

To insure against switching noises during operation of the range switches, the condensers in the various sections are shunted with suitable resistors to provide a continuous discharge path. Furthermore, the switching arrangement is such that in passing from one set of contacts to the next continuity of the signal through the filter is maintained, thereby avoiding any program breaks if adjustments are made during a broadcast.

Since the filters are often used in low-level circuits (such as between the output of a preliminary amplifier and the mixer control), adequate shielding must be provided to prevent pick-up from adjacent stray electromagnetic fields. The use of hum-bucking construction in the coils also helps in this respect.

9-44. Studio Control Consoles—Thus far in this chapter, only the components employed in studio

audio facilities have been considered. To illustrate how these components are assembled to form complete studio control systems, several of the studio audio consoles now in actual operation in broadcast stations throughout this country are described in the following paragraphs.

9-45. The CBS 3B Studio Control Console—The CBS 3B console, Figure 9-73, is a studio control unit designed for use in larger broadcasting studios and radio theaters of the Columbia Broadcasting System. It incorporates in a relatively small desk-like unit all the amplifying, mixing, monitoring and special-effect facilities normally required in the production of complex network radio program originations.

Two examples of departure from convention to achieve compactness are the use of single plugs and jacks in place of the more conventional twin

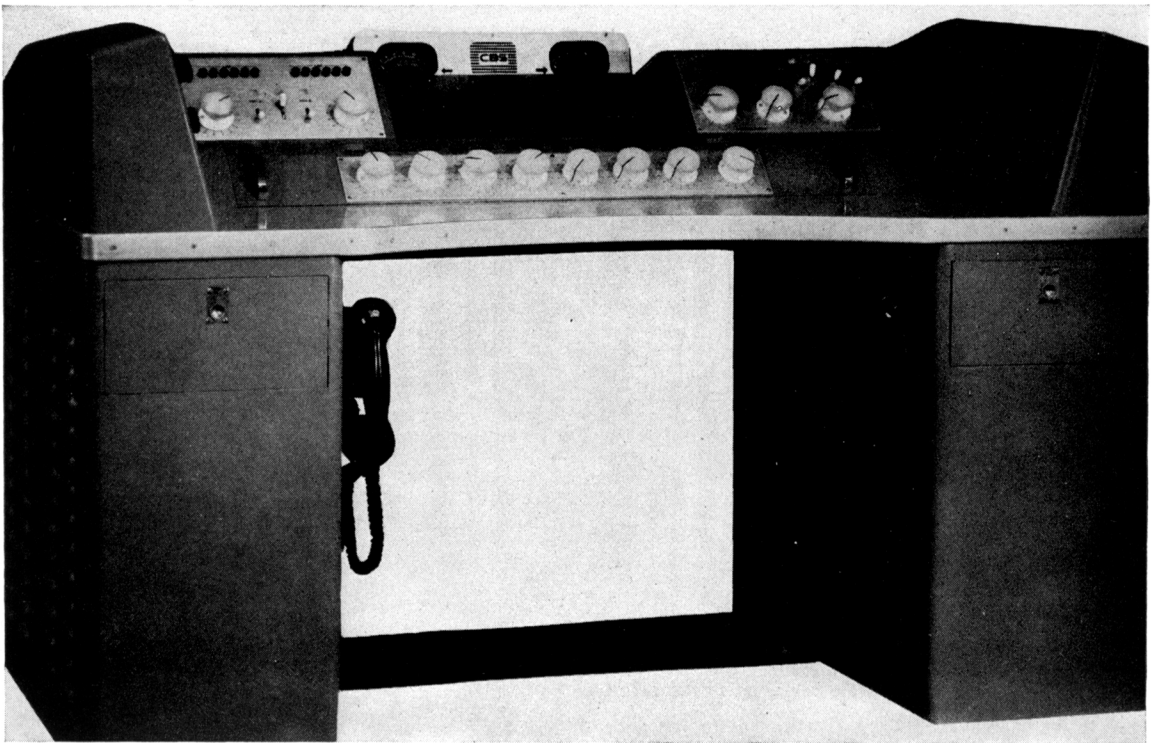


FIG. 9-73. A front view of the CBS 3B studio control console. Microphone mixer positions 1 to 7 and the channel 1 master volume control are arranged across the lower portion of the center section.

The A and B position mixed controls, together with the associated incoming line push-button selectors and mixer key switches are located on the small panel in the center section immediately to the left of the script rack. The microphone mixer key switch is also located on this panel between the A position and B position key switches. The corresponding panel to the right of the script rack contains microphone mixer positions 8 and 9 and the channel 2 master volume control. Immediately above the two mixer controls are the reverberation push-button selectors which are used when these two positions are employed as reverberation mixer controls. The four key switches above the channel 2 master volume controls are two "utility" key switches, the "channel" key switch, and the "line" key switch.

The audio jack field and "sound-effects" filter occupy the entire panel space on the right wing of the console, while the left wing contains volume controls for the control room loudspeakers, studio loudspeakers, headphone-cue circuit, and rehearsal-break circuit. The "utility" volume control, rehearsal-break key switch, and telephone dial are also located on this panel.

Immediately below the table top are two telephone instruments. One is a regular dial extension while the other is a private line direct to the master program distributing center.

The over-all dimensions are 62 inches in length, 34 inches deep, and 39½ inches high. (Courtesy CBS.)

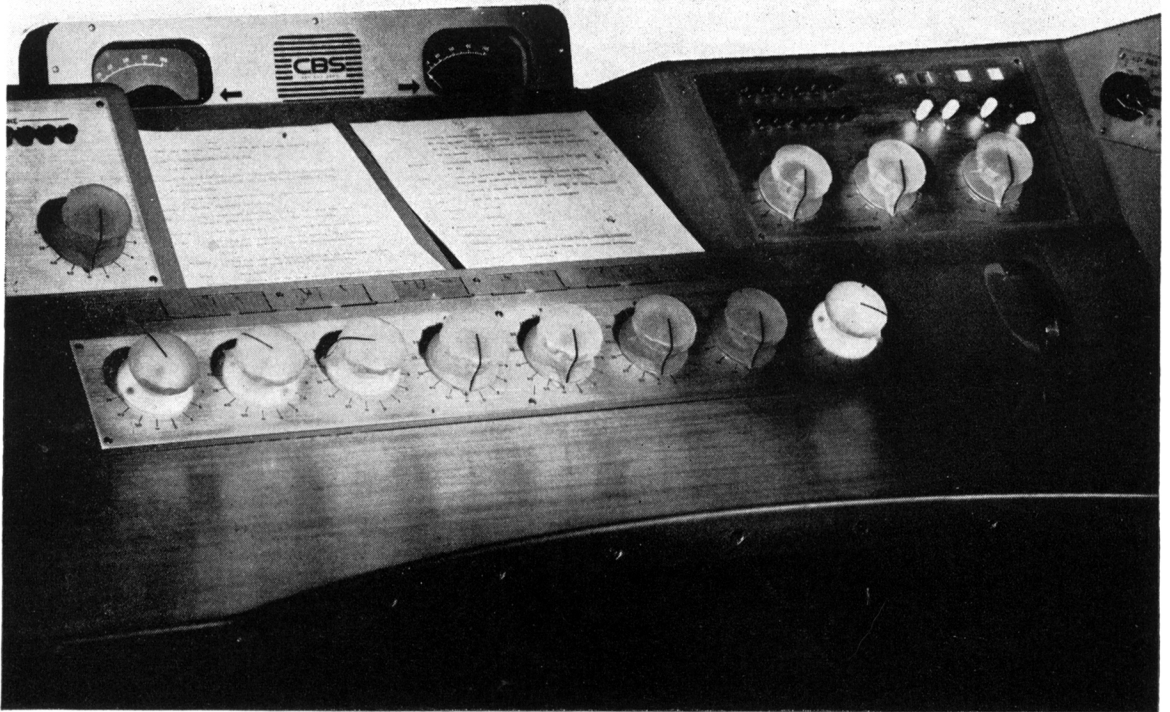


FIG. 9-74. A close-up of the center section of the mixer control panel of the CBS 3B console showing the control knobs which light when the mixer channel is in use. Two devices have been employed to eliminate marking the panels with pencilled notes and setting marks. The first are the small "magic slate" writing pads mounted above each mixer control. These permit the operator to make temporary markings which may be removed by lifting the clear plastic top sheet. The second device is a control knob setting indicator: a disc of clear plastic the same diameter as the skirt of the knob which is provided with a protruding indexing marker. This indicator is mounted between the control knob and panel and may be rotated until the indexing marker indicates the desired knob setting, established during rehearsals. The protruding indexing marker can be felt as the control knob is advanced, making it unnecessary to use the eyes in setting the control knobs to the desired point.

Immediately above the script rack is a panel containing the two volume indicators and the rehearsal-break microphone which is mounted behind the center grill work. This section has been made plug-in for the purpose of expediting maintenance.

At the side of each volume indicator are arrow-shaped red plastic indicators which light up to indicate the channel in use. These indicators are so interlocked with the "line," "channel" and "mixer" key switches that they light only when all switches are in the proper "on-air" position.

It will be noted that a black scale is employed on each of the volume indicators. The divisions and lettering on these black scales are made with paint containing a fluorescent material which glows under the influence of ultra-violet light. The meter pointer is coated with the same material. Small ultra-violet lamps are mounted directly beneath the volume indicators with the light entering the meter enclosure through an opening in the bottom of the meter case. The fluorescent markings glow green on the scale range up to the reference point while the markings above the reference point glow in red. (Courtesy CBS.)

plugs and pairs of jacks, and the use of specially developed, small plug-in amplifier units. Two amplifier types, which require only two tube types, fill all amplifier requirements of this console. The plate and relay power supply units are also of the plug-in type and employ rectifiers of the selenium type, no rectifier tubes being necessary.

Other features of the 3B console include a program script rack, plastic control knobs that light up to form large, easily visible channel-in-use indicators, and pilot light panel indicators that change color as a function of key switch setting. Volume indicators equipped with a black scale containing

fluorescent divisions and markings which are illuminated with black light are employed.

Visibility into the studio is not obstructed by control panels or script rack because of the physical design. The amplifier and power supply compartments were designed to provide adequate ventilation. The mechanical placement of components provides maximum separation between the power and audio units, thereby reducing hum pick-up to the lowest possible value.

A block diagram is given in Figure 9-76. It can be seen that an eleven-position mixer which permits the simultaneous mixing of nine studio microphones

and two incoming program line channels is provided. Program material to these latter two channels, which are known as the A and B channel, may be selected from any one of five sources by means of push-button selectors.

Two complete and independent program channels have been included. The second channel, which includes separate visual and aural monitoring facilities, may be used as an emergency, test, or utility channel. Also included are rehearsal-break (talk-back) facilities, reverberation facilities, sound reinforcement feeds, headphone-cue circuits, and a sound effects filter. A utility volume control, utility key switches, utility bridging transformer and parallel-connected jacks are also included.

A circuit impedance of 150 ohms, which has been employed throughout, assists greatly in achieving uniform response-frequency characteristics at the higher audio frequencies and, in addition, reduces cross-talk to an exceptionally low value.

The performance characteristics of the CBS 3B console are well within the requirements dictated by good engineering practice and readily meet the F.C.C. requirements for A-M, F-M, and television sound broadcasting service. The response-frequency characteristics of the program channel are uniform, within 0.7 db of the 1000-cycle value, from 50 to beyond 15,000 cycles per second. The response-frequency characteristic of the monitoring channel (including the program channel) is substantially equivalent to that of the program channel.

The single-frequency harmonic distortion of the program channel, measured at an output level of +20 dbm (which is 10 db greater than the normal program output level of +10 *vu*), is less than 0.2 percent from 100 to 15,000 cycles, and less than 0.4 percent in the region from 50 to 100 cycles. The distortion through the monitor channel (including the program channel) measured at an output level of +38 dbm, is less than 0.75 percent from 50 to

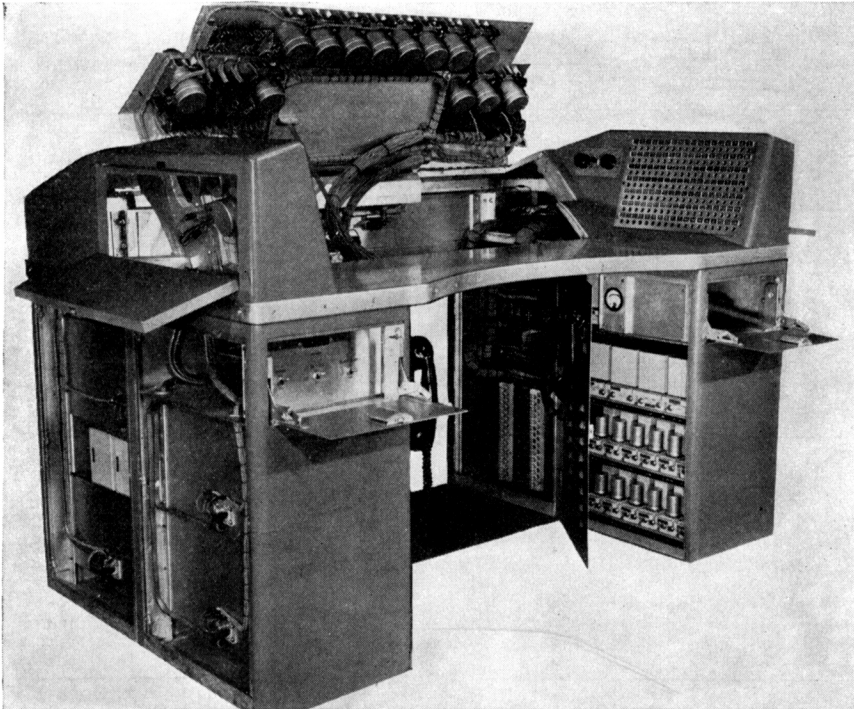


FIG. 9-75. A view of the CBS 3B studio control console with all access doors as well as the center control panel opened. This view shows how components may be reached for inspection and servicing.

The two pedestals of the console serve as equipment compartments. The forward section of the right-hand compartment contains all audio amplifier units as well as a compartment for storage of spare tubes, program scripts, pencils and other miscellaneous items. The rear section of this compartment contains the audio transformers, audio relays, audio terminal blocks, and resistance attenuation networks.

The power equipment is housed in the left-hand equipment compartment. The forward section of this unit contains two plug-in power supplies which provide amplifier plate power. The upper section contains a power panel, accessible through a small door in the front of the unit. A master on-off magnetic circuit-breaker switch, as well as regular-emergency, a.c. supply and regular-emergency low and high voltage supply transfer toggle switches, are mounted on this panel. The rear section of this compartment contains a 24-volt d.c. power supply for operation of relays and pilot lights, two filament lighting transformers, and "on-air" sign relays.

All power rectifiers are of the selenium type, no rectifier tubes being employed. (Courtesy CBS.)

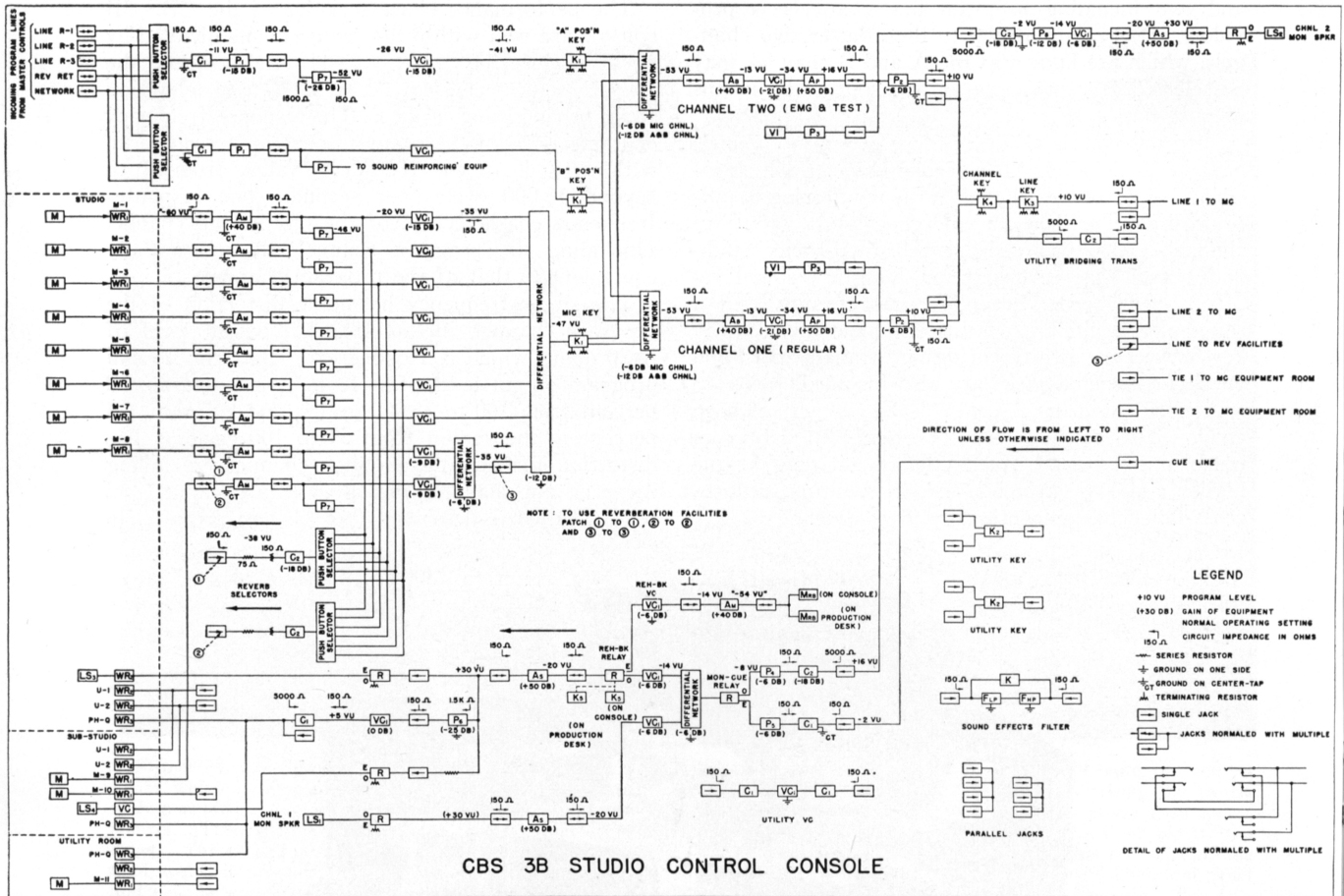


Fig. 9-76. The scope of the audio facilities incorporated in the CBS 3B studio control console is evident in this block diagram. The facilities permit the simultaneous mixing of program material from nine studio microphones as well as two incoming program lines. Two independent program and monitor channels are employed. (Courtesy CBS.)

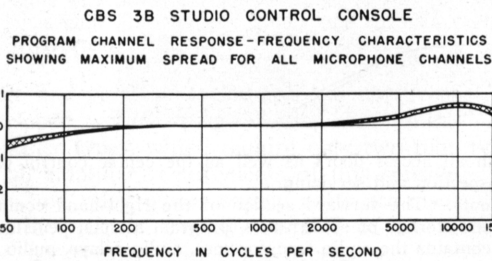


Fig. 9-77a. The curve above shows the response-frequency characteristics of the program channel of the CBS 3B console. From these data it may be seen that the performance is well within the requirements set forth for A-M, F-M, and television audio facilities. The signal-to-noise ratio of the complete program channel ranges from 73 to 75 db. (Courtesy CBS.)

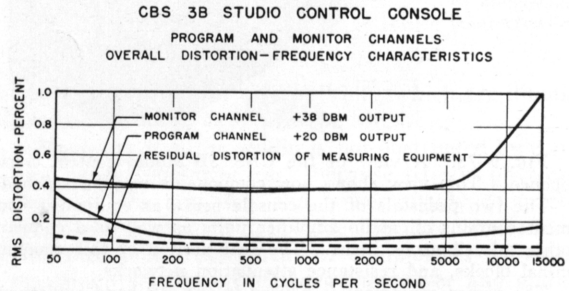
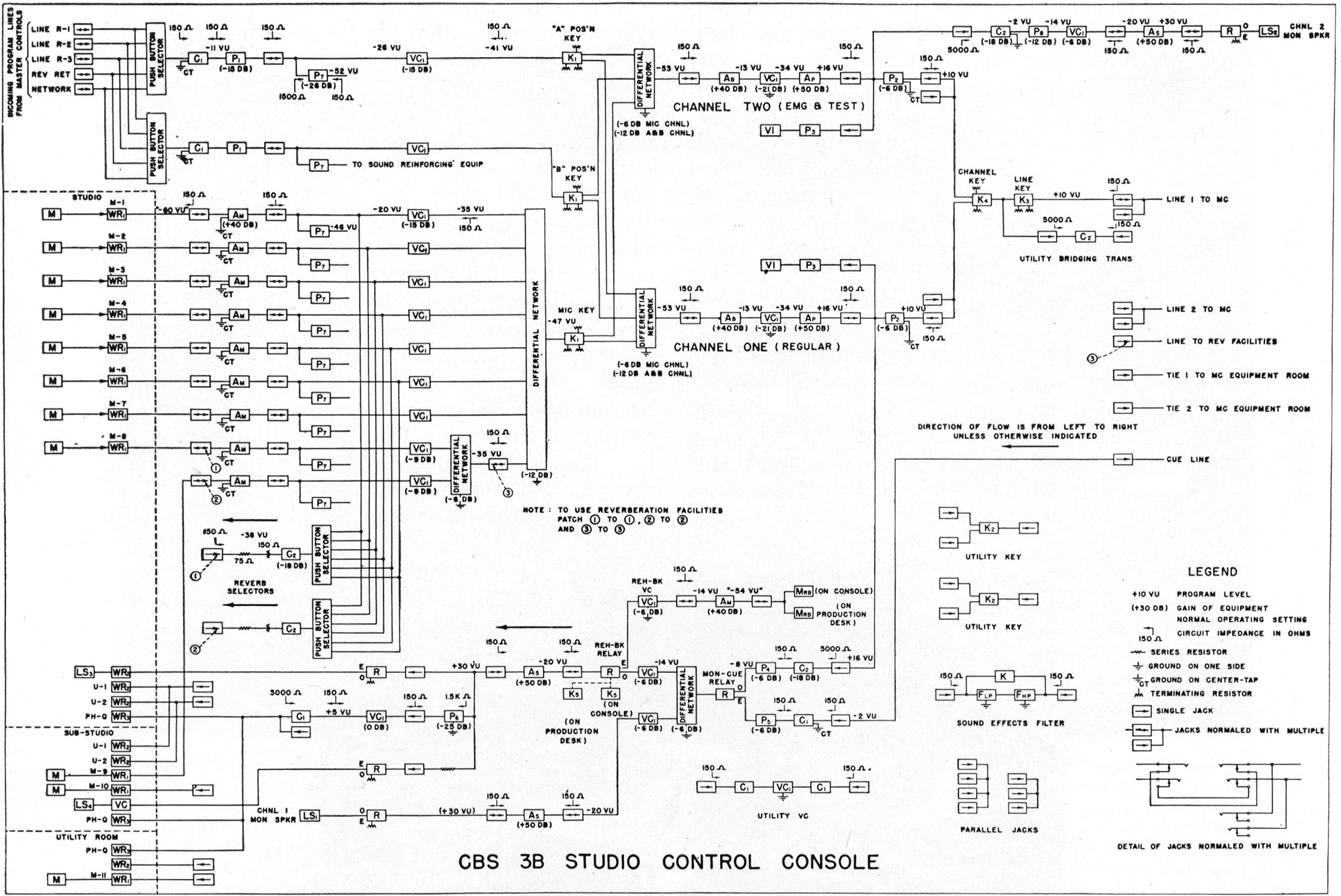


Fig. 9-77b. These curves show the distortion-frequency characteristics of the CBS 3B console. The program channel measurements were made at an output level of +20 dbm which is 10 db higher than the normal program level. (Courtesy CBS.)

LEGEND					
A ₁ PRELIMINARY AMPLIFIER	C ₁ BRIDGING TRANSFORMER	K ₁ LINE KEY SWITCH	LS ₁ STUDIO LOUSPEAKER	P ₁ FIXED "N" PAD 6DB 150:150 Ω	P ₁ BRIDGING "T" PAD 15K:150 Ω
A ₂ BOOSTER AMPLIFIER	F ₁ ADJUSTABLE LOW PASS FILTER	K ₂ CHANNEL KEY SWITCH	LS ₂ SUB-STUDIO LOUSPEAKER	P ₂ VOLUME INDICATOR ATTENUATOR	P ₂ FIXED "T" PAD 12DB 150:150 Ω
A ₃ PROGRAM AMPLIFIER	F ₂ ADJUSTABLE HIGH PASS FILTER	K ₃ REHEARSAL BREAK KEY SWITCH	M MICROPHONE	P ₃ FIXED "T" PAD 6DB 150:150 Ω	P ₃ R RELAY
A ₄ MONITORING AMPLIFIER	K ₁ MIXER KEY SWITCH	LS ₁ CHNL-1 MONITOR LOUSPEAKER	M ₁ MICROPHONE, REHEARSAL-BREAK	P ₄ ADJUSTABLE "T" PAD 150:150 Ω	VC VOLUME CONTROL 150:150 Ω
C ₁ LINE TRANSFORMER	K ₂ UTILITY KEY SWITCH	LS ₂ CHNL-2 MONITOR LOUSPEAKER	P ₁ FIXED "T" PAD 15DB 150:150 Ω	P ₄ BRIDGING "T" PAD 10W 15K:150 Ω	CT GROUND ON CENTER-TAP
					VI VOLUME INDICATOR
					WR ₁ MICROPHONE WALL RECEPTACLE
					WR ₂ UTILITY WALL RECEPTACLE
					WR ₃ PHONE-CUE WALL RECEPTACLE



CBS 3B STUDIO CONTROL CONSOLE

LEGEND

A _M PRELIMINARY AMPLIFIER	C ₂ BRIDGING TRANSFORMER	K ₃ LINE KEY SWITCH	LS ₃ STUDIO LOUDSPEAKER	P ₂ FIXED "H" PAD 6DB 150:150 Ω	P ₇ BRIDGING "T" PAD 1.5K:150 Ω	V _I VOLUME INDICATOR
A _B BOOSTER AMPLIFIER	F _{LP} ADJUSTABLE LOW PASS FILTER	K ₄ CHANNEL KEY SWITCH	LS ₄ SUB-STUDIO LOUDSPEAKER	P ₃ VOLUME INDICATOR ATTENUATOR	P ₈ FIXED "T" PAD 12DB 150:150 Ω	WR ₁ MICROPHONE WALL RECEPTACLE
A _P PROGRAM AMPLIFIER	F _{HP} ADJUSTABLE HIGH PASS FILTER	K ₅ REHEARSAL BREAK KEY SWITCH	M MICROPHONE	P ₄ FIXED "T" PAD 6DB 150:150 Ω	R RELAY	WR ₂ UTILITY WALL RECEPTACLE
A _S MONITORING AMPLIFIER	K ₁ MIXER KEY SWITCH	LS ₁ CHNL-1 MONITOR LOUDSPEAKER	M _{RB} MICROPHONE, REHEARSAL-BREAK	P ₅ ADJUSTABLE "T" PAD 150:150 Ω	VC ₁ VOLUME CONTROL 150:150 Ω	WR ₃ PHONE-CUE WALL RECEPTACLE
C ₁ LINE TRANSFORMER	K ₂ UTILITY KEY SWITCH	LS ₂ CHNL-2 MONITOR LOUDSPEAKER	P ₁ FIXED "T" PAD 15DB 150:150 Ω	P ₆ BRIDGING "T" PAD 10W 1.5K:150 Ω		

10,000 cycles, and less than 1.0 percent from 10,000 to 15,000 cycles. The signal-to-noise ratio of the various channels range from 73 to 75 db.

9-46. Western Electric 25-B Audio Console—

Several basically new ideas in studio console design and operation have been built into the W. E. 25 type equipment. This console was designed by Bell Telephone Laboratories for use at broadcast stations using F-M transmission or at A-M stations planning to provide for F-M at some future time. Accordingly, high-fidelity service for F-M broadcasters is provided by the 25 type's uniform, noise-free, and low-distortion operation over a 15,000-cycle range.

The 25B equipment provides a seven-channel mixer circuit. The design is greatly simplified as to mounting and installation, requiring only a minimum of effort to put the two fully assembled and wired units into service.

The main unit houses two complete high-quality main amplifier channels, capable of simultaneous operation on different programs without interference or cross-talk. Also in this desk console are pre-amplifiers, mixers, switching, indicating, monitoring, cue feeding, and other control apparatus, arranged and co-ordinated to provide maximum operating flexibility and convenience.

A compact power supply unit serves the 25B equipment. This is arranged for wall mounting,

and is generally located away from the console. The power supply unit, mounted on a swinging frame for easy inspection and maintenance access, contains the power supply units for plate and filament power to all vacuum tubes, and also for the loud-speaker cut-off relays. Thus the only need for any other auxiliary power supply is the usual d-c signal supply for operation of indicating lights and external relay systems where employed.

Built into the main housing of the console are eight microphone or low-level transcription input circuits and four pre-amplifiers, with switching keys for ready selection of either of two low-level inputs for each pre-amplifier. These are shown diagrammatically in the schematic circuit. Four of these circuits can be used simultaneously, with four in reserve available at a moment's notice, enabling the engineers to schedule programs of eight sources, or to dispatch two successive four-source programs. Three additional microphone or transcription sources can be introduced simultaneously through the three line mixers as explained below. Optional addition of jacks, lamps, or jack-sized keys for system control and indicating circuits give the 25B still greater utility.

Especially valuable to stations operating both A-M and F-M transmitters or simultaneously originating both local and network programs are the line facilities of this audio console. The two main



FIG. 9-78. Western Electric 25B console. (Courtesy Western Electric.)