

# An American Gamelan

The collection of various tuned metal elements making up the Southeast-Asian Gamelan sparkles with heavenly music when the many gamelan players are performing. The composer Lou Harrison and I decided to make our own Western Gamelan based in general on the traditional ones but not copying anything for the sake of authenticity. Our primary consideration was to make beautiful sound; our primary purpose to build a usable musical instrument for which new serious music could be composed. (Eye appeal is very important also in musical instruments so that was kept very much in mind when designing our Gamelan.

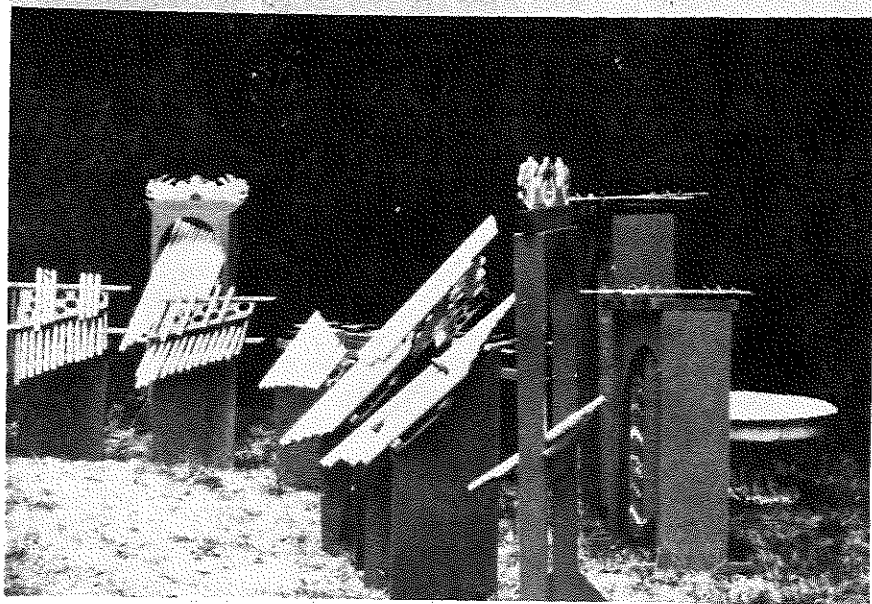
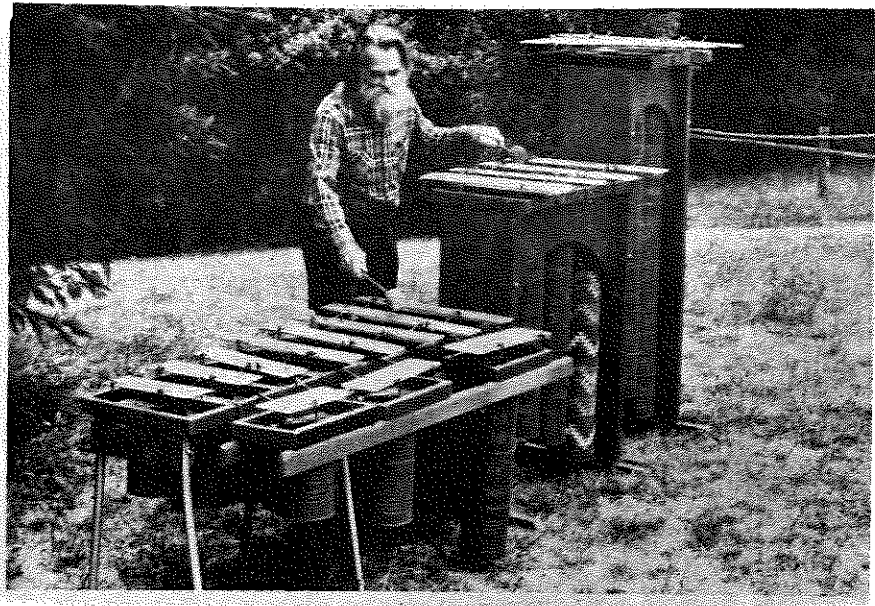
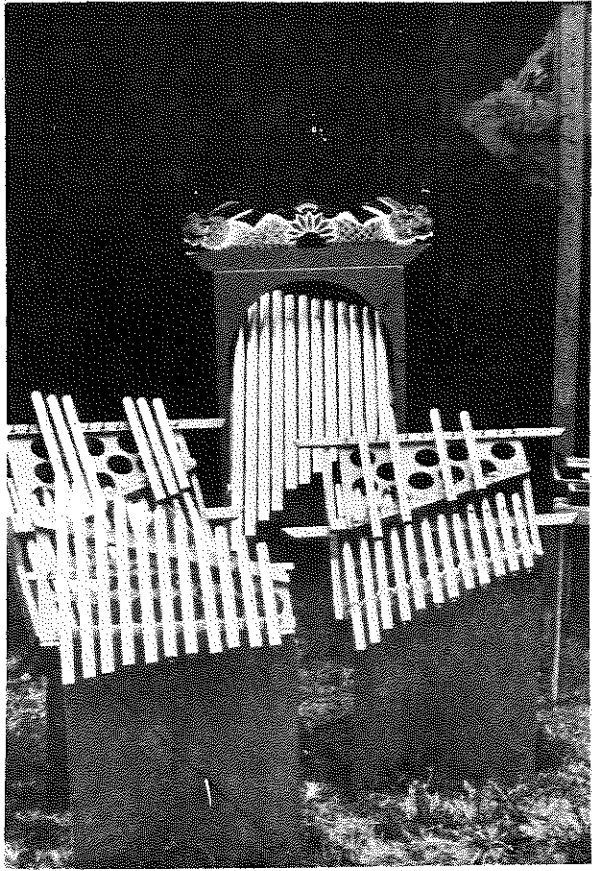
Various pentatonic (5-toned) scales are used much in the world and can be tuned with perfect harmony, whereas our western "tempered" scale is only actually in tune in its octaves. The Gamelan can make use of unusual tunings very nicely since it can be tuned near perfection then cannot be played "out-of-tune."

The principle elements in the traditional ones are cast metal slabs with bamboo resonators and round, bell-sounding, "upside-down" bronze gongs, all suspended with leather for free vibration. Using Western materials our Gamelan is a "happy hybrid" of pipes and slabs and metal resonators and rubber mountings for the pipes and wooden stands to hold everything up. The only "traditional" materials used are leather for mounting the slabs and, of course, wood.

Here are a few notes on construction: The steel upper "soprano bells" are 1" trade size thinwall electrical conduit; the "tenor bells", 1¼" trade size. The aluminum "sopranos" are 1" outside-diameter "furniture tubing" and the tenors, aluminum tube sized the same as the 1¼" electrical steeltube. The slabs for the lower tones are all aluminum with sizes varying as found in a scrap metal store. Mostly they are about 7.2 mm. (¼") thick and 90 mm. (3½") wide. The resonators for the slabs are soldered-together "billy cans", i.e. No. 10 food cans available at any restaurant back door. (176 mm. high, 156 mm. dia.) The bottom is left on the bottom can. The tone will not sustain if the coupling is too tight (resonator too perfectly tuned). All pipes and slabs are mounted at their nodal points - 22½ % of their lengths from each end- the pipes with medical rubber tubing and the slabs hung on leather shoe laces from 20d size double-headed construction nail "posts". Lumber used; ¼" plywood and ¾" pine boards. The beaters for playing: ¼" X 15" dowel sticks with 2" -dia., ¾" -thick round wooden heads padded with stretched-on slices of motorcycle or bicycle tube.

The tuning of any instrument is determined by its use. In this case, our instrument was built to be composed for by a composer so its tuning was specified by that composer (Lou Harrison). Certainly it could be made with "sharps and flats" and all tuned up out-of-tune Western style in 12 equal tones so you could play "Stormy Weather" on it. Why bother? We already have pianos and marimbaphones etc. to play your favorite tunes on. Marvellous new (to us) sound sensations can be achieved by trying different musical modes in "just intonation", the expression used for rational tuning. Once a mode is set up you can either improvise or seriously compose your music in it. Although the pentatonic scheme is basically the most harmonious, other tones can be filled in with good results too. The Western basic 7-tone "C-major" scale, justly tuned, is a good place to start with musical experimentation. We tuned ours in D, based on A-440. The pentatonic involved here is D-E-F# -A-B and the ratios simply:

A↓D, 3:2; A↓E, 4:3; D↑F# , 4:5; F#↑ B, 3:4



Metallic sounds are complicated so are difficult to tune by ear. A modern electronic tool makes possible in our Gamelan precise vibrations heretofore very difficult to obtain. The oscilloscope pictures 3 sine waves against 2 or whatever and the builder files away until the waves stay put. (If a slab or tube is cut too short, bolts, nuts, and washers work fine for lowering the pitch.) The above ratios are given as used with the oscilloscope.

The "fill-in" tones for a complete "major" scale are G and C $\sharp$  tuned D $\uparrow$ G 3:4 and F $\sharp$   $\uparrow$  C $\sharp$  2:3. What we come out with here resembles our D-major scale on the piano but in reality is "Ptolemy's Diatonic Syntonon" or "stretched diatonic" scale. It's note-to-note ratios work out: D 9/8 E 10/9 F $\sharp$  16/15 G 9/8 A 10/9 B 9/8 C $\sharp$  16/15 D. Starting with A-440 vibrations per second, 10/9 x 440 = 488 8/9 for B, 9/8 x 448 = 550 for C $\sharp$ , etc. Very good minor pentatonic modes are available from this scale starting from F $\sharp$ , while a pelog-type pentatonic mode starts from B. Changing ratios for one or more tones will make other modes to play in. We have made one for some compositions that first sounds very strange then becomes quite glamorous with further hearing. Using the 7th and 11th harmonics we call it the "7-11" scale. It's pentatonic:

A C $^7$  D E G $^{11}$  A

Experimenting with many different modes can be done easily by using a monochord to find the tones then transferring them to the Gamelan or other instruments. Here again, the oscilloscope would aid in the precise transfer of tones to metallic elements.

Our slabs range from A-55 (787 mm. long) to D-293 1/3 (294 mm. long). Our pipes, both steel and aluminum sets, go from A-220 (1038 mm. steel) to B-977 1/9 (479 mm. steel) on the big ones and A-440 (636 mm. steel) to E-2607 11/27 (251 mm. steel) on the smaller ones.

Much experimenting can be done with developing the American Gamelan. The tubes could be resonated (bulk a problem), the tubes could be small slabs (bars) instead and resonated (that's a celeste), wooden (xylophone), the big slabs could be adjusted in width to give consonant overtones (5th. or octave most desirable), all sorts of arrangements could be made to mount the elements and to decorate them for visual beauty.

While building our own repertoire for our Gamelan let us not forget the very extensive exciting Asian one. An evening's program could include Balinese and Javanese selections and something from the Philippines.

William Colvig

