Current Status and Applications of Studio Lighting Equipment Technology: Postprint

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Abstract

Television news constitutes a systematic information media engineering endeavor encompassing multiple dimensions, necessitating the organic integration of video, editing, sound, art, lighting, and other elements. Analysis of the current state of television news recording reveals that studio lighting must be optimally configured, as it exerts a direct influence on recording quality. The effective utilization of light can create a more appropriate atmosphere, thereby ensuring the rational allocation of lighting equipment. As light represents a critical photographic medium, particular emphasis must be placed on lighting configuration in studios. To substantially enhance film and television production standards, it is essential to guarantee that lighting equipment is optimally suited for the task. This paper undertakes an in-depth investigation into the current technological status of film and television lighting equipment, seeking to identify effective pathways for its rational application.

Full Text

Preamble

Title: Current Status and Application of Studio Lighting Equipment Technology

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Abstract: Television news production is a systematic information media engineering project encompassing multiple layers, requiring the organic integration of imaging, editing, sound, art, and lighting. Analysis of current television news recording practices reveals that optimal studio lighting is essential, as it directly impacts recording quality. Proper utilization of light creates more suitable atmospheres, necessitating rational lighting equipment configuration. Light serves as a critical photographic medium, demanding focused attention on studio lighting arrangements. To substantially improve film and television

production standards, appropriate lighting equipment must be ensured. This paper conducts an in-depth investigation into the current status of film and television lighting equipment technology to identify effective pathways for its rational application.

Keywords: studio hall; lighting equipment; systematic information media engineering; media photography; dimming technology; color changing
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1. Common Lighting Equipment in Studios

With China' s rapid economic development and significant technological advancement, lighting equipment technology has matured considerably. Lighting equipment plays a crucial role in television program production. Three-primary-color cold light sources have been widely adopted, substantially reducing power consumption while improving safety and stability, thereby ensuring smooth television program recording and enhanced broadcast quality. Current domestic television media primarily employ the following lighting equipment types:

(1) Spotlights: These fixtures offer high intensity and brightness with relatively hard light, commonly used in the television industry. When illuminating object surfaces, they produce ideal shadow effects that help highlight character modeling. Spotlights typically use tungsten-iodide lamps, providing uniform illumination and rich light-shadow effects, making them an indispensable lighting tool.

(2) Cyclorama Lights: These fixtures produce excellent diffuse reflection effects with large emission areas and uniform light distribution, effectively eliminating shadows to clearly present the texture of illuminated objects. In television studio settings, such background source lights are frequently employed.

(3) Three-Primary-Color Cold Light Source Lamps: As floodlight-type fixtures, these serve as primary light sources for character shooting, offering ideal color rendering and relatively soft light. Their lighting effects can be controlled according to practical needs, with advantages in stability, energy efficiency, and durability that ensure normal studio operation.

(4) LED Lights: These widely-used fixtures offer excellent energy-saving properties and rich visual effects, earning broad recognition. Compared with incandescent lamps, LEDs provide superior energy efficiency and diverse colors, cre-

ating ideal visual experiences. In television news studios, LED lights primarily function as supplementary illumination [1].

2. Importance of Television Studio Lighting Systems

Studio lighting configuration significantly impacts program quality in television production. To substantially improve program effects, proper lighting adjustment is essential. Lighting considerations include fixture intensity, position, and color to achieve desired light-shadow patterns that enhance program quality. The lighting system constitutes an indispensable component of the entire studio, exerting substantial influence during television program recording. Application of the lighting system must align with actual program recording needs to create suitable environments and maintain consistent overall aesthetics.

Beyond ensuring optimal lighting service effects, maintaining reasonable light-shadow contrast ratios guarantees television program quality. During recording, illumination modes should be appropriately adjusted according to content to meet requirements for brightness intensity and lighting environment. Character facial lighting typically employs white light, while ensuring effective auxiliary effects from backlighting and side lighting. When constructing studio lighting systems, besides ensuring full play of basic lighting functions, signal indicator values must comply with regulations to align program effects with design requirements, enabling recording in ideal environments [2].

3. Current Status and Application of Studio Lighting System Technology

To effectively eliminate problems during television program recording, lighting systems must fulfill their functions fully. Lighting system design should prioritize sub-modules including power supply, signal interaction, and control systems, constructing structural frameworks based on current sub-module applications to ensure truly targeted service functions.

3.1 Dimming Equipment

Dimming equipment primarily comprises dimming consoles, dimmers, color changers, and control consoles. Dimmers effectively control hot-light lamp brightness, while dimming consoles control the dimmers. Color control consoles play the primary role in controlling fixture color changers, altering color filters to change emitted light colors.

3.1.1 Equipment Installation Positioning Dimming consoles and dimmers should not be installed in the same room. Dimming consoles should be placed in control rooms as close to the studio as possible to ensure unobstructed observation. Dimmers should be installed in dedicated dimmer rooms near lighting fixtures but without affecting the studio or technical equipment rooms. The

lighting system' s entire power supply must pass through the dimmer room, exposing power cables to significant hazards. Therefore, ideal fireproof and soundproof materials must be selected when designing dimmer rooms.

3.1.2 Development and Current Status of Dimming Technology Current television program dimming systems employ two primary methods: analog and digital. Early systems used analog dimming, where dimming consoles controlled dimmers that regulated lamp power, with each silicon circuit requiring dedicated control lines in large quantities. Small silicon circuit cold-light systems still use this method, offering relatively simple control. For multi-silicon circuit control systems, analog systems suffer from excessive line complexity and severe interference. Digital dimming systems are now widely applied, using a single three-core shielded cable to serially connect the dimming console room, dimmer room, and silicon boxes. Dimming consoles control each silicon circuit' s output power through serial digital signals. Such systems feature simple wiring, low failure rates, and minimal digital signal interference. Digital system silicon boxes contain digital signal decoding boards and address selection dip switches. Connecting digital dimming consoles with general-purpose computers substantially enhances functionality, enabling storage of all lighting patterns for direct retrieval during scene changes. Current digital dimming systems possess strong capabilities with significantly improved equipment performance and minimal differences between related products.

3.1.3 Color Control Consoles and Color Changers Installing color changers on fixtures enables them to receive digital signals that drive mechanical actuators to change color filters. Color changing control systems feature high digitization. Color control consoles should be installed in control rooms alongside dimming consoles.

3.2 Suspension Systems

Constructing lighting systems for television program studios requires focused attention on suspension subsystems. This subsystem exhibits systematic characteristics with substantial workload, directly affecting fixture layout, lighting equipment operational stability, coverage range, spatial adjustment sensitivity, and fixture styles. Technical type selection must consider control modes and cost inputs, with common options including fixed structures, rail systems, electric lifting devices, and electric booms. Different suspension modes feature varying load capacities, operating speeds, and control precision. For frequently replaced fixtures, suspension modules ensure substantially improved stability, with high technical modes, component structures, and framework types in performance parameters. Regarding module styles, technical breakthroughs present certain difficulties, with traditional styles still employed while appropriately optimizing flexibility, controllability, precision, and safety. Suspension module construction must consider studio actual conditions, including load performance, spatial parameters, and area dimensions.

3.3 Control Systems

In television studio lighting system operations, both primary lighting devices and auxiliary special effects equipment require integration through management systems to achieve centralized control and full studio coverage. Due to relatively large data volumes, backbone networks are generally constructed to enable signal interaction, with signal conversion completed at the top and signal placement achieved through booms. Alternatively, network design can be completed according to actual signal interaction needs, with network signals interacting in terminal devices to ensure truly comprehensive network connectivity. Furthermore, improving wireless signal interaction can effectively eliminate problems in traditional signal modes, providing viable solutions even when line construction is difficult. Control consoles come in various types, allowing single operators to control related lighting equipment or dividing tasks between two operators for coordinated lighting management, thereby achieving greater specificity [3].

3.4 Power Supply Systems

Lighting systems consume substantial power in television studios, requiring focused attention on reliability and effectiveness when researching power system solutions. Power supply systems generally employ integrated approaches, with all sub-circuits achieving distribution through distribution cabinets to ensure actual power requirements for related equipment are met. However, as studio spaces increase, circuit quantities also rise, making distributed power supply systems more appropriate. Selection between trunk distribution and full distribution modes must consider power supply requirements and integration types. Currently, numerous manufacturers provide suitable power supply systems with more diverse functional services, including condition monitoring, operational protection, and fault alarms. Power supply system design must ensure reasonable lighting energy consumption while enabling effective supervision of stage design, screen projection, and special effects fixtures.

3.5 Lighting Fixture Systems

Among lighting system components, fixtures occupy key positions and exhibit distinct personalized characteristics compared with suspension, power supply, and control modules. In recent years, LED fixtures have been widely applied, significantly transforming the lighting industry. Traditional fixture manufacturers only provided lamp bodies while light source grading structures were handled by bulb manufacturers. The comprehensive integration of lamp bodies and light sources now grants users autonomous selection rights for types and parameters, substantially reducing the importance of naming standards and positioning design. From this perspective, the term "fixture" inadequately presents product characteristics, making "electronic product" a more suitable designation. Studio fixture module selection should be based on actual needs, choosing between LED and tungsten lamps to ensure effective compatibility, thereby guaranteeing

more reliable lighting effects during program recording. Additionally, users pay considerable attention to operational stability and life cycles.

3.6 Studio Supporting Systems

To ensure stable studio operation, staff must maintain good collaborative relationships to guarantee proper stage design, directing and camera work, and logistical services. After completing main equipment installation, supporting systems must be perfected. Truly integrated systems with improved supporting equipment enable smoother program recording. For catwalk design, height parameters, circumferential direction, and signal power must be effectively controlled. Scenery catwalks must ensure proper density, load range, and safety factor control, while access passages must satisfy actual needs for audiences, performers, and equipment. Indoor ladder structures should be reasonably configured, with air conditioning heating and cooling meeting established standards, and exhaust positions and air outlet angles designed according to actual venue conditions. Venue lighting scheme determination requires comprehensive consideration of positioning, switching methods, and regional scope to ensure television program recording remains unaffected. If lighting designers can fully utilize lighting systems, screen effects can meet expectations and create desired atmospheres. China has numerous lighting fixture manufacturers applying more advanced technologies with substantially improved functionality and quality. In current studio construction, solving lighting effect problems requires focused attention on fixture selection, ensuring optimal placement and control modes. When suspension modules and power supply systems are perfected, fixtures can perform effectively in suitable environments. Suspension modules directly affect fixture distribution and determine power supply types and control modes, demonstrating clear relevance to lighting system functionality presentation [4].

4. Design Principles and Development Strategies

4.1 Tracking Latest Research

With rapid technological updates, technical personnel must maintain clear awareness of latest achievements and change their thinking, identifying lighting technology development trends through industry exhibitions and product launches to ensure application of cutting-edge technologies.

4.2 Selecting Mature Technologies

While forward-looking design emphasizes advancement, current construction requires further improvement of technical models. Two perspectives exist on this issue: first, selecting the most advanced technology from existing mature technologies; second, selecting the most perfected technology from relevant advanced technologies. Mature technologies refer to those proven through practical application that can effectively eliminate product problems, achieve system compatibility, and guarantee stability and applicability. For fixture and lighting effect

applications, imperfect technological innovations should not be used. Regarding system control platforms, safety and reliability must be prioritized.

4.3 Emphasizing Safety and Stability

Lighting system construction must achieve required stability and effectiveness to ensure technological maturity. Lighting systems feature multiple functions with prominent integration, facing considerable risks. Suspension modules, power supply, and signal interaction must maintain stable states, with comprehensive monitoring systems and backup management implemented according to actual needs. Hardware systems affect stability, while operational specifications, maintenance systems, and servicing also exert certain influences.

4.4 Leaving Room for Development

Although forward-looking design attempts to control system positioning, numerous changes often occur. Even with advanced system equipment, rapid iteration makes keeping pace with development difficult. Therefore, expansion space should be reserved for potential objectives, needs, and additional technical services that may emerge during use. In actual television studio construction, strict control is required over which aspects of suspension modules, power supply, signal interaction, control systems, and fixture placement should be completed gradually versus all at once. For gradually implemented modules, specific planning schemes must be provided with comprehensive analysis of actual environments. If budget constraints prevent one-time completion, reasonable distribution plans should be formulated for gradual implementation according to priority. Even with sufficient funding, system space should be reserved—though one-time completed closed systems may appear nearly perfect currently, they cannot be optimized or adjusted for long-term use and cannot accommodate new technologies or equipment. Reserved thinking is particularly important in project construction, enabling new technologies and structures emerging in the industry to better function within original systems. This also tests system designers' ability to control development directions and lay foundations for new technology compatibility [5].

In television studio construction, lighting system design is crucial, directly affecting overall post-construction quality. Lighting system construction must be reasonably implemented according to actual studio conditions to ensure the studio meets future planning needs, enabling lighting systems to perform their proper roles in television recording and broadcasting to satisfy overall program requirements and provide audiences with excellent television programs. In summary, the biggest, most expensive, and newest is not necessarily the best—what is suitable is truly the best and most important.

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Note: Figure translations are in progress. See original paper for figures.