An Auxiliary Mixer for TV Studios

GEORGE A. SINGER*

A description of a commercial unit which combines good engineering with a practical consideration of the requirements of modern studio operation.

PRODUCTION TECHNIQUES of the more elaborate television shows require an extensive and flexible audio system. In particular, a much larger number of microphone inputs are needed in television than are required for a similar radio show. There are two basic reasons for the use of more microphones in a television production. First, the microphone has to be kept in close proximity to the actor to reduce noise pick-up from the audience or changes of props. As the scene shifts, the microphone has to follow the action or when this is not practical—as is frequently the case—other microphones, distributed at strategic locations, have to be used to pick up the sound.

Unlike radio it is not usually possible for the actor to step up to the microphone to deliver his lines, then to step aside to make room for the next actor, thus reducing the number of microphones required.

The second reason for the need of additional microphone input facilities in television is the fact that frequently more than one set or staging area is used in a single studio. Each area requires its own complement of microphones. However, usually only one area is in use at a time, and it is therefore possible by providing suitable input selector switches to reduce the number of microphone mixer channels needed.

Many of the television stations which have been on the air for some time are faced with the need of expanding their audio facilities. Similarly, the many new stations which are now springing up all over the country will require or are at least planning for more microphone inputs than the standard broadcast studio console affords.

* *Engineering Products Department, RCA Victor Division, Camden, N. J.*

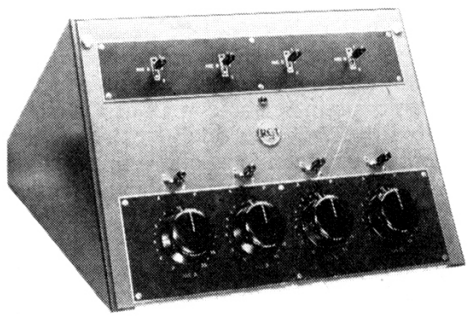

Fig. 1. Over-all view of the BCM-1A Auxiliary Mixer which may be used to extend the number of microphone inputs of a conventional studio console.

Auxiliary Unit Needed

There is, therefore, a definite need for a unit which may be added to a studio consolette to provide additional microphone switching, amplifying, and mixing channels. Such a unit should of course not only match in styling the other studio equipment but also be convenient to use and easy to install.

With these considerations in mind, the BCM-1A Auxiliary Mixer was designed to supplement the facilities of the type BC-2B Studio Consolette.[1] The new unit is shown alone in *Fig.* 1, and in its normal operating position alongside the consolette in *Fig.* 2.

As shown in the block diagram of *Fig.* 3, the Auxiliary Mixer provides four mixing channels. The input selector switches S_1 to S_4 permit a selection of any one of three microphone inputs for each of the four preamplifiers, making available a total of twelve microphone inputs.

The preamplifiers employ two stages of amplification with inverse feedback to reduce distortion and stabilize gain. Low-noise tubes are used to obtain a high signal-to-noise ratio. The amplifier chassis are secured by vibration mounts to eliminate microphonics.

Following the preamplifiers are the ladder type attenuators AT_1 to AT_4. These attenuators have 20 steps of 2 db each except for the last three steps which taper to infinity. The lever key switches S_5 to S_8 connect the output of the mixer attenuators to either the program bus or the audition bus.

To make convenient external connections for special applications, the inputs and outputs of the selector switches and amplifiers have been brought out to terminals on the audio terminal block, as shown at the top of *Fig.* 4, which shows the internal appearance of the mixer with the top removed and the front panel tilted forward.

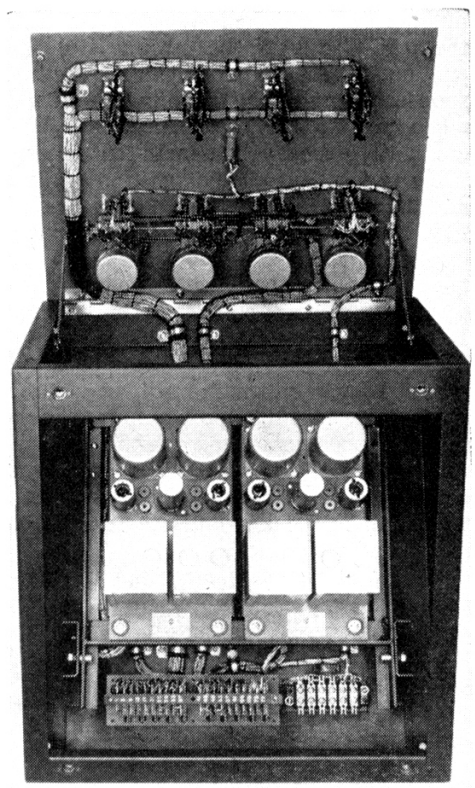

Fig. 3. Removing the top and tilting the front panel forward provides easy access to the interior for maintenance. The bottom of the amplifier chassis is accessible simply by raising a hinged framework.

[1] P. W. Wildow and G. A. Singer, "New AM-FM-TV studio consolette," AUDIO ENGINEERING, September, 1951.

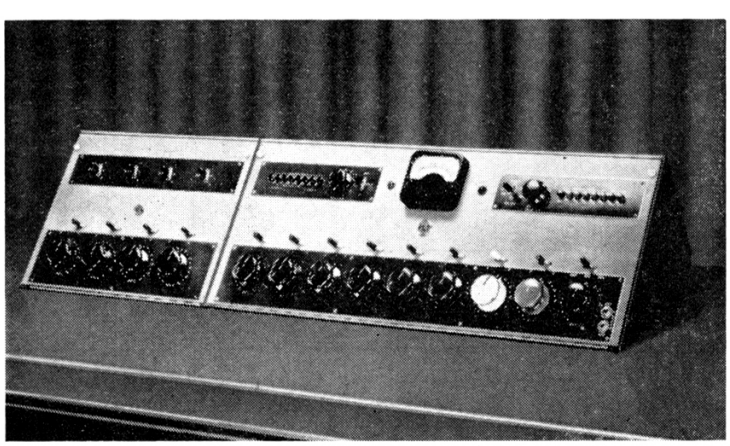

Fig. 2. The Auxiliary Mixer as set up for use with the BC-2B Consolette—which it matches in finish and design—for side-by-side operation in the studio.

Flexible Mixer Circuit

The mixing circuit itself was designed so that the mixer busses of the auxiliary mixer can be paralleled with the mixing busses of the consolette. This was accomplished by making the output impedance of the auxiliary mixer the same as the resistance of the load resistors in the mixing circuit of the consolette. These load resistors are removed when

the two units are connected together. In addition, the auxiliary mixer circuit was designed so that its proper load impedance would be that of the mixing circuit of the consolette.

The imposition of these conditions resulted in an output impedance of 370 ohms and a load impedance of 255 ohms. It is therefore necessary to use a matching pad when the output of the auxiliary mixer is fed into a 150 or 250 microphone input of either the consolette or another amplifier.

The program-audition switches are also equipped with contacts for interlocking circuits which activate the speaker muting and studio warning light relays of the consolette.

Thus there are two ways in which the auxiliary mixer can be connected to the consolette:

1. *Paralleling of the mixer busses.*

The program and audition busses of the auxiliary mixer are connected directly to the corresponding mixer busses of the consolette. Eight connections are required between the interlocking circuits of the two units. This type of installation results in 12 mixing channels—8 of which are microphone mixing channels—and a total of 18 possible microphone inputs.

2. *Using the* MIC 1 *mixer of the consolette as a sub-master gain control.*

In this type of connection, the program bus of the auxiliary mixer is connected through a matching pad to the MIC 1 input of the consolette. The audition bus of the auxiliary mixer may be connected through a matching pad to an external monitor amplifier if so desired. No interlocking connections are required for this case since the program-audition switch of the MIC 1 channel in the consolette controls the speaker muting and warning light relays. The MIC 1 mixer attenuator of the consolette may be used as a "sub-master" gain control for the auxiliary mixer. This type of installation reduces the number of possible microphone mixing channels by one. The added feature of a sub-master gain control, however, simplifies operation as it makes possible to fade four channels in and out simultaneously.

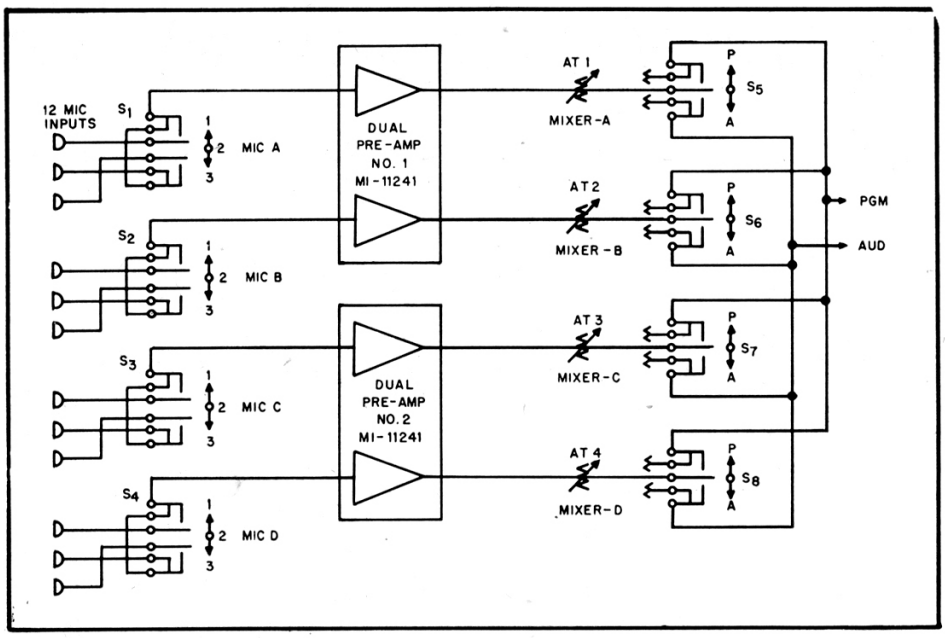

Fig. 4. Block diagram of the Auxiliary Mixer.

Typical Application in Studio

The audio facilities of a typical TV studio are illustrated in *Fig.* 5. The studio is divided into three staging areas. Each of these areas contains four microphone inputs to the auxiliary mixer. In the main staging area #2, are an additional three or four microphone inputs leading directly to the consolette. (The microphone 1 input is shown dotted because it cannot be used if the output of the auxiliary mixer is fed to the MIC 1 input of the consolette.)

(*Continued on page 61*)

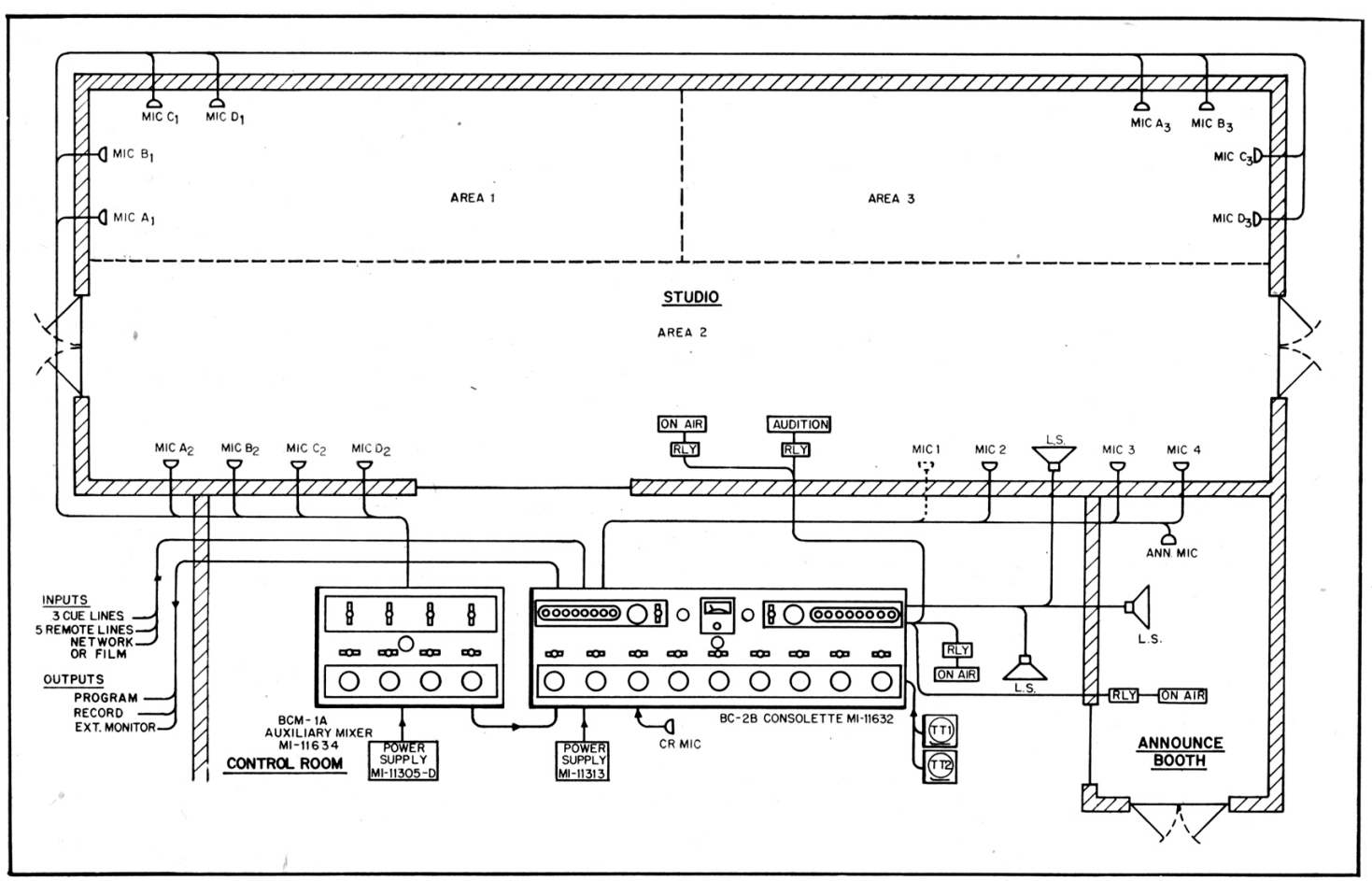

Fig. 5. Typical studio layout which employs the capabilities of the Auxiliary Mixer to augment the number of microphone inputs available for instant use.

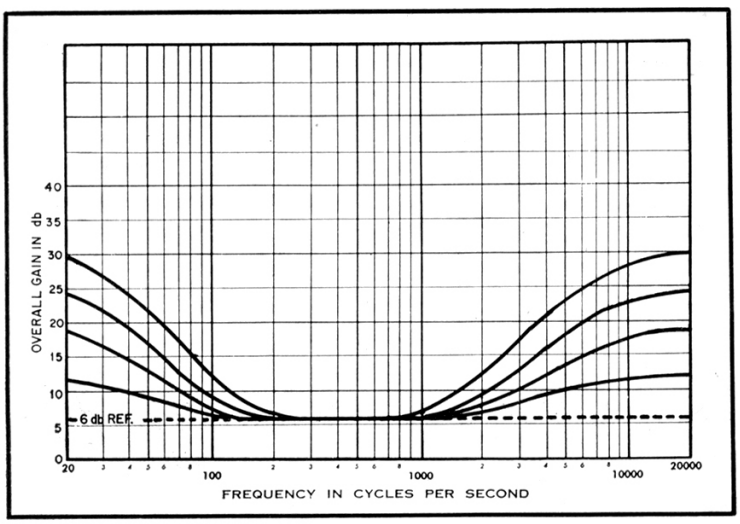

Fig. 4. Response curves obtained with three-channel tone-control amplifier of Figs. 2 and 3.

A question might be raised regarding the problem of the additional phase shift of 180 deg. in the high- and low-frequency channels, since they both have one more stage of amplification than the center channel. It is conceivable that a condition could arise wherein the low- and high-frequency components of the broad band passed by V_{2A} would cancel the signals of the other two channels. This does not occur, however, because of the additional compensating phase shift introduced by the low- and high-pass R-C filters.

The response curves of *Fig.* 4 illustrate the measured results obtained from various settings of the low- and high-boost controls. Boosts ranging from 6 db to 24 db at the 20- and 20,000-cps. spectrum extremes are shown. Note that practically no increase occurs in the middle-frequency range between 200 and 1000 cps, even at maximum settings.

Construction of the tone control amplifier is not difficult. It may be incorporated directly into an existing or proposed amplifier, or else built up as an accessory on a small subchassis similar to that used for magnetic pickup preamplifiers.

The author has used variations of this type of tone control for over ten years, and the results have been very satisfactory. Although it will not work miracles for a poor audio system, the degree of depth and crispness imparted to music and speech is remarkable.

PARTS LIST

C_1, C_5, C_8	0.1 μf, 400 v. paper
C_2	0.25 μf, 400 v. paper
C_3, C_4	20–20 μf, 450 v. electrolytic
C_6	.05 μf, 400 v. paper
C_7	.02 μf, 400 v. paper
C_9	500 μμf, 500 v. mica
C_{10}	200 μμf, 500 v. mica
C_{11}	100 μμf, 500 v. mica
R_1	470 ohms, ½ watt
R_2	47,000 ohms, 1 watt
R_3, R_{12}	47,000 ohms, ½ watt
R_4, R_{13}	0.1 meg, ½ watt
R_5	0.22 meg, ½ watt
R_6	0.5-meg potentiometer, audio taper
R_7, R_{11}, R_{15}	2200 ohms, ½ watt
R_8, R_{16}	22,000 ohms, 1 watt
R_9	0.33 meg, ½ watt
R_{10}	0.18 meg, ½ watt
R_{14}	0.25-meg potentiometer, audio taper
V_1, V_2	12AT7 dual triodes

AUXILIARY MIXER for TV (*from page 27*)

The control room and announce booth microphones, turntable, cue, remote line, network, and film inputs are handled in the usual manner.

This is only one of many possible arrangements, but it shows the flexibility of the auxiliary mixer. The microphone inputs can also be divided between two studios which may be used simultaneously—one for program, the other for audition purposes.

The BCM-1A auxiliary mixer should be installed adjacent to and to the left of the consolette. Both units are identical in cross-section and similar in styling. The auxiliary mixer is 16¾ in. in length, and the combined length of the two units is only 49¾ inches. All controls are therefore within convenient reach. The front panel of the auxiliary mixer is hinged and tilts forward as shown in *Fig.* 3 to provide access to the attenuators and switches for inspection, cleaning and service. The sloping top cover is removable to expose the tubes and tube test jacks. The amplifier wiring becomes accessible by raising the pivoted amplifier mounting frame. Power for operating the speaker muting and warning light relays is supplied through the consolette. Only an external plate and heater supply is required for the operation of the auxiliary mixer.

The BCM-1A auxiliary mixer is another example of the building-block type of broadcast equipment which may be placed in operation at the initial installation or may be added later to existing equipment as the need for greater facilities becomes apparent.