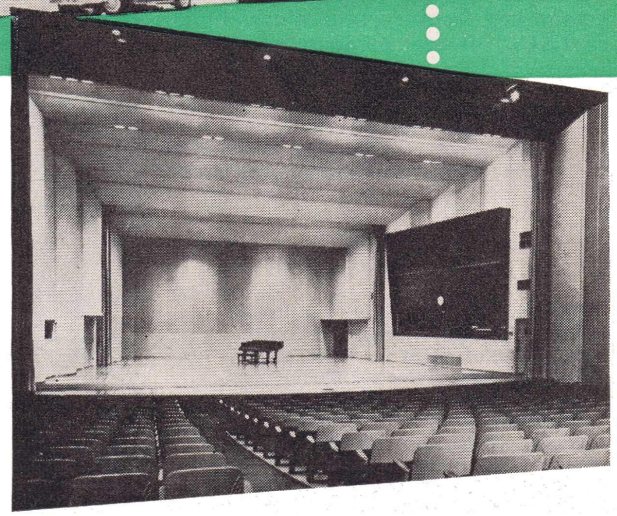
Don Lee's New $3,000,000 STUDIOS



By
WALTER W. CARRUTHERS
Chief Eng., Studio Div.,
Don Lee Broadcasting System

The "Electronic Brain" is one of the many unique features of Mutual Don Lee network broadcasting headquarters in heart of Hollywood's radio center.

Shown above is Mutual Don Lee's new three-million-dollar broadcasting building. Insert shows one of the four radio-television studios. Each studio is painted in 19 colors, running through the spectrum from a lemon-yellow to a deep blue-green.

A NEW building has gone up in Hollywood. . . . the new home for the West Coast operations of the Mutual and Don Lee Broadcasting Systems, one of the most complete installations of its kind ever to be erected. The growth of Mutual and Don Lee required repeated expansion of the program production and studio facilities in use at the Hollywood headquarters. When the requirements became clear, however, it was decided to make a complete break with the past and design a new network center from the ground up, with new equipment designed specifically to provide the most efficient facilities for both existing and future needs. Description of the three-million-dollar, block-square building divides naturally into two parts: studio complement and acoustic design and program control equipment.

The studio designing program started in 1943 by Willet H. Brown, vice-president and general manager of the Don Lee Broadcasting System, and Walter W. Carruthers, called for four auditorium sound stages—each 115 feet by 65 feet—four spacious dramatic studios and six smaller commentary and announce booth type studios. Each was studied individually for a particular type of radio program and was built as a separate and completely isolated cement structure. Claude Beelman, architect, tied the eight individual buildings into one four-story structure with general and executive offices, lounges, dressing and conference rooms, and work areas for the many network departments.

In contemplating the design of the new Mutual Don Lee Broadcasting Studios, several problems had to be considered.

Since radio programs usually fall into three general categories—musical and variety, dramatic, and commentary and announcement—each had a specialized requirement which needed consideration in studio design. To use the space requirements of the musical studios as an example, a certain room size is demanded consistent with a certain type of music. Since we usually hear orchestras in halls bearing certain relationships in size to that of the orchestras, there is an emotional satisfaction when this effect is reproduced. The quality of the reverberation of a large room is successfully simulated at the present time only in rooms of commensurate size. Another way to think of this relationship is as "space effect," an audible perspective to the ear, as "depth" in a picture is perspective to the eye.

In order to facilitate picturing an actual orchestra, the direct sound must reach the ear surrounded by the indirect reflections or reverberation

character of the natural surroundings. Lack of this effect lessens our ability to mentally orient an orchestra with its component parts separated in space, resulting in an underestimation of the size of the orchestra and a diminished sense of the number of instruments playing each part.

Although the number of instruments may be increased in a studio of insufficient volume, the impression of added orchestral size is not proportional; however, where the number of instruments is small compared to the volume normally associated with the group, it is possible, with proper pickup, to create the effect of numbers in excess of those actually employed.

Much has been published on the problem of optimum reverberation characteristic for each type of studio. In order to correlate objective data with the subjective, or "sound," as interpreted by management, producer, artist, engineer, etc., first-hand information was required.

In the growing art of broadcasting, the optimum reverberation characteristic for a given room size has been controversial as with most things dealing with the aesthetic. Programs emanating from certain music halls and studios seemed to score a unanimity of opinion as to sound excellence. Equipment capable of producing tones and graphically recording the time of sound decay was moved into these favored places and the resulting curves were compared. There was an unmistakable similarity about all of them. An average of these measurements was taken as the optimum reverberation characteristic. The studio which had a sound characteristic closest to the selected standard was chosen as the place to produce a series of programs, so that a more careful study could be made in listening tests.

Aside from the quantitative aspect, other, more subtle, factors were considered, among them, the shape of each studio. To minimize sound and mechanical transmission, each studio was basically designed within an isolated 8 inch concrete enclosure dimensioned to a ratio of 2:3:5. To minimize standing modes, the inner walls of wooden construction were angled to avoid parallel surfaces. The ceiling was angled with respect to the floor. As a compromise between sound diffusion and the retention of room character, the walls and ceiling were alternately treated with different areas of convex and flat surfaces. For acoustic amplification, the auditorium stages were shaped to form a gigantic orchestra shell.

In the sound treatment calculation another acoustic factor considered was the use of wood. All areas not otherwise employed were used to expose wooden panels in an effort to gain tonal enrichment by sympathetic vibration. For producing aperiodic irregularities in the reverberation decay characteristic, the sound absorbent materials were randomly placed yet the architectural beauty and symmetry were preserved.

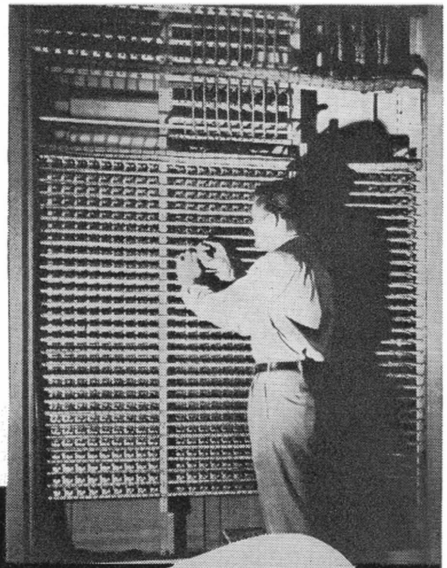
The next problem was to design an auditorium which would conform to the optimum sound characteristic. In earlier building history, such an undertaking would be difficult. Today, with the science of acoustical engineering, it is possible to calculate the sound treatment for a given volume enclosure so that the desired reverberation characteristic can be obtained. The audible spectrum was divided into three regions—high, middle, and low frequencies. Each group was studied separately and given a different type of treatment in an effort to gain the desired results.

Low-frequency reverberation is usually excessive in rooms because materials normally found there do not absorb the lower tones as rapidly as higher tones. Through use of diaphragmatic areas, control can be exercised in the dissipation of low frequency sound. A "polycylindrical diffuser" is a form which has been used as a low-frequency reverberation control element. It is constructed with a thin sheet of veneer wood bent over a convex form. The wood is at a tension and by virtue of the ribs which are spaced at random, many diaphragms are created which vibrate at different frequencies. The multiplicity effect in the vibrating diaphragms causes an evenness in the attenuation of the low frequency reverberation.

The absorption of middle frequency sound is controlled by the amount of exposed area of such common materials found in the auditorium as upholstered seats, carpeting, drapes and wall treatment. Each material has a different coefficient of absorption, and all surfaces in the room must be taken into account.

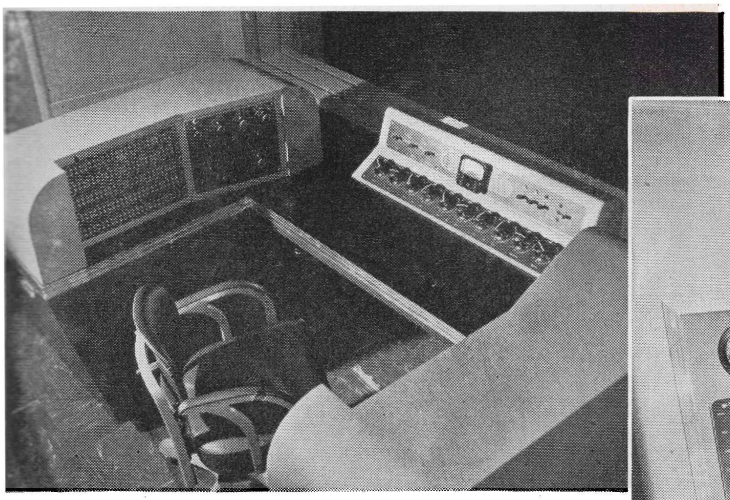
High frequencies are usually absorbed to a greater degree by the same material affecting the mid-band frequencies and to further exaggerate the condition, sound travel through the air acts as high frequency absorption. To help compensate for this natural attenuation the convex surface was painted with hard enamel so that while it was acting as a low frequency control it could be highly reflective in maintaining high frequency persistence.

In the Don Lee studios the construction schedule was so arranged that sound measurements could be made as each type of material was added. There was a two-fold purpose in this procedure: (1) The acoustic measure-



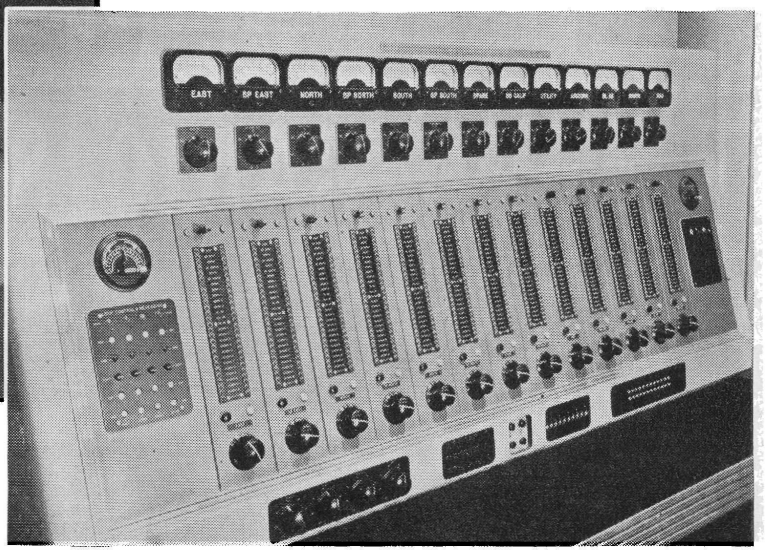
Engineer Doc Bennett works on the relays behind the master control unit. The board, which cost $300,000, is one of the largest control systems in the country.

Earl Grant (left, standing), Don Lee Engineer; D. P. Loye, Technical Construction Superintendent for Western Electric; J. Garafalo, Western Electric Engineer; and Walter Carruthers, Chief Engineer, Studio Division, Don Lee, make sound measurements during construction of one of the large auditoriums.



Custom-built speech input console. Mutual Don Lee's new Hollywood headquarters include four large auditorium studios, each 170,000 cubic feet in volume and seating 350 people. All of these four studios have Western Electric control consoles located in the control booths which are at left of the stages.

A close-up of the control panel shows the numerous meters and controls necessary to serve the eleven studios and five different network lines radiating from this network center.



ments gave a family of related curves, each of which allowed a check on predictions as calculated for that stage of the building program. If, at that time, curve measures were indicated, it was simple to make them while that part of the construction crew was still on the job. (2) From an academic point of view the calculation of the sound absorption coefficient of each type of construction and material was made possible which would greatly facilitate the building program in the future by virtue of such information being compiled and available. Fig. 1 shows a typical family of curves resulting from measurements made during the course of construction. Here, for the first time, a building was constructed to the optimum reverberation characteristic indicated by the curves as they approach the dotted line representing the optimum.

It has been the usual practice for network centers to expand facilities on an add-a-unit basis in which the new would supplant the old as it became obsolete. The new $3,000,000 Mutual Don Lee Broadcasting System plant is different in that with the move to the new quarters there was a complete break away from the old. There was very little, if any, transfer of equipment. Fortunately, the change had been anticipated for sufficient time to allow research and development with the exacting standards and demands imposed by modern AM, FM and television broadcasting.

In considering the studio control desk and master control room equipment, the engineering and developmental services of *Western Electric* were called upon to pose problems and needs and to share the vast experience and engineering background acquired through many years in the field of telephone communication.

The present master control equipment is the result of a vast amount of collective study over a period of years. In the early days of the network, the switching was done by patch cords in which the line from the originating studios was manually patched into the telephone lines. The "patch-up-bridging bus-system" of program distribution proved inadequate as it became common for a number of programs to stop and others to start at the same time, and there grew a need for a coordinating center in program switching. Relays were substituted for patch cords. A system of pre-set selection followed, allowing the operator to anticipate forthcoming programs rather than act under the pressure of time.

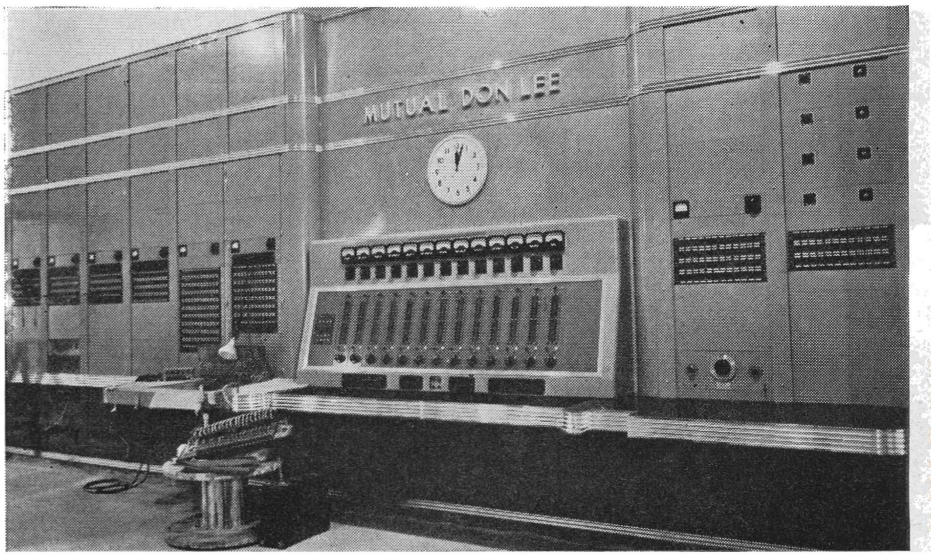
With the rapid advance in the D. L. B. S. network activities, the installation became overloaded and obsolete. In 1934 a master control switching panel was set up using *Western Electric* locking 92 type keys to activate the relays. One hundred and forty-four program switching possibilities were represented by 144 keys. There were twelve incoming and twelve outgoing lines.

In 1940 a move to the Melrose Ave. location gave rise to a larger and more complex master control system. The switching panel was expanded to a 17x20 board with 340 possible connections. For presetting, 92 type keys were replaced with rotary switches at the bottoms of the strips of green and red lights. Above each strip was located a volume indicator. It was then only necessary to rotate the switch until a green light stopped opposite the desired switch to be made. Then by push button a red light would be lit opposite the green showing the switch had been completed.

In 1948 a system was evolved which was a far cry from the early days of patch and cord switching. *Western Electric* engineers were invited to sur-

(*Continued on page* 156)

Over-all view of master control panel. Built by Western Electric, this master control incorporates a switching system for over 800 possible program combinations and requires 821 relays, 49 amplifiers, 850 indicator lamps, 2500 jacks and 13 volume indicators. This entire system can be controlled by only one man.



Don Lee Studios

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vey the traffic problem and equipment needs of the expanding network. The outgrowth of many round table discussions was master control equipment with a switching system of over 800 possible program combinations requiring 821 relays, 49 amplifiers, 850 indicator lamps, 2500 jacks, and 13 volume indicators. The equipment contains facilities for handling 12 studios, 3 announce booths, 4 recording channels, 4 simultaneous remote programs, 96 remote connections, 7 incoming networks, 10 outgoing networks, and equipment for special facilities. Despite the complexity, there are tell-tale indicators, automatic features, and convenient control arrangements to permit its entire supervision by only one man.

In regard to the automatic features, it is normal to allow 20 seconds after cue for fill to the network before switching, permitting the master control operator only 10 seconds to perform his many functions. He now can press *Delay Master* buttons on cue, which will automatically switch the network 20 seconds later, leaving him free for other duties. The equipment has its own dust-free air conditioning system.

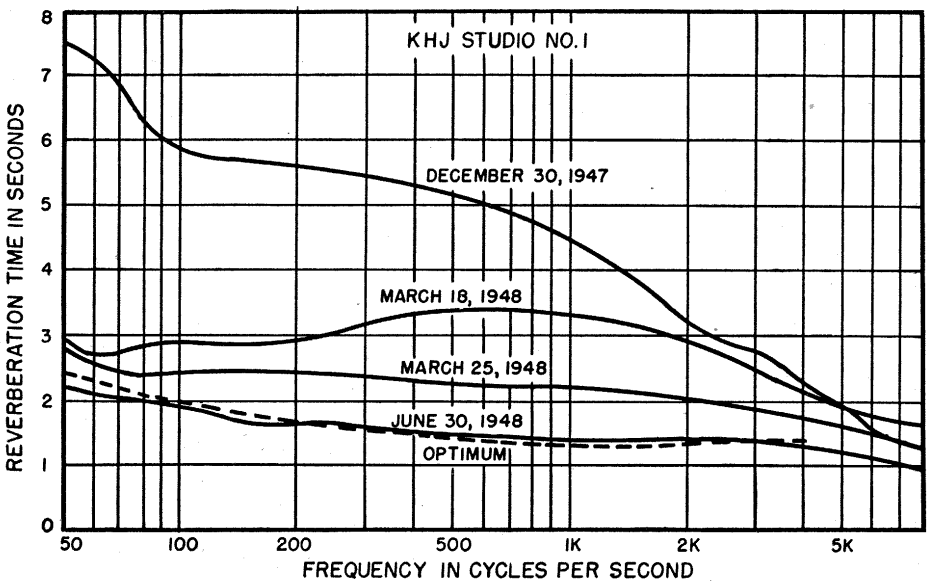
A mixing console which would incorporate facilities necessary to the needs of radio production had been planned for several years. Many schematics were drawn and revised. It was desired to have the greatest amount of flexibility and facilities for fulfilling the demands of all types of programs, but unfortunately the mixing console became excessively complicated. Often it has been said that an engineer's job is one of making the best compromise and here a compromise was necessary.

With this in mind, less frequently used special effect equipment was deleted with the idea of housing such equipment in a separate cabinet so that it could be wheeled to the side of any console when the occasion demanded. The desk circuits were treated to gain maximum flexibility through the use of jack bays. The eight channel mixer, operationally speaking, was simplified by keys, which, by choice of the technician, split the board into channel groupings controllable by sub-masters. On certain types of programs this greatly facilitates mixing. For example: the multi-microphone pickup of an orchestra, controlled by one hand, can be balanced against the instrumental solos or vocal microphones controlled by the other hand. The sound microphones can be balanced against the cast microphone in the dramatic programs.

Through the continual exchange of ideas with *Western Electric Company*, there emerged a control desk which in one year of trial installation has proven very satisfactory. The readily accessible plug-in amplifiers have made the occasional service requirements very simple.

The equipment installed in the KHJ network and FM announce booths is to provide for fading into or out of programs, giving identification and spot announcements, playing transcribed commercial spots or recorded fills in case of program failure, and cueing and monitoring necessary to the operation. The Don Lee Broadcasting System production department and announcing staff studied the possible layout of equipment fulfilling these needs with the intention of improving the ease and accuracy of operation. The number of controls appearing on the equipment was held to a minimum to avoid confusion and the placement was based on frequency of use. Much consideration was given to the slope

Fig. 1. A typical family of curves resulting from reverberation tests made during the course of construction. Here, for the first time, a building was constructed to the optimum reverberation characteristic as indicated by the curves.



of the control panel and location of the volume indicator to further facilitate operation. It was decided that a control desk similar in shape to that developed for the small studios would be ideal with circuit and control modification for use in the announce booths.

A need existed for control room equipment associated with the small studios used in commentary and round table discussion types of programs, preparation and playback of delayed broadcasts with facility for cut-in announcements, and assembly of record shows with the announcer (disc jockey) working in the control room or in the studio with a technician at the controls.

The design philosophy was that of simplicity, ease of operation, and dependability. With an intent to minimize operational errors resulting from poorly placed and excessive numbers of controls and switches, a careful study was made to determine the most frequently used controls and the most convenient location for each with the least hazard to smooth operation. The aim was to satisfy program production demands with the minimum number of controls in order to facilitate fast and accurate operation. To insure greater dependability, each part was studied as a potential trouble maker. For ease of operation, two turntables were built into one side of the desk, and a third was placed in a separate cabinet on the other side of the operator as optional equipment. Moreover, the physical shape and color of the control desk were worked out with *Western Electric* engineers to give eye appeal and modern design rather than just the "technical look."

Mutual Don Lee is convinced that the care and effort expended in the design and construction of this network center have produced the ideal home for its operations in Hollywood. The acoustic characteristics of the studios add measurably to the quality of the broadcasts. The provisions in the building for technical services and the careful planning of the layout for storage, for entrance and exit of the public, and for the managerial functions of the networks are of great value, and finally, the audio system brings simplicity and efficiency to program production and dispatching.—30—

"But all I said was that her battered old chassis was sprung and bulged where it shouldn't."