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HIGH PERFORMANCE STEREO

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**A STATE OF THE ART SOUND SYSTEM  
FOR MOTION PICTURE THEATRES**

**BY  
JOHN F. ALLEN**

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*FIRST IN DIGITAL STEREO*

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# **A STATE OF THE ART SOUND SYSTEM FOR MOTION PICTURE THEATRES**

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Last July's issue of **BOXOFFICE** contained a profile of the Community Playhouse in Wellesley, Massachusetts. The owner of this 460 seat sub-run theatre, Leslie B. Spencer, has embarked on an ambitious program to bring not only the finest in films to her patrons, but also the finest presentation. Many things needed attention but none more than the sound system which hadn't been overhauled in some 30 years. After much thought and research, Mrs. Spencer decided to install a true state-of-the-art sound system using Klipsch speakers driven by two separate sound processors. A Dolby CP-50 was purchased for proper decoding of Dolby stereo films and a Kintek KT-30S for the enhancement of monophonic films.

Such a commitment to quality sound is not unprecedented though it is all too infrequent. Such a complete and versatile sound system does, I believe, represent an advance in theatre sound and is now being copied. This article describes the system.

With the exception of the Dolby unit and a Pioneer cassette deck, the electronics in this installation are supplied by Kintek of Newton, Massachusetts. The exciter lamp supply is a model KT-43. It is a massive, hand built, highly regulated 9.5 amp supply. The exciter lamps themselves are new 9 volt lamps being operated at about 7 volts DC. Operating the lamps at 75-85 percent of their rated voltage increases life, of course, but also provides more uniform illumination and reduces filament sag.

Both the Kintek and the Dolby systems have their own optical preamplifiers. This redundancy isn't strictly necessary as it is possible to use the Dolby preamplifiers for both systems. However, it was decided that were a preamplifier failure to occur during a show, a simple switch over to a redundant system would restore sound in only a few seconds.

The Dolby CP-50 was ordered with a spare optical preamplifier card and a backup power supply. I strongly recommend these extra items. Without both of these modules functioning, there can be no sound through the unit and no stereo in the theatre. The rest of the Dolby processor can be bypassed in the event of trouble and still provide stereo. I also recommend the use of the optional CAT 117 remote fader card as this provides much

better balance between the four channels than many of the old style ganged faders. (See BOXOFFICE September, 1980 for a complete description of the Dolby process.)



In addition to the separate preamplifiers for each channel and each projector, the CP-50 consists of the noise reduction modules, a matrix card which produces the left, center, right and surround channels from the two tracks on the film, 1/3 octave equalizers for the three main channels, the fader and a switching card. The surround circuit also contains an adjustable delay feature which is set according to the length of each theatre. This assures that the audience always hears sound from the screen speakers first and then the surrounds. Such delays are mandatory in these sound systems because the audience would be distracted from the screen whenever first arrivals of the sound came from a surround speaker.

When operated in mono, the CP-50 feeds only the center speaker. An academy filter is switched in so that the sound system's characteristics will match the reduced frequency range of academy mono.

In this theatre however, such operation is only used for backup. When running monophonic films, the sound is processed through a Kintek KT-30S stereo simulator

allowing all the left, center, right and surround speaker systems to be used even without a stereo film. The Kintek provides synthesized stereo for music and effects without dialog impairment and a very realistic surround effect. (See BOXOFFICE September, 1981 for a complete description of the Kintek system.)

A selector switch was installed to allow the operator to switch between the two processors in an instant. This is important for those times when mono trailers are run through the Kintek system prior to a feature in Dolby stereo. The Kintek has its own fader so that levels for the two operations can be preset for the entire show. Incidentally, Kintek has recently developed a KT-26 interface unit for use in future installations where both Dolby and Kintek are used.

The speakers are powered by two Kintek KT-100 amplifiers. These compact units have proven to be quite reliable delivering 100 watts per channel into an 8 ohm speaker and 150 watts per channel into the 4 ohm speakers which were installed.

The most important parts of any sound system are the speakers. While Klipsch LaScalas have been used in theatres for years, this is the first installation using the new TCM-3 system. Klipsch became famous around the world following the introduction of the Klipschorn loudspeaker system. Requiring placement in a corner of a room, this system can reproduce live sound so naturally that most people cannot tell which is which - this for material ranging from dialog to an entire symphony orchestra. The TCM-3 was designed to equal the performance of the Klipschorn at 8 times the acoustic output and without reflective surfaces such as a corner. It can deliver a whooping 70 plus acoustic watts. Levels of 100 dB sound pressure level have been measured outdoors at a distance of 1500 feet. It is a three-way system consisting of fully horn loaded woofer, midrange and tweeter sections.

All three horns are the axial or straight mouth type. Curved mouth horns, called radial horns, are not, in my opinion, best for behind the screen use. This is because they "spray" so much sound all over the back of the screen. This energy gets bounced around backstage and then out through the screen to the audience. Without considerable absorption behind the screen, these reflections can color the sound and obscure dialog. Axial horns are placed with their entire mouths close to the screen, reducing behind-the-screen reflections as much as 80 to 90 per cent.

Because these speaker systems already have substantial woofers, no additional bass enhancement circuits, amplifiers or subwoofers were needed. This resulted in a savings of about \$4500.00.

The three TMCM-3 systems were placed behind the screen and aimed at the center seat in the back row. Toeing the outboard speakers in this way improves stereo imaging for those not sitting in the center of the theatre. The speakers required only minimal equalization adjustments. The treble controls were slightly adjusted to compensate for the screen attenuation (which did not occur below 6000 Hertz). Three of the 27 1/3rd octave controls were used to “reduce” a small room peak in the 200 Hertz region. The sound quality throughout this rather reverberant theatre turned out to be quite uniform, except in the far seats in the front rows where there is a drop in the high frequency response. This is due in part to the excellent directional characteristics of the horns as well as a fairly good room. There are three sections of drapery material on each side wall made to appear as covered windows and reduce reverberation. At present there is no acoustical treatment on the rear wall. Such treatment would help as there is a slight slap echo which can be detected in the front rows when there isn't a large audience.

Particular attention was paid to the surround speakers, a chronically weak component in theatre systems. It was felt that the surrounds should be unobtrusive and should match the sound from the screen speakers. The Klipsch Heresy system uses the same midrange driver used in the TMCM-3 system only on a shorter horn. Though only 1/30th the size, its sound is remarkably similar to the TMCM-3.

It seemed that there ought to be a more scientific approach to the placing of surround speakers than just putting them up every few feet around the theatre. After a careful analysis of certain aspects of the radiating pattern of the Heresys, a series of formulas and tables were developed to provide a mathematical approach to the problem. These equations can apply to any surround speaker and even point out which speakers would not be suitable for surround use. It was found that only ten Heresys were required for this 45 by 80 foot theatre. The formulas not only provided their locations along the walls, but their heights and angles as well. The question was, would this approach work? The answer turned out to be yes.

The goal of surround systems is to provide a uniform sound field without directional cues. Standing anywhere in this theatre, one cannot tell whether any particular surround speaker is on or off - this even with pure tones as high as 6000 hertz. The level in the area defined by the array is uniform within  $\pm 1/2$  dB (slightly greater variation is found at the walls as expected) and  $\pm 1/4$  dB wall to wall across the front row. The level there drops about 4 dB due to the distance from the surround speakers. The surround sound is very clean at all volumes and does match the sound from the screen. The formulas proved so accurate, that no repositioning or re-aiming of the surround speakers was required.

**We are pleased with the results of this design approach (we've dubbed it the Allen Surround Array™) and are making it available exclusively to our dealers and acoustical engineering firms. It has been chosen for the National Geographic Society theatre complex now under development in Washington, D. C.**

**On May 23, 1981 this system was showcased to 200 members of professional engineering societies and theatre owners. If one can believe their comments and those of many patrons, the system is a very proud success.**

**As to the future, the design of the horns and the entire playback array has been done according to the laws of physics and is fundamentally correct. Undoubtedly improvements in driver technology and amplifiers will occur, though many modern versions are nearly perfect now. Motion picture soundtracks are improving all the time. As digital recording techniques become a greater part of the business, greater demands than those of current 70 mm six track magnetic Dolby stereo will be placed on theatre sound systems in terms of frequency response and especially distortion. This theatre can now be considered ready for these improvements as its sound system is fully up to their demands.**

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