DISTORTION is an ugly word, and to the quality enthusiast it conjures up visions of conditions which are insufferable and demand instant correction. It is, perhaps, because of this that there has been much confused thinking about the subject of scale distortion.

It would appear from the many articles written on the subject that scale distortion is met with only when sound is reproduced by a loud speaker fed by an uncorrected straight-line amplifier, and this argument seems to have sprung from the false premise that the output from such a loud speaker and amplifier is itself level in regard to frequency.

The argument develops along the line that while the sound output at full orchestral volume is satisfactory, at lower levels of volume there is a disproportionate loss of the upper and lower frequencies. The cause of this, it is stated, is scale distortion.

Now in disproving this argument it is necessary to agree that scale distortion is not peculiar to mechanically or electrically reproduced sound, but is due to the comparative insensitivity of the ear to the extreme sound frequencies — a condition which becomes more pronounced at lower volume levels and that no matter what the source of sound, the ear reacts in exactly the same way, and the result is scale distortion.

Natural “Scale Distortion”

In the concert hall, no matter where one sits or stands, the volume varies from one place to another, and because of this one has to put up with that nightmare of the quality radio enthusiast, scale distortion. The farther from the orchestra, generally speaking, the worse the distortion, but does one worry about it or complain or use some frequency-correcting gadget to clamp over one’s ears? No!

It seems clear, then, that for the full enjoyment of a “live” performance, no matter how far from the orchestra one sits, so long as the sound is loud enough for comfortable listening there is no need for frequency-correcting devices, although scale distortion is inevitably present. The balance is automatically corrected by that very peculiarity of the ear over which we have worried unduly.

In short, scale distortion is both necessary and desirable for realistic listening, because if correction is not needed when listening to a “live” performance, then it should not be necessary, or needed, when listening to radio reproduction, provided that the reproducing chain is itself not introducing distortion.

Assuming Good Transmission

Now, granted all this, if we have a good radio transmission of an orchestral performance, received by a good receiver coupled to an amplifier which will deliver to the loud speaker an exact copy of the original in terms of electrical energy, then we should be able to vary the volume of sound by means of the volume control in exactly the same way as we can vary the volume of the sound at the ear by moving away from the orchestra in the concert hall, and at the same time similarly to preserve the original musical balance at each gradation of volume. The effect, as heard, should be the same, because scale distortion is purely a product of frequency, volume of sound, and the peculiarity of the ear, which latter is totally indifferent as to the actual source of the sound.

In practice, however, there is no doubt that this most desirable result is not obtained when we listen to the sound reproduced by our baffle-mounted loud speakers.

Why not? Not because of scale distortion, because enough has been stated to show that this is necessary and desirable because it is present when listening to the original performance. So, if the sound as heard from the loud speaker is lacking in balance, then the fault lies elsewhere.

As already stated, the false premise is that the sound output of a baffle-mounted loud speaker fed by a straight-line amplifier is itself level and gives faithful reproduction at full orchestral volume. If it does so, then, with the lowering of volume, scale distortion by the ear would, as it does in the concert hall, automatically adjust the balance for realistic listening.

The fact is that the sound output of a reproducing equipment given a straight-line amplifier, follows a curve, and the ear reacts to it accordingly.

Figure 2: The suggested correction circuit, designed for English valves, but readily adaptable for our types.

Figure 1: The heavy line shows the response of the author’s loud-speaker before correction, and the dotted line the approximate curve after correction.