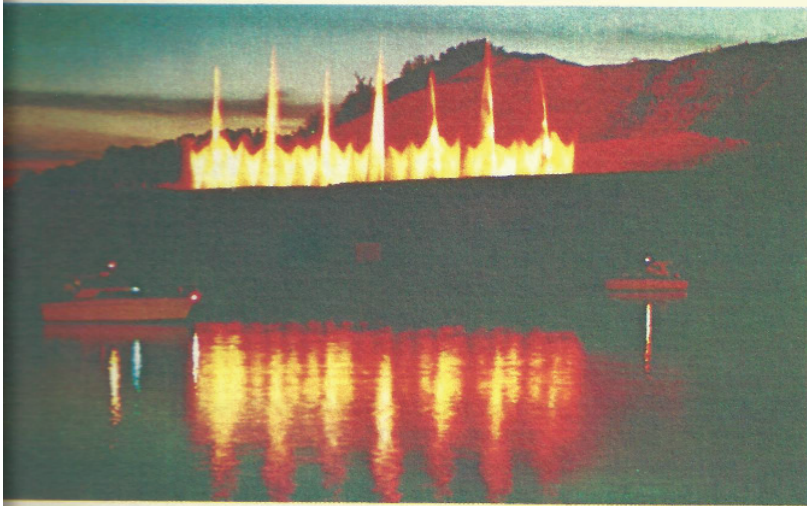


GRAND HAVEN MUSICAL FOUNTAIN

PRESS DAY

August 19, 1983



*Grand Haven Musical Fountain*

## City of Grand Haven

Grand Haven, Michigan 49417

Telephone 616/842-3210

The Grand Haven Musical Fountain is a manually directed, computer assisted, and programmable controller-run water fountain operated for the benefit of the citizens of Grand Haven, Michigan. It is situated on the side of a sand dune and across a river, which is used in international commerce, on the extreme of the central shopping district of the city. The fountain features a wide variety of pre-programmed performances viewed nightly incorporating water formations, lights, and motion, all syncopated with musical selections forming a theme or mood.

The programs, about 50 in number, are stored on standard recording tape for playing on a specially configured four-channel tape recorder. The music is recorded in stereo, then combined for broadcasting across the river by more than 8,000 watts in amplifier and speaker system capacity. One of the continuing problems with the fountain even today is control of the sound for pleasing results viewed across a 200-yard wide river, yet not objectionably loud more than a mile away. The remaining two channels store timing and control information created by the directing computer, and played for the programmable controller, which controls all fountain valves and lights.

The directing computer is a commercially available microcomputer used by the person programming the fountain to record the fountain actions he (or she) desires to express while listening to the music. The specific computer used here is the Radio Shack Model 3, however, its use does not endorse the machine by implication. With this computer, he can direct the fountain to raise the wedding cake formation and light the cake with red, yellow, and green lights, alternately changing the lights and height of the water formation as the music dictates a change in mood.

In reviewing the details of programming the fountain, remember that the program is totally stored on the reel of tape, the music and control. The operator has very little control over the ultimate performance, and the performance will be duplicated each time it is played, unless the programmer changes the control or music.

The equipment required to program the fountain includes the tape recorder with amplifier and speaker, the directing computer, and modem. The recorder is used to record, edit, and listen to the program tape. The computer is used to generate a synchronization and control information, and the modem is used



to connect the two machines.

After the music and voice are recorded and placed in their proper sequence, the first computer function is to record a clock image on the tape channel #4. This image is used to synchronize the actions and music in the final recording process. Also, while listening to the music, the programmer may view the clock on the computer screen, and later use this information while viewing the program from the grand stand to locate areas where he wants to make changes in his program.

Once the clock is recorded, the process of programming turns to the process of listening to the music, visualizing the desired fountain action, and recording that information on the directing computer. The directions are stored on the computer much like text is stored in word processors, however, the language is "fountain" rather than English. One of the planned features of the directing computer is to simulate the actions of the fountain as an assist to the programmer in locating unexpected actions and reviewing his work prior to proofing the program on the fountain. Programs are often run for the benefit of the programmer late at night until he feels it is worthy of presentation, without music being heard by spectators who happen by.

The final computer step is to record the control information on the program tape. Once this step is complete, the program is ready for playing at the fountain. A printed listing may also be prepared as a record or editing tool.

As a final note, there are no specially manufactured hardware items in the control equipment, but there are specially written programs. This may be a characteristic of our times. When the fountain was conceived, there was little on the market to serve the needs of the fountain, so this committee fabricated a fine control system which served the fountain for over 20 years. Today much equipment is available and directly applicable to operating the fountain; over the past few months the committee has installed a control system which will satisfy all existing programs and be suitable for expanding into new programming features. The next 20 years hold the promise of more sophisticated and interesting fountain activities. The next generation may be able to install both equipment and programs when it becomes desirable to expand the capabilities of the fountain beyond today's dreams.

The specially written programs for the computer were designed and developed by GEORGE F. VERDUIN of Grand Haven.



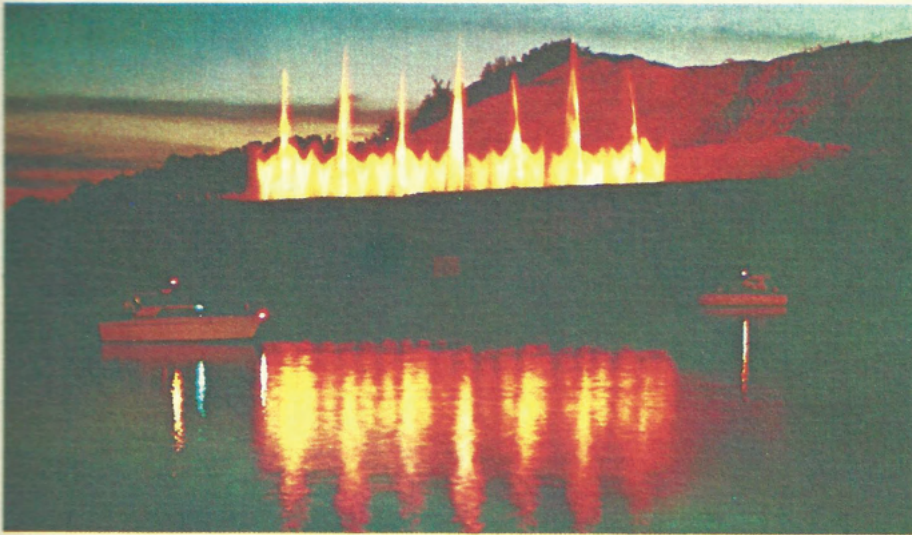




GRAND HAVEN MUSICAL FOUNTAIN  
Grand Haven, Michigan

Programming for the many and varied musical performances of the Grand Haven Musical Fountain is done at this computer center. A Radio Shack model TRS-80 III is used to prepare the programs and connected to the Teac2340SX 4-channel tape deck through a Hayes 'smart modem.' The tape contains two audio tracks with music and voice plus a clock synchronizing track and control track from the computer.





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The Grand Haven Musical Fountain is controlled by an Allen Bradley PLC-2/30 programmable controller (P.C.). A P.C. is an industrial type computer which is specifically designed to operate in harsh environments and is primarily used in industry to automate machinery. The P.C. which has been installed on the fountain represents the latest in state of the art technology.

The P.C. is connected at the fountain to the reel-to-reel tape recorder which provides the music. One channel on the music tape has been encoded by the TRS-80 computer with special codes. The P.C. listens to the tape, deciphers the special codes, and activates the water valves and colored lights accordingly. There are 124 water valve circuits and 40 lighting circuits.

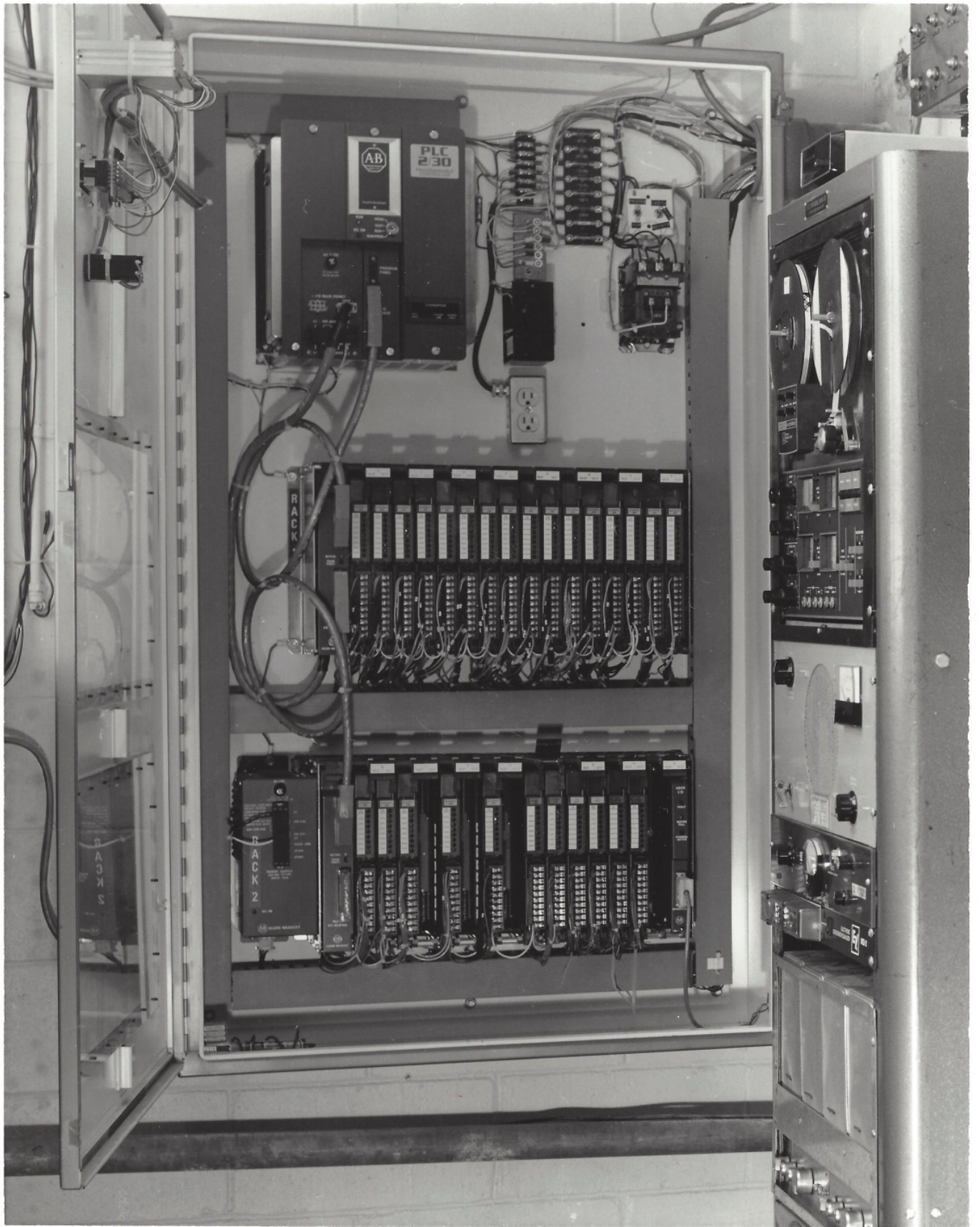
The P.C. has 6,144 words of 16 bit memory and can be expanded to over 16,000 words. The memory is protected in case of power loss by battery back-up. Fountain functions can be programmed to be initiated based on codes from the music tape, or from timers and counters internal to the P.C. Movement of the sweeps is controlled by five limit switches which indicate sweep position and provide inputs to the P.C. system. Manual controls consisting of thumbwheel switches and a LED display have been added to allow the fountain codes to be entered manually by the operator, for fountain maintenance, special effects, and monitoring.

The fountains are created by water pumps driven by a 100 hp, a 40 hp, and a 25 hp motor pumping from a basin of 45,000 gallons. The pumps can deliver 4,500 gallons per minute and can shoot water over 125 feet in the air.

The new P.C. on the fountain will provide more reliable control, will allow for more versatile programs to be created in a shorter length of time, and will accommodate future design changes to be made to the fountain quickly and easily.

The P.C. has been programmed by  
TERRY STEVENS, an Application Engineer  
for Fitzpatrick Electric of Muskegon.







**GRAND HAVEN MUSICAL FOUNTAIN**  
Grand Haven, Michigan

The recently installed Allen-Bradley PLC 2/30 industrial programmable controller shown with door open. The many modules that control water valves and lighting relays are mounted in the center and bottom area of the cabinet. Main tape deck that feeds signals to the controller and audio to power amplifier racks located in cabinet on extreme right.



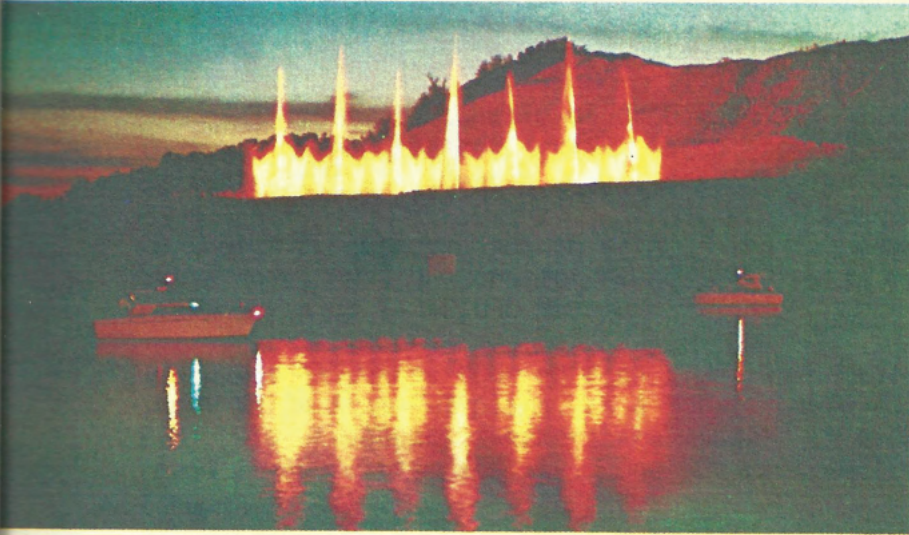
**GRAND HAVEN MUSICAL FOUNTAIN**  
Grand Haven, Michigan

Principle electronic controls for the musical fountain are the programmable computer/controller in cabinet on left and the 4-channel tape deck, pre-amp/compressor, cross-over equalizer, and monitors in center cabinet. Auxiliary controls such as remote door openers, pump motor starters and air compressor switches, etc., are mounted in the small cabinets on the right.

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*Grand Haven Musical Fountain*

"Say Yes to Michigan!" could well be the theme for the new audio system just installed at the Grand Haven Musical Fountain, with speakers and amplifiers manufactured in Michigan.

Loudspeakers were designed and made by the Electro-Voice Company, Inc., of Buchanan, Michigan, and amplifiers by Professional Audio Systems in Troy, Michigan.

Slightly larger than a home hi-fi system, over 8,000 watts of audio power are developed, making the new Grand Haven fountain music system one of the largest permanently-installed sound systems in the country.

The older system, which will still be in use, was designed to project sound to the marine stadium area, directly across the river at the foot of Washington Street. It uses 1,200 watts of audio power, 4-JBL high-frequency horns with eight bass cabinets.

With the expansion of the City Marina and addition of Bicentennial Park, it was obvious that a larger speaker system was needed to direct sound to these areas to cover the large crowds viewing the fountain.

With the engineering assistance from the Electro-Voice Company, a system was planned and installed in time to make its debut for the 1983 Coast Guard Festival.

For the hi-fi fan or technically minded, the system can be described as a "bi-amplified" system with 10, 800-watt solid state power amplifiers forming the main power source. To keep line losses to a minimum, No. 8 gauge wire, 28 runs, deliver power to the speaker arrays, housed in two buildings located at the river shoreline.

Crossover/equalizer network, Electro-Voice, Model XEQ-2 with 500 HF frequency divider, receives signal from the four-channel TEAC 2340-SX tape deck and alter compressor-pre-amplifier, and in turn drives the 10-PAS 800-watt power amplifiers.



The system is capable of producing 118 decibels of audio power 10 meters in front of the speaker arrays, which attenuates to approximately 87 to 93 decibels at the listening areas, depending on conditions.

High frequency horns in each of the two systems consist of six Electro-Voice Model HR4020A constant directivity units with DH1012A drivers. High response is up to 12,000 HF.

Bass cabinets, four on each side, were constructed in Grand Haven by Terry Velik from E-V plans, as a Model TL4050 folded horn enclosure. Two, EVM15L low frequency speakers are mounted in each enclosure, each speaker rated at 400 watts capacity. One 800-watt amplifier drives each of the low frequency cabinets.

The buildings that house the speaker arrays each have a roll-up door that protects the speakers when not in use.

Experts that have heard the new audio system proclaim it to be one of the finest outdoor systems in the country.

The Grand Haven system, although slightly larger and more modern, was patterned to a degree after an Electro-Voice system installed at Disneyworld in Florida some years ago.

A new system of this size and scope will require some weeks of adjusting, testing, and equalizing to fully realize its full capabilities.

So, come to Grand Haven and view the world's largest and most spectacular animated, lighted musical fountain and hear one of the largest outdoor high fidelity music systems.

Sound system was designed and engineered by RICHARD HAMMER, member of the original Fountain Committee.







**GRAND HAVEN MUSICAL FOUNTAIN**  
Grand Haven, Michigan

Dr. William Creason, chairman of the Grand Haven Musical Fountain Committee, points out the new loudspeaker arrays, housed in each of two protective buildings. The six high-frequency horns ("tweeters") at the left project a beam of acoustical energy up to 12,000 HZ in frequency at a level capability of 118 decibels. The 4 low frequency ("woofer") cabinets each contain two 400 watt speakers producing 'lows' down to 25 HZ, exceeding the capabilities of most home hi-fi systems. Power amplifiers can deliver over 8000 watts to the new system. Speakers are manufactured in Michigan by the ELECTRO-VOICE Company in Buchanan. Roll-down automatic doors protect the system.





GRAND HAVEN MUSICAL FOUNTAIN  
Grand Haven, Michigan

Main power amplifier rack consisting of ten 800 watt solid state amplifiers generates over 8000 watts of audio power to feed loudspeaker arrays in new buildings at river shoreline. The model PAS 800 amplifiers are manufactured in Troy, Michigan by Professional Audio Systems. Units are wired in a "bi-amplified" arrangement with a Crossover-Equalizer, EV-XEQ-2, set up for 500 HZ separation of frequencies.

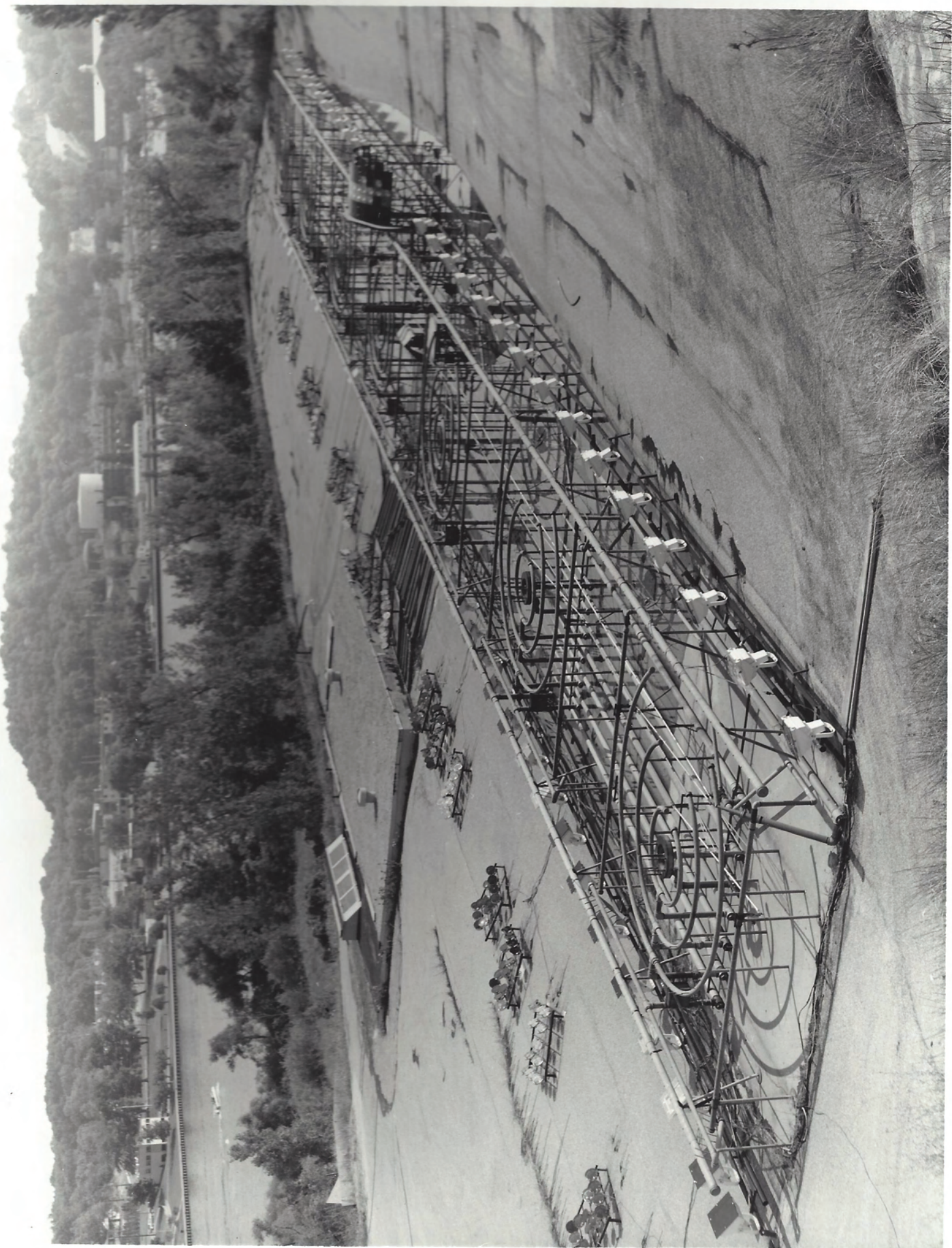




**GRAND HAVEN MUSICAL FOUNTAIN**  
Grand Haven, Michigan

View looking across the Grand River toward downtown Grand Haven and the marine stadium from the fountain location on Dewey Hill with the new speaker buildings in the foreground. The speakers in the center building have long served area directly across the river with high fidelity sound. The new system, angled to project music to the Marina and Bicentennial Park areas, greatly enhances the capability of Grand Haven's famous fountain.







**GRAND HAVEN MUSICAL FOUNTAIN**  
Grand Haven, Michigan

Thousands of feet of many-sized pipes and thousands of watts of specialized lighting are key components in the Grand Haven Musical Fountain, largest of its type in the world. Seven ring-modules, shown in the photo, provide many of the variable water sequences. Over 40,000 gallons of water are pumped every ten minutes.





**GRAND HAVEN MUSICAL FOUNTAIN**  
Grand Haven, Michigan

Motors totalling 300 horsepower drive the pumps that force 4,000 gallons of water per minute to make the intricate displays at the Grand Haven Musical Fountain. Pressure regulators and valves run on air pressure from electric solenoid valves, each in turn controlled by the new computer/controller and audio tape.