CGE

UTC

EQUALIZERS

UNITED TRANSFORMER COMPANY • 150 VARICK STREET, NEW YORK 13, N. Y.

MODERN EQUALIZATION

The earliest common form of equalizer was the "tone control" employed in radio receivers to cut off the high frequencies. These controls were frequently decried by engineers, on the basis of the fact that the fidelity of the equipment was being reduced through the loss of high frequency performance. More recent engineering knowledge has justified the use of this type of equalizer, as it has been found

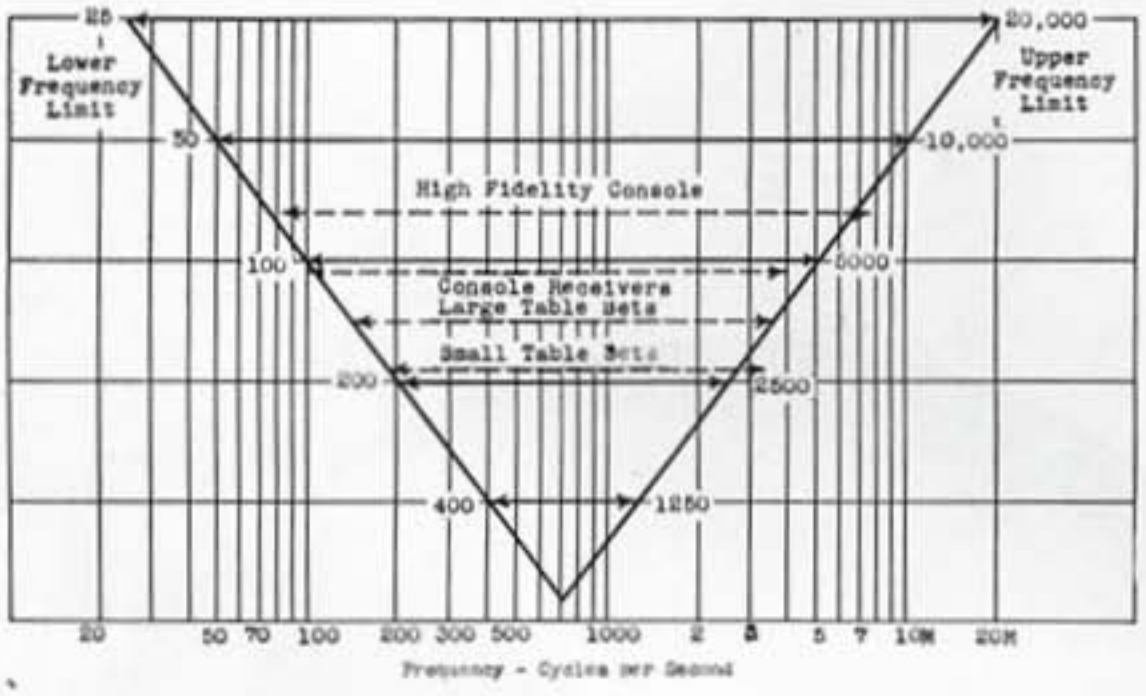


Figure 1

from preferred listener tests (see Figure 1) that to obtain a balance between the low and high frequency response is highly desirable, and that for good performance, the product of the lower frequency and higher frequency limits of the equipment should equal approximately 500,000. In other words, where a listener had a set that was good to only 200 cycles at the low frequency end, a "tone control" was necessary, and when it set the high frequency end to 2500 cycles, the best balance of response was obtained. A similar condition exists in the reproduction of phonograph records, which are recorded with a sharp drop-off at the low end. Again, to obtain balance the high end frequencies are frequently removed unnecessarily.

Unfortunately, while the sound becomes balanced to the ear, the fidelity is, of course, greatly decreased. The low notes which originally were not reproduced, are still not reproduced, but the high notes as well are now lost. The obvious answer is to bring back the low notes through the use of an equalizer and, thus, increase the overall fidelity rather than reduce it.

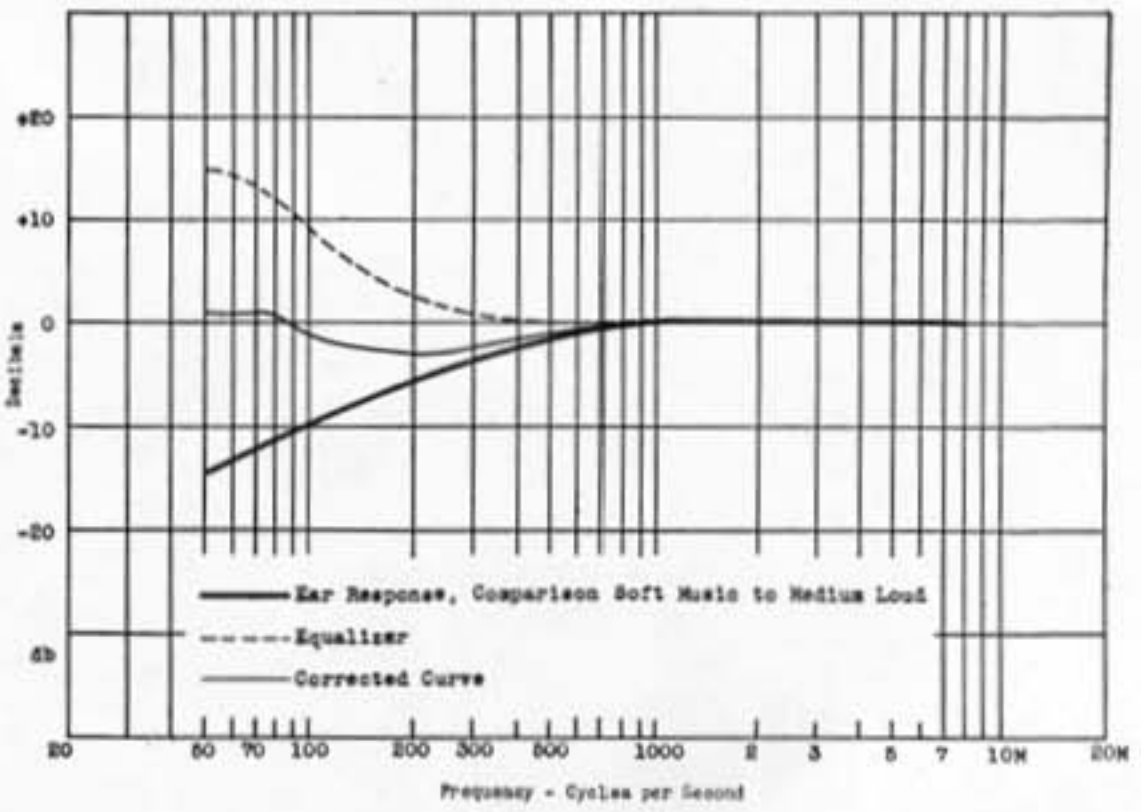


Figure 2

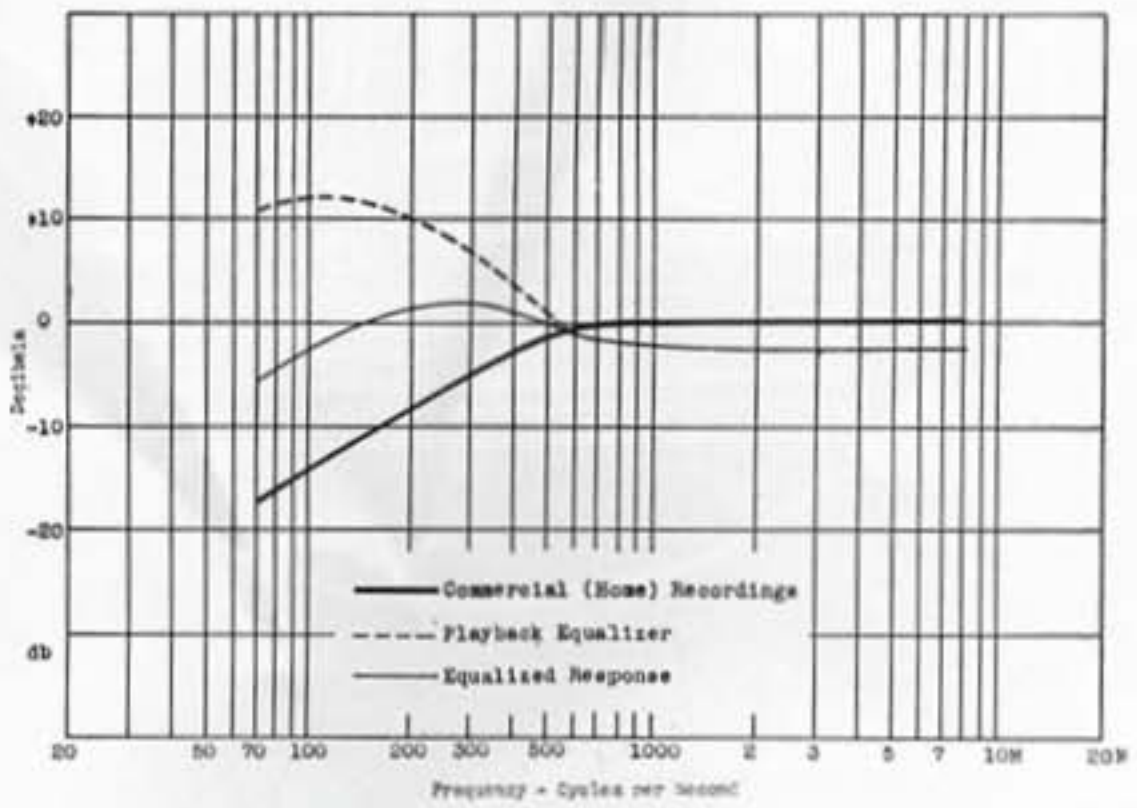


Figure 3

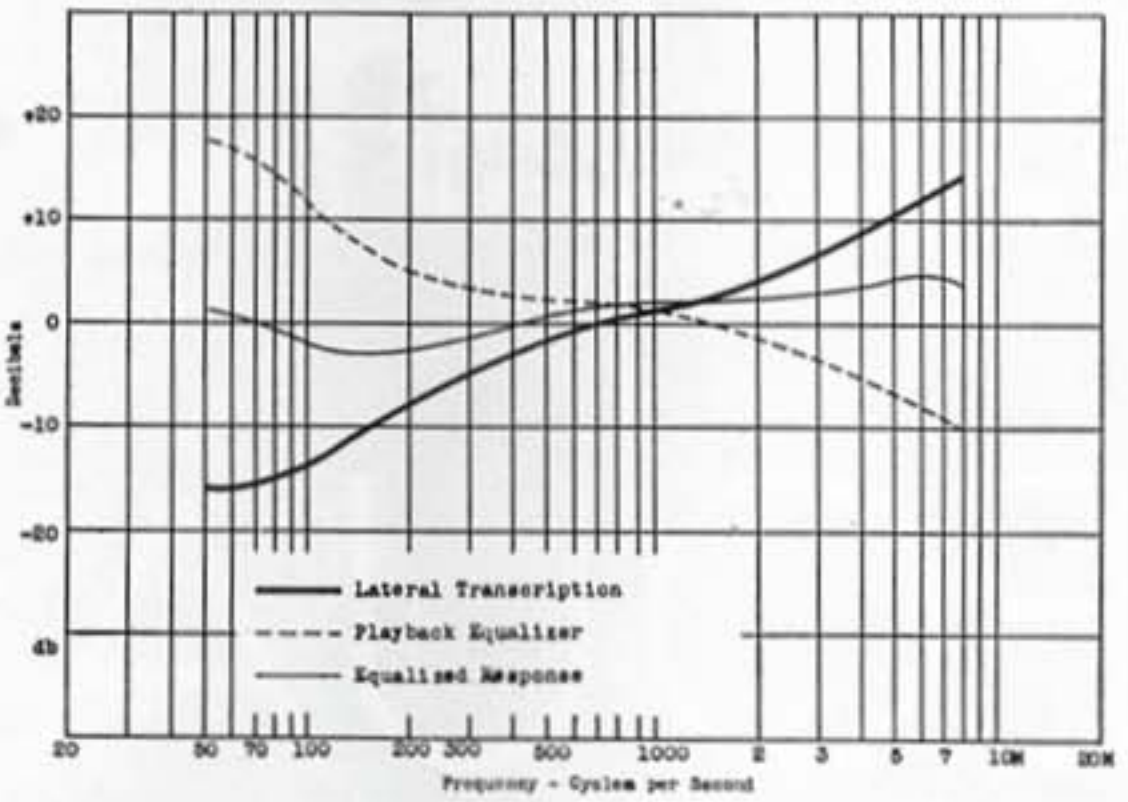


Figure 4

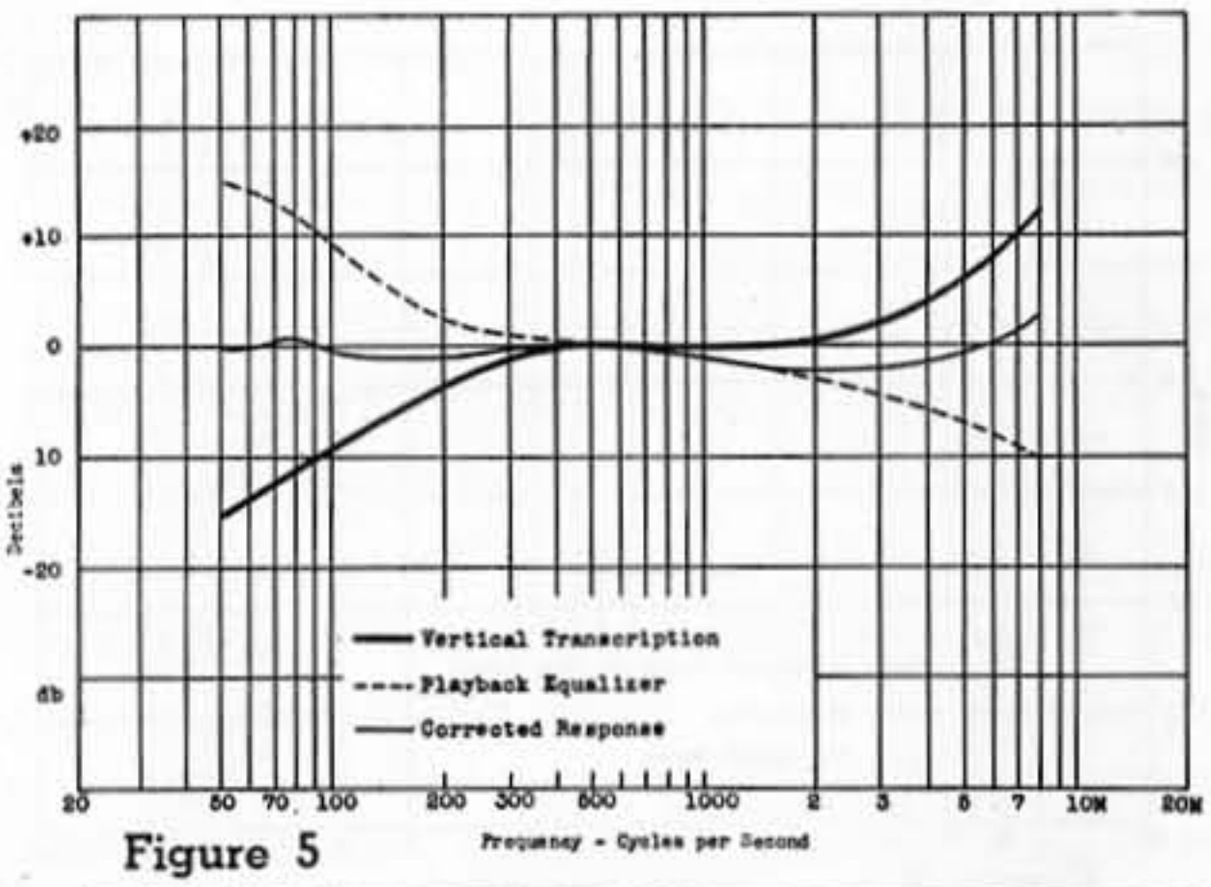


Figure 5

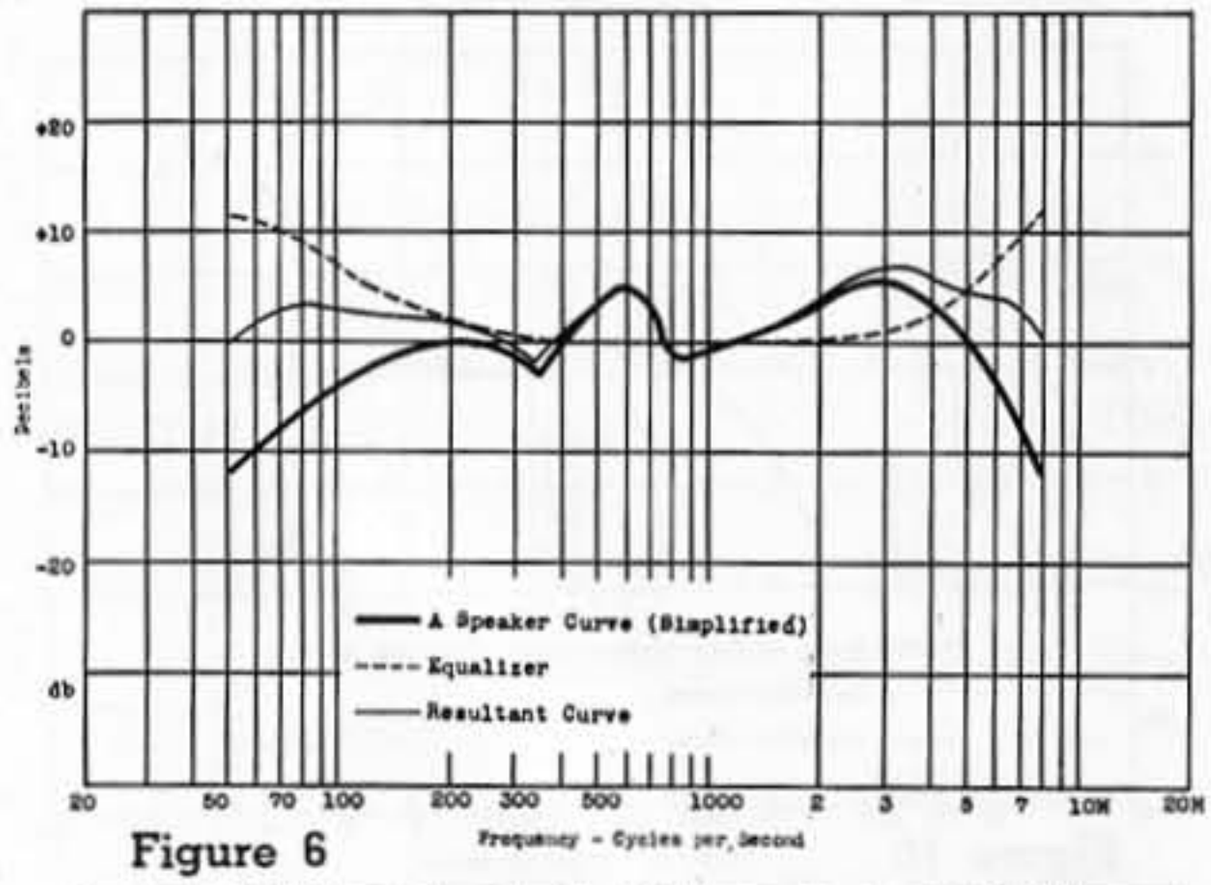


Figure 6

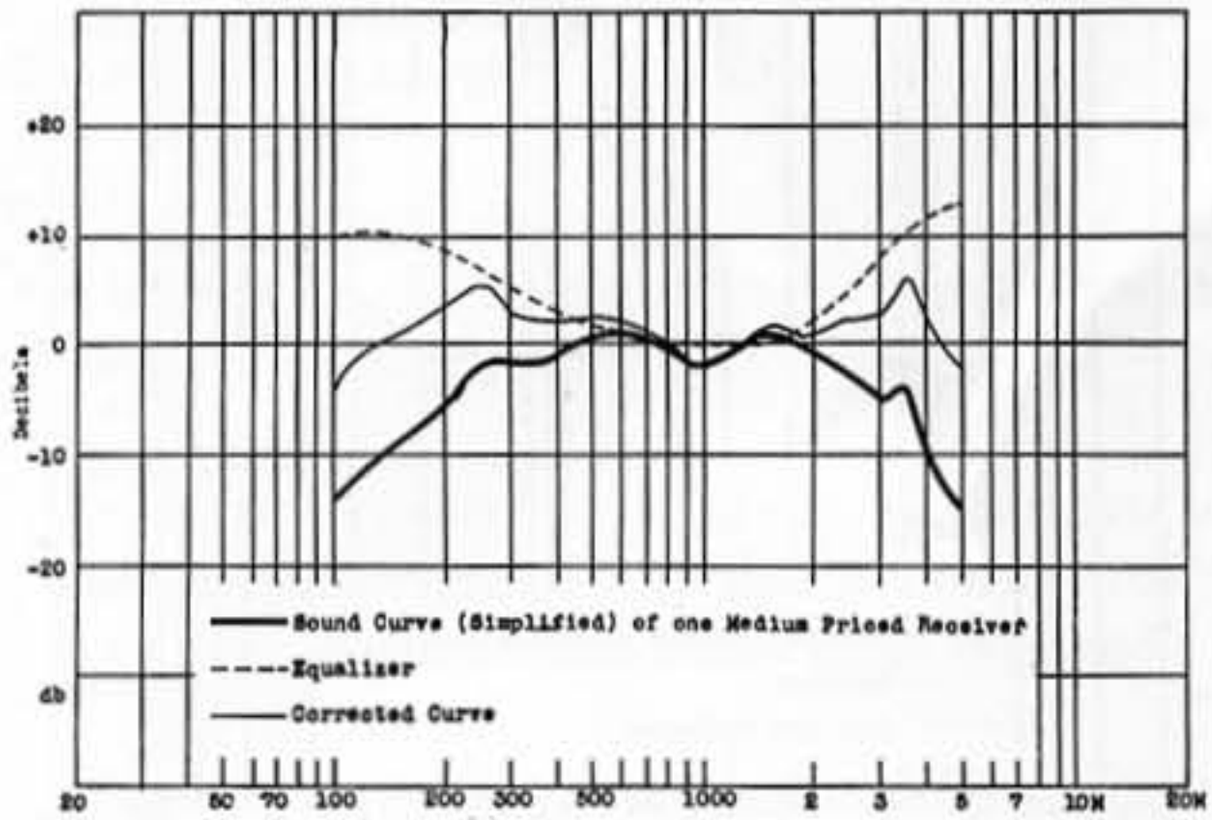


Figure 7

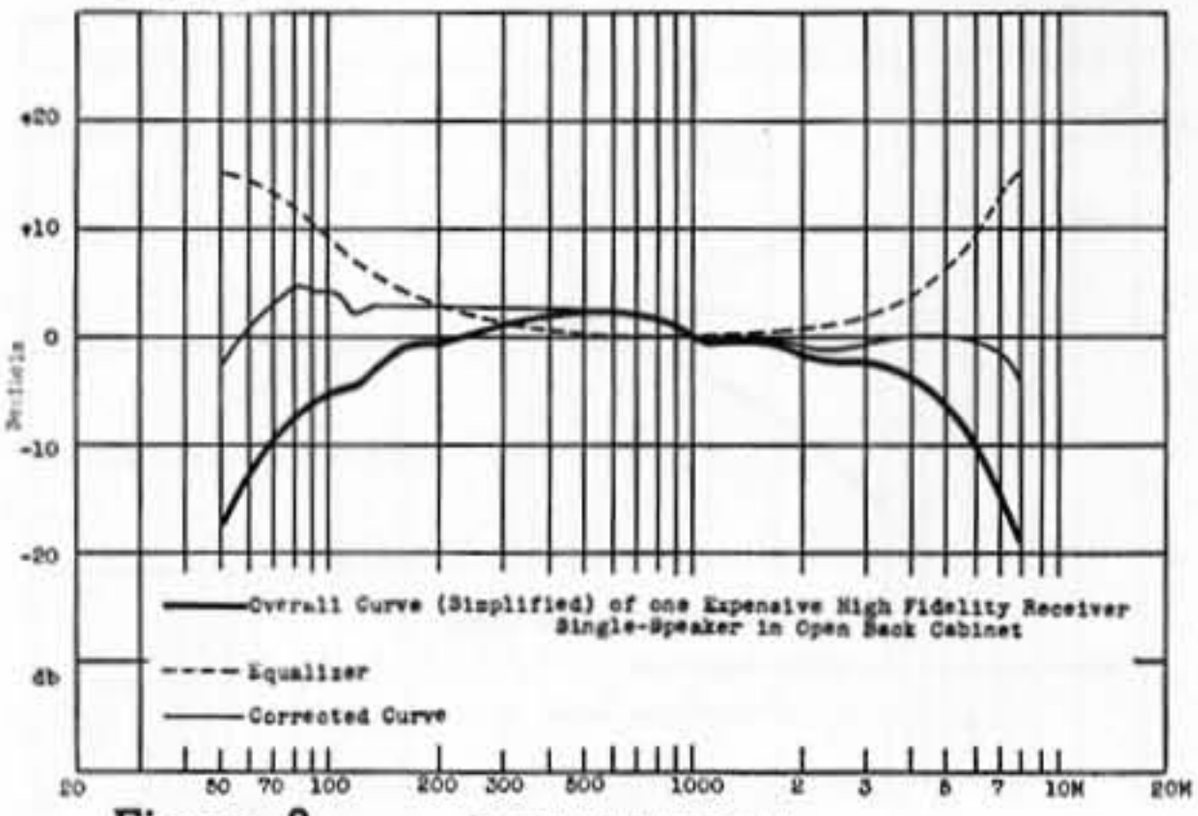


Figure 8

Broadcast stations have long realized the need for equalizing the various components employed in sound reproduction systems, and for over a decade the UTC 3AX equalizer has been the standard of the broadcast and recording fields. However, it was not until the CGE-1 universal resonant equalizer was developed that an inexpensive general use article became possible.

The necessity for equalization is now generally apparent. The accompanying figures illustrate a few of the tremendous number of equalizer applications. Virtually all recording systems, whether discs, sound on film, sound on wire, embossed film, etc., require playback equalization as well as, in most instances, equalization when recording . . . Most pickups, microphones, and loudspeakers can be effectively equalized . . . Dialogue equalization (low frequency droop) will improve speech intelligibility, and will permit higher power levels from speakers used in PA equipment; a portion of the power normally going into the speaker and not necessary for intelligibility is removed . . . Mid-frequency equalization (low end and high end droop) is frequently used by amateurs to effect a maximum signal level in the frequencies most necessary for intelligibility . . . Acoustic conditions will frequently lend themselves to equalization. The absorption of high frequencies may easily be 15 DB, depending upon the drapes, rugs, and number of people in a room . . . Another point of equalizer use comes from the realization that at low sound levels the ear is less responsive to low frequencies. This type of equalization is commonly called bass boost.

THE CGE-1 EQUALIZER

In developing the CGE-1 equalizer, a number of basic requirements for an ideal though inexpensive unit were first set forth:

1. The curves obtainable should be well suited to virtually all applications.
2. The electrical components should be stable, pickup free, and dependable.
3. The mechanical arrangement should be convenient for installation in new or existing equipment.
4. Ready adaptation to commonly used audio amplifier equipment.

Referring to #1 above:

Realizing the necessity for equalization, and faced with a lack of a relatively inexpensive quality product, there has been a tendency for the sound specialist to turn to resistance-capacity or resistance-inductance equalizers. Unfortunately, the frequency

correction curve obtainable from this type of equalizer is a gradual slope. This does not accomplish what is required in the boost condition. If the item to be equalized, for example, is down 15 DB at 5,000 cycles, an equalizer which brings back this 15 DB but also boosts 6 DB at 1,000 cycles is not desirable. For this reason, the CGE-1 unit employs resonant circuits for both the low and high frequency boost. As will be noted from the curves, with 15 DB boost at 8,000 cycles, the response curve is flat at 2,000 cycles. A similar condition exists at the low end.

Referring to #2 above: The problem of the resonant type of equalizer is twofold:

A. The coils and condensers must be precisely adjusted and very stable.

B. They must be well shielded to prevent inductive pickup.

Both of these points are well taken care of through the use of UTC modified variable inductors, high quality condensers, and metal coil shielding.

Referring to #3 above: The CGE-1 equalizer has been arranged for maximum simplicity, in either panel or chassis mounting. Only two controls are employed. One either boosts or drops the low frequencies; the other either boosts or drops the high frequencies. The unit consists of a drawn enclosure incorporating the coils, condensers, etc. . . . the two controls . . . an etched calibrated panel . . . and the control knobs. In the most common method of use, four holes are drilled in the panel or chassis. The etched panel and controls are mounted and the two outside mounting screws for the panel support the drawn case directly behind it.

In some applications space may not be available behind the etched panel for the mounting of the drawn case. To take care of this type of application, the leads between the controls and the terminal board of the drawn case are approximately 10" long, permitting the case to be mounted separately at a reasonable distance from the control panel.

Referring to #4 above: The CGE-1 equalizer is a high impedance unit designed for insertion in an audio amplifier between a triode plate and subsequent grid, or from a high impedance source (5,000 to 30,000 ohms) other than a crystal microphone, to a subsequent grid loaded with 10,000 ohms. Figure 14 gives the circuit connections.

Some insertion loss is effected by this equalizer, particularly at the maximum settings. If the existent amplifier system does not have substantial excess gain, an additional audio stage may be required. Figure 14 illustrates the addition of such a stage. As the filament and plate drain of the added tube is small, it can normally be taken from the power supply of the original equipment.

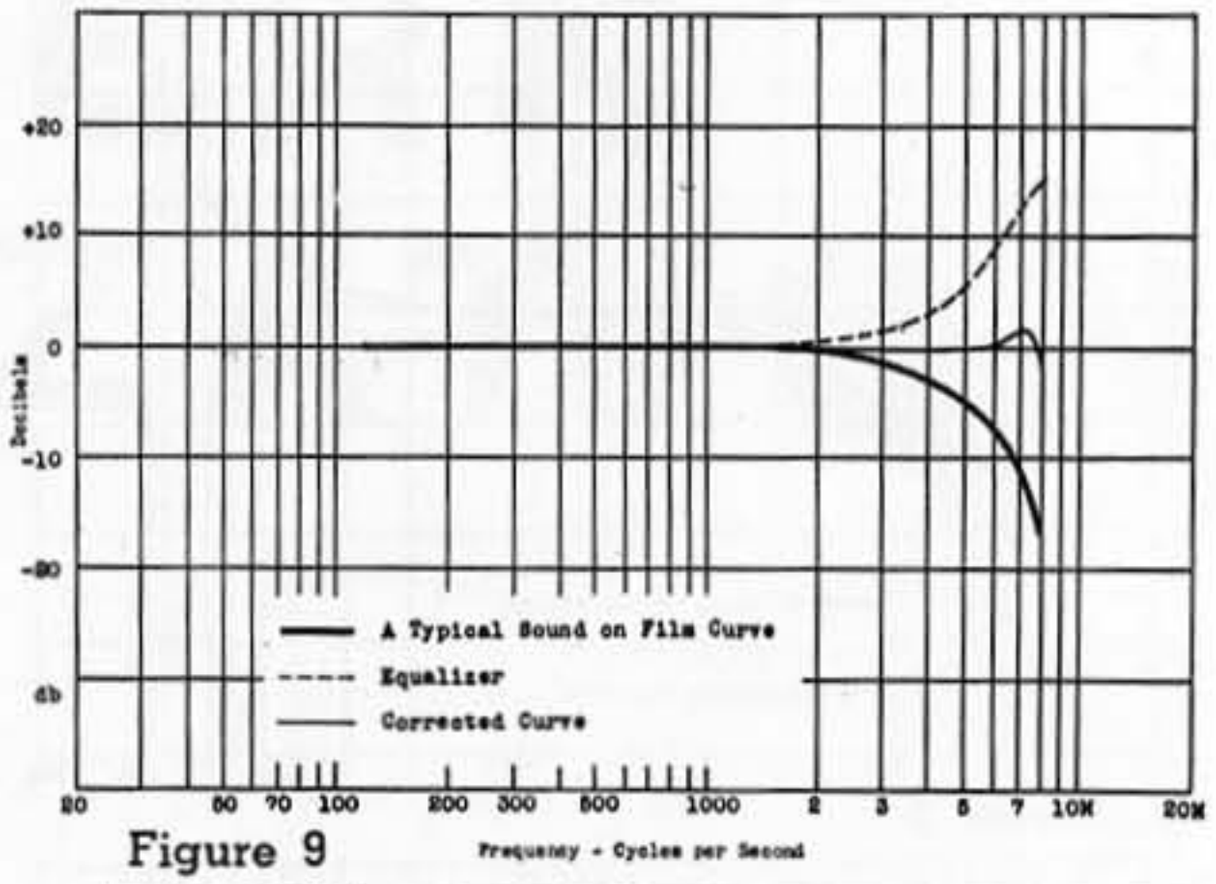


Figure 9

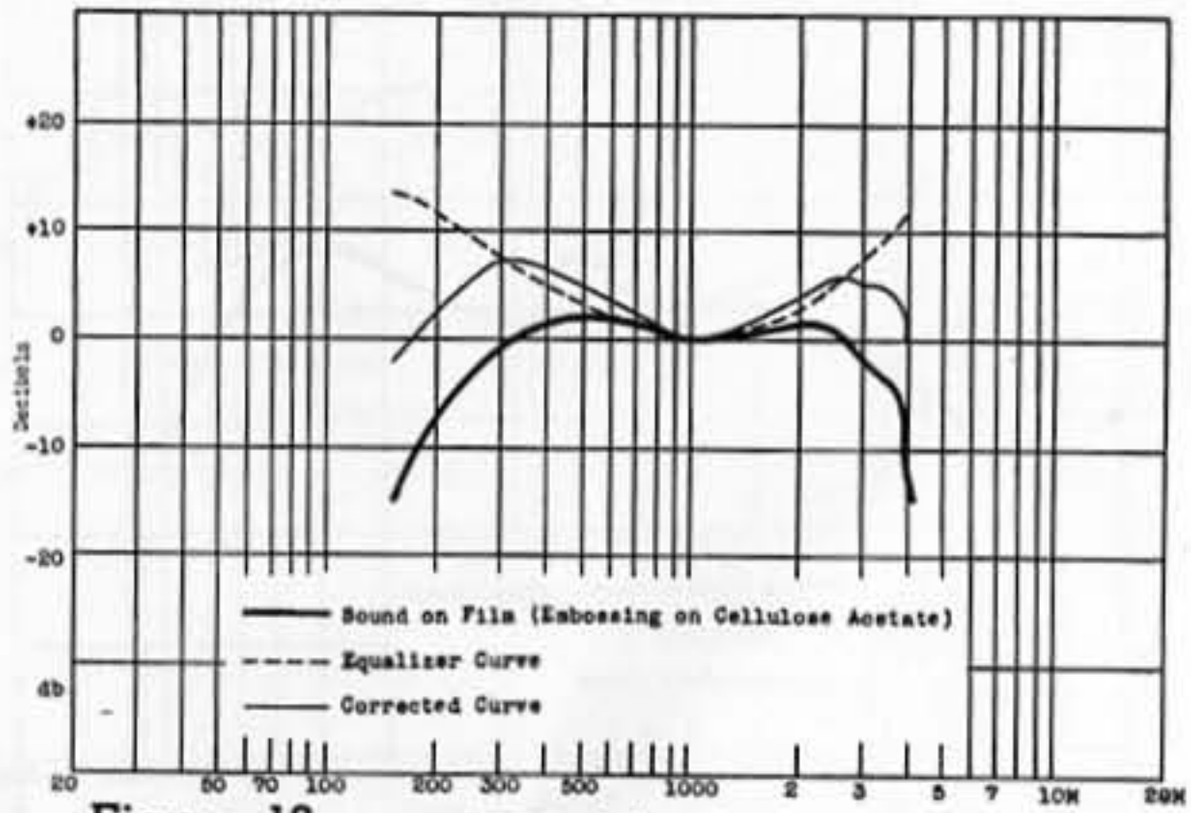


Figure 10

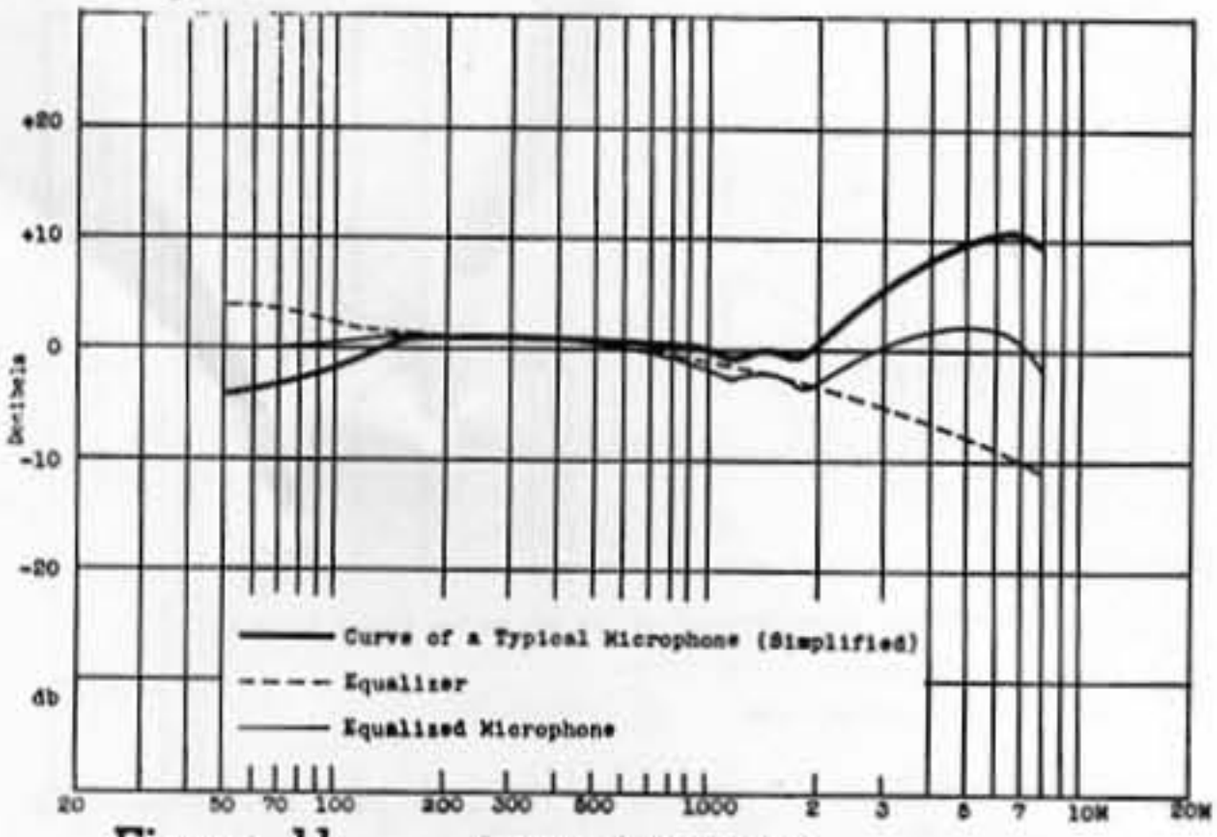


Figure 11

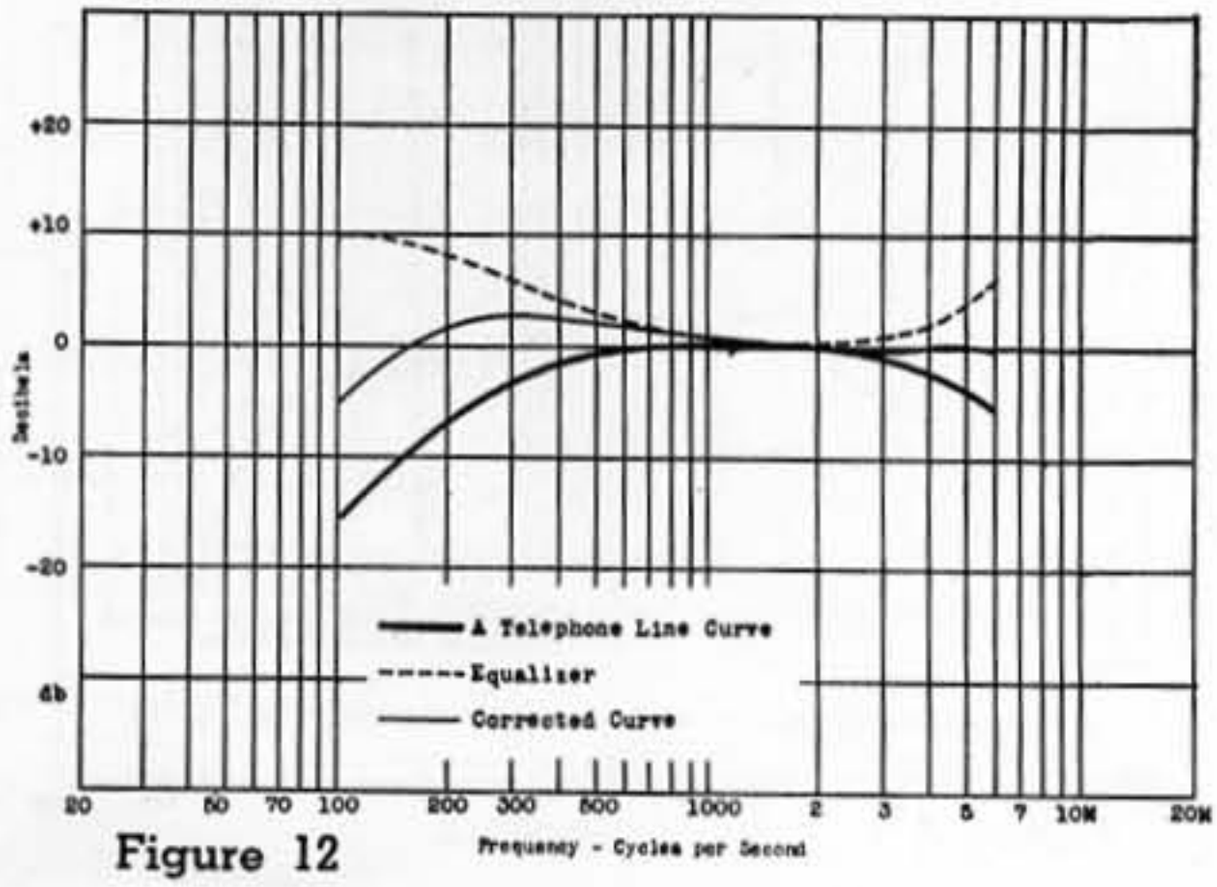


Figure 12

Figures 2 through 13 illustrate the various typical
ırves obtainable with the CGE-1, with the setting
: maximum value. The panel is calibrated from zero
15 DB, permitting precise adjustment. Where in-
rmediate values of setting are employed, the gen-
·al slope of the curve will be similar to that at the
aximum setting.

The controls are very simple to operate. The left-
ɔnd or bass control, when set at zero, has no effect
n response. When turned to the left, it increases
ıe bass . . . when turned to the right, it decreases
ıe bass. Exactly the same action is effected in the
ght-hand or high frequency control.

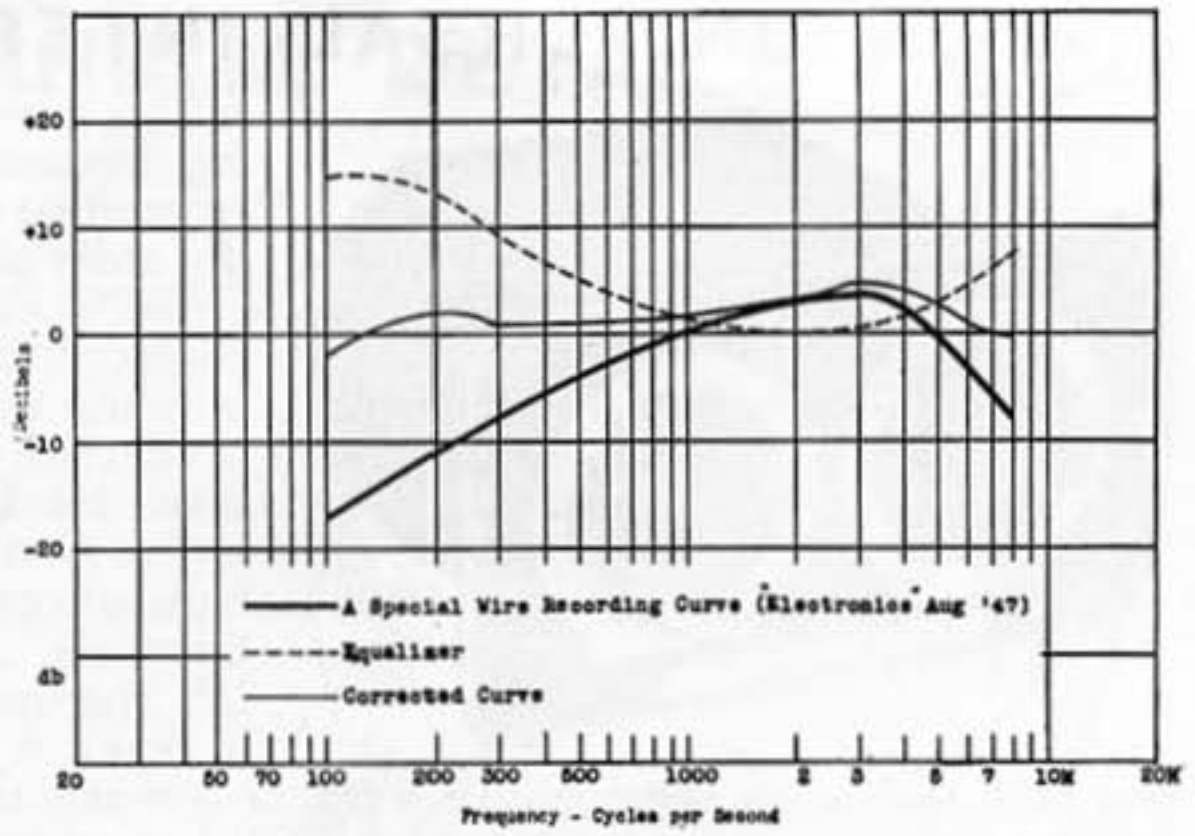


Figure 13

To permit precise equalization for a wide variety of applications, the high frequency and low frequency
ɔost sections are arranged for two frequencies each. In most applications the frequency desired is predeter-
ıined, and when the unit is wired in to the equipment, the appropriate connections are employed. If a wide
ınge of use is anticipated, the 50 cycle and 100 cycle terminals can be brought out to a single pole double
ırow switch, and in like manner, the 5 Kc. and 8 Kc. terminals to a similar switch, thus permitting instantane-
ıs change-over to the desired resonant frequency.

The following considerations should be observed in order to take full advantage of the possibilities of the
GE-1 Equalizer:

1. The unit is designed to work between two impedances of 10,000 ohms, and this value of termination
ıust be used to maintain accuracy of calibration.

2. No distortion is introduced by the CGE-1 if the maximum level at the equalizer input is held below 2
ɔlts, with negligible distortion at several times this value. The CGE-1 should not be used at signal levels
ɔove 10 volts.

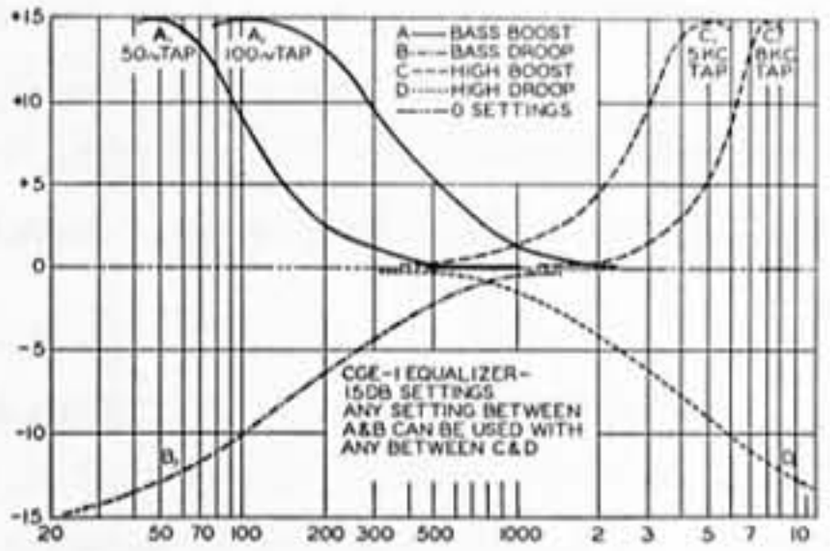
3. When adding the CGE-1 to an amplifier with very little reserve voltage gain, a preamplifier such as
e cascaded triodes in Figure 14 will result in an output voltage essentially equal to the input voltage when
ɔth maximum bass and treble boost are used.

4. When an amplifier incorporating the CGE-1 is run with no boost, the mid-frequency gain is 30 deci-
ɛls over that with full boost. For best signal to noise ratio under these conditions, a master gain control
ıould be used in the circuit after the equalizer itself. This may be in the form of the equalizer terminating
sistor, as shown in the DeLuxe 15 Watt Amplifier of Figure 19.

UNIVERSAL INTERSTAGE EQUALIZER

This new UTC unit is the ideal device for any application requiring frequency response correction. Designed to be connected between two triode audio stages or will match a high impedance (in the order of 10,000 ohms) source to grid.

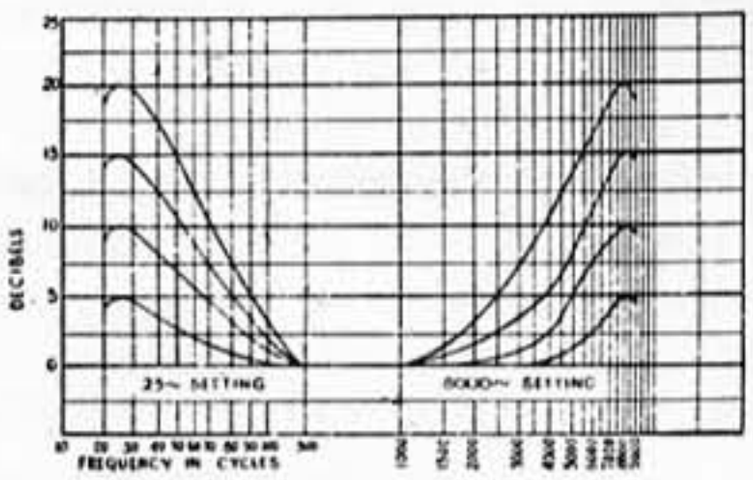
The CGE-1 equalizer is not a simple R-C tone control, but employs resonant circuits to permit low or high end equalization without effecting mid-frequencies. With controls in center, no equalization is effected. Moving one control to left increases bass; to right, drops bass. Moving other control to left increases highs; to right drops highs. Controls are independent so that bass may be raised and highs dropped simultaneously, etc. Amount of equalization is continuously adjustable, up to 15 DB. The insertion loss effected is equal to the combined low and high frequency settings plus 6 DB, or a maximum of 36 DB. Unless existent gain of equipment to which CGE-1 is added is high, an additional audio stage may be required.



This unit comes complete so that controls with etched panel (calibrated in DB) can be mounted on a chassis (2½ inch minimum) or a panel with case containing the electrical elements held by etched panel screws.

CGE-1 — Panel Dimensions 2⅜ x 4" — Weight 2 lbs. — List Price $25.00

3AX UNIVERSAL EQUALIZER*

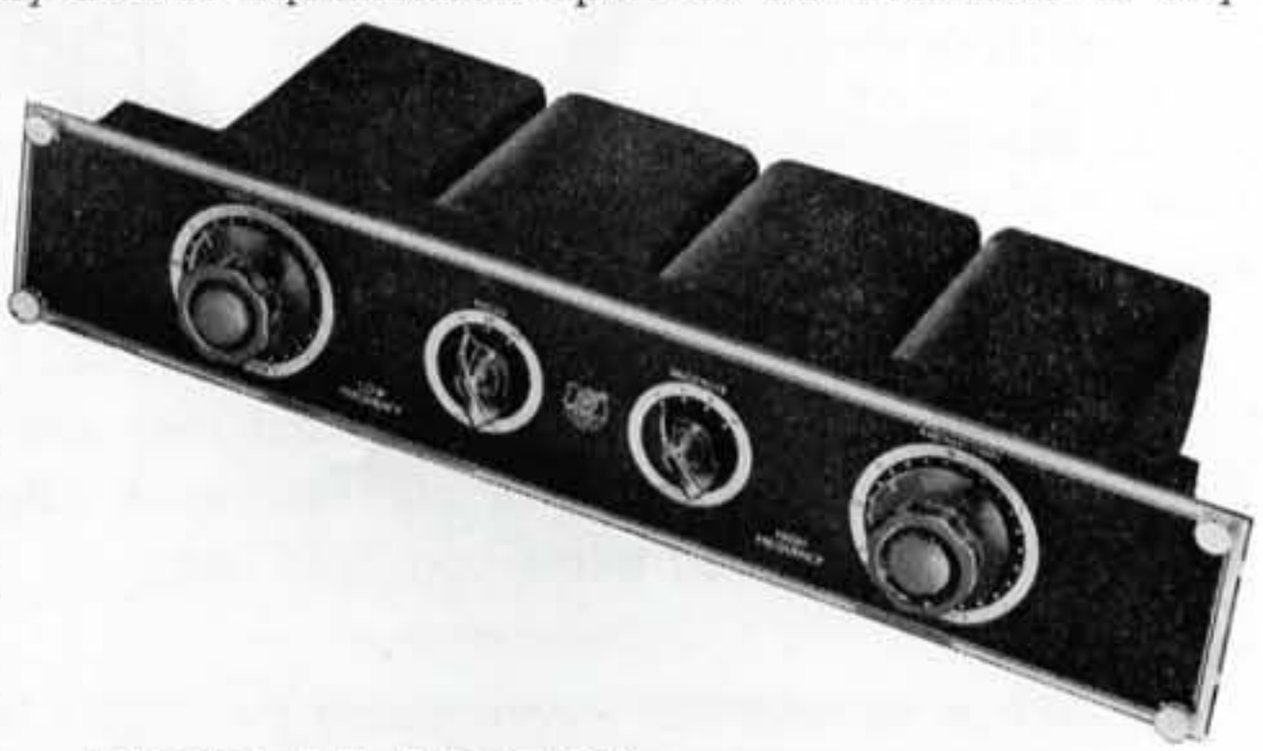


Typical Curves Obtainable with 3A or 3AX Equalizer

The universal characteristics of the UTC 3AX equalizer have made it the most popular item for broadcast and recording equalization. This unique unit, with which most communications engineers are already familiar, is an accurately calibrated, quickly adjustable, combined low and high frequency equalizer. The low frequency controls include a switch for adjusting the maximum equalization frequency to 25, 50, or 100 cycles and a calibrated T-pad for exact adjustment of the amount of equalization. The high frequency portion of this unit includes a switch to set maximum equalization point at 4000, 6000, 8000, 10,000 or 15,000 cycles, and a similar calibrated conirol reading directly in DB. Equalization up to 25 DB available at any frequency selected.

Through a unique arrangement of compensating pads, changes in adjustment of the 3AX equalizer do not affect the insertion loss (50 DB). This permits rapid changes in tone color, with negligible change in volume; where rapid changeover is required in service from one line to another, or from recording to play back, it is merely necessary to predetermine the required setting. The actual adjustment of the controls can be taken care of almost instantaneously. The construction is of the depressed chassis, etched panel, rack mount type. Thoroughly shielded against inductive pickup with UTC Trialloy Shielding.

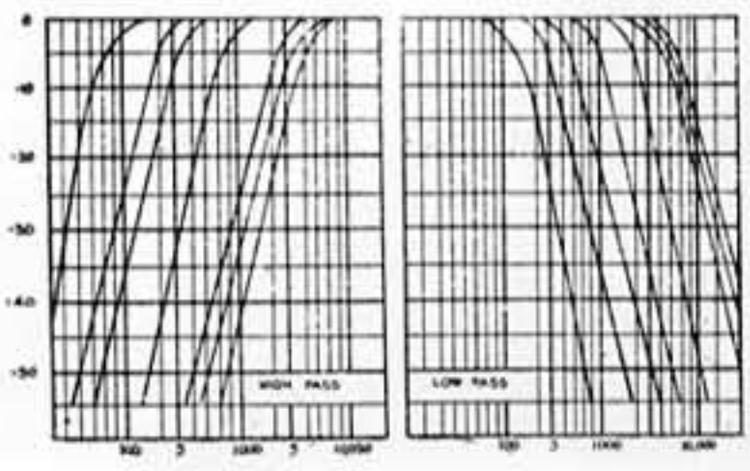
Panel Dim. 3½x19x7½—Wt. 15 lbs.—List Price $205.00



3A UNIVERSAL EQUALIZER*

The 3A equalizer is identical to the 3AX described above, except that it does not incorporate the compensating pads for constant insertion loss. The insertion loss is roughly proportional to the amount of equalization employed. All other characteristics identical with the 3AX unit, this item weighs 10 lbs. **List Price $125.00**

4C SOUND EFFECTS FILTER*



Characteristics Obtainable with 4C Filter

The use of filters to obtain unusual sound effects is now finding wide application in broadcast technique. The Model 4C Filter was originally developed for one of the large broadcast chains, and is now used extensively by most broadcast stations. Two controls are provided on the 5¼"x19" panel, which is similar in appearance to the 3AX unit. The weight of the 4C unit is 20 lbs.

The low pass switch can be set for cutoff frequencies of 100, 250, 500, 1000, 2000, 3000, 4000, or 5000 cycles. The high pass switch has identical frequency points. The great number of cutoff frequencies provides for a wide latitude of tone control. If desired, though not normally necessary, external potentiometers may be inserted in circuit for attenuation control. **List Price $185.00**

*** 500/600**

ELECTRICAL AND MECHANICAL DETAILS CGE-1

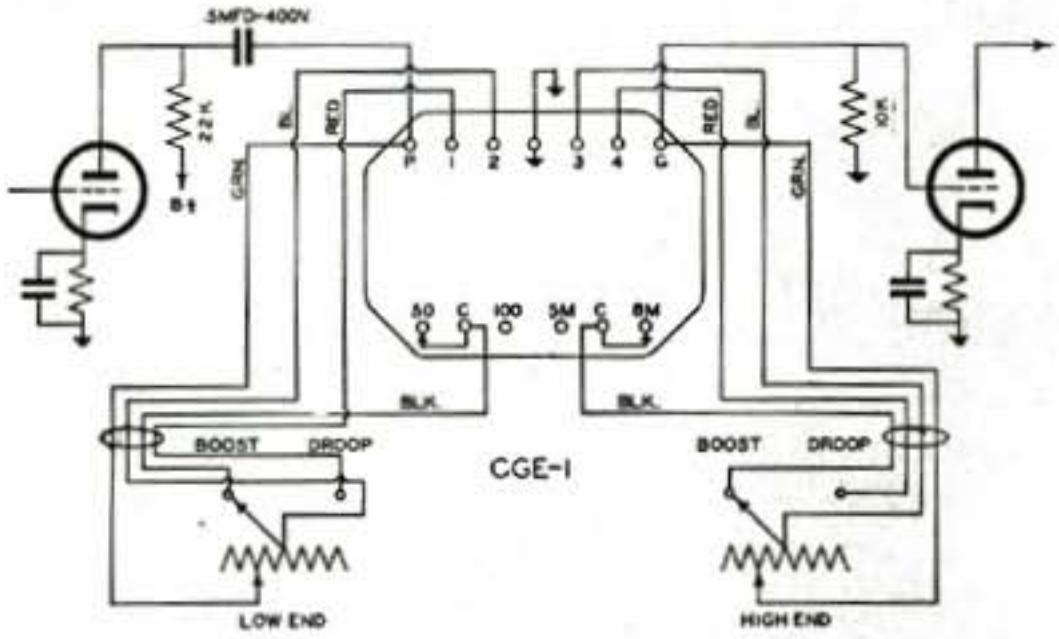


Figure 14 — Circuit for connection between triode plate and subsequent grid.

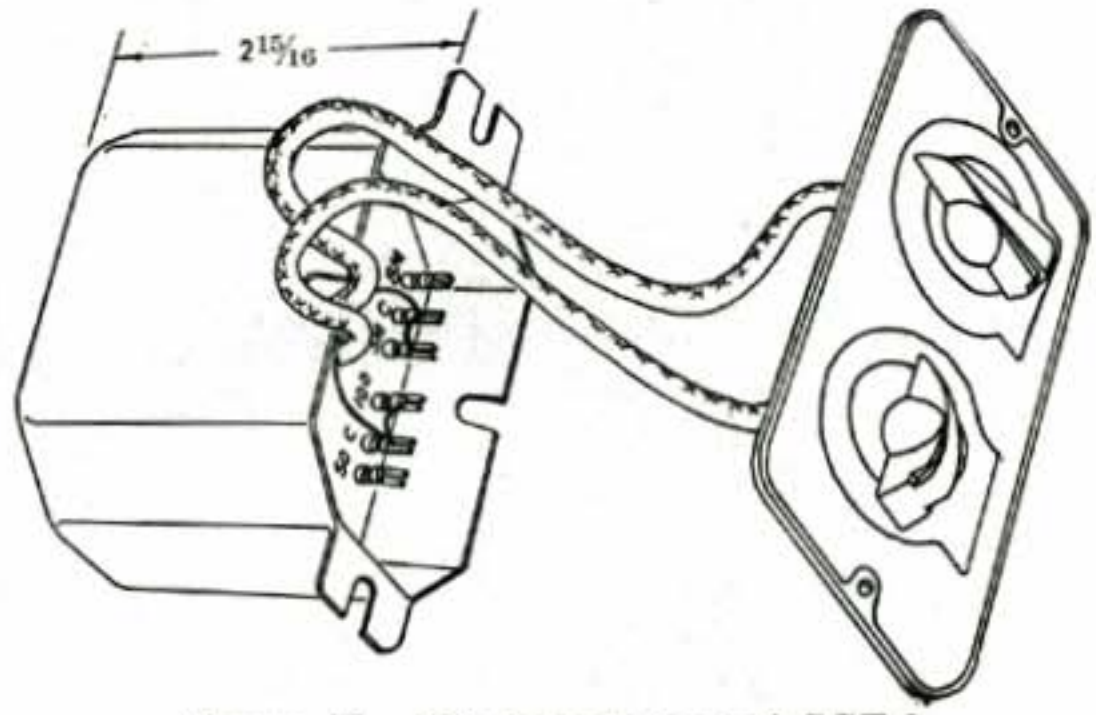


Figure 15 — Exploded view of CGE-1.

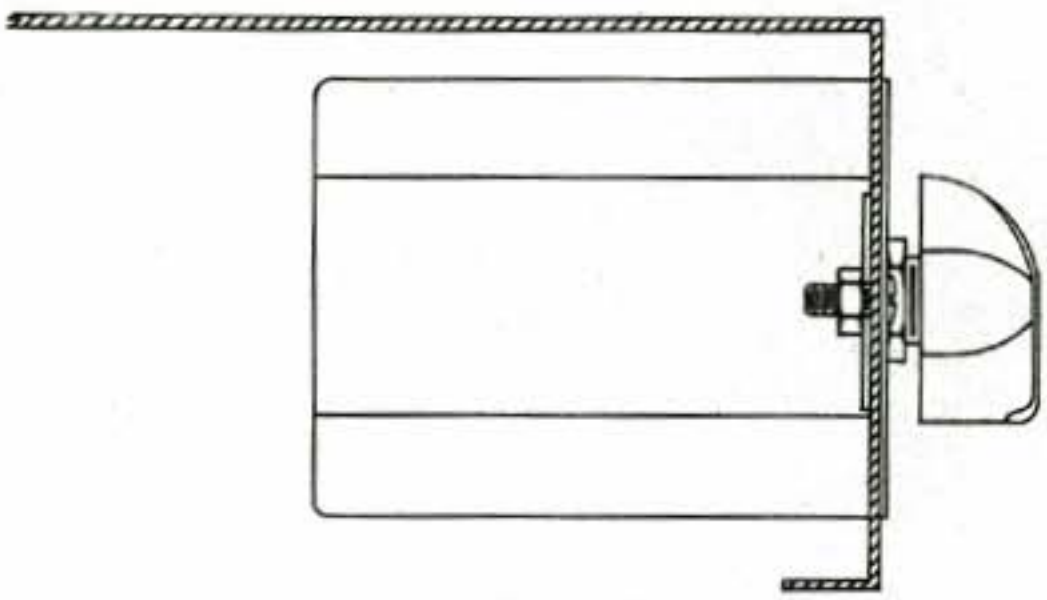


Figure 16 — Panel mounting of CGE-1 as integral unit.

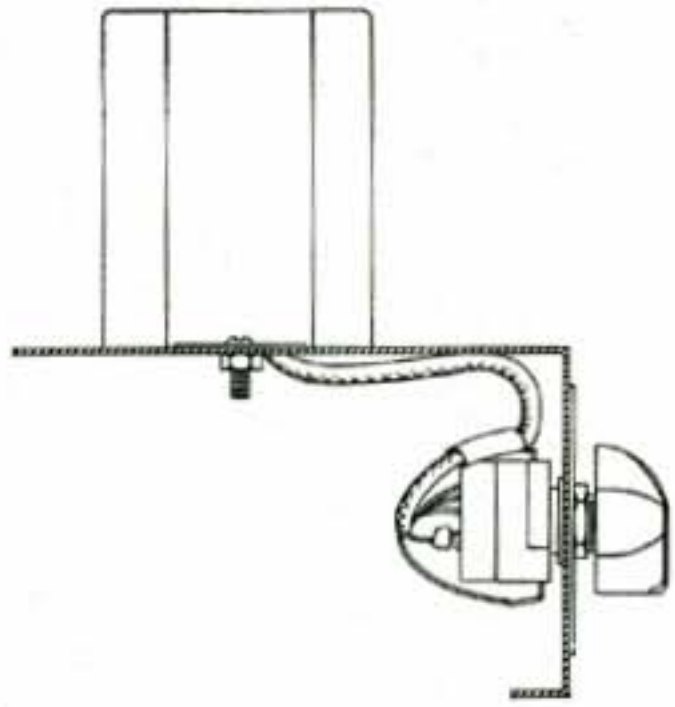


Figure 17 — Alternative mounting with filter on chassis.

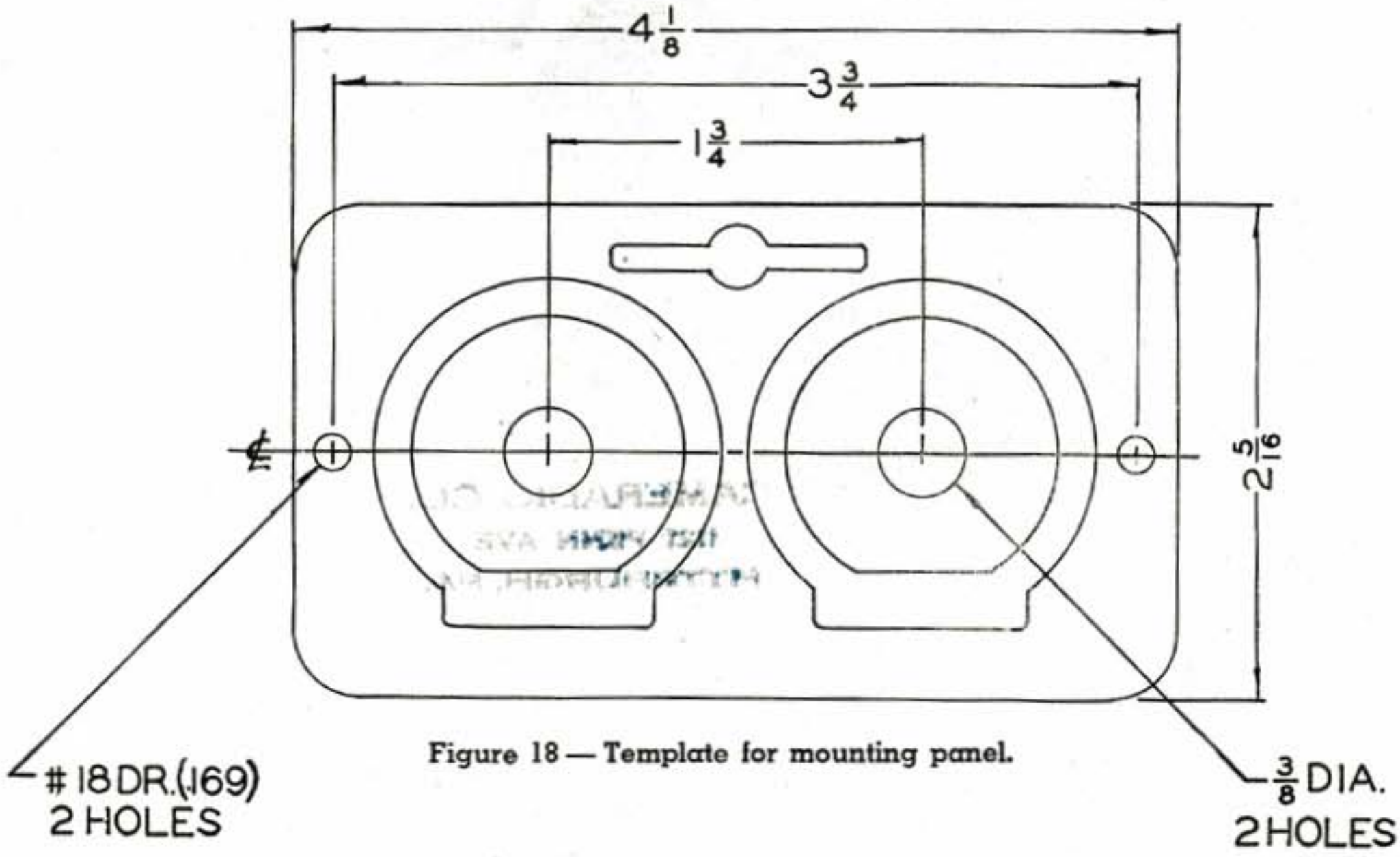


Figure 18 — Template for mounting panel.