "Five Alive" has been made easier for North American readers. It is available in either disc or cassette form for $10.50 postpaid from Pipe Organ Presentations, P.O. Box 20704, Castro Valley, California 94546.

Eric Wicks
Ivanhoe, Victoria, Australia□

ELECTRONIC TUNING AIDS FOR PIPE ORGANS

by John L. Little

In recent years there have become available the equivalent of precision electronic "tuning forks" for each of the notes in a rank of pipes or the strings in a piano. Each pipe or string can readily be tuned in unison with the sound from the electronic device and tuning is thus simplified. There is, however, a controversy over the superiority of the human ear sensing beats vs. electronic aids in setting pitch. Some elderly tuners are deaf or hard of hearing in the upper ranges and must rely on visual aids for the higher notes.

A piano tuned note-by-note precisely to the equal temperament theoretical pitches sounds rather lifeless. This is because of "inharmonicity" in pianos, varying from piano to piano, resulting because the unison or fundamental note of a string or group of strings is accompanied by something closely akin to, but not exactly, harmonics, also called partials. These higher tones which are nearly twice the fundamental, three times, etc., are actually slightly higher than twice, three times, etc. A "well-tuned" piano sounds better if an "octave up" is not exactly twice the unison pitch, but is slightly higher throughout the 88 notes.

Organ pipes have somewhat related characteristics, but to a much lesser degree. Two pipes sounding at once will "pull" one another off pitch perceptively to a trained ear. This is a minor complication in procedures using two pipes sounding at once with reliance on the human ear to detect beats. Setting the pitch of pipes one at a time with an electronic aid overcomes that particular problem. Resonances in organ pipes are somewhat related to inharmonicity in pianos, and one can make a lifetime study of these effects, as some piano technicians have done with piano tuning.

One recognized tuning procedure for organ pipes involves aural tuning with an electronic aid. Some pipe tuners prefer to use an electronic tuning aid that can:

1. Provide for easy selection of any note in any of seven or more octaves.
2. Produce an audible tone for the target pitch of each pipe.
3. Provide volume control to accommodate small and large pipes.
4. Provide calibrated adjustment of A = 440 Hertz over a range of several Hertz, or up to ± 15 Hertz if old temperaments are required.
5. Provide calibration adjustment for at least ± 1/2 semitone (also called ± 50 cents) to accommodate temperature deviations during tuning compared to the normal playing temperature, especially for metal pipes.
6. Provide visual indication to aid tuning and to accommodate hearing impairment in the high ranges.

If a technician embarked on the design of a visual indicator to aid an organ pipe tuner, the most obvious choice for an indicator would be a cathode-ray tube (CRT) oscilloscope as found in every electronics laboratory. The Japanese Yamaha PT-3 and PT-4 tuning aids used CRT techniques, but these devices have been withdrawn from manufacture because they required a connection to an electrical power source, and they have been superseded by other indicators that are practical to operate from batteries, making them more portable and convenient.

Some of the tuning aids are either battery and/or power-line operated. Their accuracy and stability, based upon quartz control, is phenomenal, especially those in the higher price ranges. Some have built-in computers to simplify the operation while providing extensive feats to aid the tuning technician.

These tuning aids typically have selector switches so that the technician can select the octave and one of its twelve notes. They also have either a built-in loudspeaker or a connection to an external amplifier so that the tuning technician can hear the target pitch. Some of them allow A = 440 Hertz to be adjusted, in a calibrated way, over a range of several Hertz, and also allow a calibrated flat or sharp adjustment of about ± 50 cents to accommodate temperature variations between the tuning environment and the performing environment. They also have a built-in microphone and/or a connection to an external microphone to pick up the pitch of the pipe being tuned.

Devices with "strobe or strobo" in their name have spinning disks with sectors containing black and white segments, illuminated by an internal flashing stroboscope light, triggered by the tone from the pipe being tuned.

When the pipe is "on pitch" one of the rings appears to be focused, standing still or moving slowly, while the other rings appear blurred. Slow rotation one way or the other indicates that the pipe is flat or sharp, requiring further adjustment. The Peterson 7050 has twelve spinning disks, one corresponding to each of the twelve notes in an octave, and these disks are arranged like the white and black keys on a keyboard. Each disk has seven sectors, one for each of seven octaves, so that any note will produce an immediate indication in one of the twelve windows.

The Hale and Sanderson devices have a ring arrangement of eight jewel lights, and also an additional light in the middle of the ring. If the pipe (or string) being tuned is slightly flat or sharp, the ring lights appear to rotate slowly one way or the other. When the pipe or string is on pitch the lights will remain stationary. If the pitch is substantially off, the direction of rotation of the lights is not obvious. A bright center light indicates that the pitch is sharp, and dark indicates flat. The Widener 300 has a "ring" of three lights to accomplish similar visual indication.

The Sanderson Accu-Tuner has a foot pedal, so that a piano tuner can advance the pitch a semitone at a time while both hands are free for the keyboard and tuning wrench, a feature which might also be useful in tuning electronic organs. The Sanderson device covers nine octaves, and it can be programmed for any temperament scale.

The Widener tuners are specialized for accommodating a wide variety of historical non-equal temperaments and may be of particular interest to voicers and tuners of baroque organs. The Wittner tuners also provide several baroque temperaments along with equal temperament, and an electronic metronome.

Some tuners argue that the human ear can sense a change in pitch of 2/10 cent, and therefore tuning aids need an accuracy of 1/10 cent or better. The Sanderson and modified Hale devices are accurate to 1/10 cent. Most good tuning devices do have stability and accuracy to a fraction of a cent. Temperature effects on metal organ pipes may cause greater changes and thus make such accuracy seem unnecessary, especially while tuning in working environments.

Inexpensive electronic tuning aids for simple musical instruments are readily available at musical instrument stores. Some trade names are Boss, Casio, Micon, Morley, Protune, Seiko and many others. However, most of these devices, which typically retail for less than $100, are of little use in tuning instruments as complex as an organ or piano.

Some of the available tuning aids useful for tuning pipe organs and pianos are shown in Table 1.

Some sources of supply and further information on these tuners are:

1. American Piano Supply Co.
   242 South Parkway
   Clifton, New Jersey 07014
   201/777-3600
   (Conn, Korg, Peterson)

TABLE 1

Electronic Tuning Aids for Complex Musical Instruments

Manufacturer	Device Name	Made In	Approximate Selling Price
Conn ST-11	Strobotuner	USA	$ 375
Hale	Slight-O-Tuner	USA	400*
Inventronics	Sanderson Accu-Tuner	USA	950
Korg AT-12	Auto Chromatic Tuner	Japan	175
Peterson 320	Chromatic Tuner	USA	340
Peterson 450	Strobe Tuner	USA	400
Peterson 520	Audio/Visual Tuner	USA	640
Peterson 7050	Node Chromatic Strobe Tuner	Japan	3950
Widener 110	AccuTone Tuner	USA	225
Widener 250	AccuTone Tuner	USA	475
Widener 300	AccuTone StrobeTuner	USA	425
Wittner TM-1	Quartz Tuner	Germany	300

*$600 when modified to Sanderson accuracy.

2. Arndt Organ Supply Co.
   1018 Lorenz Drive
   Ankeny, Iowa 50021
   515/964-1274
   (Peterson)

3. Rick Baldissin
   2684 West 220 North
   Provo, Utah 84601
   801/374-2887
   (Modified Hale, Sanderson, Used Yamaha)

4. Continental Music (G.C. Conn, Ltd.)
   150 Aldredge Boulevard SW
   Atlanta, Georgia 30336
   800/241-3030
   (Conn)

5. Yves Albert Feder
   2 North Chestnut Hill Road
   Killingsworth, Connecticut 06417
   203/663-1811
   (Widener)

6. International Violin Co., Ltd.
   4026 West Belvedere Avenue
   Baltimore, Maryland 21215
   301/542-3535
   (Wittner)

7. Inventronics, Inc.
   171 Lincoln Street
   Lowell, Massachusetts 01852
   617/459-2312
   (Sanderson)

8. Midco International
   908 West Fayette Avenue
   Effingham, Illinois 62401
   217/342-9211
   (Wittner)

9. Organ Supply Industries
   645 West 32nd Street
   Erie, Pennsylvania 16508
   814/864-3011
   (Peterson)

10. Pacific Piano Supply Co.
    11323 Vanowen Street
    North Hollywood, California 91605
    818/769-2490
    (Conn, Peterson)

11. Peterson Electro-Musical Products
    11601 South Mayfield Avenue
    Worth, Illinois 60482
    312/388-3311
    (Peterson)

12. Schaff Piano Supply Co.
    451 Oakwood Road
    Lake Zurich, Illinois 60047
    312/438-4556
    (Conn, Korg, Peterson)

13. Song of the Sea
    47 West Street
    Bar Harbor, Maine 04609
    207/288-5653
    (Korg)

14. Tuners Supply Co.
    94 Wheatland Street
    Somerville, Massachusetts 02145
    617/666-4550
    (Hale)

15. Tuners Supply Co.
    190 South Murphy Avenue
    Sunnyvale, California 94086
    408/736-2335
    (Hale)

16. Washington Music Center
    11151 Veirs Mill Road
    Wheaton, Maryland 20902
    301/946-8808
    (Conn, Korg, Peterson)

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