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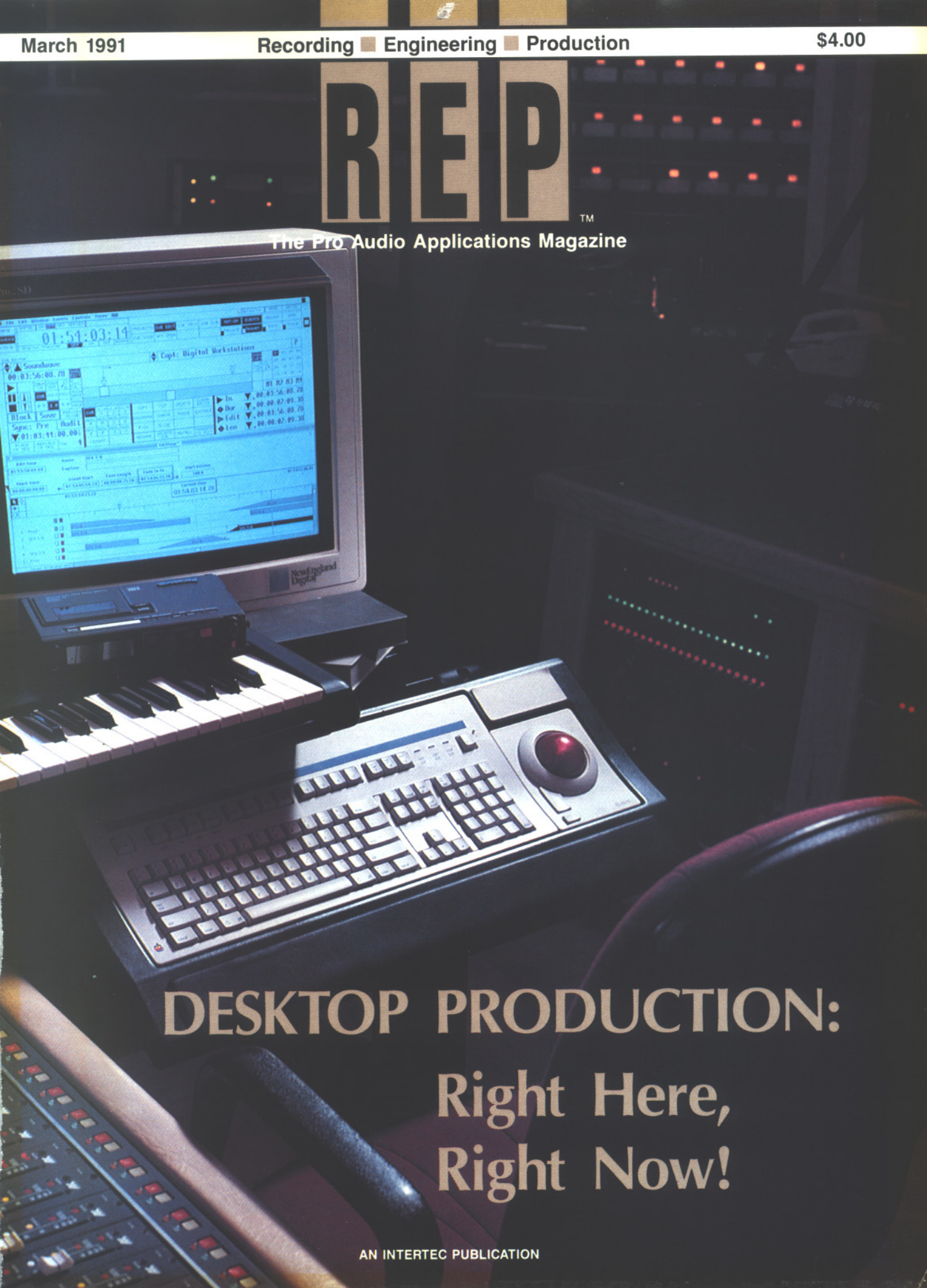

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Loudspeaker rigging comes of age.

HANGIN' HIGH

By Andrew T. Martin

Loudspeaker rigging hardware has become an integral equipment component of mid- to large-scale sound reinforcement rental companies. Rigging is also becoming a larger part of smaller regional companies, not to mention the local contracting markets.

The demand for flyable loudspeakers has created a new area for rental houses and manufacturers to explore. Together, the two parties are making advancements that will change the outlook of loudspeaker flying hardware. Nevertheless, the sound reinforcement industry is relatively immature on the technical subject of flying loudspeakers.

To date, most of the loudspeaker rigging hardware systems have been mustered together with components from the aircraft cargo control industry. Only recently have some manufacturers and rental houses begun to build rigging hardware that is requirement specific for utilization with loudspeakers.

To generalize, slow development of specialized rigging devices in the sound reinforcement industry originated from a lack of experience in the field. Specialists in rigging loudspeakers are few and far between, and those who are experienced are often too busy to share their knowledge with others.

In the hopes of promoting safe rigging practices, this article will touch upon many of the aspects of loudspeaker rigging that affect the practice of flying loudspeakers in both portable and permanent applications.

The primary concern for anyone flying loudspeakers should be safety, a consideration that begins with the loudspeakers themselves. There are many manufacturers of loudspeakers that offer factory-installed rigging attachment hardware, and the user can be fairly confident that a factory loudspeaker set up this way will be adequately braced internally for use in multiple loudspeaker arrays.

However, there are structural limitations to any loudspeaker with rigging hardware, and it is always a good idea to ask the manufacturer for the certified structural engineering specifications prior to rigging anything. If the loudspeaker is of a proprietary design, the entire structure needs to be engineered and certified. On the road, copies of the certified engineering specifications should always accompany the loudspeaker system.

RIGGING DESIGNS

Loudspeaker attachment point methodology varies by manufacturer, thereby making most loudspeaker rigging systems incompatible. However, there are a few common rigging system designs worth reviewing. Perhaps the most common uses the cargo control pan fitting (see Figure 1). Other common attachment points include extruded aluminum track, stud fittings and threaded plates. Most of these fittings are reinforced on the inside of the loudspeaker enclosure with steel backing plates which help distribute the stress through the loudspeaker cabinet. To further aid with distributing the stress, many loudspeakers have the attachment hardware side mounted, or angular backing plates that channel the weight load to the side of the loudspeaker enclosure directly. Other manufacturers incorporate steel members through the entire loudspeaker, thereby eliminating the need to rely on the cabinet's own structural integrity.

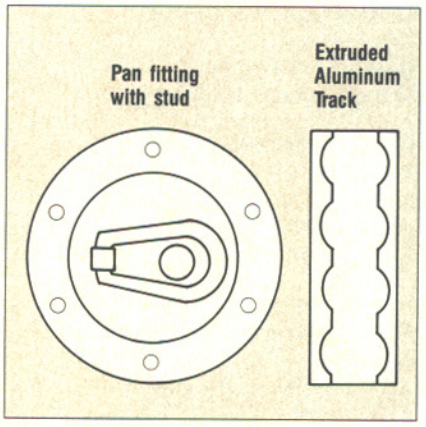

Figure 1. Common attachment points include the cargo control pan fitting (left) and the extruded aluminum track.

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As mentioned earlier, most attachment hardware originates from the aircraft cargo industry and is extremely strong. In most cases, the attachment points are so strong that the loudspeaker cabinet becomes the weakest link in the loudspeaker's rigging system. For this reason, it is important to know the load rating of the loudspeaker enclosure, and what safety ratio the load rating reflects. In the United States, it is reasonable to consider a 4:1 safety ratio as being adequate to appease most safety inspectors. However, a 5:1 safety ratio is developing as a self-regulated industry standard. Some manufacturers are certifying at 6:1 (the cabinet or internal rigging hardware failure point being six times over the typical operating load conditions).

The same rules apply to any loudspeaker rigging hardware external of the loudspeaker, whether it is proprietary, manufacturer recommended, or built to suit. For rental companies, it is important to have copies of the certified structural engineering specifications available at all times that the loudspeakers are being flown. Contractors should maintain complete files with load rating information as well.

Other safety factors that must be realized when dealing with loudspeaker rigging hardware include suspension of the array, load distribution and suspension hardware. Much of the time, the house riggers will be handling everything down to the suspension hardware. However, it's not a bad idea to know what the riggers are doing. There are many informative books from the rigging and construction industry (available at theatrical supply houses) that describe in detail the proper methods for grid attachment and load distribution.

Suspension hardware of importance to the loudspeaker rigger includes items such as wire rope, shackles, carabiners, rigging slings, adjustable pull straps and custom assemblies. A general rule to follow when working with any of these items is to throw them away if they look damaged. Do not use wire rope that is kinked, stretched or rusty. Throw away shackles that feel like they are binding or look elongated; the same holds true for carabiners. All of these items are relatively inexpensive when you consider the possible costs of a failure.

Also, always use the load-listed and labeled variety of suspension hardware if it is available. Components that are not listed may be flawed, and labels will be helpful to inspectors unfamiliar with the componentry. If the component is proprietary or custom-built, it should be rated by a certified engineer and documentation should accompany the system at all times. This is especially true overseas, or in certain large, union municipal events.

While safe rigging hardware is an abso-

lute necessity, the rigging system must suit the requirements of the user as well. Loudspeaker rigging system flexibility and ease of installation is extremely important if the rigging system is going to be of maximum benefit.

FLEXIBLE ADJUSTMENTS

Another important aspect of the loudspeaker rigging system is tilt and splay angle adjustment (see Figure 2). There are various methods of achieving different tilts and splays. Most system designs will incorporate an adjustable pull strap that attaches to the bottom of the loudspeaker and runs to a top grid suspension truss for adjusting loudspeaker tilt. Some of these systems also use track type rigging hardware, which can tilt the loudspeaker by changing the suspension point in relation to the loudspeaker's center of gravity. With this type of design it is not always necessary to use an additional adjustable pull strap if the tilt is gentle.

The latest advancement in rigging hardware comes from manufacturers that use a movable suspension point that allows greater flexibility than a track-type rigging system offers. These new rigging systems often allow the elimination of adjustable pull straps altogether.

For adjusting loudspeaker splays, most loudspeaker rigging systems will incorporate an overall top grid suspension truss. The top grid truss will have one of a few methods for varying the splay of the loudspeakers it supports. One method is to integrate a series of different attachment points: the user is able to select the proper points for the desired splay. This method is usually designed to keep the loudspeakers touching at all times in order to optimize loudspeaker coupling and sustain a coherent acoustic wavefront.

Another method is to build the top grid truss with a swivel suspension bar. In this design, each column of loudspeakers is suspended from one swivel bar, and the column can then be rotated. This method will allow the spacing of the loudspeakers apart from one another, which results in variable pattern overlap, adjustable low frequency coupling of the loudspeakers and acoustic wavefront alignment.

Yet another method of achieving splay between loudspeakers has been developed by manufacturers using a truss assembly that mounts onto each individual loudspeaker, in conjunction with a second assembly that mounts between the loudspeaker trusses. The two components work together to determine the loudspeaker spacing (see Figure 3).

AESTHETIC CONSIDERATIONS

Of course, even the best loudspeaker rigging hardware system will not be utilized to its fullest potential if it is ugly and obtrusive. Aesthetics play an important part of any rigging system. Not only does the system need to look nice to the client, but it also has to look strong to the riggers and inspectors. It is for this reason that most rigging systems are designed around a bulk appearance. That is, they are built with large aluminum members that look heavy duty, but are then used in a horizontal, flat configuration to make them seem less obtrusive to the client. Flat, top grid suspension trusses are designed along these lines.

Newer loudspeaker rigging designs are incorporating the loudspeaker truss onto the loudspeaker itself. This type of system is extremely unobtrusive, as the rigging truss seems to blend into the loudspeaker and does not extend beyond the footprint of the loudspeaker.

A loudspeaker rigging system that works well and looks good is an enormous asset to the sound reinforcement rental company. However, there are many liabilities that go along with rigging loudspeakers as well. The first liability realized by the user is the cost of flying the loudspeakers correctly. It is very costly to build a loudspeaker rigging system, not only in financial investment, but also in the time investment spent on research and development. It is not uncommon for an entire rigging system to take tens of thousands of dollars and years of modifications before it is finished. As a result, the smaller sound reinforcement rental houses and contractors have avoided flying loudspeakers if possible.

The second liability realized by the user of a loudspeaker rigging system is the legal responsibility of flying loudspeakers. The user must have the rigging system insured, and again, the rigging system should be certified as a system. This is for the user's protection, as well as their clients' and the general public attending the production. Insurance packages that cover rigging are not inexpensive, but a cheap insurance plan will not provide the protection necessary. One falling cabinet can wipe out any number of financial resources.

A third, and not so apparent, liability has to do with education for the users of the rigging system. It does not matter how safe the loudspeaker rigging system is if the user is unable to assemble the system correctly and safely. A loudspeaker rigging system can be difficult to teach to an inexperienced stagehand. Patience, guidance and enthusiasm must be present during training to reinforce a cooperative ef-

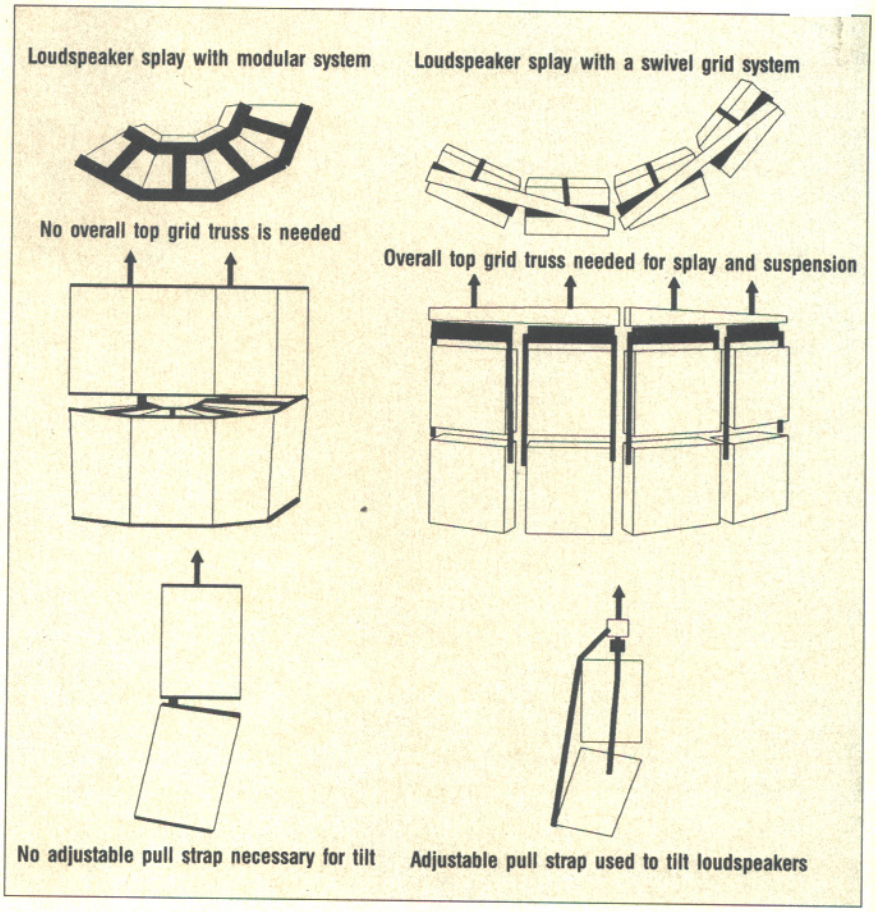

Figure 2. Various methods are available to achieve different tilts and splays.

fort to assemble the rigging system successfully. This will not only assure a safe event, but will also promote safety in future events and for the future of loudspeaker rigging in general.

The future of loudspeaker rigging is important to protect, as the industry is just beginning to develop. The advent of modular designs that are lightweight, perhaps made of alternative materials such as plastics or fiberglass, hold tremendous promise. Loudspeaker rigging systems will become more specialized as loudspeaker manufacturers start to build dedicated rigging systems into the loudspeaker's construction. Also, the future will hold motorized, servo driven adjustment capabilities for tilts, splays and attitudes with computer based controllers.

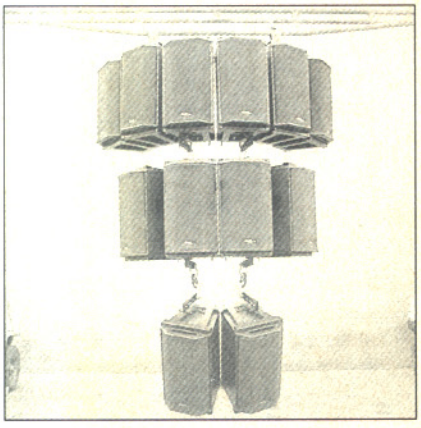

Figure 3. Individual truss assemblies that mount onto individual loudspeakers is another method of achieving splay.

Loudspeaker arrays will be easily designed on computer simulation software, and easily modified to suit each individual application. Loudspeaker array software and room simulation software will be integrated, so that the acoustic effects of modifications in array configurations can be seen on screen, before the loudspeakers are flown and positioned.

Such information as dispersion, directivity and intelligibility estimates will be available to the user for loudspeaker array plotting. And with promising recent developments in computer simulation software, it will be possible to listen to a loudspeaker array's acoustic output in its environment before the array is constructed and placed.

The field of loudspeaker rigging is an exciting area with tremendous potential for creative solutions to many complicated problems. The future holds innovation and efficiency, and above all else, always improving safety margins. ■

Figure 3 courtesy of ATM Fly-Ware.